



**Masters' Thesis for Partial Fulfilment of Masters Degree in Urban Design  
and Development**

**Addis Ababa University**  
Faculty of Technology  
Department of Architecture and Urban Planning  
July 2007

**Public transportation system and its impact on  
urban mobility:**  
The case of Addis Ababa

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# Acknowledgment

I would like to express my debt of gratitude to my advisor, Professor Gurdeep Singh, for his continued, tireless advice and objective comments throughout this research period. Without his astute and timely advices as well as sustained support, it is hard to imagine this paper coming to fruition.

I would also like to thank my professors, Dr. Ashenafi Gossaye, for his ever present willingness to help me with all the questions I had, Dr. Fiseha Wogayehu and Dr. Rose Curran, for it is their positive influence since the beginning that has culminated in this successful completion of yet another journey.

I would really like to thank Ato Abraham Workneh, who gave me encouragement and endless support all along instilling in me the urge to work harder than I thought I could.

The professional assistance, both in terms of literature material as well as several consultation sessions afforded me, of Ato Alemayehu, head of research and planning at the City Bus Enterprise, Traffic Engineer Belay Wakjira and Ato Mathewos Asfaw is unforgettable. I am truly thankful for their tireless support throughout this process.

My deepest gratitude goes to my parents, Ato Kassahun Asfaw and W/ro Enanu Abera, my sister Frewoini Kassahun and my brother Abiy Kassahun for always being supportive and understanding.

Last but not least, All Praise and Glory goes to Almighty God!

Meron Kassahun

Addis Ababa,

July 2007

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# Abbreviations and Local Terms

## *Abbreviations*

<i>AA</i>	<i>Addis Ababa</i>
<i>AAU</i>	<i>Addis Ababa University</i>
<i>CBA</i>	<i>Cost/Benefit Analysis</i>
<i>CBD</i>	<i>Central Business District</i>
<i>CSA</i>	<i>Central Statistics Authority</i>
<i>LDP</i>	<i>Local development Plan</i>
<i>PTC</i>	<i>Public Transport Corporation</i>
<i>PTS</i>	<i>Public Transport System</i>
<i>UN</i>	<i>United Nations</i>
<i>'Birr'</i>	<i>Ethiopian currency unit (US \$ 1.00 = Birr 9.10)</i>

## *Local Terms*

<i>Kebele -</i>	<i>The smallest local administration unit (average size of Kebeles is 2000 households)</i>
<i>Woreda -</i>	<i>Local administration unit above Kebeles (the number of Kebeles in each Woreda ranges from 4-18)</i>

## **Abstract**

A review of relevant literatures covering the issue of public transport and its impact on mobility suggests that, a heavy reliance on this mode of transport increases the efficiency of urban mobility while at the same time easing the level of congestion. The literatures reviewed also suggest that the presence of an efficient public transport system creates a safe, sustainable and equitable urban mobility.

This study evaluates the extent to which the public transport in Addis Ababa has an impact on the urban mobility of the city. It also assesses the possible strategies and approaches that can be devised to enable this mode play a significant role in mitigating the worsening level of congestion that we see in the city today. The study mainly relies on secondary data for its analysis and findings; however primary data has also been generated and analyzed with the help of sample surveys and structured interviews.

The overall findings of this study revealed that despite the fact that an efficient public transport system is the best way to maximize urban mobility, in reality this mode of transport is in a critical condition to begin with in Addis Ababa. Furthermore it has been observed that increasingly heavier reliance on vehicles with small passenger carrying capacity, such as private automobiles and mini bus taxi, is resulting in congested junctions, with heavy traffic. Other factors such as the existence of only one dominant core area in the city, demand overlap that emanates from the similar working hours that are observed for almost all institutions in the city have also been identified to be the main drawbacks that need to be addressed to create an efficient public transport system in Addis Ababa.

While assessing ways that can make this mode become more efficient, it was further noted that there are other factors at play, namely, the existing transport

infrastructure, the socioeconomic realities, the prevalent traffic management practices, that call for an integrated approach so as to create a multi layered exhaustive proposal .

Finally the paper puts forward suggestions that revolve around policy issues and decision making considerations. Furthermore rather detailed and particular solutions to some existing realities of the public transport have also been included.

# **Part one**

## **Description of the Study and the Research Method**

## 1.1 Introduction

### 1.1.1 Background of the Study and Problem Formulation

Today, Addis Ababa is faced with huge challenges emanating from years of poor coordination between its existing *urban systems*. *Transport*, one of these components of the urban system, which is responsible for bridging the gap between areas of production and consumption, as well as creating a medium for spatial interaction, continues to be in the thick of these challenges. The lack of properly planned urban transport in Addis-Ababa is manifested through the low degree of efficiency of urban mobility that is now observed in almost all of the city's centre, sub-centers and other major traffic corridors.

Urban mobility, which is increasingly becoming inefficient in Addis Ababa and resulting in congestion, can be viewed as a function of various components of the urban transport system. These elements are *Transport system*, *Traffic Management*, and *Transport Infrastructure*.

Congestion is becoming a common experience in all the different parts of the city due to the lack of consistent concerted efforts from the various stakeholders. It is also in part a result of the numerous socio-economic factors whose combined effect is to increase the pull factor of the city of Addis Ababa and hence resulting in an ever increasing population that in turn makes the battle to curb the gap between the demand for an efficient urban transportation system and the city's ability for its provision, a seemingly perpetual one.

The public transport system, is one of such elements mentioned above, with regards to the urban transport systems, that can be a valuable area of focus in this battle against congestion with all its socio-economic implications in particular and urban mobility in general.

In light of the preceding scenario this paper henceforth will dwell upon shading some light into the existing realities of the public transport sector of the city of Addis Ababa

with a general objective of providing solutions and suggesting measures that should be taken to make it play a leading role toward *maximizing urban mobility*.

## 1.1.2 Addis Ababa City Profile

Addis Ababa, which is the capital city of Ethiopia, has an expanded area of over 540 sq. km and is situated at an altitude of about 2500 meters above sea level.<sup>1</sup> Administratively, the city is subdivided into 10 sub cities and 99 kebeles. Addis Ababa is also an unofficial capital city of Africa, largely due to the fact that it hosts various international organizations such as The African Union, United Nations and so on.

The transport network of Addis Ababa is characterized by poorly maintained roads, streets and sidewalks coupled with occupation of sidewalks by economic and human activities, subsequent use of vehicle lanes by pedestrians, for walking, mounting buses, and taxis. Overall the city transport system suffers from many inadequacies. Traffic on the roads is increasing while the major routes in the city are still few in number. The primary roads of the city include two east-west and north-south axial, a newly built ring road and a number of other roads.

Only a small proportion of roads and streets have hard paving or asphalt. Due to the topography and unplanned and uncontrolled growth of the city, certain areas of Addis Ababa are without coverage by transport network suitable for vehicular traffic. These include slums and shanty quarters but also blocks with permanent housing and other facilities. At the same time there are some streets and roads in the urban center built properly and with grandiosity. However, some of these roads do not actually have any useful links to the other existing road network and thus, carry only little traffic.

<sup>1</sup> Source - CSA (Central Statistics Agency)

The traffic in Addis Ababa in general, is characterized by features that are common to many metropolitan cities of the developing world. Some of these common features include:-

- Very high proportion of pedestrian trips
- Small number of cars compared to the population
- Relatively large number of medium size private taxis, pick-ups and mini buses mainly running on lines
- Relatively less number of buses running on lines.

Other more rare and peculiar features of traffic in Addis Ababa include

- Negligible number of bicycles and motorcycles
- Higher number of pack animals on certain routes and during times of the day
- 'Live' transport of meat, especially around special holidays
- Negligible/ small traffic volume in rail transport

Today the public transport system of the city of Addis Ababa which mainly consists of the city bus and shared taxi is facing significant challenges due to the following key and general problems:

- The continued spatial growth of the city horizontally or urban sprawl, is becoming a major cause for the increase of travel distances. This phenomenon discourages people from resorting to non-motorized transport modes such as walking and cycling and results in an increased demand for public transport.
- Furthermore the demand for public transport services in Addis Ababa is growing at a rapid rate due to the continued rise in population. This is apparent from the mismatch between the estimated growth of need and the reality i.e. the growth rate of transportation was estimated to show an increase of 45,000 trips per year. However, the current reality shows that the growth rate is 64,300 per year.<sup>2</sup> As car ownership has not gone up corresponding to the population growth rate, public transport operations end up having a dominant role in urban mobility.

Furthermore the limited growth of Addis Ababa City Bus enterprise (Anbessa), the only institution tasked with the cumbersome function of public mass transport, in comparison with the fast growing number of passengers continues to show huge disparities.

## **1.2 Objective**

### **1.2.1 The General objective**

- The main objective of the research is to investigate possible strategies and approaches that could enable the public transportation system to play a major role in creating safe, sustainable, and equitable urban mobility in the context of Addis Ababa.

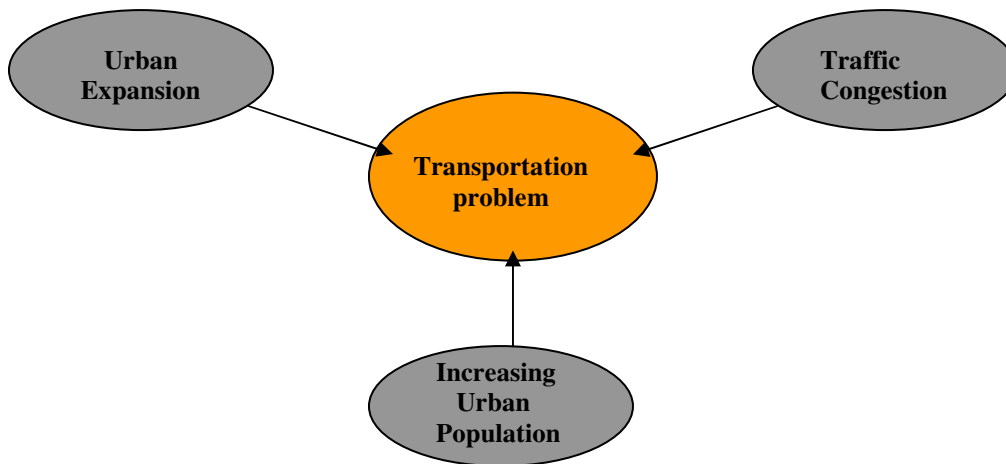
### **1.2.2 Specific objectives**

- Assess the existing transport system with special emphasis on mass transport.
- Study the problems of the system
- Study the relationship with other supporting systems such as the existing road network, the local development plans, traffic management, and the like...
- Examine the relevance of the public transportation system in alleviating the imbalance between our transportation systems as a whole and the ever growing urban population in the city of Addis Ababa.
- Come up with meaningful suggestions or solutions that can help make the public transportation system better and more efficient.

## 1.3 Research Questions

Urban mobility is an effect of various actors in an urban area such as spatial dimensions, road networks, traffic management system, socio-economic profile and transport system.

- The present study's main research question is therefore; what possible strategies and approaches do exist to enable the public transport system play a major role in mitigating the worsening level of congestion in Addis Ababa, which is an indication of the level of inefficiency of urban mobility?
- Where is the balance between the provision of an efficient transportation system, urban expansion, traffic congestion, and the high population growth rate of Addis Ababa?



- Why have the current efforts by the concerned institutions, such as building of new roads, increasing the number of automobiles rendering public transport services, tightening of traffic safety regulations and so on, not been able to curb the level of road congestion or decrease the average travel time?

## **1.5 Research Methodology**

### **1.5.1 Data Collection Technique**

This paper tries to demonstrate facts and findings by using (Data and information) primary and secondary sources. The secondary data was mostly obtained from such sources as published and unpublished documents collected from pertinent institutions as the City Bus Enterprise, Addis Ababa Roads Authority, Taxi Associations, Addis Ababa Traffic Police, Central Statistics Agency (CSA), different research papers studied by the former office for the Revision of Addis Ababa Master Plan (ORAAMP).

Surveys were made with subjects under varying circumstances such as taking bus rides, riding in mini bus taxis, waiting in line for a bus to come and the like. This is aimed at giving a glimpse of the public transport sector at work.

The survey was carried out with the help of data collectors that were given adequate briefings in order to enable them conduct their survey efficiently.

### **1.5.2 Case Study as a Research Strategy**

Even though this research could have been carried out with the help of secondary data alone, a case study (primary data) has been identified so as to be able to assess the socio economic aspects of the public transport sector. This was done with the help of semi-structured interviews with the subjects of the survey, questionnaires, in depth open ended interviews with the pertinent government officials, and personal observations that have been depicted both in terms of photographs and writings.

### **1.5.3 Sampling**

The case study covers a general assessment of mobility along the east-west axis (from “Tor Hailoch” to “Ayat”), which is one of the busiest and most congested routes in the city and also it can be the best axis to study because one can get different kinds spots like the main transit spot “Lagar’ which has a regional bus terminal at the same time the train station and also it is one of the major city bus terminal station. The other reason is that there is a study made by researchers on that street so that it is very easy to get information. The primary data for the analysis was obtained in three major ways:-

#### **1. Questionnaire surveys**

- These were conducted on subjects, five hundred in number (random), who rely on the public transport sector (the city bus and the shared taxi) along this line. Here special emphasis was given to the particular times of the day when the sample was taken, i.e. surveys were conducted both on and off peak hours. Furthermore deliberate focus was given to such major public transport transit areas as Lagar and Megenagna.
- The conditions under which this sample questionnaire was surveyed have varying characteristics. This was done in order to get a real feel of the public transport system in operation. To this end, samples were taken of subjects actually taking a ride on a bus, others waiting in line for one to come and still others hustling on early mornings to get aboard a taxi.

The questionnaire prepared to collect the primary data in general has three parts. The first part of this survey deals with the socio-economic characteristic of the subjects of the study. The designed data for this section of the questionnaire comprises of sex, occupation, average monthly income, household size, and average daily transport expenditure. The ultimate purpose of this data is to analyze the socio-economic status of the subjects in order to know the basic issues in play in the decision making with regards to choice of travel-mode.

The second part of the analysis deals with the travel behavior of the subjects, the design data used for this part includes, mode of public transport used, purpose of travel, average number of trips per day, origin and destination of trip and time of travel. With the help of this data, we will be able to see demand patterns of the public transport. Furthermore this data will help us in assessing the relationship between the frequency of trips and time of travel as compared to an individual's financial status. Such kind of data is of paramount importance in any proposals of intervention in this transport sector.

Lastly, a set of questions, which were aimed at getting a brief feedback about the current status of the public transport sector were forwarded to the subject of the survey. These include such instances, if any, whereby the service providers (city bus and the shared taxi) may have maltreated their customers or misbehaved in clear contradiction of the guidelines that exist, and suggestions about possible measures that should be taken.

## **2. On-site Traffic count/Observation**

Traffic count of the different modes of motorized urban transport that exist in the city of Addis Ababa was conducted at selected junctions along this axis. These junctions were selected based upon the degree of congestion observed especially at peak hours. Therefore based on the various observation sessions, which are depicted below with the help of pictures, four principal locations were pinpointed. These are “Megenagna”, “Urael”, “Stadium” and “Tor Hailoch”.

## **3. In depth Interviews**

The last and the third type of primary data were informal discussions made with taxi drivers and with people moving around the study area. This was aiming at knowing the attitudes and reflections of the average citizen on the functions of the Public transportation system, namely the city bus and the shared taxi as it exists now. This is aimed at providing the social context in which these transport modes operate.

### **1.5.4 Data Analysis**

After collection of the research data the analysis of the data and its interpretation will then follow. The analyses of the collected information from the different sources are organized into their representative categories so as to come up with logical results.

In dealing with the qualitative analysis based on the evidence collected from the different sources, an effort was made to carefully understand and interpret the information to use it together with the quantitative data.

## **1.6 Significance of the study**

This research document is of significant value in terms of the following aspects:-

- The outcome of this study will be able to assess the public transport sector of Addis Ababa from as many angles as possible. Hence the end result will give a comprehensive overview of the constraints as well as the potentials that this mode of transport offers.
- Secondly, the outcome of this research can also be used as a springboard for further studies in the urban transport area.
- This study will also be significant in terms of providing the necessary resource in light of the possibility of future urban transport intervention projects that might be proposed or even carried out.

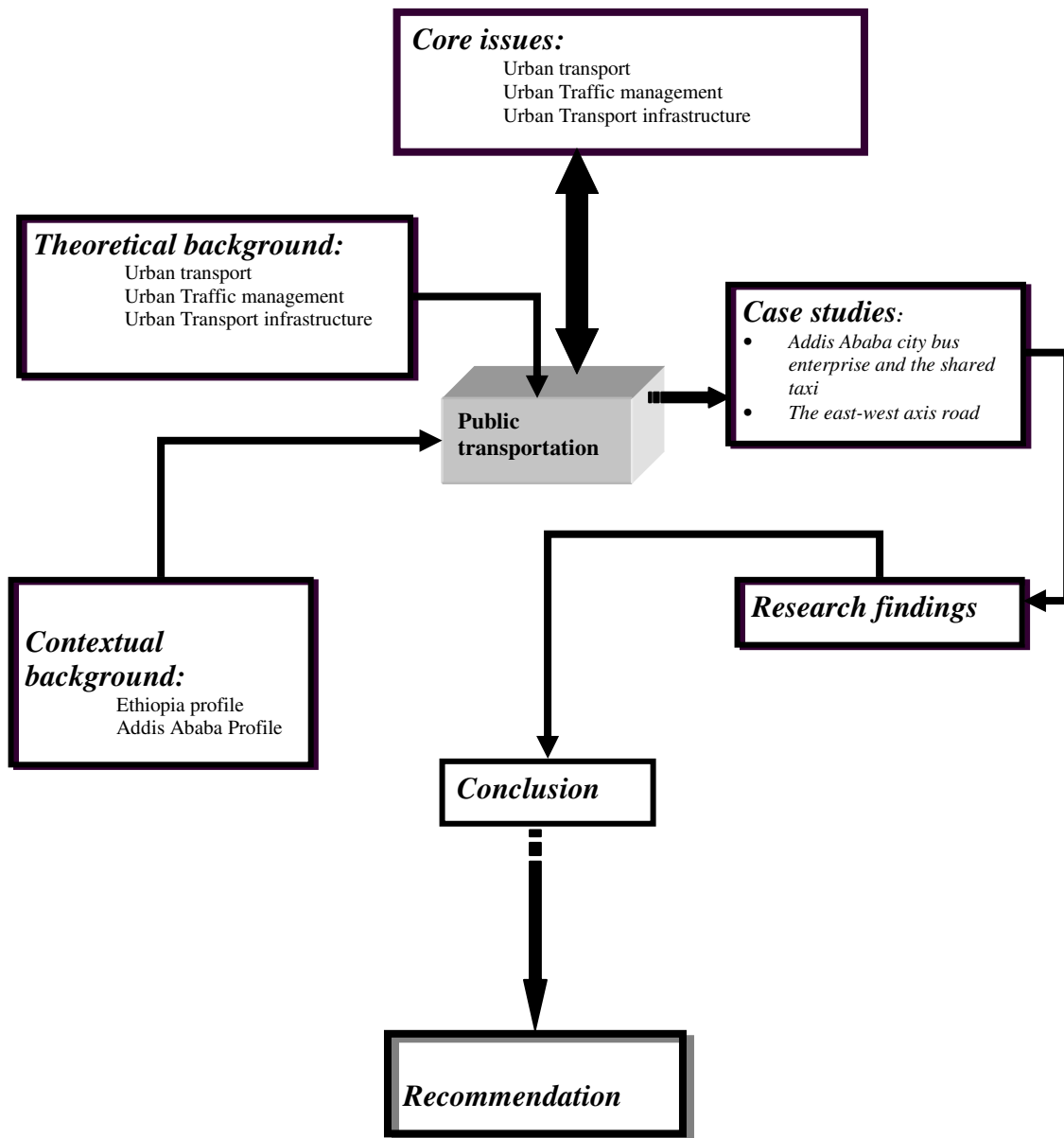
## **1.7 Scope of the Study**

The scope of this study is very much limited to the study of the role the public transportation system in urban mobility as it pertains to the city of Addis Ababa. Thus the paper will greatly dwell upon discussions about the two existing public transportation service operators that we have, these are The City Bus Enterprise and The Shared Taxi. In so doing the principal focus will be the discussion of their impact upon the East-West axis of the city as it exists now. However the paper will limit itself to suggesting recommendations that can make this sector function more efficiently.

## 1.8 Limitations of the Study

- Unwillingness of the subjects of the survey to disclose some important data such as financial income, family size and so on.
- Unavailability of up to date resources for and research and literature review
- Financial limitation

## 1.9 Structure of the Thesis



## 1.10 Organization of the thesis

This study has six main parts.

- The first part is the introductory section which depicts the existing characteristics of urban mobility in Addis Ababa. This part also includes the following subtopics, objective, methodology, scope and rationale of the study.
- In the second part of this study literature review of relevant topics, namely, transport systems, traffic management and transport infrastructure is presented from various sources.
- Part three gives the contextual background in general
- Part four gives the analysis of urban transport system in Addis Ababa in a detailed manner under the three subgroups that have been discussed in the literature review
- This is followed by the fifth part of the study which deals with the case study presentation. Even though the research could have solely relied on secondary data, this part was included so as to be able to get primary data about the social aspect of public transport and also enrich the research.
- The sixth part presents the findings of the study and conclusion.
- Finally, part seven puts forward recommendations.

# **Part two**

## **Literature Review**

## **2.0 Theoretical Framework**

### **Introduction**

Transport plays a vital role in the development of the modern era as an integral part of the socio-economic and political structure of the country. Thus urban transport, Transport infrastructure, and traffic management should involve optimal integration of the means and ways of mobility to create maximum ease and comfort maintaining the socio-economic and physical integration of the city.

It is well understood that the modernization and urbanization processes accelerate, the importance of this sector in providing accessibility and mobility reaches higher levels.

Transport is an integral part of human life. Proper transport link enable efficient frequency of services, flow of passengers and commodity on (Rail, Roads, Air, Water) mode of travel. Transport theory (or the law) stresses strongly that whatever the mode will be, it should primarily consider the human aspect (i.e. safety, livability, economy, satisfaction...etc.).[Peter Freeman & Christian Jamet, 1998] This gives every individual the right to choose the services that he/she desires.

Transport and the different modes have evolved through time to where now in the quest to accommodate the complex pattern of the world trade and globalization, its magnitude and efficiency in the distribution process is continuously being brought into effect by technological and operational improvement.

The urbanization process increases substantially the demand for urban services such as transport, on whose efficiency and availability, the successful and continued existence of urban society depends. It has played a great role in the transformation of the society and facilities modernization at large. By so doing it has changed the lifestyle of society from traditional to modern.

The level of motorization and cost of its accommodation directly correlates with trends in per capita income and the demand for urban transport is affected the city size and population.

The urban transport system should be modified and structured to contribute and operate within the principles and limitations of urban development planning by simultaneously considering and weighing several socioeconomic, spatial and other perspectives in the problem solving process. Hence, an efficient urban transport system can only be realized and sustainable through planning which responds adequately to movements requirements and offers guidelines for better and efficient use of investment serving as invaluable input for spatial development policy.

## 2.1 Definition of Key Terminology

**Transport** - a means of conveying people or goods from one place to another.

**Urban transport** - all types of means of transportation used in urban areas.

**Urban public /Mass/ transport** -Transportation by buses, trolley buses, and trams (not by cars) it includes mini-bus services in the current context.

**Traffic Control** - system of traffic engineering, employing prescribed traffic rules and regulations and devices such as signals, signs, and markings, to relieve vehicular congestion and air pollution, and to promote safety and pedestrian mobility, usually in heavily populated urban areas. In smaller towns, with lighter traffic, similar but simpler control devices and engineering techniques are used.

**Road** - public way, usually maintained by governmental authority, for the passage of vehicles, people, or animals. Roads in cities or towns are also called streets, lanes, avenues, or boulevards. Roads that connect populated areas to one another are often called motorways or highways.

**Terminals** - the places, where the customers get in touch with the city bus enterprise i.e. Anbessa. The way the terminals are managed, indirectly reflects, the importance the organization pays for customer information, customer service and quality of bus operations. The terminal is the ideal place, where all information regarding bus operations could be made available to passengers.

**City Bus** – the yellow bus which operate in the inner city of Addis Ababa

**Shared Taxi** – Mini buses (Blue taxis) which operate in the inner city of Addis Ababa

## 2.2 Urban Transport

“It is commonly accepted that cities are the engines of growth in most developing as well as developed countries. *More importantly, urban transport can be viewed as the oil that prevents this engine from seizing up.*”<sup>3</sup>

Transportation is also diverse. It is multi-sector and, as such, it needs to be fully integrated with other municipal sectors. New transport infrastructure must be part of a balanced urban development program including traffic demand management, public transport provision and supporting land use policies.

Economically, transport is an essential element of city development that, in turn, is a major source of national economic growth. ***Simply stated, poor transport inhibits growth.*** Furthermore, socially, transport is the means of accessibility to jobs, health education and social services essential to the welfare of the city residents. ***Deteriorating transport conditions affect all city residents;*** they impact particularly the poor through a decline in public transport service levels, increased length of the journey to work and other essential services and the negative impacts on environment, safety and security that the poor are least able to mitigate.<sup>4</sup>

"The urban sector in most developing countries accounts for at least 50 % of the gross national product and in some countries over 70 %. Cities in developing countries often devote 15% to 25% of their annual expenditures to their transport system and some times much more".<sup>5</sup>

<sup>3</sup> Project proposal for Addis Ababa Transport Sector, October 2002, ORAAMP

<sup>4</sup>\* World Bank, *Cities on the Move: A World Bank Urban Transport Strategy Review*, Draft Document October 17, 2001.

<sup>5</sup> Source - Mass Transport ORAAMP, Addis Ababa, Ethiopia

## **2.2.1 Urban Transport Problem**

Even though, urban transport plays a big role in maximizing the rate of mobility of an urban population, it also has its own problems which are being observed in most cities nowadays. The urban transportation problem is actually a complex bundle of inter related problems. These problems can be grouped into three major categories: congestion, mobility and other additional impacts.

### **A. Congestion**

Congestion causes increased costs for travelers and freight movement, loss of time, accidents, and psychological strain. [Alan Black 1995, p. 2] This is not simply congestion of transit vehicles during peak hours, congestion of pedestrian on sidewalks as well as congestion of bicycle e.g. (Holland).

Congestion is neither a new phenomenon nor a role effect of automobile. [Lewis Mumford 1991, p. 28] described the situation in ancient Rome.

“As soon as the increase of population is created a demand for wheeled traffic in Rome, the congestion became intolerable. One of Julius Caesar’s first act on seizing power was to ban wheeled traffic from the center of Rome during the day.... Just as motor car congestion now affects small towns as well as big ones, so the increase of animal-drawn vehicles impeded circulation everywhere. Hence Claudius extended Caesar’s prohibition to the municipalities of Italy; and Marcus Aurelius, still later, applied it without regard to their municipal status to every town in the Empire”

Congestion is what most people find objectionable about traveling in cities. It is the most common complaint. If there were no congestion, most people would be happy with their cars, and transportation would not be a widely discussed problem.

Congestion has several generic causes. [Alan Black 1995]

- The first is urbanization-the concentration of people and economic activities in urban areas.

- The second cause is specialization within cities. People want to travel between **different land uses, which are dispersed around the city. Workplaces are** concentrated in some areas, living places in other areas, and recreation activities in still others. But these activities are interdependent, and people must travel between them.
- The third cause is the problem of matching supply and demand temporally. Demand, however, varies greatly over the day; this is the *peaking problem*. It stems largely from the Journey to work and the practice of having most people start and end their workdays at about the same time.
- A fourth cause of congestion is that supply often creates demand. Increases in transportation capacity can be self-defeating. A new highway that seems spacious when it opens may fill up with traffic in a few years.

## **B. Mobility**

In a recent paper [Akinyemi 1998]; a new concept of mobility was introduced. It was shown that the level of mobility of a group of people is dependent on four main characteristics which are;

1. Traveling time budget of people
2. Availability of transportation modes or services to the people
3. The average speed at which the people can convey from one location to another by available modes.
4. The person carrying capacity of network of facilities.

It has also shown in Akinyemi (1997) that sustainable mobility requires, among other things, acceptable levels of environment impacts and costs of development and operation of transportation system etc. three main inferences can be made from these ideas.

The first inference is that sustainable mobility is significantly transportation supply-dependent. The better and more sustainable the supply characteristics of a transportation system, higher will be the level of mobility of peoples.

The second inference is that current levels of people mobility in many developing cities can be said to be low and unsustainable largely because of inadequate transportation

supply characteristics. The inadequacy of transportation supply in many countries manifests mainly through inadequate public transportation services, low productivity and level of rideability of facilities and high level of transportation related environmental impacts. For example, in many cities, it is difficult to move around by any mode of transportation without physically and/or mentally exhausted in the process. Thousands of people wait for hours at public transportation stops while public transportation vehicles are unable to get to them because they are stuck in queues on the roads. In addition, walkways are often non-existent or in very poor condition. In places where there are walkways, pedestrians are often forced to walk on the streets due to market and trading activities occurring on the walk ways. Traffic delays are ubiquitous and rides by any vehicle are uncomfortable, unsafe and expensive because of inadequate law enforcement and presence of large crevices on many roads. Furthermore, there is little or no classification of roads in general and inadequate distributor and access roads in particular in many cities. Also, based on the results of studies such as [TRRL 1998] the efficiencies of major roads in many cities seem to range between 5 to 25 percent.

The third inference is that sustainable mobility can be engineered. That is, mobility can be sustainably enhanced through appropriate design and management of the facilities and the services they provide.

In general mobility is one of the structural elements which influence the transformation of urban systems. Transport is discussed either as a spatial interaction or as a stage in the marketing process that bridges the gap between points of production and points of consumption. Transport plays probably the most important role in shaping the general structure and urban land use spaces and hence urban transport plays a crucial role in maximizing the degree of mobility.

### **C. Ancillary Impacts**

The ancillary impacts of a transportation system or the externalities make up the third aspect of transportation problem. These are:

Land Use (Urban sprawl), Energy consumption, Environmental impact, Land consumption, Aesthetics, Accidents, and Disruption of urban fabric. (A detailed explanation of these impacts is given under the section that studies, the social impact of public transport system)

### **Land use**

Fulfilling the resource requirements of a **growing population**, due to either migration or natural growth, ultimately requires some form of **land-use change or urban expansion (urban sprawl)** in order to provide for food, living space, recreation, infrastructure development and service provision. This in turn is easily manifested through the demand for an increased transport supply. However there has always been a major debate amongst land use and transport planners over which comes first, the development of land or the provision of transport. Does development follow the availability of road infrastructure and/or rail, bus or taxi transport or does intensified land use and development occur which results in the demand for improved transport. [J.D. Sampson1980]

### **Energy consumption**

Transport is a major and an increasing user of energy in modern society and road transport is responsible for a bulk of the energy consumed within the transport sector. D.A. Blacklegge [1994] identifies the combined effect of a number of factors that have contributed to increases road transport energy consumption as follows,

- Increases in the number of journeys resulting from the considerable growth in urban activities and dispersion of the population.
- Increases in private vehicle ownership.

## **2.2.2 Urban Transport Modes**

Urban transport is broadly categorized into motorized or non-motorized modes. The choice of a particular mode of urban transport depends on such factors as accessibility and ease of operation. Non-motorized modes include Animal drawn Mode, Walking

mode, and Bicycle. Whereas motorized modes includes Railways, Air plane, and Vehicular and Motor cycle.

## **2.2.3 Public Transport Mode**

### **The History of Public Transport**

#### **The Beginnings**

The first public transportation known to history was introduced by the Romans, who established a system of vehicles for hire during the reigns of Emperors Augustus and Tiberius [Alan Black 1995]. These two- or four-wheel wagons were stationed at inns every five or six miles along the fine highways for which the Romans were famous.

Coaches that ran on regular schedules between major towns appeared in Europe during the 16th century. Stagecoaches were introduced in the 17th century. However, most roads were poor, fares were high, and the service was slow and uncomfortable.

The first form of public transportation to operate solely within cities was the “*hackney carriage*”, the forerunner of the taxi, which appeared in Paris and London shortly after 1600. The name came from the French word “*haquenee*”, meaning a horse of fair size and quality used for riding, but not for war or hunting.

In 1662 the French philosopher-mathematician Blaise Pascal obtained a patent from the King and began a low-fare coach service on five fixed routes in Paris. Although successful at first, the service lasted less than 2 years. This was partly because Pascal died, at the age of 39, but also because hackneys offered competition and people in certain classes (e.g., soldiers and servants) were not allowed to ride the coaches. [Alan Black 1995]

As the 19th century opened, the average person walked to work. Cities were dense and compact; the geographical area of a city was largely limited to the radius of walking distance from the center. Some wealthy families lived on the outskirts and traveled by horseback or carriage, but horses were too expensive for common people to keep.

The modern era of urban mass transit began in 1819 with a coach line in Paris [Miller 1941]. It used an existing type of stagecoach called “*a diligence*”. The first transit service in the United States was started by Abraham Brower on Broadway in New York City in 1827. For this he designed a modified stagecoach seating 12 passengers, it was named “*the Accommodation*”. The second generation of this stagecoach had a different design: all the seats ran lengthwise, and there was a door at the rear with an iron stairway to the ground. This vehicle was named the “*Sociable*”.

## Development of Public Transport

### Omnibus

In 1825, a coach builder named George Shillibeer built specially designed coaches with large seating capacity for use in Paris. The vehicle was called *an omnibus*.

### Horse-Drawn Street Railway

A major advance came in the form of the horse-drawn street railway. The first one in the world was the New York & Harlem Railroad, which began service in 1832. The use of horses was first considered temporary, but the horses performed well and were never replaced by steam engines.



FIGURE 2-1 A horse car. (Source, Alan Black 1995)

### Cable Car

In this system, a cable is laid in a small trough between the rails and is kept in continuous motion by a steam engine located at the end of the line. A car is propelled by gripping

onto the cable with a metal arm that reaches down; the grip is released when the car brakes to a stop. The car itself has no motor. Besides a driver-conductor, each car carries a grip man, who must develop skills at the trade.



FIGURE 2-2 A San Francisco cable car. San Francisco was the first city with cable cars. (Source, Alan Black 1995)

### **Electric Streetcar**

The streetcar-also called the electric railway, trolley, or tram-was the next and most important innovation.



FIGURE 2-3 An early streetcar. (Source, Alan Black 1995)

### **The Steam Railroads**

The 19th century also witnessed the development of steam railroads. The first intercity railroad service began in 1830 between Liverpool and Manchester in England. This inaugurated a century in which steel wheels on steel rails became the dominant form of

intercity transportation. The railroad industry formed a major part of the economy, much as the automotive industry does now.

### **Subway and Elevated Systems**

Several attempts were made to introduce steam trains into the heart of cities. The first Subway in the world, 3.7 miles long, opened in London on January 10, 1863 [Bobrick 1981]. The trains were pulled by steam locomotives, and while special efforts were made to expel the smoke, ventilation remained a major problem. The line was popularly called “the sewer railway”. However, it continued to operate for many years and eventually was electrified.

### **Arrival of the Motor Vehicle**

The forerunner of the private motor vehicle was the road locomotive or steam carriage. This was a steam engine on wheels-something like a railroad locomotive, but with flat-surfaced wheels to run on highways.

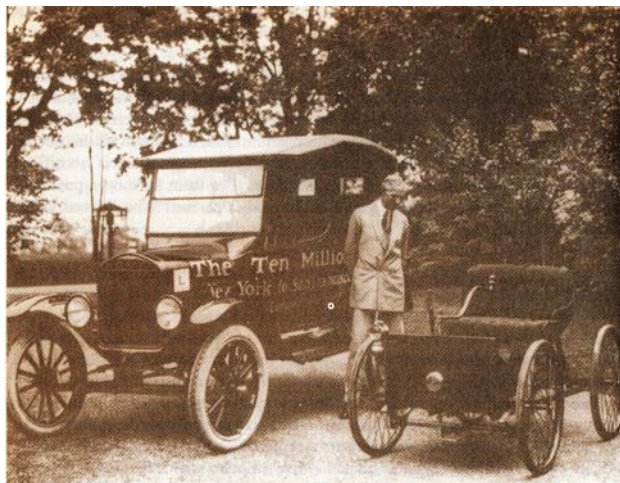


FIGURE 2-4 Early automobiles. (Source, Alan Black 1995)

The automobile was soon accompanied by the truck, the tractor and the bus. The first motor bus service in the world began in London in 1899 and by 1911 the London General Omnibus company had completely replaced horse-drawn omnibus with motor buses [Miller 1941]. Because of the narrow streets, double-decker buses were designed to increase seating capacity.



*FIGURE 2-5* A double-decker bus. (Source, Alan Black 1995)

Early buses ran on gasoline, but its high price in Europe led to experimentation with the engine invented by the German Rudolf Diesel back in the 1890s.

### **General Observations**

The pace of transit-related inventions during the 19th century was very rapid. In 75 years most western countries went from the horse-drawn omnibus to the motor bus and electric subway trains. All the major technologies were developed by 1900[Alan Black 1995]. In the last century, there have been incremental improvements but no breakthroughs comparable in impact to those of the 19th century.

The dissemination of innovations and the construction of facilities also happened very rapidly. When a new technology such as the cable car or electric streetcar was proved viable in one city, it spread like the proverbial wildfire to other cities. Almost all the street railways in these countries switched from animals to electricity within a dozen years.

**It is significant that major improvements in the technology of building construction occurred while mass transit was the primary mode of urban travel.** Elisha Otis perfected the elevator in 1852; without this, tall buildings would have been impractical. The first steel-frame skyscraper was erected in Chicago in 1885. A wave of skyscraper construction followed, and heights rose higher and higher.

*“Tall buildings and high densities were compatible with mass transit. Transit made it possible to bring many thousands of workers into the city center in a short time each day, which could not have happened if people were still walking to work. On the other hand, the dense city centers created a market for transit that was attractive to entrepreneurs.”<sup>6</sup>*

## **2.2.4 General Natures of Modern public transport:**

Various studies have classified Modern public transport in to four general categories based on their nature of operation [Dandena Tuffa &Tsegaye Girmay 2001]. These are

1. Buses and trolley buses: - operate on public streets in either mixed traffic or bus only lanes or exclusive bus ways. They employ engines that use fuel and or electric energy. Electric buses usually run with the help of cables that are mounted on electric poles which run along the whole line.
2. Light rail transit Trains: - operate in mixed traffic along public streets to semi-metro rail systems on exclusive trucks.
3. Rapid rail transit (Metro, subways or underground): - operates on exclusively right-of-ways at high speed and high capacity passengers’ board from high-level platform to facilitate rapid loading.
4. Sub-urban rail transit (Commuter rail system): - operates on trucks shared with inter-city passenger crews and freight.

Urban Mass Transport systems can also be classified based on the line system they employ [Dandena Tuffa &Tsegaye Girmay 2001].

- On-street systems: buses; trolley-buses; trams.
- Mixed on-street and off-street systems: bus lanes; bus ways; light rail.
- Off - street systems: metros; commuter-rail.

## **Comparison of Public Transport Modes**

### **1. City - Bus Service**

- Advantages:
  - Can be used on the existing streets
  - Low cost of investment (initial)

6 Alan Black, Urban Mass Transportation Planning, 1995

- Flexibility in use on steep streets.
- Accustomed technology (easy to maintain, operate, etc.)
- Affordability
- Environmentally friendly, in the case of electric bus.
- Disadvantages:
  - Pollution and excessive noise
  - Long waiting time where there is no only bus lane
  - Moves fewer travelers (in comparison to light rail transit)

## **2. Light Rail Transit**

- Advantages:
  - In most case, the existing rail line can be utilized.
  - Consumes less energy than buses
  - Can move more people
  - Emits less pollution
  - Reduces congestion on the street
- Disadvantages:
  - Inflexibility (existence of line and slope to be crossed)
  - Expensive truck maintenance
  - High initial cost (construction of line, demolitions)
  - Users should change mode of transport beyond the end of the line.

## **3. Trolley-Bus**

- Advantages:
  - Environmentally friendly
  - Can move more people
  - Cheaper operation cost than normal buses
  - Reduces traffic congestion on streets.
- Disadvantages:
  - Very high initial cost
  - Relatively high electric consumption
  - Doesn't provide flexibility

- Maintenance and power distribution needs skill.
- Needs heavy subsidy

*Table 2.1 Comparison of Public Transport Modes*

	Bus	Articulated bus	Trolleybus	Tramway
Length (m)	12	18	12 to 18	30 to 60
Width (m)	2.5			2.4 to 2.65
Capacity/vehicle (pass)	70 to 150	115 to 200	70 to 200	200 to 500
System frequency	3 minutes			2 minutes
System capacity (passengers/hour/way)	1400 to 3000	2300 to 4000	1400 to 4000	6000 to 15000
Maximum speed	70 km/h			80 km/h
Commercial speed	12 to 20 km/h			18 to 25 km/h
power	Thermal engine		electricity	
Maximum gradient	13%			7 to 10%
Minimum turning radius	12 m			25 m
Investment cost	Between 20 to 50 MB/km		40 to 80 MB/km	70 to 150 MB/km
Operation cost	~ 15 B/km	~ 18 B/km	~ 15 to 20 B/km	~ 30 B/km
Main benefits	<ul style="list-style-type: none"> <li>- low capital cost</li> <li>- flexibility of routes</li> <li>- existing workshop</li> </ul>		<ul style="list-style-type: none"> <li>- medium capital cost</li> <li>- no pollution</li> <li>- more comfortable system</li> </ul>	<ul style="list-style-type: none"> <li>- high capacity</li> <li>- modular design</li> <li>- accessibility</li> <li>- dedicated lanes</li> <li>- comfortable system</li> </ul>
Main drawbacks	<ul style="list-style-type: none"> <li>- low capacity</li> <li>- air pollution</li> <li>- lack of comfort</li> <li>- limited accessibility</li> </ul>		<ul style="list-style-type: none"> <li>- low capacity</li> <li>- limited accessibility</li> </ul>	<ul style="list-style-type: none"> <li>- high capital cost</li> <li>- inflexibility of rail based system</li> <li>- new depot and workshop</li> </ul>

*(Source- comments about prospective mass transport system)*

*SEMALY-Greater LYON- Town planning agency LYON*

## 2.2.5 Public Transport in the Socio-Economic Context

### Introduction

The need for an understanding of the factors affecting demand, and hence the research necessary to gain such understanding, depend upon the social and economic context in which public transport providers operate. This section discusses the characteristics, policies, roles and resultant objectives of public transport, and the associated criteria for making decisions about resource allocation.

## The Decision-Making Context

In relation to the allocation of resources for public transport within the general economy it is possible, in theory at least, to identify three levels of decision making: [Report of the international collaboration study of the factors affecting public transport patronage UK, 1980]

- Resources to the transport sector versus non-transport components of public-sector expenditure, e.g. health, housing etc.
- Resources within the transport sector: public transport versus private transport.
- Resource allocation within public transport.

Within the hierarchy suggested above, decisions at level (i) tend to be taken on purely political grounds because of the immense problems associated with trying to quantify and relate the multiple and differential objectives. Theoretically a social benefit/ cost framework <sup>7</sup> could be applied to such allocation problems, but because it would involve compressing a complex set of objectives and sensitive political judgments into a single measure (money) it would inevitably be restrictive and inadequate for decision making at this level.

## The Characteristics and Role of Public Transport

“However large-scale the operation of a public transport organization may be, the economic realities dictate that the services can never be instantly available at all times of day and night, can never be so comprehensive as to cover every road and street within the area and never so easy to use as to remove all physical, mental and psychological strain from travel.” <sup>8</sup>*Travel by public transport is necessarily subject to constraints in time, space, money and effort*, since people are restricted to traveling at certain times and to certain places only.

<sup>7</sup> This would involve setting monetary values on all the benefits to be obtained from a given expenditure of resources, and on the costs involved, and then using the benefit/cost comparison to see whether the investment were worthwhile. Of course, many of the benefits (and some of the costs) would lie in broad social aspects to which it would be extremely difficult to apply meaningful monetary values

<sup>8</sup> The demand for public transport, Published by the Transport and road research laboratory, U K 1980

The conflict between the needs of travelers and the costs of satisfying these demands leads to a divergence of views with regard to the role which public transport should play.

- At one end of this spectrum, public transport is expected to 'pay its way' with the services being provided in the most cost-effective way possible and paid for entirely by passenger revenues,
- While at the other end public transport is regarded as a social service to be funded largely from public monies so that users pay much less than the true costs, and those with a special need (the old, the infirm, children, those in remote areas, those with no car available) are treated even more benevolently.
- A role of a rather different nature is the use of public transport to further objectives which are only indirectly connected with public transport travel; these are mainly concerned with problems of the environment such as air pollution, visual intrusion, noise and congestion and urban form which rely on travelers switching from private transport to public transport for their achievement.

### **Objectives of Transport Policy**

**“Good public transport implies that the complete journey between home and work, home and school etc. is good. A good public transport must also be ‘appropriate’ to the income level of the city and its inhabitants”<sup>9</sup>**

Public transport is the lubricant which allows the city to function properly [Allport 1995]. As such it is obvious that a workable policy in this area can have a profound influence.

The preceding section has suggested that the roles which public transport is expected to fill are so various and complex that no single goal can be defined for it, even in a given situation. These roles overlap considerably, and may even conflict, but the many aspects involved can be divided into the four main categories listed below. [Allport 1995 & Report of the international collaboration study of the factors affecting public transport patronage UK, 1980]

<sup>9</sup> R..J. Allport, *Creating civilized cities - the role of mass transit policy*

### **Social and Equity Considerations**

It is obvious that some people are able to travel about more easily than others. These differences in mobility between sections of society are, in practice, largely a reflection of differences in the availability of the private car. This may well result from a number of factors, but the most important one by far is income. Lower income groups without the use of a private car in areas with poor public transport provision are obviously disadvantaged to a considerable degree, but even where the public transport services are very good, the cost can act as a strong deterrent to their use by low income groups.

Indicators which reflect the ease or otherwise with which people can travel to a range of attractions can be used to test the adequacy or otherwise of the transport facilities and services of an area. It is important therefore, to distinguish between the observed travel patterns and the underlying 'need' which individuals have for travel. On the other hand the 'need for travel' is a difficult item to quantify since needs and expectations are inevitably shaped by the existing possibilities, and so some 'needs' are more 'necessary' than others. [Report of the international collaboration study of the factors affecting public transport patronage UK, 1980]

### **Environmental Considerations**

There has been an increasing awareness in recent years of the potential environmental impacts of transport policy. Undesirable environmental impacts are not confined to just certain areas of the country nor are they due solely to particular types of transport: almost all modes can be detrimental to the environment in certain locations. Pollution, for example, is a more serious problem in urban areas than in rural areas and is produced more by road traffic.

### **Safety Considerations**

There is no doubt that if people traveled by public transport instead of by private car the number of accidents would diminish, but care is needed when assessing the safety implications of different transport policies because in many cases where public transport

has increased its share of the market, it has done so at the expense of the walk mode, often involving a shift in destination, so that for example, a short walk trip is converted to a longer bus trip, rather than the car mode. [Report of the international collaboration study of the factors affecting public transport patronage UK, 1980]

### **Efficiency Considerations**

In situations where there is a high concentration of demand for travel both in space and time, there are likely to be strong economic advantages from public transport compared with private transport.

Efficiency in terms of resources used to transport a given number of people can be considered under four headings: *Land use, Energy efficiency, Manpower efficiency, Total use of resources*. [Report of the international collaboration study of the factors affecting public transport patronage UK, 1980]

- **Land Use**

Buses are very efficient in terms of land use because they almost always use roads which would be required for access and/or for through traffic and rarely require extra space. This is not the case for car travel especially in major cities. Furthermore, because public transport has a high passenger-carrying capacity and requires very little space, *it allows a much higher concentration of activities to take place in areas where this is advantageous, for example in the Central Business District*, and hence permits higher land-use densities than would be possible if all or most travel was done by private car.

- **Energy Efficiency**

In most situations public transport, with a reasonably high utilization of capacity, results in lower energy consumption per trip than private transport. Differences in energy price and taxation between countries may alter the actual monetary cost per trip by the different modes and this may be an important consideration, as also may be the form of the energy used, particularly in countries where one type of energy is in much greater abundance than other types, for example, hydroelectricity versus oil. Another aspect which should be considered is the

directness of travel; car travel on the whole takes the most direct route, bus travel coming in next.

- **Manpower Efficiency**

While public transport is normally reasonably efficient in terms of land and energy, it in general relies on a relatively intense use of man power. High labor intensity of bus operation and increasing real rates of pay have resulted in substantial increase in the staff employed by the public transport providers. On the other hand, a large amount of manpower is devoted to the professional maintenance and repair of private vehicles so that, in the wider picture, the manpower efficiency aspect becomes less clear.

- **Total use of Resources**

If all these resources, land use, energy, manpower and the other resources consumed in the provision and operation of the total transport system are considered together in a comparison of the total resource efficiency of alternative transport systems, *it seems clear that high levels of public transport provision can achieve an overall efficiency advantage in areas where there is a concentrated travel demand in time and particularly in space.* In such areas the unrestrained use of private cars would not be possible for reasons of space and cost.

## **Resource Allocation With in the Transport Sector**

It can be seen therefore that questions of resource allocation within the transport sector, between public and private provision, hinge in very general terms around:- [Report of the international collaboration study of the factors affecting public transport patronage UK, 1980]

- Firstly, the efficiency arguments favoring public transport in areas of concentrated travel demand;
- Secondly, the environmental objectives which are particularly important for large cities and historic towns;

- Thirdly, social objectives in relation to the provision of public transport for those who can not afford private means of transport, which will be especially important in areas where the efficiency benefits of public transport either do not apply or are not overriding.
- Fourthly, safety considerations

Thus, any comprehensive comparison of the performance of public and private transport, or of different public transport modes, is faced with the difficulty of comparing quite contrasting aspects. For example consideration of the efficiency of public and private modes, purely in terms of their direct transport effects, would have to compare the faster private car which saves travel time but is more expensive to operate against the slower public transit mode which is cheaper but involves its users in spending more travel time.

In principle it is possible to treat other costs and benefits of transport in similar fashion so that the advantages and disadvantages of different modes in terms of the various social, environmental and safety effects could all be estimated in terms of money, though as has already been noted above there are severe practical difficulties in attempting to do so.

Thus, considerations of this sort may justify the provision of subsidy to public transport, but unless the various factors can be quantified there is still no answer to the question of how much subsidy should be provided to achieve the transport system which offers maximum benefit to the whole community. In an attempt to overcome some of the difficulties inherent in costing the more indirect social and environmental effects, and so producing a single monetary measure which can be used in a social cost/ benefit analysis (CBA), there have been attempts to develop multiple goal objective functions that rank non-monetary objectives, such as environmental quality and income redistribution effects, in parallel with the direct transport effects.

## Operational Criteria for Public Transport

The general guidelines under which most public transport providers operate are broad in terms of their objectives. These objectives are often couched in very general 'social' terms, such as 'the provision of public transport facilities to meet the needs of the community'. There is hence the need to translate such overall aims into quantifiable criteria in order to determine optimal allocation of resources within the public transport operation. A range of possible operating criteria is identified below:- [Report of the international collaboration study of the factors affecting public transport patronage UK, 1980]

- Profit maximization
- Use of standards, covering e.g. access to the public transport network, or frequency of service
- Maximization subject to constraints
  - Turnover maximization with a budget constraint
  - Maximization of the benefits to public transport travelers, within a budget constraint. Technically, this corresponds to maximizing 'consumer surplus' i.e. the difference between the amount the traveler is prepared to spend in time and money (and effort) and the amount he actually has to spend in order to travel.
  - 'Social surplus' maximization within a budget constraint (i.e. maximizing the benefits to society )
  - Demand or output maximization, e.g. the maximization of passenger-kms or journeys or vehicle-kms (or journeys) within a budget constraint.

Of these criteria, simple profit maximization is almost completely inappropriate for most public transport operations, because of the increasing importance of social objectives. It would be irrational to treat support payments from Government, regional and local authority funds simply as revenue and to run the operation on strictly commercial lines, because the justification for the subsidy would depend on the extent to which the services provided met the non commercial objectives.

The use of 'standards', on the other hand, has much to commend it. It is a relatively simple and understandable system to operate, although it tends to be insensitive both to differential needs and potential marketing opportunities. Despite these limitations, however, the sheer simplicity of the method has meant that it has become the most common type of criterion applied in practice to public transport operations.

### **Concluding Remarks**

Allocating funds between public and private transport is concerned mainly with social and equity considerations, the environment, safety and efficiency. There is no doubt that the increasing use of the private car has tended to widen the gap between higher and lower income groups as far as the ability to choose where to live, work, shop and socialize is concerned. With regard to environmental and safety considerations, a switch from private to public transport would be generally beneficial. When all these factors are taken into account it is no doubt desirable, in order to obtain the best possible transportation system from the whole community's point of view, to shift the balance between private and public transport in favor of the latter.

Hence the subsidizing of public transport is an almost universally accepted viable best solution which would ensure that the commercial objectives in running public transport systems are increasingly giving way to social objectives.

Of the many ways of running public transport, the profit-making which was the major incentive in the past is becoming inappropriate in most situations these days when public transport objectives contain such a high social content.

### **2.2.6 Urban Transportation Planning**

The three important variables that must be quantified before any form of solution can be found while entertaining issues of urban transportation planning are: [New town planning and principles]

1. Desired level of usage of vehicles,

2. Standard of desired environment, and
3. Cost of improving the environment by changing existing physical patterns. The solution is largely to be found in the unification of the new separated functions of the road engineer and planner-architect, as well as 'administrative split-mindedness.'

## **Planning Transportation Systems**

Transportation networks are compromises between planners' ideals and complex reality. Transportation has always been dictated by such factors as economics, dynamics, social intensity, physical constraints, financial resources, and political desires. Thus planning transportation systems should be a result of the contribution of team experts before final formulation of network. Although concerned professionals such as economists and sociologists may play an important role in forwarding the alternative assumptions in light of the future developments, a final plan should include flexibility alternatives and adaptability to future changes. Generally the following steps should normally be considered in the planning process of transportation systems.

1. Define goals and objectives
2. Study the site and region.
3. Collect data and survey.
  - A. physical aspects
    - (1) Land suitability
    - 2) Soil hazards and limitations
    - (3) Availability of quarries and building materials.
    - (4) Projected land use information and scheme
  - B. social and economic aspects
    - (1) Existing and expected travel behavior of the population
    - (2) Trends of income
    - (3) Potential development traits
4. Plan preparations
  - A. pedestrians
  - B. highways and streets

- C. town traffic center
- D. local and regional transportation centers
- E. setting in regional network

## **Public Transport Network**

A network is a kind of graph, which is a geometric figure made up of points and lines. In practical applications, the points and lines are always interconnected. Each line has a point at each end, and several lines may meet at a single point. Transportation planners usually refer to a point as a node and to a line as a link. A network is defined as a graph in which there is some sort of flow. [Alan Black 1995]

A transit network resembles the route map that a transit operator publishes. The links represent segments of transit routes. For a rail line, a link is a section of track; for a bus route, it is a street on which buses run.

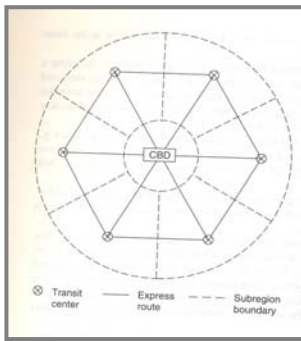
## **Bus Network**

In most small cities, bus routes are radials converging on the CBD. In medium-size and large cities, the bus networks are larger and more complex and may not resemble any simple pattern. Most routes follow major streets, so the network resembles the street pattern. [Alan Black 1995]

In cities where radial streets are prominent, the busiest routes are radials.

Real bus networks differ from any ideal pattern. There may be irregular streets, topographical constraints, or barriers such as freeways and railroad tracks. Further, routes are adjusted according to demand. *In low-density areas where most households have automobiles, routes are spaced farther apart than in high-density areas that generate more transit riders. Socioeconomic characteristics of the residents also play a part.*

*Low-income communities may be served by numerous routes, while wealthy areas have little service*

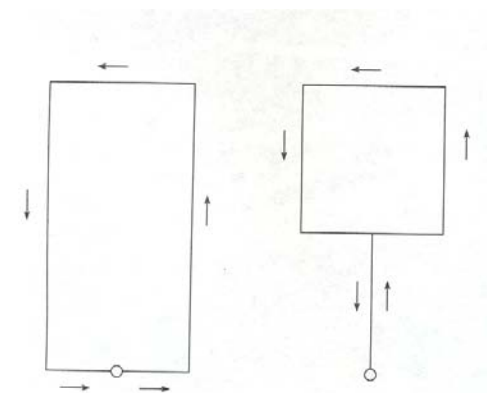


The region is divided into sub regions, as indicated by the broken lines. The central one contains the central business district (CBD) and has conventional service. Each of the others has a transit center where buses circulating within the sub region (not shown) terminate. Express buses run between each transit center and the CBD. There is also circumferential express service connecting the transit centers. (Source, Alan Black 1995)

**Figure 2.6 - The transit center system for buses**

### Designing a Single Route

Bus routes should follow arterial streets as much as possible and avoid minor streets. Arterial streets are wide enough for buses which are otherwise difficult to maneuver and have higher average speeds because of traffic engineering measures designed to increase flow. Side streets are more likely to be blocked by parked vehicles or children playing. Arterials are more likely to be lined with buildings that have high trip generation. Ideally a bus route should be straight and direct. This is easier for people to understand, and usually it provides a faster trip from end to end. [Alan Black 1995]



In a cycle route (on the left), buses travel in one direction around the entire loop. In a balloon route (on the right), buses follow a one-way loop on the outer portion of the route, while two-way service is provided on the rest of the route. (Source, Alan Black 1995)

**Figure 2.7 - Cycle and Balloon routing.**

### Spacing of Routes

In a radial city with radial bus transit routes in which population density varies with distance from the center, the following relationship is observed: when the total amount of service is held constant, wide spacing between routes leads to

- Lower construction cost, because fewer routes are built;
- More frequent service on each route and hence less waiting time; and
- Greater access distance to the routes which is an important factor if most people walk.

The opposite results hold: Close spacing between routes means greater construction cost, less frequent service on each route, and shorter access distance. [Alan Black 1995]

### **Spacing of Stops**

The spacing of stops largely determines the average operating speed on a line, which affects the quality of service perceived by travelers. The maximum speed of the vehicles is only secondary. In deciding on the number of stops on a line, it is important to realize that each stop causes time losses for

- braking to a stop,
- unloading and loading passengers, and
- Accelerating back to running speed.

There is a certain spacing of stops that will minimize travel time for passengers. As stops come closer together, each person walks less distance to a stop. At the same time, average speed of the transit vehicles declines and the ride takes longer. Feder [1973] found that the optimal spacing between bus stops should be 0.5 mile. Typical bus routes have 6 to 10 scheduled stops per mile but they stop only on demand. [Alan Black 1995]

## **2.3 Traffic Management**

### **2.3.1 Traffic Management in Public Transport**

An increasingly important task in traffic management is the improvement of public transport services. *A primary objective of current transportation planning strategy is to encourage more public transport use, and this can be achieved by restraint of personal vehicles and better service levels of public transport.* It is necessary not only to improve services but also to provide additional facilities for travelers transferred or restrained, from the use of other modes if the viability of an area is to be safeguarded. Once the specific objectives of the transport plan have been derived, for the respective areas in terms of movement requirements, standard traffic study methods are applied to a number of case studies. These include the location of potential transport interchanges on bus and rail systems and *the siting and size of appropriate car parks.* Estimates of existing and

future traffic are required to determine *generated and diverted traffic*. Because *catchment areas* are likely to be changed, and route patterns affected, particularly for the remaining car drivers, schemes must be carefully assessed for environmental consequences before making changes to the road network. In most cities and towns, the principal public mode is the bus and most of the improvements will be directed towards improving their priority over other vehicles.

### 2.3.2 Traffic Control

The primary emphasis of traffic control is on the safe and efficient flow of vehicles over urban streets and highways. The means of promoting this can vary from simple improvement of local streets by installing **traffic signs and road markings** to constructing comprehensive motorway control systems. Such comprehensive systems use access-road meters to monitor and control motorway access; closed-circuit television surveillance to detect quickly any deterioration in traffic flow; and emergency services to provide aid in case of accident and injury.

Other traffic-control techniques include the use of one-way streets, enforcement of traffic flow regulations, **channelization** (building traffic islands, turning lanes and so on), and the use of traffic signals.

**Traffic signs** and road markings follow a uniform practice throughout the world and are designed to convey information with a minimum of words to avoid confusing drivers unfamiliar with the area and the language. Uniform pictorial signs and markings have been adopted throughout Europe and the United States. They include uniform sign formats and sizes, and uniform codes regulating traffic flow.

**Traffic signals** are installed to permit safe movement of vehicles and pedestrians at busy intersections. In recent years, greater attention has been paid to the efficient movement of public-transport vehicles and the sharing of cars. These aims are being accomplished in several ways. Specially *marked traffic lanes may be reserved for buses* and, in some cities, for cars with more than one occupant; city-centre streets may be reserved exclusively for buses; certain types of vehicle may be given priority access to motorways;

and traffic-signal systems that detect and favor buses may be employed. The overall use of highways may be restrained by road pricing, in the interests of reduced air pollution and congestion.

## **2.4 Transport Infrastructure**

As a general rule, the optimum urban transport system and the road network should involve the efficient integration of the means and ways of mobility to create ease and comfort so as to maintain local, regional and international interactions.

Accordingly, urban road classification depends on the character of services they provide. The role that road network plays in providing access to property and travel mobility is the major part of traffic management.

Efficient urban road network classification is derived from blood circulation patterns of living organism.<sup>9</sup>The patterns are hierarchically divided into main roads, secondary roads and tertiary roads. Equally important intersections are in urban road network because of their effect on the movement and safety of vehicular traffic flow. In the planning process of road network system and the overall nature of mobility and accessibility, planners should take environmental dimensions as well into consideration.

Transport infrastructure has negative economic, spatial, social, environmental impacts such as (Air pollution, community displacement) etc. The generation of ancillary impacts, positive and negative, by the provision of transport facilities and by their use is another argument put forward to support public supply of only selected infrastructure facilities.

Lastly, there is an argument of equity which essentially implies that spatial mobility, provided by infrastructure facilities, is a merit that should be provided at a minimum level to all citizens, irrespective of their ability to pay for it. Hence the need for the government's involvement in the provision of transport infrastructure is indispensable.

<sup>9</sup> Mathewos Asfaw, *Urban Mobility; Challenges and Prospects*, (Nov., 1999)

# **Part Three**

## **Contextual Background**

### **Overview of the Urban Transportation**

#### **System**

#### **In**

#### **Addis Ababa**

### **3.1 Introduction**

### 3.1.1 Background

#### Ethiopia profile

Ethiopia, is a large size country, located in the eastern part of Africa b/n latitude 30-50N and longitude 330-480E. The geographic area extends over 1.25 million sq. km. The country includes 11 regions. The population size is estimated to be 71.07million (2004) and estimated to reach 129 million by 2030. The population is growing at a rate of 2.92 per annum. The urbanization level is low at 15.76%. There is unequal distribution of population. Ethiopia is a low-income country with nearly 90% of the population.

Agriculture is the main economic base contributing 45-50%of the country's GDP, providing 80% of employment and accounting for 85% of export. The contribution of industries is low at 12%. (Source- Consultancy Engineering Services (India) Private Limited in association with Saba Engineering (March 2005) Urban Transport Study and Preparation of Pilot Project for Addis Ababa Findings report, Volume I)

Roads are the most important component of Ethiopia's transport system. Their availability is low at 16,609km of all-weather and 14,480 km of rural roads. The condition of the roads is poor. The total number of vehicles on road is about 183,159 (Source-Addis Ababa Transport Authority) of which nearly 77% are in the city of Addis Ababa.

#### Addis Ababa profile

Addis Ababa, the 'New Flower' of the nation, founded by emperor Menilik II in 1887, is the administrative, political, economic and cultural capital city of Ethiopia which is located in the heart of the country. It has an area of 540km<sup>2</sup> of which 18 km<sup>2</sup> are rural. The largest vacant lands are located in the eastern and south-eastern parts. In addition, there are scarcely populated mountain ranges in the north and in the west. The city is dominated by 3,000 meters high Entoto Mountains to the north. **Addis Ababa is cut by a number of rivers flowing generally from north to south**, all of them being tributaries of Great Akaki River or Little Akaki River flowing to Aba Samuel Lake just outside the southern border of the metropolitan area.

Addis Ababa depends on its transportation system for its existence. The system permits people to reach work, school, health and social services, shopping, recreational, cultural

and sports events, visit friends and family. It allows employers to access a supply of labor, and goods to be sent and received in the course of domestic and international trade.

### 3.1.2 Addis Ababa City Development Plan

Previously, there have been two Master Plans that were prepared for Addis Ababa so as to guide and regulate its growth. The first Master Plan was prepared in 1984, later on a Comprehensive Development Plan (CDP), as the second Master Plan, was prepared in 1994 with a perspective up to the year 2010. Presently the period of the second Master Plan has been extended up to 2020. **Transport was an important component of this CDP.** It envisioned for the residents of the city to have access to **‘affordable transport, enhanced access and mobility’**.

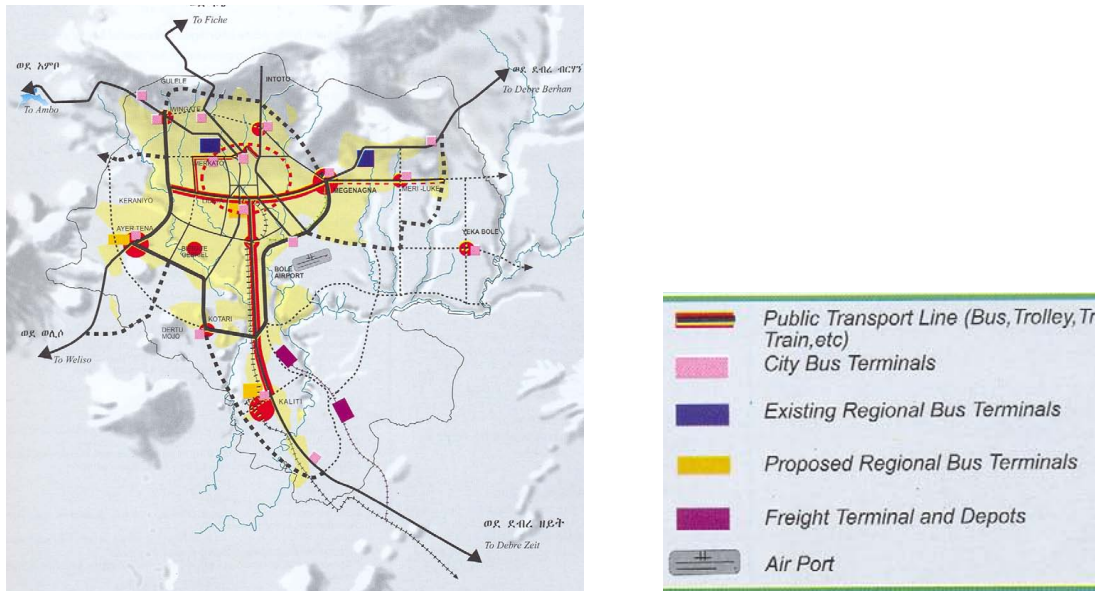


Figure3.1 - Transport Systems and Terminals

### 3.1.3 Population

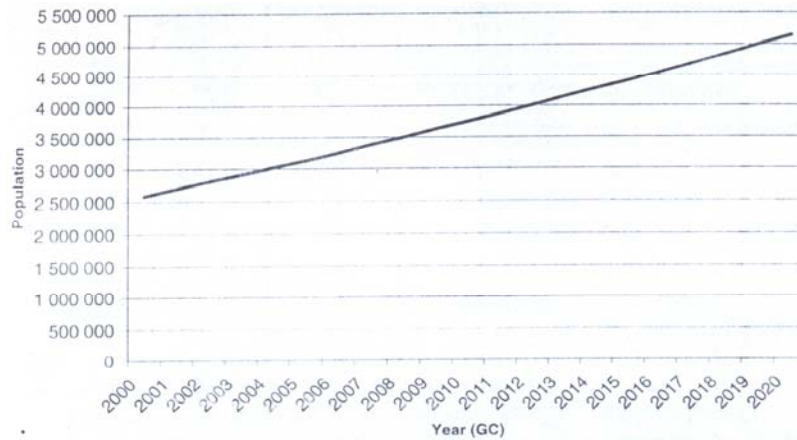
Since its establishment in 1887, the population of Addis Ababa has been growing fast especially in the 1960 and 1970s. The growth is expected to continue. According to the 1994 census, the population of Addis Ababa was 2.3 million. Modest estimates of the population in the year 2015 vary from 4.1 million to 4.6 million while the United Nations Development Program has given an estimate of 6.6 million people in 2015.<sup>10</sup> Much of the population growth is expected to happen due to internal migration of people from rural areas to Addis Ababa. The majority of migrants are young adults and adolescents. Quite many of the migrants are expected to be females.

**Population Forecast for Addis Ababa**

Duplication time is about 20 years. The range of the low, medium and high population estimate for 2000-2020 is given below.’

**Table3.1 - Addis Ababa Population forecast variations for 2000-2020**

Year	Estimated population, million people			Estimated no. of households
	Low	Medium	High	
2000	2,58	2,59	2,60	503 000
2005	3,06	3,13	3,18	603 000
2010	3,56	3,75	3,86	724 000
2015	4,06	4,41	4,62	856 000
2020	4,63	5,15	5,53	1 000 000



Source – Central Statistics Agency

<sup>10</sup> Project Proposal for Addis Ababa Transport Sector, ORAAMP

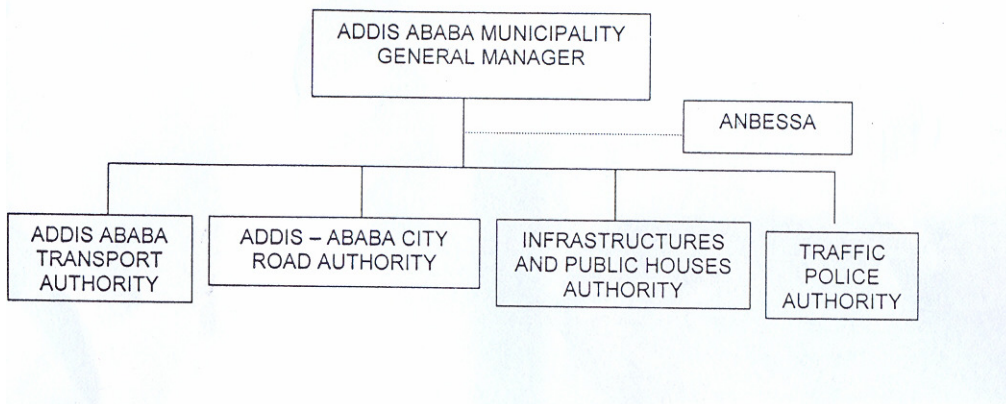
A large majority (over 90%) of the population of Addis Ababa falls under the three lowest classifications of socio-economic status of 'absolute poverty', 'affected by poverty' and 'low income'. Less than 6% of the population belongs to the middle income group and less than 3% to the high income group.

The household sizes vary roughly from 7.6 persons per household in lower income groups to 6 persons per household in the middle income group and 5 persons per household in the high income group.<sup>11</sup>

### 3.1.4 Institutional organization

The private and public transport in Addis Ababa comes under the responsibility of the Transport Authority, which is part of the Addis Ababa City Administration Municipal Services; the organizational structure is as shown in the following chart.

Figure3.2 - Institutional organization



Source – Addis Ababa transport Authority

<sup>11</sup>Project proposal for Addis Ababa Transport Sector, ORAAMP

# **Part four**

## **Analysis of The urban transport system in Addis Ababa**

# The urban transport system in Addis Ababa

## 4.1 Urban transport problems in Addis Ababa

As it has been mentioned in the literature review, urban transport problems are classified into three areas of interest.

### 4.1.1 Congestion

Peak hour traffic in A.A is so overcrowded that the speed/flow relationship is increasingly being affected for the negative. The effect of reduced speed and strained flow on total productivity and energy consumption is high. The load on the existing limited road infrastructure by the coinciding deployment of 12000 minibus taxis, 534 City Buses, 78,244 private vehicles not to mention the significant contribution of 1360 trucks and 240 passenger buses entering the city everyday is monumental.<sup>12</sup>

### 4.1.2 Mobility

As it has been mentioned in the introductory part, the urban mobility in the city of Addis Ababa is increasingly becoming less efficient. Mobility may be considered as a system in which the human, the vehicle and the road interact with each other. Mobility is one of the structural elements, which influence the transformation of urban systems. Transport plays probably the most crucial role in shaping the general structure and urban land-use spaces. Typically some or most of the urban transport and mobility conditions are found in urban areas in Africa.<sup>13</sup>

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<sup>12</sup> Addis Ababa Transport Authority

<sup>13</sup> Tatenda Mbara, *Mobility Challenges for the 21st Century, Paper presented on Urban Mobility and Poverty Reduction*

### 4.1.3 Ancillary impacts

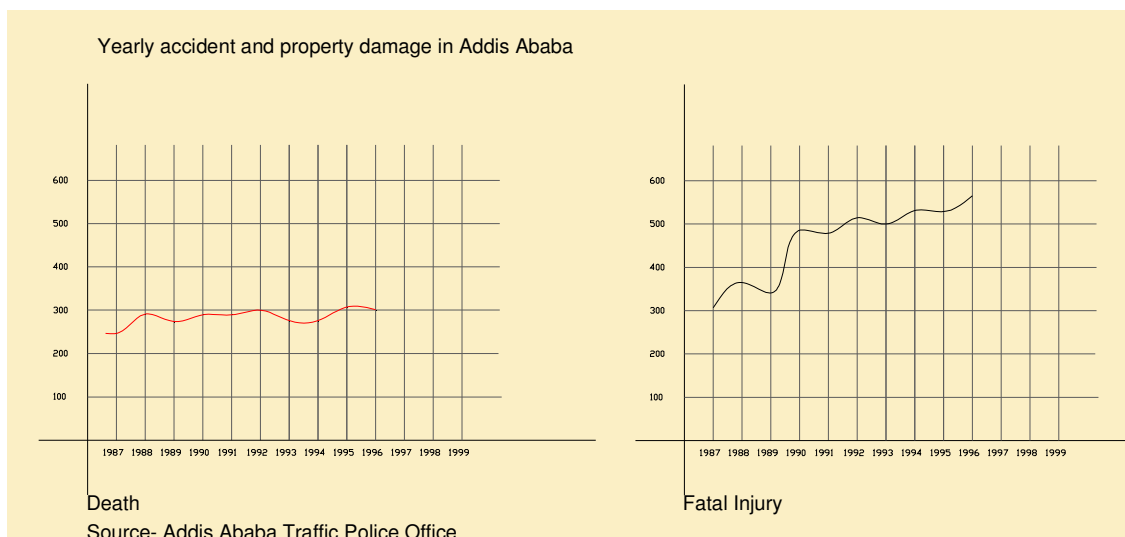
#### I- Accident

Car accidents in Addis Ababa are increasing at a very high rate of 12.5%. The age-group 18-50 is found to be the most vulnerable (70%). As can be expected accidents are usually higher on undivided roads, hence nearly 67% of the accidents are on mid-sections. Furthermore, it has been noted that pedestrians tend to be more vulnerable to accidents (67%).<sup>14</sup>

**Table 4.1** - Traffic accident

	Death	fatal injury	light injury	property damage	Total	estimated cost of property(Birr)
1987	255	314	643	2233	3445	7,430,744
1988	286	370	1312	4234	6202	11,029,727
1989	264	340	1261	4987	6852	12,311,129
1990	283	487	1527	6284	8581	11,685,154
1991	280	470	1409	5186	7345	12,019,031
1992	300	515	1358	5120	7293	11,765,441
1993	268	499	1347	5089	7203	14,948,650
1994	269	532	1309	5512	7622	15,677,142
1995	319	528	1360	6429	8636	20,365,227
1996	305	563	1483	7839	10189	22,436,120

Source: Addis Ababa City Traffic Police office



**Figure 4.1** Traffic accident data, Death, Fatal Injury, Light Injury, and Property Damage

14 Addis Ababa Traffic Police



**Figure 4.2** Traffic accident data, Death, Fatal Injury, Light Injury, and Property Damage

\* The above figures demonstrate the rate of increase of traffic accidents in the city. Traffic accidents are categorized into death, heavy and light injury and property damage. It can be clearly seen that total number of accidents is rising in general. The main causes of traffic accidents in Addis Ababa are congestion, poor road conditions, poor driving behavior, inadequate traffic management systems, and poor vehicle maintenance upkeep.

This can be attributed to some or all of the following factors, poor infrastructure that is unable to support the number of automobiles on the streets, lack of parking space, lack of an encroachments management plan, concentration of economic activities and services in certain areas, inadequate traffic facilities such as traffic lights, signs, crossing marks, inadequate drivers training and vehicle inspection

**II- Environmental Consideration (The contextual aspect)**

“With life expectancy just above 41 years and basic needs such as food production, clean water, health care, and infrastructure maintenance on the priority list, it is safe to say that air quality is the least of the government’s worries right now.”<sup>15</sup>

15 Source Web site- Pilot study of air pollution in Addis Ababa

On the streets of Addis it is common to see buses, trucks and heavy duty machineries belching dark plumes of diesel exhaust along side with private vehicles and blue taxis. To add to that the streets are mostly dilapidated asphalt and dusty gravel roads. Due to these reasons the city's sky is full of dust clouds.

The majority of the vehicles in the city of Addis and the country at large are at least 15 years old and most of them have a smoky trail of pollution leaving their tail pipe.



**Figure 4.3** – Pictures showing vehicles polluting in the inner city of Addis Ababa

It is common knowledge by now that exhaust from vehicles is the main cause of air pollution in urban centers including Addis Ababa due to the uncontrolled use of both diesel and gasoline engines.

From the topographic point of view, the city is surrounded by mountains on all of its sides and has monsoonal climatic conditions that make it susceptible to stagnant air

conditions from time to time. These facts worsen the situation by blocking the movement of polluted air.

### III- Energy Consumption

Fuel consumption trends in the country and Addis Ababa

**Table 4.2 – Fuel consumption Trends in the county and Addis Ababa**

Country	Benzene	Naphthalene
Past five years	↑ 4.6% annual growth rate	↑ 8.8% annual growth rate
Past ten years	1.62% annual growth rate	2.41% annual growth rate

Addis Ababa	Benzene	Naphthalene
Past five years	↑ 29% annual growth rate	↑ 16% annual growth rate
Past ten years	↑ 7.6% annual growth rate	↑ 10% annual growth rate

Source – Ethiopian Petroleum Company<sup>16</sup>

Share of fuel consumption of Addis Ababa

- Benzene- 60% of the country
- Naphthalene- 18% of the country

\* This indicates the city’s heavy reliance on smaller motorized vehicles which consume much more fuel per passenger per kilometer.

<sup>16</sup> ORAAMP, *The Urban Transport Road Network of Addis Ababa, January 2000*

## 4.2 Urban Transport Modes in Addis Ababa

The urban transport modes in Addis Ababa comprise of two main components:- Motorized and Non-motorized.

### 4.2.1 Non-motorized modes

#### I- Animal-drawn

These are mostly found in Weredas 26 and 27, the area that is commonly known as “Kaliti” (fringe area Phenomenon). The general characteristics can be viewed as follows

- There are around 300 Horse-drawn carts (Gharri)<sup>17</sup>
- Little or no noticeable improvement in design and operating characteristics since their introduction into country.
- Distance covered ranges from 4-20km.
- Average running speed 10km/hr
- Gives employment opportunities and is source of income for considerable number of families.

\* It can be said that due to minimum carrying capacity coupled with urban expansion, the importance of this particular mode of transport has dwindled overtime.

#### II- Animal – Borne Modes

Currently there are around 5000 Heads of donkey that are in use for lower capacity freight movement in Addis Ababa. They usually transport foodstuff into market areas and are also used in construction areas for supply of water and other building materials. On average, pack animals numbering up to 3,172 heads per day travel in to the city and market areas.<sup>18</sup>

\* Even though this mode plays a significant role in the supply of materials for the urban population, it also has its own side effects that usually emanate from the lack of specialized infrastructure. Due to this fact it is quite common in Addis Ababa, to see herds of animals trailing along side vehicles and pedestrians resulting in congested streets.

17, 18 The Urban Transport Road Network of Addis Ababa, OPAAMP

### **III- The Bicycle Mode**

Role of this particular mode is negligible as compared to any cities within and outside Ethiopia. This is mainly due to the topographic nature of the city.

### **IV- Walking Mode**

This is by far the cheapest and the most dependable mode of non-motorized transport. Its efficiency and effectiveness is observed in compact urban areas. However in light of the horizontal expansion of the city, it has negative impact on productivity.

## **4.2.2 Motorized urban Transport**

Even if the main area of emphasis of this research will be mainly on the *public transport* mode, the other modes of motorized transport that exist in Addis Ababa are categorized as follows:

### **I- Railway Transport Mode**

- Addis –Djibouti railway transport mode has the city as origin and destination for its freight transportation services.
- It recently stopped rendering passenger transport service.

### **II- Airlines Transport mode**

- Ethiopian airline transport mode has the city as origin and destination.
- It provides both cargo and passenger services from its Addis Ababa hub.

### **III- Vehicular urban transport mode**

- Under this category, we have private vehicles, and the public transport mode.
- Other subgroups such as motor cycle also fall in to this same category.

## Registered Vehicles in Addis Ababa (14/5/2007)

**Table 4.3**–Reregistered Vehicles in Addis Ababa

Vehicle Type	1994	1995	1996	1997	1998
ABATOR'S SPECIAL EQUIPMENT	13	13	14	15	15
AGRICULTATED TRAILER	7	7	7	7	7
AGRICULTATED TRACTOR	35	41	42	45	47
AMBULANCE AND MEDICAL USE SPECIAL EQUIPMENT	246	276	286	306	318
ARTICULATED DRY-CARGO LOWBED TRAILER	234	246	246	246	247
ARTICULATED DRY-CARGO SEMI-TRAILER	207	212	215	218	219
ARTICULATED LIQUID-CARGO SEMI-TRAILER	8	13	13	13	13
AUTOMOBILES	49989	55488	57948	60383	61858
BUS	18948	22602	23962	25207	26075
COMBINATION MOTOR-CYCLE	252	252	267	393	543
CRAINS SPECIAL EQUIPMENT	387	411	420	447	490
DRAWABAR DRY CARGO TRAILER	6349	6488	6525	6549	6832
DRAWABAR LIQUID CARGO TRAILER	1391	1407	1408	1411	1413
DRY-CARGO DUMP TRUCK	4946	5389	5437	5688	6392
DRY-CARGO PICKUP	8857	9460	9705	9901	10073
DRY-CARGO TRUCK	18926	20960	22330	23289	24297
FIRE FIGHTING SPECIAL EQUIPMENT	17	24	24	24	25
HORTICULTURE SPECIAL EQUIPMENT	2	4	4	5	5
LIQUID CARGO TRUCK	1622	1733	1744	1762	1807
LIVESTOCK SPECIAL EQUIPMENT	3	3	3	3	3
MOBILE GARAGE SPECIAL EQUIPMENT	49	55	55	58	58
MOBILE HOUSE SPECIAL EQUIPMENT	15	15	16	16	16
MODIFIED VEHICLES	50	73	82	106	123
OTHER SPECIAL VEHICLES	157	174	175	180	185
OTHERS	15	16	20	28	39
PUBLIC & CARGO MULTIPLES PICKUP DOUBLE CABIN	11417	13135	13605	14254	14763
REFUSE COLLECTOR SPECIAL EQUIPMENT	91	93	93	95	95
SOLO MOTOR-CYCLE	1571	1799	2028	2342	2920
SPECIAL MOTOR-CYCLE	24	31	36	40	44
SPECIAL TRAILERS	11	11	12	12	12
STATION WAGON PUBLIC	16598	18740	20055	21422	22324
TRACTOR ARTICULATED	1661	1729	1736	1765	1901
<b>Total</b>	<b>144098</b>	<b>160900</b>	<b>168513</b>	<b>176230</b>	<b>183159</b>

Source- Addis Ababa Transport Authority

\* It can be observed from the above data that the total number of vehicles in the city of Addis Ababa is continuously increasing. This rate of increase in vehicle population of the city is not being matched by investment in infrastructure which results in a decreased rate of urban mobility.

## **4.3 Public transport modes**

In Addis Ababa there are only two types of public road transport services The City Bus enterprise and ‘shared Taxi’ Service.

### **4.3.1 The City Bus Enterprise**

#### **History and Background**

Addis Ababa City Bus Service Enterprise is the oldest and the only city bus enterprise in the country. Having been established in 1952 EC as a share company to conduct city and intercity transport activities, the enterprise was nationalized in 1975 EC and put under the Public Transport Corporation (PTC). PTC was liquidated in 1994EC and split up into three enterprises (Addis Ababa City Bus Service Enterprise, Walia Intercity Bus Service Enterprise and Abay Technical Enterprise). Addis Ababa City Bus Enterprise was re-established as a public enterprise by the Council of Ministers Regulation No 189/1994 effective from 18th July 1994EC to render city bus transport service in accordance with the provisions of Public Enterprise Proclamation No 25/1992.<sup>19</sup>

#### **City Bus Transport System of Addis Ababa**

Addis Ababa City Bus Enterprise is the main public mass transport system in Addis Ababa which is run by a public agency. With a fleet of 534 buses it operates on 93 routes and transports about 640,000 passengers per day. In addition to these, peak hour services are operated on 37 routes, out of the above 93 routes. On average a City bus covers about 138 km per day and makes 16,471 trips. The bus stops, about 900 in number. It utilizes buses that have high passenger carrying capacity 100 (30 sitting & 70 standing passengers). The fare system is flat but varies on different routes.<sup>19</sup> The list of buses allotted, types of vehicles, routes, their fare structure, route length, etc are given below:-

<sup>19</sup> Addis Ababa City Bus Enterprise

**Types of vehicles**

*Table 4.4 –Types of Vehicles of Addis Ababa City Bus*

Yr of purchase (EC)	Fiat	Mercedes	Volvo	DAF	Total
1973	8				8
1983		60			60
1988				100	100
1989				100	100
1990				66	66
1992				50	50
1995			1	150	150
Total	8	60	1	466	534

Source- Addis Ababa City Bus Enterprise

- The total number of **new buses** is 466 buses
- 64 buses were giving services before 1988 EC
- 4 buses are out of use due to different accidents

Therefore the total number of buses, which are fully operational to the public, are 530.

Out of these buses:

- 330 give fulltime service
- 43 operate during pick hours only
- 41 give services for the governmental offices and other organizations.
- And the rests are ready for backup.<sup>20</sup>

\* Even though it was stated earlier that the City Bus Enterprise has been providing service for close to half a century, the total number of buses it has, only amounts to roughly about 10 buses a year, which is very much less than what is needed to support the growing demand.

<sup>20</sup> Source- Addis Ababa City Bus Enterprise

## The Buses Network

### Addis Ababa city bus routes

*Table 4.5 –Origin, destination point and tariff details*

Line No	Start	Destinations	Tariff	Distance / Km
1	Kazanchis	Addis Ketema	0.50	.....
2	Korie Mekanisa	addisketema	0.50	11.1
3	Ayer tena	Minilik Adebabay	0.50	10.8
4	Kality	Addis Ketema	0.75	19.4
5	Korie Mekanisa	Minilik Adebabay	0.50	12.7
6	Kera	Semien addisu gebeya	0.30	9.9
7	megenagna	legetafo	0.50	
8	Semien Gebeya	addisketema	0.35	9.4
9	Bole School	Piassa	0.35	4.4
10	Kotebe teachers college	piassa	0.50	12.7
11	Kolfe efoyta	Minilik Hospital	0.50	6.9
12	Ferensai film Center	addisketema	0.35	9.9
13	Bela	addisketema	0.50	8.9
14	saris abo	piasa	0.50	12.4
15	kazanchis	addis ketema	0.25	8.3
16	Kidane Mihret	addisketema	0.25	7.9
17	Kuskuam	addisketema	0.35	9.1
18	Keranio	addisketema	0.35	7.3
19	Asco	6 kilo	0.50	9.7
20	Dilber	addisketema	0.25	6.3
21	Fetino Derash	piazza	0.50	5.5
22	Samit legehar	addis ketema	0.50	.....
23	lamberet	addisketema	0.50	12.4
24	burayu	Degol adebabay	0.75	17.7
25	legehar	Akaki	0.75	14
26	addisketema	Sebeta	1.25	23.5
27	legehar	saris abo korki fabrica	0.50	8.5
28	ascosansuzi	addisketema	0.50	11.1
29	addisu sefer	addisketema	0.50	12.7
30	Sululita	addisketema	1.25	25.8
31	legehar	Shiro meda	0.35	7.4
32	Hana Mariam	legehar	0.35	10.6
33	Kotebe Gabriel	Arat Kilo	0.50	11.4
34	Gofa Kamp	addisketema	0.35	9.8
35	Cherkos	addisketema- kolfe- mesalemia	0.50	6.7
36	Kara Korie	Legehar	0.50	11.7
37	Keranio	M/adebabayi	0.50	12
38	gofa kamp	6 kilo	0.50	11
39	bole School	addis ketema	0.50	7.3
40	Karaalo	adiss ketema	0.75	17.9

.....Public Transport System and Its Impact on Urban Mobility

41	Eyessus	Mercato	0.25	8.5
42	Megenagna	Via bole –legehar	0.35	9.8
43	menagesha	marcato	1.50	30.2
44	legedadi	marcato	1.50	30.4
45	legehar	dilber	0.50	5.6
46	gergi	4 kilo	0.50	8.5
47	yenegew fire school	mercato	0.35	7.3
48	Bole michael Adebabay	m/adebabayi	0.50	10.9
49	Meri CMC	megenagna	0.25	6.8
50	Total No 3 mazoria	megenangna	0.50	12.1
51	Bihere tsege	via legehar balcha	0.50	8.1
52	gergi	mercato	0.50	14.1
53	Bole	shiro meda	0.50	11.5
54	Lafto	legehar	0.50	9.5
55	Legehar	ferenci kela	0.50	16.2
56	Saris Abo	shiro meda	0.50	14.2
57	Kara	legehar	0.50	14.4
58	legehar	alem bank	0.65	10.4
59	betel hospital	minilik adebabayi	0.50	11.5
60	debre zeit	legehar	2.25	47.2
61	meri cmc	via kazanchis-legehar	0.50	13.8
62	sebeta	legehar	1.25	23.5
63	bole michael	via welo sefer legehar	0.35	9.1
64	sidist kilo	via Megenagna gorf aswogagi	0.50	4.5
65	mercato	alem bank	0.65	.....
66	adisketema	Kara korie	0.50	10.5
67	mekannisa adebabayi via. ring road	legehar	0.50	10.2
68	Balcha hospital	Minilik adebabay	0.25	8.7
69	Kolfe fetnoderash	Kazanchis	0.50	.....
70	Kazanchiss	Ayertena	0.50	11
71	Bole gumruk	balcha hospital	0.50	9
72	Adisu sefer saris	legehar	0.35	9.6
73	legehar	Winget school	0.50	10.2
74	michael cmc	via ghion-mercato	0.50	13.3
75	Sidist kilo	Kera	0.50	9
76	Megenagna zerihun building	saris abo	0.50	12.1
77	ayer tena	saris abo	0.50	13
78	megenagna	Gofa kanmp	0.50	0*
79	megenagna	Balcha hospital	0.50	7.9
80	Semien Gebeya	Kasachis meganegna	0.50	.....
81	Arat kilo	yenegew fire school	0.50	9.7
82	Yerer ber	Balcha Hospital	0.50	11.3
83	CMC	Sidist Kilo	0.50	13.8
84	kolfe	Legehar	0.50	6.4

85	Addis Ketema	Wholeta	0.50	45
86*	Ayertena ring road	Saris abo	.....	13
87	Kolfe adebabayi via ring road	Ayer Tena	0.50	10.5
88	Addis Ketema	Chancho	3.00	40
89	addis ketema	Sendafa	3.00	44
90	Betel Hospital	Legehar	0.50	10
91*	Lafto	merkato	0.75	.....
92	Hana mariam dildiy (kelebet mended)	Balcha Hospital	0.50	9.6
93	Saris Abo Via ring road	megenagna	0.50	10.2

*Source: Addis Ababa city bus service enterprise*

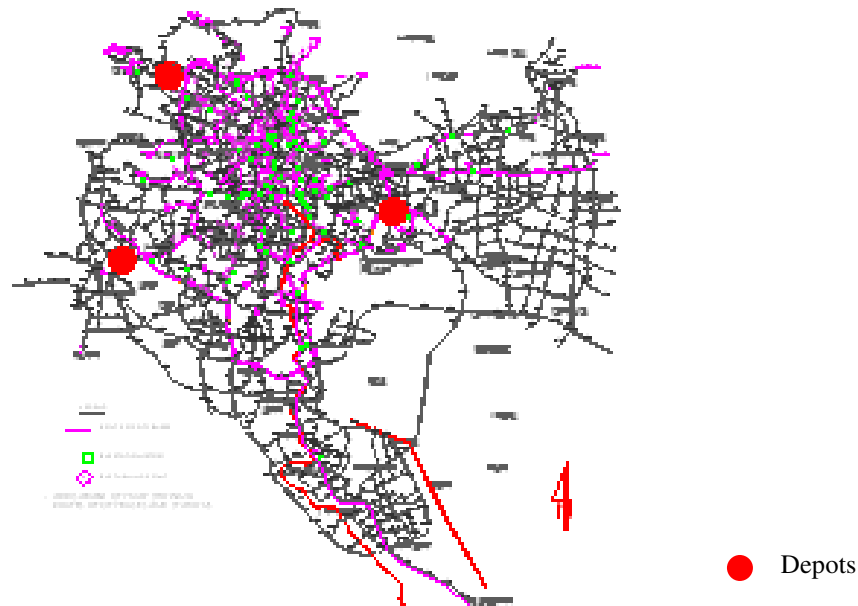
\* The above data has been coordinated with the city map to show the bus routes and stops in an interactive manner. It is worth mentioning here that the fact there is a dense concentration of bus routes in and around the core area of the city.

See the map ‘City Bus route in Addis Ababa’

### Depots and their Locations

The City Bus Enterprise head office and depots are located in the three localities

- The City Bus Enterprise head office is located at Yeka, in a spacious premises of over 70,000 square meters, with workshop facilities that are equipped with machines, garage equipment and special tools. Yeka Depot has an operating fleet strength of about 221 buses.
- The City Bus Enterprise also owns the Shegole Depot, located in the northwestern part of Addis Ababa, lays on a land covering an area of 53,996 square meters. This facility has a satellite spare parts store, satellite fuel station, greasing and washing bay, in addition to light machines garage equipment and special tools. This 'Depot has an operating fleet of 171 buses.
- The depot at Mekanissa which is in the southern part of Addis Ababa covers an area of 72,861 square meters and there are about 73 buses that run their operation from this depot.<sup>21</sup>



**Figure 4.4** – The existing Location of Depots in Addis Ababa

\* The fact that there are only three depots in the whole city has resulted in a ‘negative traffic’, that is, empty buses are forced to travel long distances in some cases, to get to the origins of their trips, this also happens at the end of the day when empty buses travel from the end point of their last trips to their bases.

<sup>21</sup> Source- Addis Ababa City Bus Enterprise

### Resources of Addis Ababa City Bus Enterprise (Anbessa)

Addis Ababa City Bus Enterprise does not have assured source of finance, for capital expenditure like purchase of buses, construction of depots, purchase of machinery, tools & plant etc **though Public Transport demand is growing**. Even for meeting Revenue expenditure, it heavily depends on subsidy granted by the city Government. The revenue account reveals nearly 40 percent share of subsidy by the city administration during the last five years, which has gradually been reduced to 20 percent as of 2003. As the fare level is controlled by City Government, the scope for increasing the revenue is limited, while cost of inputs like fuel, tyres, spare parts etc are showing increasing prices year after year. See the table below

**Table 4.6 –Income and expense Balance (in thousands.)**

	1989	1990	1991	1992	1993	1994	1995	1996
<b>Revenue</b>								
Service	52800	89947	109035	114599	116585	108710	113974	122550
Contract	2392	1531	1940	3477	4193	4541	3245	2777
Miscellaneous	542	808	1102	1035	1881	2776	2143	2200
Total	55734	92286	112077	119,111	122659	116027	119,362	127527
<b>Expense</b>								
Salary	7558	9450	11153	12531	15525	16542	14575	21072
par time	2590	3138	3826	4477	5185	5453	5763	6575
Miscellaneous	1718	2421	3046	3177	3105	3161	3865	4993
Fuel:								
Gasoline	8503	14717	17589	20426	26478	27400	32001	3638
Benzene	32	39	69	112	160	140	3209	212
oil and Grease	1331	1352	1538	2094	2638	2730	8095	3422
Tyre & plastic	1069	3236	4154	5963	5599	6783	17601	6745
Maintenance	1890	6346	8578	10566	13612	13512	2552	19206
Insurance	673	1288	1628	1667	1743	1872	39566	2748
depreciation	23039	37665	43165	41257	38988	39032	-	59052
interest	7716	6735	8805	5915	-	-	-	-
Stationery	266	344	747	466	480	547	-	500
Printings	937	1669	2061	2834	2545	2459	-	2375
Misc.expenses	620	3029	3078	4390	3818	3795		2904
Total	57942	91429	109437	111485	119876	123426		133442

#### Revenue

1997 – 131,872,000 Birr

1998 – 124,149,000 Birr

1999 - 119,805,000 Birr

#### Expense

1997 – 189,072,000 Birr

1998 – 174,449,000 Birr

1999 – 168,805,000 Birr (now)

190.805.000 Birr (Expected)

#### Registered Loss

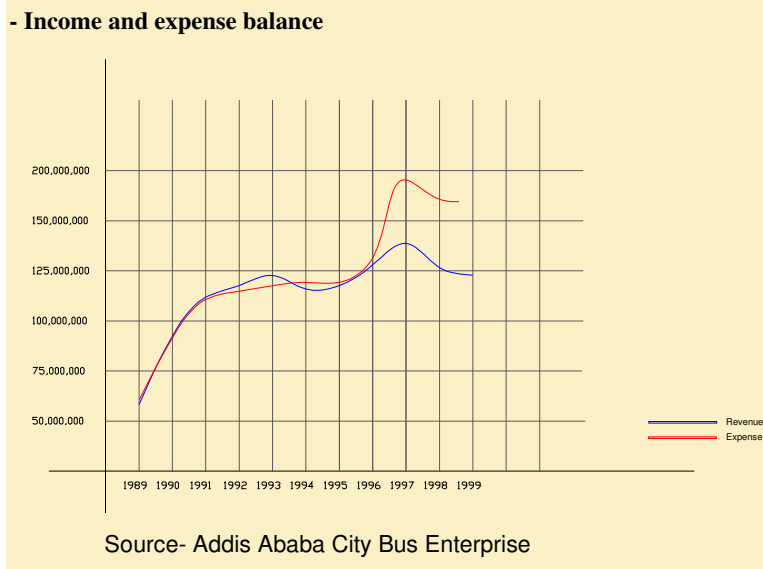
1997 – 56,000,000 Birr

1998 – 54,300,000 Birr

1999 – 49,000,000 Birr (now)

61,700,000 Birr (Expected until the end of this year)

Source: Addis Ababa City Bus Public Enterprise



**Figure 4.5** Income and expense balance every year

\* This is obvious from the graph above that the total revenue generated, is steeply decreasing from year to year which is an indication of the weak financial status the enterprise finds itself in.

**Scheduled Operations**

1. Addis Ababa City Bus Enterprise has two types of schedules for operation, i.e.
  - Basic schedules, where the bus operates for 2 shifts, about 15 hours a day, starting from morning 6:00am to evening 9:00 pm.
  - Peak Hour Services, which operate only for 7 to 8 Hours during a day, utilizing only one set of crew, duly splitting the operation into two spells, one during morning peak hours and second spell during the evening peak. <sup>22</sup>

The distribution of buses scheduled on basic routes, in terms of number of buses/route is shown in the Table below

<sup>22</sup> Addis Ababa City Bus Enterprise

**Table 4.7**–Distribution of scheduled buses for basic operations (Number of buses/route)

No	No of buses/route	No of routes	No of buses
1	10	3	30
2	8	2	16
3	6	11	66
4	5	5	25
5	4	29	116
6	3	20	60
7	2	18	36
8	1	1	1
Total		93	530

Source: Addis Ababa City Bus Service Enterprise records

2. The Peak Hour Services are scheduled on 37 routes, covering 42% of basic routes.
3. The 37 routes where peak hour services are planned are also on the whole route length of the normal routes except for 6 routes (Route No 3,11,49,52 and 92), where the peak hour service is planned only for places where the demand is comparatively high.

### Quality Control

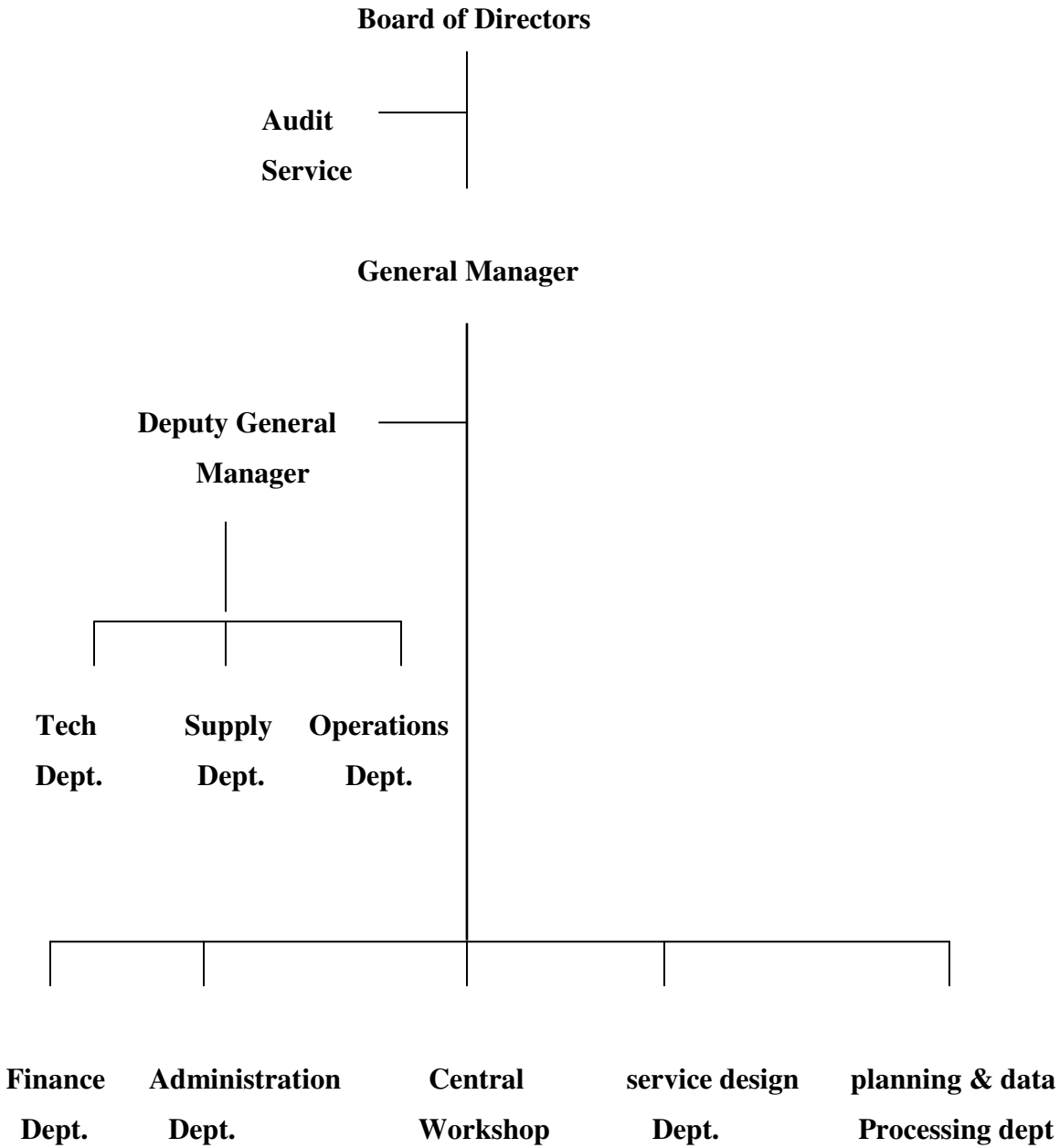
The quality control section strives to ensure that all the revenue is collected by the conductors from passengers and remitted to the enterprise. The section allotted 26 line controllers for each of the three terminals i.e. Merkato, Lagar & Menelik Square. These 26 controllers are organized into two shifts, and each line controller is expected to check a minimum of 24 buses during his duty of 8 hours. The work of the line controllers is supervised by a special controller, posted at each of the major terminals. All these line controllers are expected to conduct about 50,000 checks on the conductors to prevent any possible mishandling of revenue.<sup>23</sup>

\* It is thus clear that such manual collecting mechanisms are subjected to human errors which then cast a negative impact on the efficiency of the services resulted by the City Bus Enterprise.

<sup>23</sup> Addis Ababa City Bus Enterprise

**Organizational Structure**

The organizational structure of Addis Ababa City Bus Enterprise is given in the figure below



*Figure 4.6 – organizational Structure of Addis Ababa City Bus Enterprise*

*Source: Addis Ababa City Bus Service Enterprise*

### Number of Employees in the City Bus Enterprise

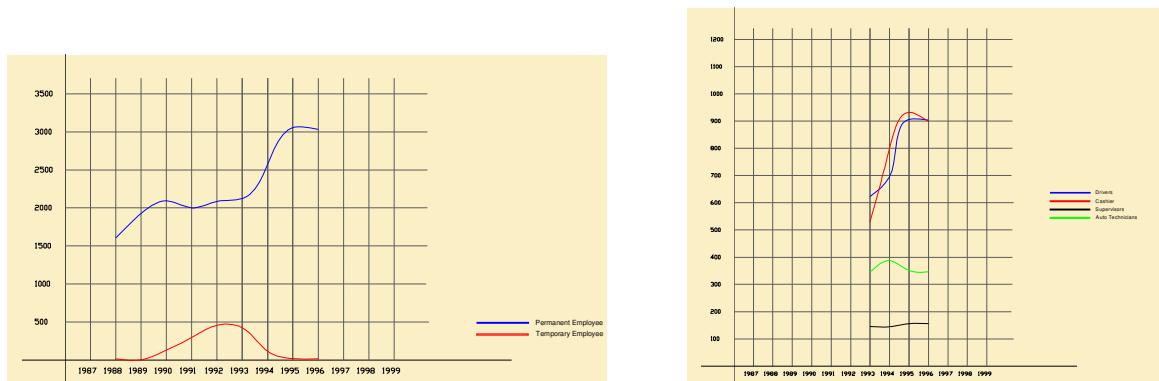
**Table 4.8** Number of Employee in Addis Ababa City Bus Enterprise

Year (EC)	Permanent	Temporary	Total
1988	1615	4	<b>1619</b>
1989	1899	3	<b>1902</b>
1990	2136	130	<b>2266</b>
1991	2000	334	<b>2334</b>
1992	2132	471	<b>2603</b>
1993	2182	435	<b>2617</b>
1994	2598	122	<b>2720</b>
1995	3104	3	<b>3107</b>
1996	3075	3	<b>3078</b>
1999	3075		<b>3075</b>

**Table 4.9** Number of Drivers, Cashier, Supervisors and Auto technicians

Year (EC)	Drivers	Cashier	Supervisors	Auto technicians
1993	635	532	140	342
1994	695	801	137	388
1995	917	941	148	453
1996	909	897	147	447

Source: Addis Ababa City Bus Public Enterprise



**Figure 4.7** – Number of Employees in Addis Ababa City Bus Enterprise

\* The above figures indicate that the number of employees is increasing from time to time, which is at odds with the financial status of the enterprise describing the previous section.

## Terminals

### Major Terminals

Addis Ababa City Bus Enterprise has 3 major terminals, for its city bus operations. The table below gives the details about buses touching them and trips operated from these three major terminals.

*Table 4.10 –Details of operations from major terminals*

Name of terminal	No of routes operated	No of buses operated	No of trips operated
Addis ketema	33	109	2006
Lagar	23	88	1622
Menelik square	9	42	760
Total from major Terminals	64	239	4388
Total of Anbessa	93	530	7000

*Source: Addis Ababa City Bus Service Enterprise records, field Surrey*

### Minor Terminals

Addis Ababa City Bus Enterprise has 7 minor Terminals for its operations. The **Table** gives the details about buses touching them and trips operated from these seven minor Terminals.

*Table 4.11–Details of operations from Minor Terminals*

No	Name of the terminal	Quantity of operations		
		Routes	Buses	Trips
1	Megenagna	6	16	411
2	Ledeta	5	16	292
3	6 kilo	5	21	412
4	4 kilo	3	13	240
5	Ayere tena	3	10	187
6	Mesalemiya	2	7	174
7	Shero meda	2	6	102
		26	89	1818
	Percentage out of total operation of Anbessa	29	21	26

*Source: Addis Ababa City Bus Service Enterprise records, field Surrey*

The terminals, both major and minor, cover most of the operations as detailed in table below.

**Table 4.12** –Operations covered by Terminals

No	Particulars	Terminal coverage		
		Major	Minor	total
1	Routes-total-93	64	26	88
2	Buses-total-415	235	89	324
1	Trips-total-7,000	4388	1818	6206

Source: Addis Ababa City Bus Service Enterprise records, field Surrey

### 4.3.2 Shared Taxis

The Transport Authority, which registers the vehicles in Addis Ababa, registers all taxis under one category. However these taxis can be broadly categorized in to two classes: -

- Mini-Bus Taxi (12 seats) and
- Small Taxi, also called Saloon Taxi (4 seats)

#### Mini Bus Taxi

About 12,000 Mini Bus taxis operate in the city of Addis Ababa, that have a seating capacity is of 12 passengers. Most of these vehicles are old in age. These minibus taxis operate on 105 routes and carry more than 1,200,000 passengers per day. The mini Bus system provides employment opportunities to a large number of people (24,000 direct and about 12,500 indirect).<sup>24</sup>

There are no entry restrictions for Mini Bus Taxis in terms of routes or areas, where a vehicle may operate. The fares are regulated by the City Government; however they are usually 2 to 3 times more expensive than that of city bus fares.

The presence of Shared Taxi service in Addis Ababa is very high. Most of the shared taxi operators own a single vehicle generally the vehicles are operated by hiring personnel, that is, drivers and their aids. On average a mini bus taxi covers about 138 km per day and makes 15 trips. Most of the passengers belong to low and medium income groups.

24 Urban Transport Study and Preparation of Pilot Project for Addis Ababa and Interview, local taxi association

### Small (Saloon) Taxi

This sub group can further be categorized into two sub-classes: -

- Yellow Taxis and
- Blue Taxis

The Yellow Taxis predominantly serve the air port passengers, and also make a significant presence at prestigious hotels (Paratransit) while Blue Taxis serve the regular commuter traffic.

To estimate the ratio of Mini Bus Taxis and Small Taxis out of the total volume of taxis registered in Transport Authority, discussions were held both with Taxi Association People (Namely Segon, Nib and Selam Taxi Associations) and Transport Authority. The opinion was that 80 to 90% are Mini Bus Taxis, and the figure was verified with others in the industry.<sup>25</sup>

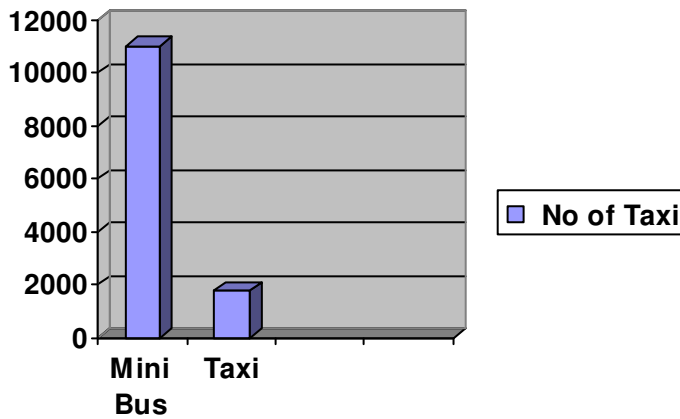


Figure 4.9 – proportion of Mini Bus and Saloon Taxi

<sup>25</sup> Urban Transport Study and Preparation of Pilot Project for Addis Ababa and Interview, local taxi association

As per the most recent data available which extends up to 2002 G.C, the growth of mini buses is detailed in the Table 3.14 below. It is observed that growth rate of Taxis is 11.2% per annum against 8.5% for all vehicles, during the same period. Thus growth rate of Taxis is 32% higher than the growth rate of all vehicles in Addis Ababa.<sup>26</sup>

**Table 4.13** Growth of Taxis in Addis Ababa

Year	Total Number of Taxis	Taxis as Percentage To total Vehicles	Estimated number of Taxis at 90-10 ratio		Estimated with 80-20 ratio	
			Mini bus	Saloon	Mini bus	saloon
1992	7,395	10	6,656	739	5,916	1,479
1993	8,152	10	7,337	815	6,522	1,630
1994	8,857	10	7,971	886	7,086	1,771
1995	9,903	10	8,913	990	7,922	1,981
1996	10,765	11	9,689	1,076	8,612	2,153
1997	11,093	11	9,984	1,109	8,874	2,219
1998	11,855	11	10,670	1,185	9,484	2,371
1999	12,501	11	11,251	1,250	10,001	2,500
2000	13,165	11	11,849	1,316	10,532	2,633
2001	14,553	11	13,098	1,455	11,642	2,911
2002	15,704	11	14,134	1,570	12,563	3,141

Source-Transport Authority of Addis Ababa

<sup>26</sup> Source – Interview, local taxi association (Namely Segon, Nib and Selam Taxi Associations)

### 4.3.3 Regional Buses

Presently there are two regional bus terminals in the centre of the city, namely, the Merkato and Lagar stations. About 321 buses operate from these terminals catering for 18,618 passengers per day. Overall 138 buses operate from the inter-urban terminal at Merkato, and it is estimated about 35,000 passengers use this facility per day. There is also a third terminal, which is part of the initiatives to build five regional bus terminals on exit points of the city, which has been constructed at a location about 1 Km North-East of Megenagna, also known as Lamberet. This terminal has not become operational as yet.<sup>27</sup>



*Figure 4.10 – Location of Regional Bus in Addis Ababa*

\* The location of these two terminals, at Merkato and Lagar, being in the inner city, is adding a significant share to the level of congestion observed. However the current approach of locating new terminals at entry and exit points to and from the city is better suited for alleviating the above mentioned issues of congestion.

27 Urban Transport Study and Preparation of Pilot Project for Addis Ababa

## 4.4 Socio-Economic and Travel Characteristics

Review of previously conducted researches that were based on extensive Household Interview Surveys with the aim of obtaining socio-economic and trip characteristics of the people of Addis Ababa has been analyzed and presented to appreciate the spatial variations as follows,<sup>28</sup>

- The average household size is around 5.8.
- Females are more in number (53% to 46.3%)
- Addis Ababa is a city of young people. (80% below 40 years).
- ***The city is highly literate (84.3%).***
- 'Students' and 'Service' are the main occupations accounting for 45% of population.
- Unemployment rate is high (21.3% of total population; 15.6% excluding age group up to 5 years).
- **Nearly 51% of household income is spent on 'Food'.**
- ***Expenditure on transport is 9.1%.***
- About 3.4 million trips are generated on an average day.
- The mobility rate in Addis Ababa is low.
- A large share of trips is by 'Walk' (60.5%). However their share has come down from 70% observed in 1984. The average trip length of all trips is 3.3 km; and those of 'walk' trips 1.49 km.

28 Consultancy Engineering Services (India) Private Limited in association with Saba Engineering (March 2005)

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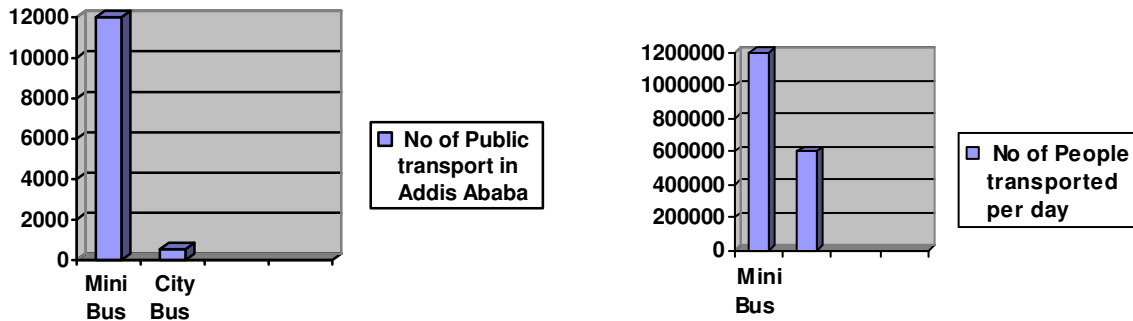
Findings report, Volume I

**A Brief Summary of City Bus Enterprise (Anbessa)**

To summarize analysis of secondary data on the existing city bus service and shared taxi reveal the following facts:

Addis Ababa has a vehicle population of 183,159 vehicles in 2007, out of which 40% are private vehicles (cars); 37% are commercial vehicles (Buses & Trucks); 11% are Taxis, 7% are Government vehicles and 5% other vehicles.<sup>29</sup> *The Public Transport buses of ‘Anbassa’ are hardly 0.29% of total number of vehicles, but account for 35% of the trips, which speaks for the role of Public Transport and its advantages.*

- Addis Ababa City Bus Enterprise with 534 buses operating per day accounts for nearly 35% of the trips while Mini Buses with nearly 12,000 vehicles account for only 20% of the trips.



*Figure 4.8 – proportion of Mini Bus and City Bus/ Number of people transported per day*

- Number of Addis Ababa City Bus Enterprise Buses operating now is 534 which means that there are 1.35 buses per ten thousand inhabitants taking city population as 4.0 Million.
- Government subsidy per passenger per trip which was about 0.26 cents per passenger per trip fares has now reached 10 cents per passenger.
- The average waiting time for the service of Addis Ababa City bus Vehicles is in between 30-90 minutes.<sup>30</sup>

<sup>29</sup> Addis Ababa Transport Authority

<sup>30</sup> Interviews with Ato Alemayehu, Addis Ababa City Bus Enterprise planning unit

In general it would be a fair analysis to say that the public transport system in Addis Ababa is in a critical condition. This uncertain situation is self evident from the fact that, the revenue generated is decreasing from time to time, the existing number of city buses are not even comparable with the population size, the enterprise's control mechanism is manual, at the same time the number of minibus taxis is increasing continually which results in congestion in most of the major roads of the city, the rate of traffic accidents is increasing at an alarming rate, whereas for the non-motorized transport mode the problems seem to emanate from the lack of properly paved pedestrian walkways, the ever increasing distance between work places and residence areas, the illegal use of side walks for business transaction and the like. In addition, the number of motor vehicles is increasing from time to time at a rate of 3.5% per year[refer to table 4], which the current investments in transport infrastructure can barely support.

Hence the combined effect of all of these factors is manifested through the inefficiency of urban mobility in the city.

## 4.5 Traffic management in Addis Ababa

- Traffic management is limited in scope and extent.
- A large volume of traffic moves on the road network system. Nearly 20,000 vehicles enter/exit the city on an average day.
- A large volume of traffic (131,790 vehicles) enter/exit the Core Area.
- Peak hour flows are high (9 to 22%). 'Through' traffic is high (28.6% of passenger modes).
- Until the end of 1997 EC, there were only 28 junction roads that had traffic lights.<sup>31</sup>

Judging by the safety record and the general lack of coherent traffic circulation plans, the culture for traffic management (the design and implementation of traffic management schemes for both motorized and Non-motorized transport modes) is weak.

## **4.6 Transport infrastructure**

### **4.6.1 Road network in Addis Ababa**

Addis Ababa basically has a radial road system focusing on St George Cathedral-Railway Station axis. There are five main arterial roads with the southern one, the Akaki-Debrezeit section, being the most heavily used. A system of ring roads (currently incomplete) is designed to provide relief for inner city traffic and for cross-city traffic.

*31 Addis Ababa Traffic Police*

#### **A brief history of roads in Addis Ababa**

As long as a city exists, the need for road networks is there, even though the extent of coverage might vary. The development of the roads in the city owes its history to the founders of the city, namely Emperor Menilik and Etege Taitu. History has it that the Emperor himself was at the forefront of the development even partaking in hard physical labor.

In 1894 EC, the Emperor undertook the construction of the roads from Addis Ababa to Addis Alem and from the palace (presently located in the area known as Arat Kilo) to the British Embassy and in many different directions. Even if it wasn't highly successful emperor Menilik brought in rollers (stone crushers) and tried to construct modern roads with the help of local laborers.

Only the roads from the palace to 'Entoto Genet' and Addis Alem were successfully upgraded into modern standards. The rest were doomed to be dusty in the winter and muddy in the summer times. The same person, Emperor Menilik, imported 2 vehicles to Addis Ababa in 1899 at the end of his reign. However, up to 1912 EC, movement in and around the city was limited to mules and horsebacks with most of the roads being nothing more than mule trails. Better and modern road construction did not materialize in Addis Ababa until the era of Emperor Hailesellase I. It was during his reign that road construction began to be undertaken in a modern and extensive manner. During this time a new office, 'The Public Works Department' was set up, with the objective of constructing new roads and upgrading the existing ones in and around the city of Addis. This new Public Works Department that was formed at the start of



**Figure 4.11** – The first road built in 1907EC .....Ras Mekonnen Bridge  
 Source –Ababa Addis Ababa City Road Authority

HaileSELLASIE’s reign was upgraded into a ministerial level and the city developed its own organization henceforth.

The following table shows road net work coverage i.e. asphalt roads, gravel/ dirt roads, pedestrian walk ways and drainage lines in Addis Ababa up to 1997EC. <sup>32</sup>

### Road network coverage in Addis Ababa

**Table 4.14** –Constructed vehicular road coverage

Road hierarchy	Length of varying width (km)	Length in terms of 7m width (km)	No of bridges	Condition
Arterial	250	336	93	Good
Sub Arterial	95	133	34	Good
Collector	151	181	44	Good
Local	167	167	30	Good
Total	336	817	201	

Source –Ababa Addis Ababa City Road Authority

The total gravel road in Addis Ababa is 1,383 km. According to the above data, a total of 2,200 km road exists in our city.

**N.B.** this data doesn’t include gravel or asphalted roads built independently by each Sub-city.

<sup>32</sup> source- Addis Ababa City Road Authority bulletin, 1997 EC

**Table 4.15** –Constructed pedestrian roads in Addis Ababa

Road Hierarchy	Left side (Km)	Right (Km)	Total (Km)
Arterial	30.6	29.8	60.4
Sub Arterial	41.6	37.6	79.2
Collector	50	50	100
Local	12	12	24
Total	134.2	129.4	263.6

Source –Ababa Addis Ababa City Road Authority

The above table shows that the total pedestrian road which was already constructed in Addis is 264km and the total existing drainage line is 815 km in both directions of the streets.

#### 4.6.2 Transport System and Traffic Characteristics

- The road network of Addis Ababa is poor in extent of coverage.
- Capacity is limited.
- Service lanes are absent.
- On-street parking is prevalent.
- Pavement condition is deteriorating.
- There are no footpaths over a large length (63%) of the network. This is a major drawback in view of the large volume of pedestrians.
- Pedestrian traffic is very high but level of service low. For many lengths sidewalks are not available.
- Parking is emerging as a major demand and problem. Accumulation is high. Short term parking dominates.<sup>33</sup>

<sup>33</sup> Consultancy Engineering Services (India) Private Limited in association with Saba Engineering (March 2005)

Urban Transport Study and Preparation of Pilot Project for Addis Ababa, Findings report, Volume I

# **Part Five**

## **The Case Study Project, Data Analysis and Evaluation**

## 5.0 Introduction

### 5.1 Case Study

The analysis of the results from this survey has been summarized as follows:-

#### Data analysis

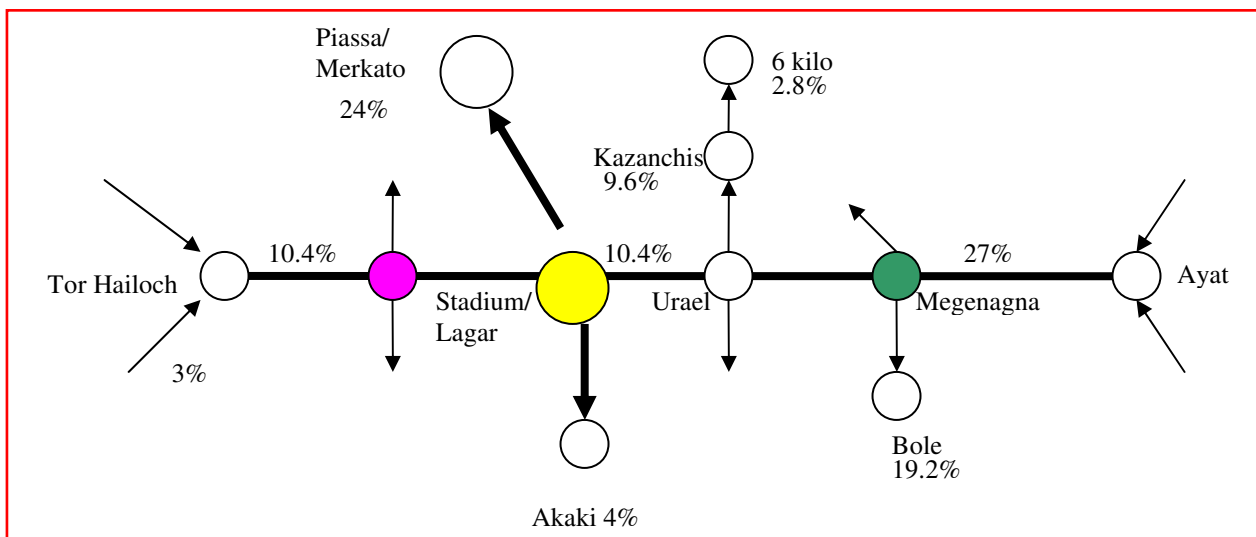
A survey was conducted with the aim of covering users (500 in number) of the existing public transport modalities, namely the city bus and shared taxi. It was undertaken throughout the different locations mentioned earlier in the introduction.

#### Sample Survey by Destination

*Table 5.1– Sample Survey at Various Locations on the East-West Axis*

Destination	Kazanchis	Akaki	Legehar/ stadium	Bole	Megenagna	6 kilo	Betel	Merkato	Total
No people	48	20	52	96	135	14	15	120	500
	9.6%	4%	10.4%	19.2%	27%	2.8%	3%	24%	100%

A graphic representation of the destinations of the subjects of the sample survey at various locations on the east-west axis. <sup>34</sup>



**Figure 5.1– Sample Survey at Various Locations on the East-West Axis**

<sup>34</sup> The sample survey is taken from passengers of both the City buses and Shared Taxis on route to their various destinations.

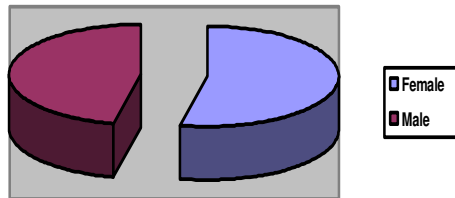
## Socio-economic data survey

### 1. Gender

The first set of data has been analyzed as follows. <sup>35</sup>

*Table 5.2–Sex Distribution*

F	M	Total
216	234	500
53.2%	46.6%	100%



*Figure 5.2–Sex Distribution*

### 2. Mode of transport frequently used

According to the results of the survey conducted, around 50.4% of the subjects use shared taxi (Mini Bus) while more than a third use the city bus as their primary choice of transport.

*Table 5.3– Mode of Transport frequently used*

	Mode of transport			
	Pedestrian	Bus	taxi	Total
No of people	74	174	252	500

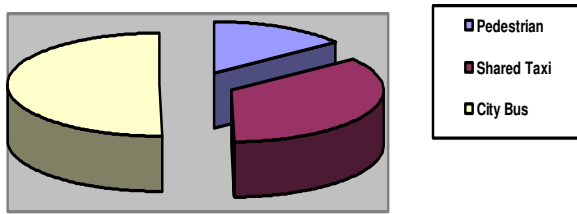


Figure 5.3– Mode of Transport Frequently used

### 3. Average daily expense for transportation

It was learnt from the survey that the monthly income people earned, had a marked influence on the type of transportation they frequent, which is also an implication of their daily expense for transport.

Table 5.4– Average monthly expense for transportation

	Monthly income			
	<300	300 - 600	>600	Total
No of people	107	203	190	500
Percentage	21.4 %	40.6%	38%	100%

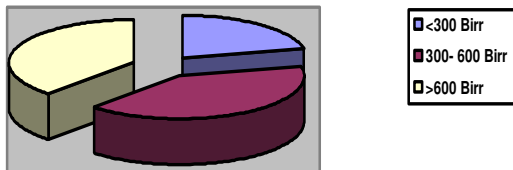


Figure 5.4– Average monthly expense for transportation

### 4. Average daily expense vs. monthly income

True to the current economic reality of the city, the amount of money people spend for transport daily is directly proportional to their rate of mobility income and it further reinforces the significant role played by the public transport in getting people from one place to another in an economically viable way.

The subjects of the survey have been grouped in to three sub classes based on their monthly income namely:-

- A. Monthly income less than 300 ETB
- B. Monthly income of 300-600 ETB
- C. Monthly income more than 600 ETB

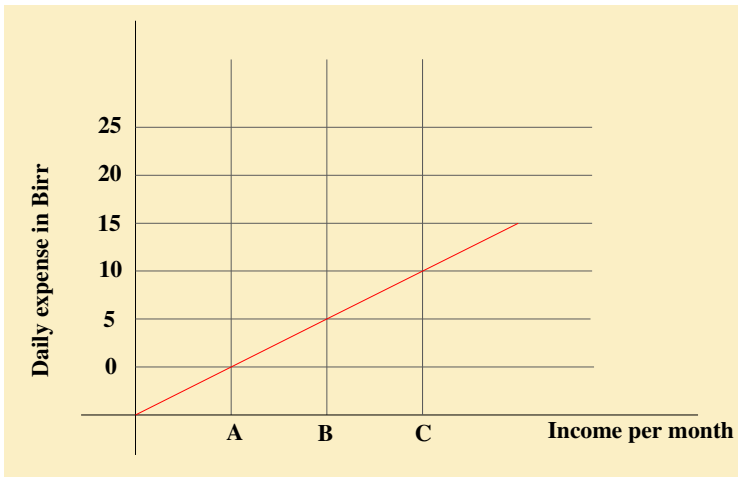


Figure 5.5– Average monthly income Vs. Daily expense of transportation

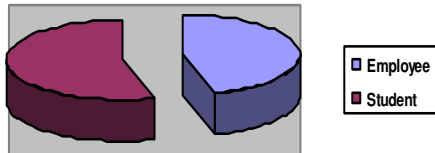
This graph shows that monthly income is directly proportional to transport expenditure. Further more; the survey indicated that on average the subjects spend around 7-16% of their income on transport. This can be found from a simple measurement of angle ‘X’ in the above graph.

## 5. Purpose of Trips Generated

While compiling the data for this set of questions geared toward assessing the travel behavior of the subjects of the study, two broader classifications namely, “employee” and “student” have been used. However it should be noted that under the subgroup of employee we have, business people (self employed), commuters, civil servants and the like, while the “student” subgroup indicates subjects traveling to some sort of educational institute. This shows that the predominant purposes of travel are work/ Education based.<sup>34</sup>

**Table 5.6 Purpose of Trip Generated Daily expense of transportation**

	Occupation		
	employee	student	Total
No of people	218	272	500
Percentage	45.6%	54.4%	100%



**Figure 5.6 Purpose of Trip Generated Daily expense of transportation**

## 6. Load of people transported

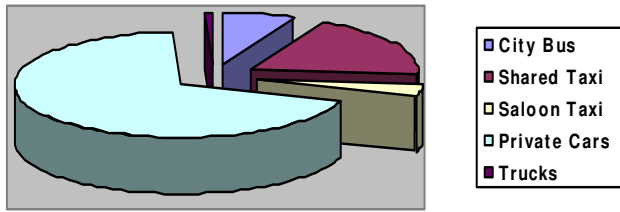
Data found from the city bus enterprise indicates that buses transport 100 passengers per ride on average. From observation of peak hour traffic carried out at the various busier intersections along this corridor, the following facts were learned.

### Motorized urban transport modes observed at *Megenagna* junction

From 7.06 am - 7:16 am

**Table 5.7 Load of Transported people observed at *Megenagna***

	Private cars	Bus	Shared (mini) bus	Saloon taxi	Truck	Total
No of vehicles	204	21	57	11	2	295
%	69.1%	7%	19.3%	3.7%	0.9%	100%
Passenger per ride	2.5	100	12	5	2	
No of passenger transported	510	2100	684	55	4	3353
%	15%	62.6%	20.4%	1.6%	0.4%	100%



*Figure 5.7 Load of Transported people observed at Megenagna*

In terms of passengers transported, it was learnt that the average number of passengers was 2.5 for private cars, 12 persons for shared taxi (mini buses) and 4 persons for the saloon taxi. Hence one can see that those 21 buses that passed through the Megenagna junction, had transported more than 2,500 passengers compared to that of the 510 passengers that used private cars.

Taking the general assumption that one city bus is three times the size of a small automobile, one can see that the buses transported roughly 1000 passengers more.

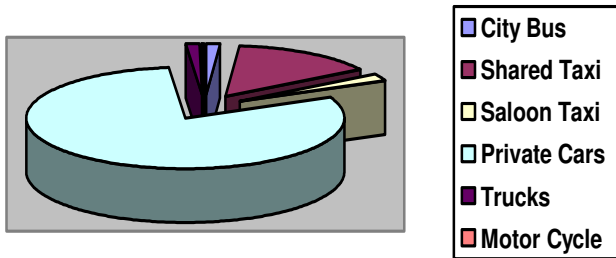
This calculation of the observed traffic flow can be made for all the other junctions that were studied, but the general indication is that the buses and mini bus taxi, even though smaller in number, are far more efficient because they transport bigger number of passengers at a time.

**Motorized urban transport modes observed at *Urael* junction**

From 7.30 am - 7:40 am

*Table 5.8 Load of Transported people observed at Urael Junction*

	Private cars	Bus	Shared (mini) bus	Saloon taxi	Truck	Motor cycle	Total
No of vehicles	239	8	44	6	4	1	298
%	80.2%	14.7%	1.5%	2%	1.3%	0.3%	100%
Passenger per ride	2.5	100	12	5	2	1	
No of passengers transported	597.5	800	528	30	8	1	1964.5
%	30.41%	40.72%	26.86%	1.53%	0.4%	0.08%	100%



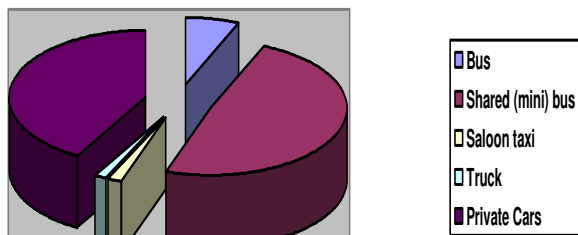
*Figure 5.8 Load of Transported people observed at Urael Junction*

**Motorized urban transport modes observed at Stadium junction**

**From 7.40 am - 7:50 am**

*Table 5.9 Load of Transported people observed at Stadium Junction*

	Private cars	Bus	Shared (mini) bus	Saloon taxi	Truck	Total
No of vehicles	96	15	112	4	3	230
%	41.7%	6.5%	48.8%	1.7%	1.3%	100%
Passenger per ride	2.5	100	12	5	2	
No of passengers transported	240	1500	134	20	6	1900
%	12.63%	78.95%	7.05%	1.05%	0.32%	100%



*Figure 5.9 Load of Transported people observed at Stadium Junction*

This shows that there is a large concentration of public transport, as one gets closer in to the center.

# **Part Six**

## **Research findings and Conclusion**

## 6.1 FINDINGS

**The major findings of the research have been summarized as follows:**

The findings of this research indicate that there has never been any kind of major intervention plans with this regard that were implemented. It is true that proposals have been put forward at different times, but none of them were enforced. A number of reasons can be forwarded as to why this has been the case, to name but a few, lack financial resources or funding, shifts in political ideology, withdrawals of support from international financial institutions such as the IMF and World Bank.

As far as the motorized mode of transport in Addis Ababa is concerned, the traffic counts performed on peak hours at various junctions (Megenagna, Urael, Stadium and Tor Hailoch) along the east-west axis have indicated that private cars are the major causes of congestion. This can be explained by looking at the proportion of number of private vehicles observed with the number of passengers they transported, i.e. even though private cars were bigger in number in all of the traffic counts, they only accounted to about one fourth of the passengers transported by city buses, in each instance. (See tables 5.7-5.9) Furthermore, the shared mini bus taxi, have the second largest presence in terms of the traffic count contribute a significant amount towards the existing congestion. In comparison, the city bus service, although it has a minimal street presence (slightly less than a tenth of the total number of vehicles), on average, accounts to about more than half of the total number of passengers transported.

- *From the results of the study it is obvious that, a city bus is roughly about 50 private vehicles or 9 mini bus taxis in. This indicates advantages of the high capacity bus (100 seats in Anbessa) compared to small capacity of Mini Bus (12 seats). What is more the road space is effectively used by the bus system.*

### **Demand overlap**

A survey of the purposes of trips taken by the subjects indicated that there are two predominant destinations, educational institutions and work places. In Addis Ababa, currently, the working hours of both these occupations are the same. This results in a phenomenon whereby almost all of the residents demand public transport services at about the same time or for the same time period, which creates a demand overlap. Furthermore, it was observed that even residents who rely on private means of transport demand the use of the existing roads with in the same periods of time of the day.

### **Movement pattern**

From the traffic count performed, it was learned that there is a concentration of public transport within the core area of the city, which is an indication of the land use pattern. This is due to the fact that there is only one main center located in the heart of the city. This has in turn resulted in a defined traffic movement pattern that heads into the center for almost all purposes of trip. When this movement pattern is coupled with the demand overlap mentioned above, it no doubt creates an increased level of congestion.

### **On street parking**

Even though the east-west axis has the provision for three lanes on each side, it was learned that on street parking dominates throughout its length, literally making it a two lane street. What is more the overflow effect of this preoccupation of the side lane for parking activities is creating traffic jams and congestion.

### **Socio-economic Dynamics**

It has been stated earlier that Addis Ababa is the economic power house city of the country, this fact has several implications in the socio economic make up of the city. As it has been shown in the population forecast, the urban population is growing continually at an alarming rate. It is obvious that this is directly linked to the fact that rural urban migration is at its highest in the case of Addis Ababa. On the other hand a detailed look at the rate of construction of transport infrastructures in Addis Ababa indicates that the rate of road

coverage has been increasing steadily. However, the degree of congestion is rising up just the same. Even though there still is a lot of work that needs to be done in terms of infrastructure provision, the capital investment in roads carried out in the city so far, should have had an impact on the level of mobility albeit a small one.

### **Addis Ababa City Bus Enterprise (findings)**

The accumulated losses of the City Bus Enterprise are mounting up and its future survival is questionable. The gap between the revenue collected and the operating expenses is increasing. (See the above table)

Actual findings indicate that following factors as the principal contributors for the unhealthy status in which the city bus enterprise finds itself today:-

#### **Unclear objectives and mandates**

There appears to be a basic conflict, in the perspective of the role of the enterprise, i.e. is the city bus enterprise a commercial organization or a civil service organization? The Federal Government views road transport as a commercial activity in general, while the Addis Ababa city Administration views city bus enterprise, as a service giving organization for urban growth.

#### **Uncertain Capital grants**

Addis Ababa City Bus Enterprise does not have any assured supply of capital grants. The enterprise relies heavily on grants from various donors such as the Netherlands Government and the State for capital expenditure financing.

#### **Share of Subsidy in Revenue Account**

There is a deficit in revenue account, as subsidy is reduced at one end while operating cost increase at the other, thus burning the candle from both sides. The enterprise is facing uncertain future due to poor financial health; especially controlling the tariffs and denying the subsidies.

### **High Staff turnover**

There is a high staff turnover of drivers, technicians and some professional staff. Salaries are not competitive for their positions. In fact, the salary scales are structured in favor of lower grades.

### **Lack of Infrastructure**

One of the major constraints of city bus enterprise is the lack of proper and adequate Infrastructure. The bus stops do not have shelters. The terminals do not have proper passenger facilities. There are no proper stopping and terminal points developed. Therefore the need for standardized development of transport facilities is imperative.

### **Lack of Public Transport Policy**

Currently, there is no coherent policy framework supporting Public Transport expansion put in place. The present control on tariff levels or the subsidy payments are not sustainable in the long term. In fact, they have a negative effect on the poor traveling section of the public as mass transport system cannot be expanded in tune with the demand.

### **The future plan Vs the existing situation**

The number of routes is increasing from time to time because of new expansion areas that are a result of various factors such as urban sprawl, increase in the density of urban population and the like.

The trend in population increase within the urban areas indicates that some core inner areas of the city have a marked rate of population growth that is greater than the citywide average. These are usually places where the urban poor dwell, and since residents of such localities depend heavily on the city bus network for their daily movements there is a

constant need for an increase in fleet that serve those localities. This in turn results in an increase in demand vis-à-vis an increase in number of passengers in such specific areas.

### **Organization structure**

There is an apparent lack of coordination between the different pertinent urban transport institutions. In addition with the city bus enterprise itself some functions are split into separate departments even though they exhibit close inter relation in practice.

### **Field of route served by the existing public transport modalities**

As can be observed in the figure below, the city bus network, which is a combination of the bus routes and bus stops, does not have any design or planning features. In fact it follows the existing land use and patterns of earlier settlements, which again is a reflection of the lack of coordinated urban planning as well as designing aspects in Addis Ababa in general. As indicated in the maps below, for both the city bus and shared-taxi route distribution, there is an overlap and concentration of these services as we get closer to the inner city. This results in peak hour congestion in the CBD, due to the added impact that comes from the use of private cars and pedestrians.

(Refer to maps at the end of this section)

### **Transport network**

The station at Lagar has a potential to serve as a transit center due to the existing infrastructures around it namely, the train station, the major city bus terminal and regional bus station.

### **Controlling mechanism**

The city bus enterprise uses manual controlling mechanisms for the operations of the transportation services it provides. This obviously has negative impact on its efficiency, especially when we take into account the added demand for public transport that exists now more than ever before. Furthermore, such services as, ticketing are also done manually, which almost always result in long queues

## **Terminals**

It may be observed that the 10 Terminals (3 major & 7 minor) cover 99% of the routes, which is a very significant part of the total operations. Out of these the Lagar terminal (major) and Megenagna terminal (minor) are located along the east-west axis which is the area of consideration of this study.

The infrastructure at all these terminals is bare minimum. These terminals are congested, and do not have any civilized facilities, such as toilets, interactive information display boards, schedules and routes of operation etc. There is need for investment on passenger facilities at the major terminals.

## **Shared Taxi**

Number of taxi in the city is increasing perpetually; this observation reinforces the fact that the public transport demand is increasing through time. Even though this mode transports about 1.2 million passengers per day, there are about 12000 taxis that make more than 15 trips per day to ensure this. It would not be a stretch of imagination to comprehend the impact this has on the city's limited road network. To throw in some numbers for comparison, the city bus transports about 0.6 million passengers per day with a fleet of only 534 buses.

Roughly around nine minibus taxis, employing at least eighteen people, stopping and going as they please, creating a lot of noise pollution, using side lanes for loading and unloading people, with a high consumption of fuel, contributing their share of carbon emission, barely transport as many passengers as does a single city bus.

## 6.2 CONCLUSION

As it has been discussed in depth in the history of public transport, maximization of mobility in urban areas heavily relies on the capacity of the existing public transport. In light of this fact, it can be said that the ability of the public transport system Addis Ababa as it exists now, to meet this goal of maximizing urban mobility is very limited.

According to the literature review that I have made earlier, it can be concluded that the generic causes of congestion in Addis Ababa are:-

**Specialization**- the fact that Addis Ababa has one dominant center and various other weak sub centers has led to a higher degree of specialization of such land use patterns in the core area of the city. Markets, corporate offices, educational institutions are located in this area and hence it has high inbound and outbound traffic at peak hours which results in congestion.

Secondly, the continued growth of the urban population which is largely due to **rural-urban area migration** or the pull effect of the city and changes in land use patterns such as development of business activities in previously residential areas, are generating a continuous demand for travel.

Thirdly, the apparent **demand overlap** which has been discussed in detail in the findings has resulted in high peak hour traffic which in turn causes congestion.

Even though the existing traffic volume in the city is not considered to be high by any standards, the degree of transport provision coverage to the general traveling public is low. This is due to the lack of both effective traffic management measures as well as timely investments on the appropriate infrastructure in the right locations.

This problem will be exacerbated in the near future as traffic volumes increase substantially due to the economic and demographic factors noted above. Both traffic volumes and the total amount of time people spend traveling are growing rapidly. Simply stated, the existing

transport system in Addis Ababa cannot cope with this increase in demand and the quality of the city transport system is deteriorating.

The combined effects that arise from the congestion factor mentioned above are:-

- The speed/ energy consumption effect
- The resultant effect on the economy which can be observed through the rise in the city's fuel consumption vis-à-vis the rise in vehicle population.
- Delay/ productivity effect, considering amount of time wasted on the road which could otherwise have been used to more productive use.

### **Transport network**

Contrary to what is suggested in the literature review about the need for putting in place a well planned public transport network, the existing situation in Addis Ababa is a mere reflection of the haphazard organic growth of the city. There are no city bus or taxi routes that indicate any planning principle. There is virtually no consideration for transit passengers.

The social aspect of urban transport planning implies that the public transport sector should be dominated by its social obligations especially to the economically challenged section of the society. In line with this argument, the city bus enterprise does not have objectives that clearly indicate whether it should strive for profit making or carrying out its social responsibility.

Taking into account the amount of fuel energy consumed level of traffic chaos and noise pollution created as well as low degree of efficiency as far as number of people transported per trip is concerned, the shared taxi is not a viable system of public transportation for Addis Ababa.

### **Non-motorized mode of transport**

The absence of proper sidewalks combined with the topographic characteristics of the city (steep slopes of the terrain) limit the efficiency of such non-motorized transport modes as

walking, riding bicycles and so on. Furthermore, this situation has made pedestrians the number one victims of motor vehicle accidents.

In view of the horizontal expansion of Addis Ababa and lack of pedestrian sidewalks, even though it is the cheapest and most dependable mode of transport which contributes to more than two third of the city's mobility. Walking has become dangerous and begun to have a negative impact on productivity.

# **Part Seven**

## **Recommendations**

## **General Recommendations**

The overall notion of this research is not to give a detailed prescription for the ailing public transport of Addis Ababa. However, the suggestions that are forwarded herein are aimed at giving broader and more general guidelines to better suit this mode of transport in its role toward maximizing mobility and easing the level of congestion currently observed. In light of this situation some of the ideas put forward as possible remedies are of a rather more policy oriented nature while still others may be specific suggestions for specific findings that have been already pointed out. Therefore the general condition under which these suggestions can perform better is if they are viewed as integral parts of a holistic approach. The various measures that need to be taken should be role players with specific objectives, and these objectives should fit together. Hence the need for effective means of communication and cooperation between the various stakeholders is of paramount importance.

There is a need for framing a workable Public Mass Transport Policy, which is sustainable and which provides not only finances but also sustainable institutional arrangement to meet the future needs of Addis Ababa. Given the existing financial and institutional limitations, in order to get effective mobility and accessibility, have safe, reliable and efficient public transport which meets the demand for its service, guiding principles and a set of implementation strategies should be formulated.

The shape, in which the public transport finds itself today, as has been already mentioned, is a result of the various socio-economic forces at play, and as such urban transport can only be taken as just one of the variables whose well being hugely depends on the workings of this dynamics. It would be unrealistic to try to diagnose this public transport system as an isolated entity. There is a need for policy directives that take into account the fact that the public transport provision will always be a daunting task unless policies are put in place that appreciate the fact that the economic role Addis Ababa plays at a national level should be supported by other regions of the country, so that citizens do not always have to flock to the capital when in search of good jobs, decent educational institutions, access to

technology (comparatively). The role that Addis Ababa is currently playing to this end should be reduced and equally competent regional centers should be created, hence the need for these policy guidelines is a pressing one. Only then can the pull effect the city has, be reduced.

### **Decentralization**

The fact that Addis Ababa has one dominant center and other weak sub centers has a negative impact on the general level of mobility in the city. Therefore the development of other competent sub centers in the city is a planning alternative that should be looked at. This way we can lessen the strain of peak hour traffic flow into or away from the CBD. Furthermore the possibility of redesigning some of the bus routes that go into the CBD is an area that should be looked into. It can be done in such a way that cyclic or balloon routes that circle around this central area can be adopted. This would necessitate walking short distances to and from the inner core to where the routes end, and hence prohibits motorized transport from getting deep into the core, which in turn would result in a vehicle free, pedestrian friendly center while at the same time avoiding congestion.

### **Staggered Hours**

It was found out from the survey conducted that various institutions demand the provision of public transport system at about the same time, with educational, civil service, financial and other institutions having similar working hours. However it might indeed be a necessary measure to stagger the operating hours of these institutions, thereby easing the demand overlap.

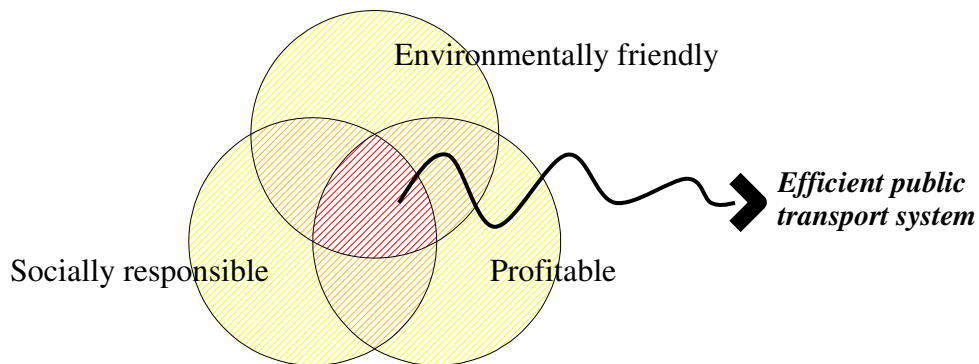
### **Mixed Traffic**

The mode of traffic observed in the city today is mixed traffic, meaning that all forms of motorized transport modes demand the use of the limited streets with equal intensity. There is a lack of prioritization when it comes to the nature of trips performed by these transport

modes. A city bus carrying well over a hundred passengers can be stuck in a traffic jam on a busy street next to a sedan carrying just one person. However it is customary practice to have segregated lanes for shared taxis, buses, private vehicle and trucks should be.

### Social Responsibility

Addis Ababa City Bus enterprise, as the major operator of public transportation in the city, should attain financial stability and sustainability in order to be efficient. It is of course true that this assessment of efficiency depends on the objectives that we set for our public transportation system. In our case, social responsibility, that is, the provision of motorized transport mode in an equitable manner takes the number one priority, while profitability and environmental considerations might be considered to be the second and third runners up. However it should be noted here that, these tasks are not necessarily mutually exclusive by definition. Hence, it is suggested that our public transport system should aim for that delicate balance which exists at the intersection of these three important parameters, and the principal development partner in such an undertaking is of course the regional government, and the federal authority by extension. Furthermore the involvement of the private sector in this area could be of great significance. This of course needs a strict supervision of the government so as to make sure that the social responsibility is always under scrutiny.



**Figure 7.1**Efficient public transportation system

### **Organizational Structure**

For effective management of an enterprise, the organizational structure plays a vital role. The organizational structure should clearly specify the responsibilities, span of control, delegation of authority; accountability and enforce proper inter relationships between various entities. The appropriate design of this structure is a pre-requisite for the successful operations of any business enterprise.

All the concerned institutions and stakeholders dealing with public transportation and urban development, such as: Traffic police, Addis Ababa City Roads authority, Addis Ababa Transport authority, Master Plan Office, Addis Ababa city Bus enterprise, Federal transport Authority and the like should channel their efforts toward increasing urban mobility in Addis Ababa and create a medium that would allow for a smooth flow of information both at political and technical levels.

### **Non-motorized mode**

It has been clearly stated that the walking mode covers about 60% of all home to work mobility in Addis Ababa, furthermore, it is also by far the cheapest and most dependable means of movement, therefore pedestrian ways including sidewalk ways should be constructed along side all arterial and sub-arterial streets. Furthermore the provision of shortcut paths, especially in areas where there are small streams and rivers cutting through residential areas is of vital importance, for it would result in a significant decrease in walking distances.

The mobility of animals in the city, especially around holidays, seems unavoidable in the near future. Thus, proper management of their mobility seems the most important solution for healthy relations between this and other modes of transports in the city. Therefore, when it is within the city limits except up to markets at periphery, animals for sale should be transported by vehicles. Furthermore some land uses that necessitate this phenomenon, such as the abattoirs need to be relocated so as not to worsen the situation.

### **Parking and stopping places provisions**

Most other aspects of urban transport and road network have been subjects of various studies at one point or another, but in depth researches and studies about the provision or the lack there of, of parking facilities are lacking. Proper supply of parking facilities, especially in transit areas is a measure that should be taken so as to avoid the spill over effect of the public transport. What is more some common practices such as on street parking should be avoided on peak hours.

Add more parking fee on private cars to discourage them from spending so much time on the street, which will help to minimize congestion. As a result people would be forced to move quickly, which would make the traffic flow smooth.

### **Bicycle lane**

It is obvious that the terrain of Addis Ababa is not suitable for using bicycle but it should be introduced on some flat lands, for example Bole road.

### **Saloon taxi**

It should be metered and the passengers should be able to pay per kilometer. Therefore the government should stipulate rules and regulations to this end. For example in the case of New York City, the meter starts from 4 dollars, which is the minimum payment regardless of distance traveled, this helps the taxi owners to cover their expense for time lost while they are stopping, hence removing the need for making unnecessary travels just for the sake of looking for potential customers.

### **Mass transport**

In the long run, introduction of such mass transport modes as trams can be of great importance in reducing congestion substantially. For instance, trams, as discussed in the comparison of the various public transport systems, have a higher passenger capacity (about 500 people), are environmentally friendly, provide more comfort for passengers,

hence lessening the need for a private car, and require turning radii that can be attained with minor adjustments on some of the major roads, such as the east west corridor, that we have in Addis Ababa. Further more in line with this, electric bus, that more or less shares the same attributes as far as energy efficiency and ease of adaptability is concerned, can be another viable option. In fact, an August 3, 2007, issue of the Amharic “Addis Admas Weekly” reported on a project funded by private investors, currently underway that is aimed at establishing electric buses on selected routes in the city.

### **Inbound and Outbound traffic**

According to the survey that I have made and different studies made by different professionals, the main congested areas in the peak hour are found along the major East West axis road and in the main center of the city. And the roads which lead to the main centers from the four direction of city are congested in the mornings which is called In-Bound-Traffic (incoming traffic is high in the morning) and on the contrary the opposite lane is congested in the afternoons, which is called outgoing traffic or outbound traffic. We can recommend here, the use of more number of alternative lanes in the direction where there is higher traffic to minimize congestion.

### **Transport infrastructure**

Similarly, in the urban road net work of Addis Ababa, intersections and drainage together with the existing road infrastructure implementation problems should be given proper attention. Lack of alternative routes and unchannalized road functions to accommodate traffic have aggravated the road network problem. Therefore, it is firmly believed that step-by-step improvement plans must be devised to mitigate design and implementation problems of the road network.

### **International standards**

Addis Ababa, as the unofficial capital city of Africa, should adopt usage of signals and traffic signs that comply with international standards. This should be given attention as one of major components of traffic management.

### **Terminals, bus bays and bus only lanes**

The transfer of passengers takes place at the terminals, and there is a need to make the transfer more convenient by provision of proper infrastructure. Such areas as Lagar can provide enough space for smooth transfer of passengers from regional bus services to city buses and then onto major streets because of their location. Similarly, provision of bus bays, on important roads would help to improve speed of buses and cause less inconvenience to other traffic on the carriageway. It is quite obvious that there is a need to give priority for buses at traffic junctions, and to provide bus lanes on high corridors to improve the productivity of the bus system

In general, it has been stated in the beginning that transport is an engine for development, hence the significant role that urban transport plays in bringing about a sustainable development and poverty reduction in the urban context can not be overstated. It is through the provision of an equitable public transport that we can aspire to bring enhanced mobility for the residents of the city of Addis Ababa.

It should be mentioned here too that, as it has been clearly stated in the concluding remarks, the realm of public transport in Addis Ababa is entangled with other multifaceted transport related as well as social issues. Thus the need for comprehensive studies in all the respective fields is of great importance. Such areas of interest as traffic management, transport infrastructure, transport systems and need to be studied in depth.

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- *Dr. Abebe (Meteorologist)*

*Ato Belay Wakjira (Traffic engineer)*

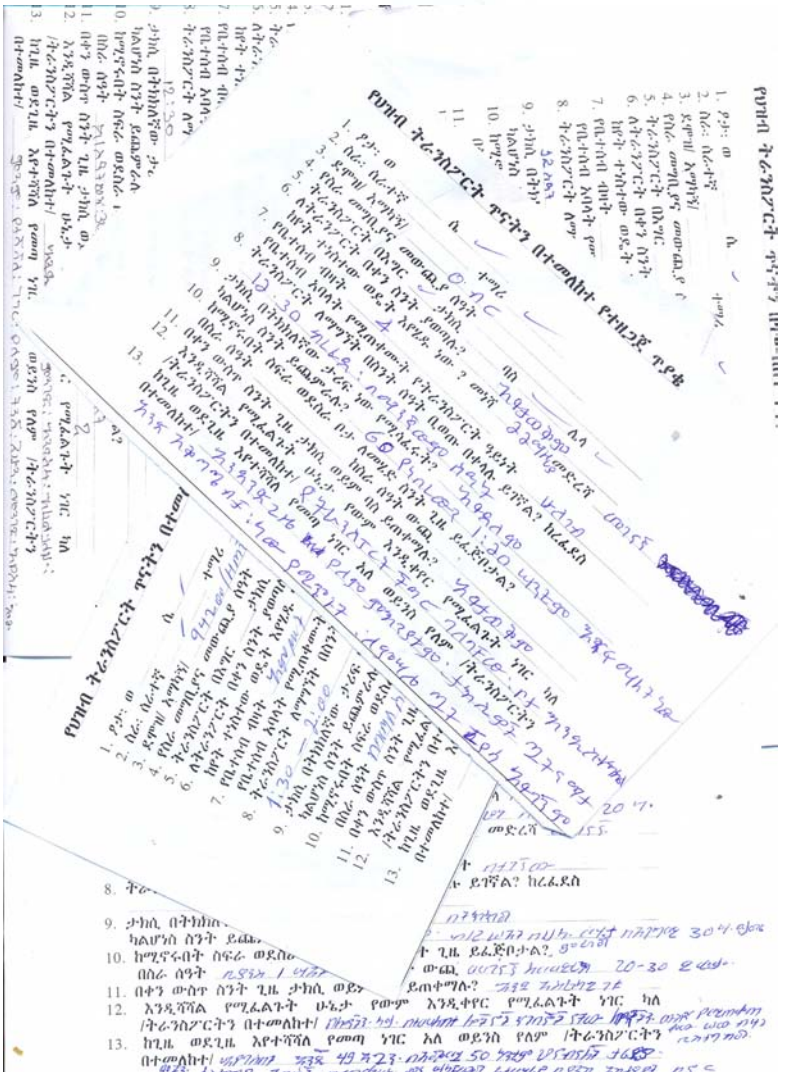
*Ato Matewos Asfaw (Architect Planner)*

*Dr. Rosemary Curran (instructor at AAU)*

# List of Annex

## የህዝብ ትራንስፖርት ጥናትን በተመለከተ የተዘጋጀ ጥያቄ

1. ያታ: ወ ስ
2. ስራ: ስራተኛ ተማሪ
3. ደሞዝ አማካኝ 942.00 (ዘጠነ መቶ ማህበራዊ)
4. የስራ መግቢያና መውጫ ደብዳቤ ሰዓት 2:30 - 9:30
5. ትራንስፖርት በእግር ታክስ ባስ ሌላ
6. ለትራንስፖርት በቀን ስንት ያወጣል? 1.65 (አንድ ብር ለአንድ ሰዓት) ከየት ተነስተው ወደ ስራ እየሄዱ ነው? መነሻ በላይ መድረሻ መሥሪያ ቤቅ
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8. ትራንስፖርት ለማግኘት በስንት ሰዓት ቢወጡ በቀላሉ ይገኛል? ከረፈደስ 1:30 - 2:00
9. ታክስ በትክክልኛው ታራፍ ነው የሚላፈሩት? አንድ ሰዓት በሆኖ ብቻ ነው
10. ከሚኖሩበት ስፍራ ወደ ስራ በታ ለመሄድ ስንት ጊዜ ይፈጅቦታል? በስራ ሰዓት ገቢ ላይ ከስራ ሰዓት ወጪ 15:00 ገቢ
11. በቀን ውስጥ ስንት ጊዜ ታክስ ወይም ባስ ይጠቀማሉ? ሁለት ሰዓት
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13. ከጊዜ ወደ ጊዜ እየተሻሻለ የመጣ ነገር አለ ወይንስ የለም /ትራንስፖርትን በተመለከተ/ አይደለም



Questioners for Sample survey

- 1- Sex- F ..... M.....
- 2- Occupation
  - Student .....
  - Employee.....
- 3- Income per month .....
- 4- Working hour
  - From .....to .....
- 5- Which transport mode do you usually use
  - Walking .....
  - Taxi .....
  - Bus .....
- 6- How much do you spend for transportation per day?  
.....
- 7- Origin of trip ..... Destination .....
- 8- Family size .....
  - Which transport mode do your family members usually use?  
.....
- 9- At what time of the day do you get transportation easily?  
.....
- 10- Are there any instances where you are forced to pay more than the stipulated fare?  
.....
- 11- How long does it take you to reach your work place from where you live?
  - At peak hours.....
  - .....
- 12- How many trips do you make per day?  
.....
- 13- What areas of improvement in the services rendered by particular mode of transportation that you are using?  
.....

### **Questions for the City Bus Enterprise and Shared Taxi association**

- 1- The number of buses (since 1990 – the latest )
- 2- Types of vehicles
- 3- How many people does a single bus carry per day on average
- 4- How many trips does one bus make per day
- 5- What is a typical workday like? How many hours does it include from start to finish?
- 6- How long does it take for a single bus to go from one station to the next (on average)?
- 7- What is the average distance from the generation point to the termination point of a single route?
- 8- What is the average distance from one bus stop to the other?
- 9- What is the maximum and minimum number of stops in one route?
- 10- How are the individual routes laid out? What are the factors taken in to consideration?
- 11- What are the areas where there are larger number of people that use the bus?
- 12- The route map
- 13- Cleaning, checking, and maintaining process....?
- 14- What is the future plan or proposal to make the system efficient?
- 15- How much revenue does it collect? Is it a self sustaining system or does it get government subsidies?
- 16- The number of employees
- 17- History of the city bus enterprise
- 18- Does the number of the city bus users increase from time to time or not?
- 19- What are the company's vision, mission and goal? And is the system accomplished the goal or is it on the process to achieve that goal? Any obstacles
- 20- For how many years can a single bus operate on average?

**Addis Ababa city bus service enterprise Basic annual figure**

Year (EC)	Purchased buses	No. of routes	Dispatch buses	bus-in thousands	passengers in millions	Distance in million	no. of accident	Amount of manpower	Revenue in Million	expenditure in million	Revenue (Birr) per distance(Km)	Profit/loss in million
1987	No	42	150	N.A	78	6.5	508	1660	26.3	27.5	4.05	-1.2
1988	100	42	112	N.A	55	4.9	385	1619	18.7	28.2	2.88	-9.5
1989	166	42	231	N.A	102	9.2	928	1916	56.9	58.8	11.61	-1.9
1990	no	75	260	N.A	165	15.6	1612	2266	93.6	92.5	10.71	1.1
1991	no	80	361	1274.5	192	18.8	1575	2334	113.2	110.6	7.26	2.6
1992	no	85	401	1354.5	209	20	1714	2603	120.2	117	6.39	3.2
1993	No	85	383	1269.0	201	19.1	1557	2617	123.5	121.2	6.18	2.3
1994	50	85	405	1258.0	187.5	18.7	1552	2720	117	124.4	6.13	-7.4
1995	150	93	462	1474.1	210.6	22.1	1441	3107	120.6	141.5	6.45	-20.9
1996	No	93	463	1763.2	249.1	26.4	2153	3075	128.6	167.5	5.82	-30.9

**Shared Taxi**

**Fleet characteristics**

Number of vehicles	12,500(approx)
Growth rate	11.2 percent per annum
Seating capacity	11 seats for passengers
Average age of the fleet	Nearly 15 years
Models of vehicles	Toyota Hi-Ace, Toyota Hi-Lux, Peugeot, Isuzu, Ford, Nissan, Mazda, Mitsubishi
No of cylinders	4
Engine capacity	2,446 c.c
Horse power	82
Body	All metal
Registered laden weight	2.6 tons
Fuel consumption(KMPL)	6 to 8 kms per lt
Capital cost of vehicles	About 120.000 birr
Pay load	1.5 tons
Width of the body	1.69 meters
Length of the body	4.83 meters
Height of the body	1.96 meters

*Source- Discussions with mini bus operators association*

**Fare structure of Mini-bus**

Distance in kms	Fare
Up to 2.5kms	0.65 birr
2.5 to 7.0 kms	1.20 birr
7.0 to 10.0 kms	1.75 birr
10.0 to 15.0Kms	2.20 birr
15.0 to 25.0 kms	2.75 to 4.00 birr

**Accidents due to taxis during 1993-2003**

Year	Number of accidents		Percentage of accidents by taxis to total	Percentage of taxis to total vehicles
	Taxis	Total		
1993	488	3,137	15.6	10
1994	607	3,445	17.6	10
1995	1,607	6,202	25.9	10
1996	1,783	6,852	26.0	11
1997	2,136	8,581	24.9	11
1998	1,570	7,345	21.4	11
1999	1,466	7,293	20.1	11
2000	1,485	7,203	20.6	11
2001	1,648	7,622	21.6	11
2002	1,960	8,626	22.7	11
2003	2,376	10,189	23.3	11

*Source- Addis Ababa traffic police*

**Violation to traffic rules for the year 2003**

Sl No	Category of vehicles	No of violation	Percentage to total
1	Taxi	241751	72.55
2	Private	35962	10.8
3	Commercial	48101	14.44
4	Government	3187	0.96
5	N.G.Os & red cross	136	0.04
6	Doners	1283	0.39
7	Others	2496	0.75
8	Diplomatic mission	338	0.11

## Population Size

By sex, area, & density; by region, zone, wereda, July 2004

zone/wereda	population size			Area (Km <sup>2</sup> )	Density (pop./Km <sup>2</sup> )
	male	female	total		
Addis Ababa	1,348,001	1,456,999	2,805,000	530.14	5,291.1
zone 1	207,730	215,486	423,216	7.95	53,234.7
Wereda 03	53,633	57,392	111,025	2.29	<b>48,482.5</b>
Wereda 04	47,954	51,656	99,610	2.06	<b>48,354.4</b>
Wereda 05	56,910	57,692	114,602	1.62	<b>70,742.0</b>
Wereda 06	49,233	48,746	97,979	1.98	<b>49,484.3</b>
Zone 2	278,175	296,684	574,859	90.40	6,359.1
Wereda 20	52,998	57,446	110,444	7.21	<b>15,318.2</b>
Wereda 21	54,804	56,307	111,111	3.87	<b>28,710.9</b>
Wereda 22	23,284	26,135	49,419	3.59	<b>13,765.7</b>
Wereda 23	67,164	74,780	141,944	18.2	<b>7,799.1</b>
Wereda 24	79,925	82,016	161,941	57.53	2,814.9
Zone 3	230,140	257,755	487,895	222.18	2,195.9
Wereda 17	77,906	89,844	167,750	72.39	2,317.3
Wereda 18	38,999	44,406	83,405	4.25	<b>19,624.7</b>
Wereda 19	74,843	82,372	157,215	44.11	3,564.2
Wereda 28	38,392	41,133	79,525	101.43	784.0
Zone 4	293,678	327,124	620,802	53.28	11,651.7
Wereda 01	33,749	37,475	71,224	1.54	<b>46,249.4</b>
Wereda 09	32,696	38,634	71,330	2.58	<b>27,647.3</b>
Wereda 11	61,256	59,488	120,744	14.67	<b>8,230.7</b>
Wereda 12	37,671	42,727	80,398	14.56	5,521.8
Wereda 13	41,074	46,204	87,278	3.69	<b>23,652.6</b>
Wereda 15	41,200	48,173	89,373	3.70	<b>24,154.9</b>
Wereda 16	46,032	54,423	100,455	12.54	<b>8,010.8</b>
Zone 5	283,635	301,206	584,841	42.50	13,761.0
Wereda 02	26,898	28,849	55,747	1.99	<b>28,013.6</b>
Wereda 07	55,777	60,161	115,938	1.98	<b>58,554.5</b>
Wereda 08	57,515	60,746	118,261	14.05	<b>8,417.2</b>
Wereda 10	51,479	56,719	108,198	9.67	<b>11,189.0</b>
Wereda 14	36,747	41,153	77,900	2.80	<b>27,821.4</b>
Wereda 25	55,219	53,578	108,797	12.01	<b>9,058.9</b>
Zone 6	54,643	58,744	113,387	113.83	996.1
Wereda 26	24,124	26,207	50,331	80.67	623.9
Wereda 27	30,519	32,537	63,056	33.16	1,901.6

Source –CSA yearly Statistical Bulletin