

∥ A STUDY OF VEHICULAR TRAFFIC CONGESTION
IN NAIROBI "

BY

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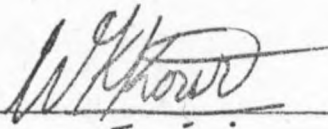
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DECLARATION

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

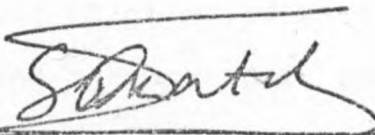
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ABSTRACT

Vehicular traffic congestion and the delays and frustration involved coupled with the time literally wasted in search of parking are the consequences of extensive ownership and usage of the private automobiles without a corresponding expansion and/or construction of new supplementing facilities.

The main cause of vehicular traffic congestion in Nairobi is the inability of the public transport means to meet the public transportation demands and the risks involved in their use. This has prompted the would be users to resort to other means of transportation such as walking, bicycling, motor cycling and private automobiling whenever costs can be accommodated. Any one of the resorted means, in different capacity and magnitude contributes towards the problem of vehicular traffic congestion. Many other factors, such as the various land uses in terms of locations and arrangements, also contributes towards the problem.

In this study attempts have been made to understand the underlying problems that governs transportation within Nairobi with special reference to private car, Kenya Bus Service ~~limited~~ buses and the matatus as the ~~principle mode~~. A closer examination

of these three means has formed the basis of knowledge of transportation problems in Nairobi upon which some viable and implementable solutions to the problem were made.

In conclusion, the study identified the fact that personal safety and comfort or ~~convenience~~ convenience are the major concerns of the public and will always be protected by individuals. An assurance of these by the public transport means in Nairobi will go a long way in solving the problem of vehicular traffic congestion.

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CHAPTER ONE

1.1 INTRODUCTION

The movement of people, goods and services, which is as old as humanity itself, has been experiencing difficulties with time. The major contributory factors to the complexities experienced being the advancement in technology and the increase in personal value for freedom and a higher degree of mobility. In expressing his concern for vehicular traffic congestion, especially in the downtown area, the mayor of Toronto, Canada once made a statement to the effect that - sure, everyone has a right to come to downtown but does not necessarily have the right to bring a ton of metal with him. His statement reflects the fact that an extensive ownership and usage of private automobiling may not necessarily be an economical means of transportation in the urban areas; this is especially so, when the demands that comes with it in terms of roads, parks and energy which has to be expended are considered.

The City of Nairobi is no exception where the above problem is concerned although its magnitude may not necessarily be the same as that of Toronto. There are a number of major factors that contributes to the problem of vehicular traffic congestion in Nairobi. Firstly, is the concentrated trip attraction structure that Nairobi has taken - concentrations of employment in the city-centre and the industrial area. Secondly, is the extensive ownership and usage of private automobiles. Thirdly, is the inadequate road network

carrying capacity, especially so in the city-centre. Fourthly, is the failure of the two types of public transport ("Matatus" and the K.B.S. buses) to meet the public transportation demands. It should also be pointed out here that the two types of public transport are more of a disamenity than amenity.

Proper planning is needed in order to alleviate these transportation problems in Nairobi which is the purpose of this study. There is need to utilize the full range of the transport means available for movement, especially those that are considered both appropriate and economical for Nairobi. The study examines the transportation demands in Nairobi versus the available means of travel and the available resources in order to suggest and recommend the appropriate means of travel that will improve ease of access rather than mobility.

The study is structured as follows:-

1. The first chapter covers mainly introduction
2. The second chapter covers the policy background
3. The third chapter covers the competition between private and public transport means in Nairobi.
4. The fourth chapter concentrates on a detailed analysis and evaluation of the problem of vehicular traffic congestion in Nairobi.
5. The fifth chapter strictly deals with the findings of the study.
6. The sixth chapter summarises the whole study and make policy recommendations and conclusions.

1.2 STATEMENT OF THE PROBLEM

Vehicular traffic congestion is a problem that not only wastes the energy that has to be expended but also frustrates the traveller in terms of delays incurred, especially when one is in a hurry. It can also excite nervourness which may lead into accidents in some cases; nervousness may result from one being afraid of either being hit or hitting another vehicle. There are three stages of congestion that are normally experienced, each succeeding the other. In an attempt to define congestion these stages will be indicated with the experiences involved in each stage; they are as follows:

- (i) the initial stage of congestion. This is the time when the driver cannot maintain speed at or near the maximum specified due to the volume of traffic on the road.

- (ii) the second stage is when the brakes have to be applied constantly due to the nature of the traffic flow. It is therefore a very costly stage of congestion in terms of energy that has to be expended. It is also a stage when one starts to get frustrated due to the attitudes

of other road users who may be pulling in and out of lanes in an attempt to get through congestion faster. This in turn makes one to concentrate more on the road out of nervousness.

- (iii) the third stage is that of maximum congestion or the peak point of congestion, at which time the traffic flow comes to a complete stop. It is also a very costly stage of congestion in terms of energy wastage due to the idling of engines.

Vehicular traffic congestion causes unnecessary delays and frustrations which in turn slacken, the overall output of an individual hence the overall development of the country. The problem of vehicular traffic congestion may be attributed to the break-down and/or the inadequacy of the management machinery, the break-down of the vehicles themselves, careless driving, and inadequate road carrying capacity. The latter is of particular interest in that, in some cases, the road can simply not be expanded; for example, Nairobi City-centre where costs are at their peak.

Barbara Ward in her book "Home of Man", points out that a consideration of the use and misuse of the private automobile is central to a saner use of space and resources.

It is true that if all the movements within the city favoured private automobiling, some acute problems will be encountered in terms of space and resources. Some cities such as Dallas and Los Angeles are good examples. Already more than half the total land areas of both cities have been swallowed up by roads and parks. With respect to energy, Barbara indicates that in such cities 94 percent out of every gallon of gasoline is lost to the idling of engines and pollution emission. This wastage of energy is mostly due to vehicular traffic congestion and the search for parking. It is just a matter of time before the city of Nairobi becomes a victim of the same situation as that of Dallas and Los Angeles unless something is done to prevent it from happening. If this situation is to be avoided, then there is need to employ the use of a transportation system which will move the public to their various destinations without too much disruption. Currently in Nairobi there are three major means of transportations used namely, the private car, the K.B.S. buses and the 'matatus'; the latter two being the two types of public transportation. The two types of public transports means are currently more of a disamenity than an amenity and both cannot meet the public transportation demands. This is reflected by travel comfort (too

congested) and the delays incurred in waiting for one. They also compete with each other very stiffly, and in most cases this leads to dangerous driving likely to cause accidents. The private car on the other hand, while promising a higher degree of freedom and mobility to the user, has a point in time when it reaches its peak, a time when the degree of freedom and mobility is drastically reduced due to its extensive ownership and usage. An extensive ownership and usage of private automobiles without a corresponding expansion of road carrying capacities or construction of more roads results in a large number of vehicles demanding to be committed to a transportation network that cannot cope with the demand; the result of this is nothing but vehicular traffic congestion and the already highlighted problems that comes with it. It can be argued that the peak point of private automobile has already been reached in Nairobi; this is especially so when the country's level of development is taken into consideration. The reflection of this being the unbearable vehicular traffic congestion and the actual wastage of energy due to idling of engines and pollution emission. Nor are the consequences of the city-centre commuting any less dubious for the drivers. The departure from home

may still be a matter of free choice. But once the vehicle joins the solid commuting convoy, their owners are estimated to get only six percent useful work out of each gallon of gasoline. The rest is lost to the idling of engines and pollution emissions.⁴

The disamenities of the two types of public transportation in Nairobi can be argued to have prompted the would be users to resort to other means to transportation such as walking, cycling, motor cycling and private automobiling whenever costs can be accommodated. Any one of these means in different capacities together with inefficient management and road misuse contributes towards the acute problem of congestion. It should also be pointed out here that a larger majority of the better abled opt to private automobiling thus multiplying the problem of vehicular traffic congestion and management. An increase on private automobile ownership and usage demand both the expansion of the existing roads and the construction of new ones consequences of which will be too costly in terms of capital, space, energy and management. The crucial question to ask in this regard is whether to let the current transportation system continue unchecked

4. Home of Man by Barbara Ward (Page 144).

and provide for its demands, for example, construction of more roads, provision of energy and provision of efficient and effective management machinery or to invest on some strategic measures that will facilitate efficient and effective means of transportation with an improvement of the management machinery. This has to be seen in the light of freedom and mobility versus accessibility guided by an appropriate cost-benefit analysis.

Both types of public transport means in Nairobi seems to be competing with each other very stiffly irrespective of the fact that they both cannot meet public transportation demands. This, to a larger degree, may signify the motives behind the provision of these means - a profit - making undertaking. Stiff competition involves overspeeding and dangerous driving, especially during rush-hour periods thus multiplying the problem of vehicular traffic congestion. It also poses some dangers to the passengers in that they are usually rushed when boarding or getting off. In some cases the bus or 'matatu' moves before the passenger has completely alighted or fully boarded, and in some cases this has resulted in fatal accidents. In terms of comfort, the vocabulary 'comfort' does not seem to exist where the two types of public transportation are concerned, the famous

statement, 'there is always room for one more' says it all. This means that the public transport users are not only frustrated with the congestion inside the public transport means, but are also nervous of being involved in an accident due to careless driving and high speed. In this case if a comparison was to be made between the public transport user and private automobile user in terms of frustration and nervousness the two would have about the same experiences. The only difference between them would be their travelling costs, with the private automobile user being the 'big-spender' with regards to energy and space. It should be noted that these problems are encountered especially during peak periods, for example, during the convoy to work in the morning and the convoy back home in the evening. Two interesting situations are noteworthy here, both of which favour the multiplication of the already felt problem of vehicular traffic congestion. Firstly, is that the private car owner's claims that he values the freedom and mobility that the private car promises and would also want to retain the pride of owning an automobile for he can afford to run and maintain one. Secondly, is that the public transport user, while resorting to other means of transportation, when it can be afforded, claims that he has been pushed around

and squeezed enough in the public transport means hence has to leave room for someone who cannot afford private means. The consequences of these being too many vehicles or a large convoy of traffic demanding to be committed to the road network. In other words, on the individual level, no one cares about the actual wastage of energy or the spatial demand resulting from the extensive ownership and usage of the private automobiles. An observation of the various transportation means in Nairobi reflects the fact that a larger majority of the public favours private automobiling to public transport; and it may as well be true that private automobiling would be an ideal means of transport to employ. However, we neither have the resources nor the space to accomodate this means of transport. 'A number of Third World Countries that import automobiles, such as Kenya, are resorting to a stiff import duty, one that sometimes exceed the market value of the vehicle'.⁵ This implies that the Kenyan policy makers have already realized the pressures and the expenses of extensive ownership and usage of private automobiles. However, whether this imposition of stiff import duty really serves the purpose of deterring an extensive ownership and usage of private automobiles is a question that

5. Ekistics - The Problems and Science of Human Settlement by Doxiadis Volume 51 (Page 137)

needs to be examined more closely. It would seem here that this imposition does not have much impact on the high and upper-middle income groups in that they can easily tolerate the pinch of the imposition. In other words, it can be argued that the imposition is geared towards particular groups in the society; for example, from the lower-middle income groups and down. Taking this assumption to be true, this policy alone cannot effectively deter the extensive ownership and usage of private automobiles, hence is not, alone, an effective means of checking the problem of vehicular traffic congestion. Those who can tolerate the pinch of the imposition of the stiff import duty can easily justify it by admitting that the prices of cars have just gone up.

Space and resources are closely related in that the further the commuting distance, the larger the amounts of energy that must be expended. It is also of significant importance to note that the resource use is largely determined by the means of transportation used. Nairobi like most other urban areas, is faced with the problem of vehicular traffic congestion due to the relatively high level of ownership and usage of private automobiles, coupled with the already mentioned factors that contribute towards the problem. Traffic Management

in Nairobi is also a problem area in terms of control and routing of traffic; in some cases three different types of control are used at one point to supplement each other, for example, the traffic lights, roundabouts, and the police officers. It should be noted too that an increase of various means of transportation, especially private automobiles, further complicates the nature of the two transportation problems (congestion and management) already experienced. There are three major factors that have to be considered with respect to transportation problems. They are as follows:

- (i) Man himself as the initiator of the necessity to get from one place to the other. The question to ask is whether man is just interested in a means to get him from one place to the other within a reasonable time or this, coupled with selfish transportation drives in terms of higher degree of mobility and pride.
- (2) A consideration of the environment itself, how much of it can be changed to meet man's selfish transportation drives.
- (iii) A consideration of energy resources; how long can man literally waste energy for the sake

of higher degree of mobility and pride by use of private transportation. This is especially so considering the fact that there are only limited energy resources.

With respect to the above stated problems, there is a need to establish a strategy which will facilitate a sound management machinery that will not only control and route traffic but also ensure the complementarity of all the transportation means used. This can be facilitated with not only one policy but with a whole array of tactics each supporting the other and commulatively moving the public without too much disruption.

1.3 OBJECTIVE OF THE STUDY

The research objectives are as follows:

1. to examine the problems of vehicular traffic congestion in Nairobi and the factors that contribute to it.
2. to examine the problems that govern the use of the two types of public transport, the K.B.S. buses and the 'matatu's, or the private car as the principal means of travel and to establish why some commuters prefer one over the other.

3. to suggest ways and means of making the two types of public transport complement rather than compete with each other and of making them more of an amenity than disamenity in order to make them attractive means of travel.
4. to suggest alternative strategies of improving travel in Nairobi with minimum or no congestion.
5. to suggest the appropriate means of travel for Nairobi with little or no congestion.

1.4 RESEARCH ASSUMPTIONS

The research assumptions are as follows:

1. that irrespective of the District Focus Strategy that has been undertaken in Kenya, Nairobi's population growth rate will remain high.
2. that the private car ownership and usage will continue to increase irrespective of any stiff import duty policy that the government may resort to.
3. that the competition between the two types of public transport will remain stiff.

4. that both the city-centre and the industrial areas will continue to be the centre of concentration in terms of employment, shopping and leisure.
5. that the disamenities of the two types of public transport will always prompt the would-be users to resort to other means of transportation whenever costs can be accommodated.

1.5 / SCOPE OF THE STUDY:

The scope of study will cover the three mostly used means of transportation in Nairobi namely, the private car, and the two types of public transport (the K.B.S. buses and the 'matatus'). These three means of transportation are actually the major contributors of vehicular traffic congestion especially during rush-hour periods. This is especially so since the City of Nairobi has taken the concentrated trip attraction structure (the city-centre and the industrial areas) which pulls the traffic flows in one direction at a given time. This in turn causes acute problems of vehicular traffic congestion.

The problems of vehicular traffic congestion in Nairobi will be examined on two selected routes namely,

Juja road and Langata road. There are two major reasons that governed the selection of the two routes as being representative of the existing situation of vehicular traffic in Nairobi. Firstly is that Juja road ranks high in terms of vehicular traffic congestion and ranks second (to Jogoo road) in terms of recorded total accidents. Secondly, is that Langata road, during rush-hour periods ranks very high in terms of vehicular traffic congestion, whereas, during off-peak periods, the route is almost underutilized. Langata road also, suprisingly, ranks third in terms of recorded total accidents.

The scope of study will also cover the analysis of the operation of each of the three major means of transportation and their efficiency. It will also cover the analysis of the management of the two types of public transport means. The major concern here is to establish why they currently compete with each other very stiffly thus rendering themselves dangerous means of travel. The scope of study will also seek to establish why some commuters prefer one means over the other.

1.6 LITERATURE REVIEW

Traffic congestion is a problem that confronts nearly all urban areas all over the world. The magnitude of the problem may differ from one country to the other depending on the level of development which to some degree, the transportation network and the means of transportation used is a reflection of. A remarkable difference in the transportation system may thus be seen between the developed and the countries. The differences may be attributed to the advancement in technology, more steady economies, and the

fact that the developed countries gained their independence many years before the developing countries. It can also be argued that these differences, at times, make it difficult for the developing countries to borrow the strategies that have been adopted by developed countries to check the problem of vehicular traffic congestion. For example, the metropolitan Toronto traffic police department may point out that the Toronto Transit Commission sub-way system has solved their downtown vehicular traffic congestion. While this may be an ideal system to employ in order to solve most of the transportation problems, the majority of the developing countries cannot afford the provision of one due to their levels of development. However whether a country is developed or developing there exists the necessity to move people from one point to the other for some particular purposes. This movement demands both space and energy; the demand for space and energy is directly proportional to the transportation means used. Yet every scale of construction carries with it the reminder that the whole system could be moving to within reach of its limits ..., roads and parking spaces make up over half of Dallas and Los Angeles and over a third of Washington D.C. and New York City. The loss of taxable space is in fact one element in New York's near bankruptcy. At present at least a quarter of the city's commuters travel by car. When one remembers that more than three million people move in and out each day - virtually the equivalent of moving the whole of Central Paris - it is easy to see that if the domains of the private motorist were still further

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increased, there would simply be no more city.'⁶

Here Barbara Ward is campaigning against the extensive ownership and usage of private automobiles, while promoting the extensive usage of public transportation. She centres her arguments on the fact that what matters where transportation is concerned is accessibility and not mobility.

Lester R. Brown, the President of World Watch Institute in his article to the Ekistics on 'Reconsidering the Automobile's Future'; argues that the future of the automobile has received very little attention. That the only question with regards to the automobile seems to have been what the resource of future fuel supplies would be. In other words, it had been assumed that the solution to the energy problem was some alternative to replace gasoline and diesel fuel. This was the belief that it was just a matter of time until the automobile became the centre-piece of transportation system everywhere. He also argued that a 1978 study of the World Automotive Industry which projected the world fleet to expand from about 300 million vehicles in 1978 to some 700 million by the year 2,000 (one car for every eight people)

6. Home of Man by Barbara Ward Page 143

were based on narrow information base with corresponding narrow set of consideration. That is, they fail to account for emerging resource, economic and political constraints. 'Competition for resources arises, for example, because automobiles require not only fuel but land as well. International indebtedness on an unforeseen scale in the Third World and in Eastern Europe is restricting automotive fuel imports in scores of countries. At the individual level, the narrowing margin of global economic growth over that of population is preventing the rise in affluence needed if car ownership is to be spread as projected.'⁷

The city structure plays a major role in the design and routing of traffic. Concentrated trip attraction centres, the structure which Nairobi takes, tend to pull all traffic towards one point at a given time, thus increasing the magnitude of vehicular traffic congestion. Dispersed trip attraction centres on the other hand, tend to disperse traffic accordingly, thus reducing the magnitude of vehicular traffic congestion to a larger degree. This is especially with respect to the locations of the places of employment, residence, leisure and commercial centres. 'Different cities have tackled the competing needs of cars and public transport in a variety of ways depending on

7. Ekistics - The Problems and Science of Human Settlement* by Doxiadis; Volume 51 (page 131)

special mix of geographical environmental, social, political, and economic circumstances. J.M. Thomson 1.2 has suggested that the different approaches can be boiled down to five broad archetypes:⁸ The five archetypes can be broken down as follows:

1. Full motorization; this is a situation where there is no one particular centre or a main city-centre but a dispersal of central area functions and a grid of high capacity roads serving them.
2. The weak-centre strategy; this is where the sub-urban centres are encouraged to grow and served mainly by cars, but the significant town-centre is preserved.
3. The strong-centre strategy; these are the long established cities with historically powerful centres made to provide for cars as much as possible.
4. The low-cost strategy; this strategy in particular may be very appropriate for the developing countries with little capital expenditure.
5. The traffic limitation strategy; this involves the establishment of a hierarchy of sub-centres in order to minimize the need or the necessity to

8. Urban Planning and Public Transport by Roy Cresswell (Page 21) .

travel. This may also be applicable in the cities of the developing countries. The City of Nairobi has adopted the strong-centre strategy coupled with the structure of concentration trip attraction centre of which consequences in terms of transportation, the city now suffers.

The problems of vehicular traffic congestion in Nairobi continues to multiply with the growth of population and in employment opportunities coupled with the increase of private car ownership and usage by the better abled group of the society. There are three major means of transportation used in Nairobi all of which contributes much towards vehicular traffic congestion; namely, the private car, the K.B.S. buses, and the 'matatus'. The latter two being the two types of public transport. The Kenya Bus Service Limited (K.B.S.) started operating in Nairobi as early as 1934 and has operated since then with a series of franchise with the Nairobi City Council (now Nairobi City Commission). However, it has never been able to expand its capacity in accordance with the public transportation demand nor has it been able to replace the stock of buses as they depreciate. The number of buses during the year 1975-1981 increased by 9%, the

number of passengers increased by 23% and bus kilometres by 12%.'⁹ The results of these problems are the rise in fare, congestion of passengers in the buses, ill-maintenance of vehicles and unreliability in terms of scheduling and break-downs. These were the kinds of inefficiencies which actually led to the inception of the 'matatus' as a supplementary means of transport in Nairobi. 'Next to the K.B.S., matatus are the most important elements of public transport in Nairobi --- As at 1979, passengers were split between matatus and K.B.S. in the ratio of about 50:50. In view of the congestion on the K.B.S. buses and inadequacy of their services to meet the public transportation demands in Nairobi, matatus have to be accepted as an integral part of the city's public transport system and their role has to be recognized as crucial and important in supplementing the bus service.'¹⁰

According to the Nairobi Urban Study Group report of 1973 the predominance of journeys were made on foot over all other means of transportation. For example they found out that the distribution of total daily

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9. Urban Planning Transport by Inter-Ministerial Adhoc Committee, Report (Page 2).
 10. Urban Public Transport by Inter-Ministerial Adhoc Committee, Report (Page 3).

trips by each means were as follows: 44.6 percent on foot, 38.0 percent by private automobiles, 14.0 percent by public transport and 2.6 percent on bicycles. This by no means should be taken to insinuate the fact that majority of the public in Nairobi prefers walking from one point to the other over other means of transportation, but rather because of affordability reasons. This also to a larger degree, portray the level of economic development of the country. This is especially so considering the fact that the means of transportation used and the transportation network reflect the level of development. For example, in more developed countries majority of the trips are normally divided between private motoring and public transport. It can also be argued that Kenya is rapidly developing so that the distribution of total daily trips by each means in 1970 given by the Nairobi Urban Study Group would give unrealistic impression of the transportation situation in Nairobi today. This is especially so when one considers the magnitude of vehicular traffic congestion and the fact that both types of public transport in Nairobi today cannot meet the public transportation demands. The major problems with the two types of public transport are the competition between them which leads to dangerous driving, especially with the 'matatus',

and the congestion of the users inside the vehicle coupled with inadequate scheduling. This in turn can be argued to have prompted the would be users to drop away and resort to other means of transportation with the better abled resorting to private automobiling thus continually multiplying the already felt problem of vehicular traffic congestion. In checking this problem, the Inter-Ministerial Adhoc Committee suggested some measures that can be employed. The suggested measures included the following:

1. to increase supply quality and efficient use of the K.B.S. buses and the 'matatus'.
2. staggering working and school hours.
3. encouraging of car pooling
4. higher parking charges

All these measures are sound, however all of them cannot be implemented simultaneously. There is need, therefore, to identify those that are not only appropriate to the current situation in Nairobi but also those that are economically and socially implementable without too much disruption.

G.W. Woollner and R.E. Delaney in their book 'Elements of Transport' points out that transportation is not an end in itself, but rather a means to many ends. That while movement consume various efforts and resources, its justification depends on the purpose to be served and the advantages to be gained. This may be true, however certain factors such as space and resources have to be taken into account. A private motorist in Nairobi, for example, would give important purposes to be served and advantages to be gained by using private means of transportation especially so since the two types of public transport cannot meet the demands. But, while this may be true of transportation situation in Nairobi, private car ownership and usage cannot increase unlimitedly, otherwise there would be no city because of the spatial demand that would prevail. Both authors also appreciated the advantages to be gained from a sound and efficient transportation system which they argued to have saved man some valuable time and a reduction in financial cost. A consideration of certain costs associated with transportation has to be taken into account in order to assess the soundness and the efficiency of the system. This includes the loss of lives, spatial demands, wastage of the limitedly available energy resources, and the frustration involved in delays of

vehicular traffic congestion and looking for parking. In some cases, the costs incurred in the usage of certain means of transportation may outweigh the advantages to be gained.

Transport planning process is a discipline that has been developed with an attempt to alleviate transportation problems which has taken more dominating dimensions with the growth of urban population and motor vehicle ownership and usage. That is, it has aimed both to ameliorated those obvious inefficiencies of the current transport system such as congestion, delay and accidents and to produce proposals for capital investments and construction in existing and new transport facilities which will improve the operating conditions of the estimated future movement flows where they are expected to overload most seriously the existing transport network.¹¹ Bruton argues that travel is a function of human activity and is therefore necessary to understand the determinants of the trip production for the nature of future demand to be assessed. He points out that 80 to 90 percent of all journeys have either a beginning or an end in the home and is therefore necessary to understand the population characteristics

11. Introduction to Transport Planning by Michael J. Bruton (Page 15).

of an area in order to assess the transportation demands. He also used some mathematical tabulations for forecasting trip generation rates which help a great deal in terms of road design and the provision of the public transportation services. These mathematical tabulations would help both the Kenya Bus Service and the matatus in Nairobi in assessing the demand for their services in the various residential areas thus enabling them to provide efficient services. Bruton also included a series of models such as trip distribution, modal split, traffic assignment and network evaluation all of which are very useful in understanding the whole process of transportation, especially when each model is considered individually. The modal split model is of particular interest here in that it helps to identify the factors that governs the choice of transportation means, although in some cases it is difficult to quantify. It is only the most superficial ones that can be identified and quantified; this includes the obvious factors influencing the modal choice such as time, costs, and purpose of journey. Others of equal influences such as comfort and the convenience of the available modes and the accessibility of the place concerned to the other places can be identified but have proved impossible to quantify adequately.

The Nairobi Urban Study Group in their recommendation on transportation policy came up with three policies as follows:

1. the policy that consisted of the provision of minimum facilities for both private and public transport. In other words the road network would be determined by the minimum facilities needed to cater for commercial vehicles, emergency and service traffic and public transport; the public transport being provided on the basis of service similar to that of 1970-1973. A gain while this is not practicable, it would tend to encourage the better abled to resort to private motoring for they would not want to walk and the public transportation would be too congested. There would exist some form of transportation stress in Nairobi, if this particular policy recommendation was to be implemented, and the only way to relieve the stress would be to resort to other means of transportation; majority of the public would resort to private motoring when the costs can be accommodated irrespective of the minimum facilities provided for private transportation.

2. the policy with no restraint on car ownership or usage. This means that the infrastructure requirement would be based solely on the levels of demand. This policy alternative does not seem practicable for Nairobi in that the capital requirements would be too high for the country and also the fact that the limited space in the downtown area cannot meet the demand. It would seem here that the above two alternative policies would encourage vehicular traffic congestion rather than discourage it. It would also be right to take the assumption that the main reason for the study was to establish and facilitate a sound transportation network for Nairobi that would help to move the public without too much disruption. In which case, it can be argued that the study failed to give sound conclusions and recommendations where the above two policies are concerned.
3. the policy which envisage that various restraints would be applied to both the ownership and the use of private vehicles, coupled with a much more improved public transport system operating with a reduced fare structure, in an attempt to maximise public usage. This particular policy recommendation

can be argued to have taken into account most of the factors relating to Nairobi and also the level of the country's development; it is neither capital intensive nor space demanding and also not energy exhaustive. However a policy such as this one needs to go a step further. There is need to examine the factors that governs the choice of means, why do people prefer private motoring over public transport, is it for the sake of freedom and higher mobility or is it because of the disamenities of the public transport. Such questions would help in paving the way for effective implementation of the policy. After all, mobility is just getting somewhere to do something, the means used being of secondary importance. The City of Nairobi needs a transport system that will not only be efficient but also effective in meeting the public transportation demands, which is the purpose of this research.

1.7 METHODOLOGY AND DATA COLLECTION

In order to investigate the various factors that governs the problem of vehicular traffic congestion in Nairobi, a field research was conducted on two selected routes that was considered as being representative of the existing situation of the problem as indicated in the scope of the study (pp. 1.5). Due to the limited time within which the field research was to be completed, the extent of Juja route was to be between the City Centre

and Dandora; while the extent of Langata route was taken to be between the City Centre and Otiende. The respondents from within the two roads included those who resides along the two selected routes to a depth of about 10 kilometres.

Some difficulties were experienced in establishing the actual number of the public transport users or the actual number of the private car owners in the study area. However, after some consultation with some expert and a review of relevant studies, a total of 400 questionnaires was considered both adequate and manageable. Some 200 questionnaires were administered to the public transport users, for example, 100 respondents along Juja route and the other 100 respondents along Langata route. The respondents included those who were travelling in either matatus or K.B.S. buses and those on various bus stages. The other 200 questionnaires were administered to the private car owners, for example, 100 respondents along Juja route and the other 100 respondents along Langata route. The questionnaires here were administered to the respondents at their places of residence. Owing to the limited time within which the field research was to be completed, a random sampling technique was adopted in the administration of the questionnaires.

The field research also included personal interviews and questionnaires administration to both the staff of

Kenya Bus Service Limited and Matatus on the two selected routes and their various appropriate parks in the City Centre and also to the management of the Kenya Bus Service Limited and the Matatu Owners Association - the appropriate branches. See Appendix for the content of the questionnaires.

The second most important sources of data collection was from the following:-

1. Nairobi City Commission.
 - i) City Engineer's Department - Traffic Section
 - ii) City Planning and Architecture Department.
2. Kenya Police - Traffic Section (Nairobi Area)
3. Ministry of Transport and Communication; Transport Licencing Board.
4. Personal observation and informal discussions with the public transport users and the private car owners.

The various statistical details, maps and information that were gathered formed the basis of knowledge of the problem of vehicular traffic congestion based on the already experienced problems, and the factors that governed them.

After obtaining the relevant data and information, analysis was done manually, upon which completion, attempts were made to point out the planning implications and the solutions to the problem of vehicular traffic congestion in Nairobi. Suggestions were also made that will ensure effective control of the problem.

POLICY BACKGROUND AND REVIEW STUDIES

2.1 NAIROBI IN ITS NATIONAL CONTEXT:

It was in 1899 when Nairobi was established as Kenya's centre for communications as well as the headquarters of the Provincial Administration. This was largely facilitated by the establishment of the railway depot. By 1905 Nairobi had a population of 10,000 people, a time at which it was made the capital of Kenya. It can be argued that from this point Nairobi grew steadily and by 1919 it was made a Municipality. After independence in 1963, Nairobi's 'Old City' area of 90 square kilometres was extended to include a total land area of 690 square kilometres. It was at this point when some of the important features such as the airport and the Game Park were included in the city's boundary. Refer to Map 2.1.1 below for the boundary extension.

Currently Nairobi is not only a Provincial District, but is also the centre of financial, industrial and service capital of Kenya. In its National context, Nairobi can be said to be well linked to nearly all parts of the country by four major international trunk roads, to the western parts it is linked by an international trunk road which connects



LEGEND



Old City Boundary

Current City Boundary

MAP 2:1:1

NAIROBI BOUNDARY EXTENSION MAP

SOURCE: MORGAN N.T.W. NAIROBI CITY & REGION

SCALE



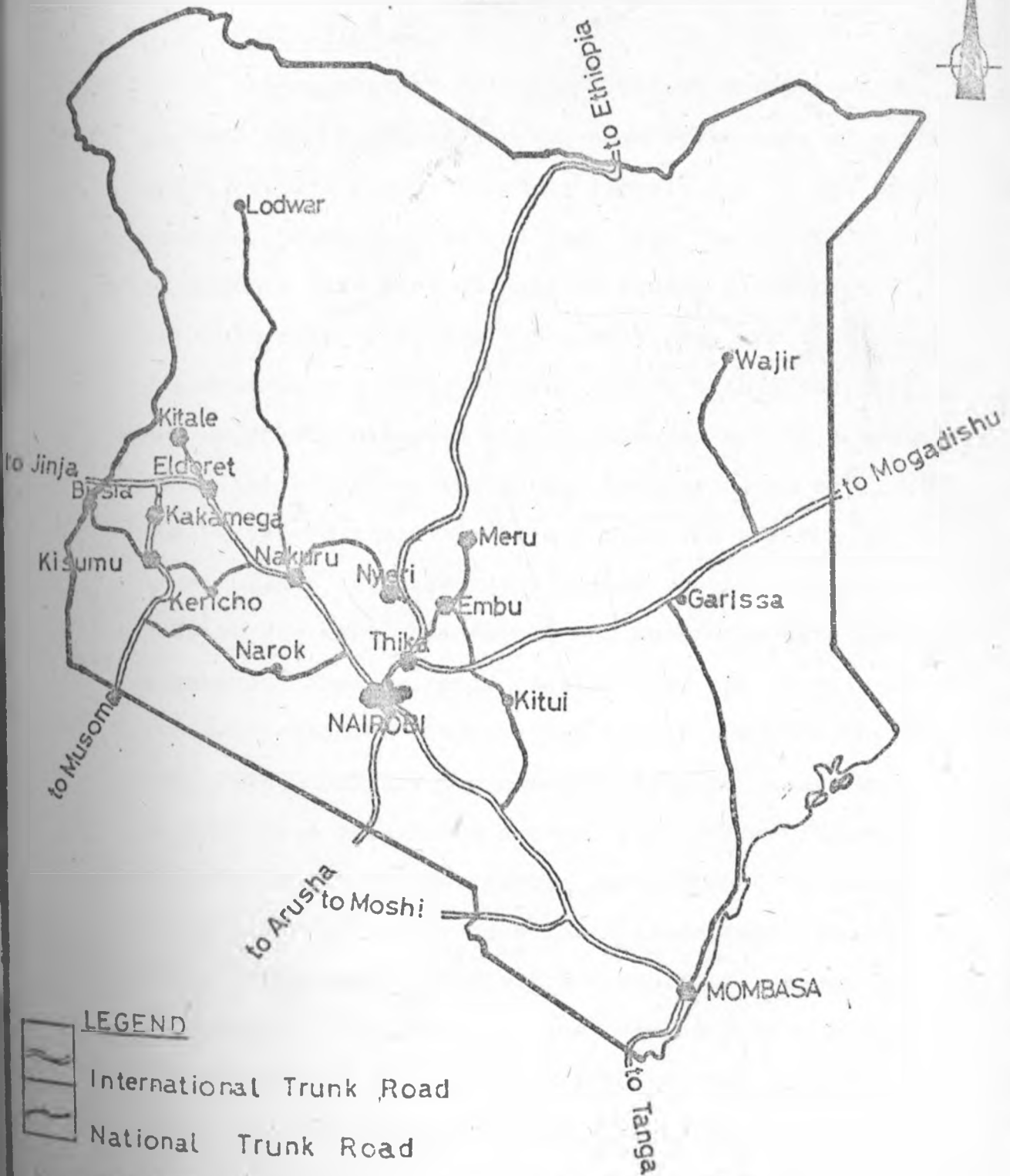
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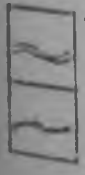
1984/1986

Nairobi to Thika, Murang'a, Nanyuki, Isiolo and Marsabit; to the eastern parts it is linked by another international trunk road which connects Nairobi with Thika and Garissa; to the coast and southern parts it is linked by another international trunk road which connects Nairobi with Athi River and Mombasa. Refer to Map. 2.1.2 showing these international trunk roads. It should also be noted that better connectivity is further facilitated by national trunk roads, primary roads, secondary roads, minor roads and rural access roads. The linkage between Nairobi and other parts of the country is further supplemented by the Mombasa - Nairobi - Kisumu railway line. Nairobi can also be said to be well linked to the neighbouring countries such as Tanzania, Uganda, Somalia Ethiopia etc. by major international linkages. The Jomo Kenyatta International Airport has also made it possible for Nairobi to be linked with other countries in Africa and other parts of the world. It is this good connectivity that gives Nairobi its strong centrality in terms of services and even in terms of employment opportunities.

KENYA



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International Trunk Road
 National Trunk Road

MAP 2:1:2

MAIN TOWNS AND TRUNK ROADS MAP

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2.2 POPULATION:

The population of Nairobi before independence in 1963 can be argued to have been increasing at a low annual growth rate. This was largely due to two main reasons. Firstly, was the fact that its boundary included a land area of only 90 square kilometres - the 'old city' boundary. Secondly, was the fact that Africans were restricted from living within the city boundary; the city was then considered by the colonialists to be the place for the Asians and Europeans only. It can be argued that Nairobi's population after independence increased at a higher annual growth rate despite the fact that Asians and Europeans were actually emigrating from Nairobi. Again, this was largely due to two main reasons. Firstly was due to the fact that the 'Old City' boundary was extended from 90 square kilometres to include a total land area of 690 square kilometres thus absorbing the peri-urban population. Secondary was the fact that Africans could since then live within the city boundary. Table 2.2.1 shows the change in population for Nairobi by race between 1962 and 1969. A comparison of Nairobi population within present city limits in 1962 and 1969 shows that it increased by 5.5 percent per annum, that is from a population of 347,431 in 1962 to a population of 509,286 in 1969. Interestingly, during the same period, Asians and

Europeans were decreasing at annual rates of 3.5 and 6.0 percent respectively, while African population had been increasing at the annual rate of 9.0 percent.

TABLE 2.2.1 NAIROBI POPULATION BY RACE: 1962 AND 1969

RACE	1962		1969		CHANGE 1962-69
	NUMBER	PERCENT	NUMBER	PERCENT	PERCENTAGE
Africans	231,744	66.7	422,912	83.0	+9.0
Asians	86,922	25.0	67,189	13.2	-3.5
Europeans	28,763	8.3	19,185	3.8	-6.0
Total	347,431	100.0	509,286	100.0	+5.5

Source: Population Census, 1962 and 1969.

Table 2.2.2 shows the registered Births and Deaths for residence in Nairobi for the years 1971 to 1982. It also includes Natural Growth figures for the same period which was derived from obtaining the difference between registered Births and Deaths. From the table it can be seen that Nairobi's Natural Growth is on the upward trend on the overall between 1971 and 1982. This is largely an attribute to the increase in fertility rate (average number of children born by a woman who lives to the age of 50) and a decrease in

TABLE 2.2.2.

REGISTERED BIRTHS AND DEATHS OF RESIDENCE IN NAIROBI: 1971-1982

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Birth	25,389	28,443	29,350	29,986	28,607	32,458	30,768	32,179	28,940	32,898	35,766	43,553
Deaths	3,865	3,592	3,503	3,808	3,299	3,652	3,486	3,642	6,126	3,727	3,458	3,814
Natural Growth	21,524	24,851	25,847	26,178	25,308	28,806	27,282	28,537	22,814	29,171	32,308	39,739

Source: Nairobi City Council.

mortality rate. This in turn is a reflection of better living standards and better medical services both in Nairobi and the country at large.

According to 1979 census figures, Nairobi had a total population of 827,775 of which 479,448 were males and 348,327 were females. It therefore had a sex ratio of 138 males to 100 females. The Central Bureau of Statistics' population projection for Nairobi for the years 1980 to 1990 are given on table 2.2.3. The projection took into account two major factors namely fertility and mortality. Fertility rate (average number of children borne by a woman who lives to age of 50) estimated from 1979 census data was 7.887. However, the National Demographic survey of 1977 and that of Kenya Fertility survey of 1977 to 1978 estimated total fertility at just over 8 births per woman. The estimated of mortality rate were based on the data obtained from the 1962, 1969 and 1979 census, the 1977 National Demographic Survey, and the 1977 to 1978 Kenya Fertility Survey. From these data, life tables were constructed for both mid - 1960's and 1970's. The decline in mortality between these two periods was extrapolated to give the following estimates for 1980's: an expectation of life at birth of 54.1 years for males and 56.9 years for females; and an

TABLE 2.2.3.

NAIROBI'S POPULATION PROJECTION 1980 TO 1990

1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
896,819	944,768	955,081	1,047,951	1,103,554	1,162,189	1,223,803	1,288,694	1,357,045	1,429,041	1,504,890

Source: Central Bureau of Statistics.

infant mortality rate of about 92 deaths in the first year of life per 1000 live births. Nairobi's population projection for 1980 to 1990 was computed using an annual growth rate of 5.17 percent with the assumption of constant levels of fertility and mortality.

The Nairobi Urban Study Group in their report on Nairobi Metropolitan Growth Strategy Projected the population of Nairobi for the year 2000 at 2,883,200 low and at 4,200,000 high. The group in projecting the population, treated separately the three main racial groups (Africans, Asians, and Europeans). Africans were paid the greatest attention for they are likely to constitute well over 95.0 percent of the total Nairobi's population by the year 2000. The natural increase of the African population was calculated on the Cohort Survival Method using 5-year intervals with the following principal assumptions:

1. that the total fertility rate which was estimated at 5.5 in 1969 was expected to drop to 4.0 by the turn of the century. This is largely due to better education, medical and clinical facilities and increased economical advantages of smaller families.

- (2) that the sex ratio of children born a live to any woman between 1969 and the year 2000 will remain at 50.50.

- (3) that the life expectancy at birth in Nairobi which in 1969 was assessed to have been 53 years for males and 58 for females will go up to 62 and 66 years for males and females respectively. The number of Asians were expected to grow by a natural increase of 20 percent per annum, less the anticipated exodus of non-citizen Asians of some 2,000 each year. European population was assumed to increase over the period by a rate of 1.0 percent per annum. This is largely due to increase on the number of expatriates participating in various development and Technical Assistance programmes, less a certain degree of loss through emigration. In their population projection the group also took into consideration the National Policy which is stated to include a policy for the nucleation of new physical development to serve the rural areas into a hierarchy of growth centres and that of designating a number of major growth centres into which important administrative and commercial development as well as large scale industrial development would be channeled in .

order to build up poles of counter-attraction to the dominant and disproportionately fast growing centres of Nairobi and Mombasa. As this gets implemented some of the immigration which would otherwise influxed to Nairobi will be diverted elsewhere.

Table 2.2.4 shows Nairobi's population projection by Age groups and sex for 1986 and the year 2000. The table summarizes the population structure for quick comparison between now (1986) and the year 2000. It also shows the percentage of each age groups. Supplementing this is the included population pyramid (figure 2.2.1) where the age groups and sex structures for 1986 and the year 2000 are shown.



TABLE 2.2.4.

NAIROBI'S POPULATION PROJECTION BY AGE GROUP AND SEX: 1986 AND 2000

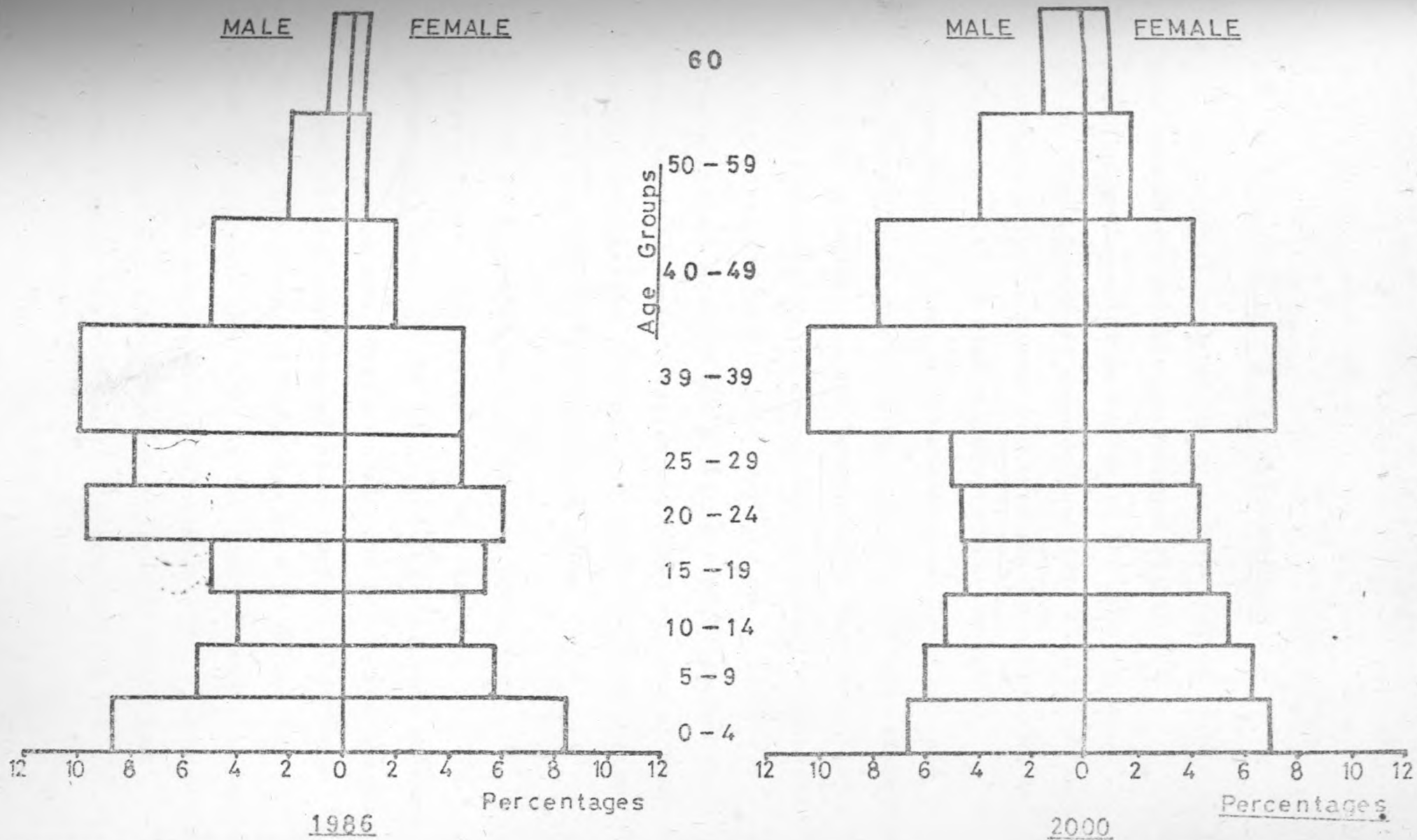
AGE GROUP	1986				2000			
	MALE		FEMALE		MALE		FEMALE	
	NUMBER	PERCENT*	NUMBER	PERCENT*	NUMBER**	PERCENT	NUMBER**	PERCENT
0-4	105,093	8.6	102,499	8.4	190,291	6.6	196,058	6.8
2-9	66,967	5.5	69,570	5.7	172,992	6.0	175,875	6.1
10-14	47,143	3.9	56,527	4.6	149,926	5.2	152,810	5.3
15-19	59,326	4.8	66,582	5.4	129,744	4.5	132,627	4.6
20-24	118,162	9.6	73,286	6.0	132,627	4.6	123,978	4.3
25-29	95,088	7.7	53,700	4.4	141,277	4.9	115,328	4.0
30-39	120,994	9.9	54,296	4.4	296,970	10.3	201,824	7.0
40-49	61,128	5.0	21,605	1.8	222,006	7.7	115,328	4.0
50-59	25,165	2.1	10,095	0.8	112,445	3.9	49,014	1.7
60+	9,282	0.8	7,298	0.6	43,248	1.5	28,832	1.0
TOTAL	708,438	57.9	515,433	42.1	1,591,526	55.2	1,291,674	44.8

* Percentages had to be calculated.

** The actual figures had to be calculated using the percentages of the low population projection for the year 2000.

Source: Central Bureau of Statistics and the Nairobi Urban Study Group Report; data for 1986 and the year 2000 respectively.

FIGURE 2:2:1 NAIROBI POPULATION AGE GROUP AND SEX STRUCTURE: 1986 AND 2000



2.3 NATIONAL POLICY ON TRANSPORTATION

It is a national policy on transportation in Kenya that there be a created and managed viable and efficient transportation system in the country as a whole. The Government ensures that this is done through the legislative machinery and through the capital works programmes. It is also the Government's overall responsibility, through the Ministry of Transport and Communication to construct and maintain all the classified roads in the country. The Government's main objective, where transportation is concerned, as clearly indicated in the 1974/1978 Development Plan, is to facilitate a transportation network and a transportation system that would keep the transportation costs and the travel time at the very minimum possible and a safe quality system that is availed for all transport users.

It is important to note at this point that Kenya got her independence only 23 years ago, in 1963. Before this time, it can be argued that the road network in the country was totally unbalanced for it was geared to meet the colonial exploitative ideals. This means that the Government of Kenya has much to do, on top of what has already been done in the last 23 years, in order to facilitate a transportation network and a transportation system that would keep the transportation costs and travel time at the minimum in accordance with the

National objective on transportation - 1974/1978

Development Plan. This is particularly the case with the less served rural areas some of which are very resourceful, especially for domestic products. It is therefore a Government policy objective to extend the existing transportation network to the deficient areas with a good transportation network in order to facilitate easy communication throughout the country. There are four major aspects that governs the process of transportation development in Kenya. First, is the continuous process of road development which is carried out on a yearly basis through annual budgetary allocations set a side for specific road projects in accordance with the Development Plan. It is through this progressive approach, since Independence, that has earned Kenya a total of 54,584 kilometres of classified roads. The classified roads include the following roads.

1. International Trunk Roads - linking centres of international importance and cross international boundaries, or terminate at international posts;
2. National Trunk Roads - connecting centres and/or areas of National Importance;
3. Primary Roads - connecting important provincial centres to each other or to higher class roads;

4. Secondary Roads - linking locally important centres to each other or to more important centres in rural areas;
5. Minor Roads - providing connections to minor centres in rural areas.

It should be noted that classified roads does not include Rural Access Roads and Special Purpose Roads; it is the responsibility of every District, through the District Development Committee, to construct and maintain these roads.

Secondly, is the Governmental concern for the overall operation of public transportation. This is a very important aspect in transportation for it facilitates ease of access to a larger majority of the public in order to enable them to participate and contribute toward the economic development of the country. It is therefore within the public authority's responsibility, be it local or central authority, to ensure that public transport facilities are well provided for and to ensure safety of the users. In Nairobi, for example, the provision of public transportation is the responsibility of the Nairobi City Council. It is the responsibility of the Council to ensure that there

are enough public transport means within the city that meets public transportation demands and to ensure that the supplementing facilities are adequately provided for. The council also has the responsibility of issuing or denying public service vehicle licences to those interested depending on the need and demand for such services; included here are the matatus, taxis and Kenya Bus Service Limited buses. In this respect, the council can be argued to be actually in control of the public transport vehicles fleets and their competitions. It is also the responsibility of the council to provide transportation facilities in general such as metred and unmetred parkings with control on the charges especially within the city-centre. Refer to Map 2.3.1 showing the public transport Kenya Bus Service Limited buses and the Matatus parks within the city centre. Currently this is a problem facing the City Council of Nairobi in that there is an imbalance between the designated matatus parks and the demand for it. This can be argued to have resulted from the fact that the matatus operation was for along time, until recently, considered an illegal means of public transport. Now matatus are recognised and appreciated as an integral part of Nairobi's public transport means. However, their operation can be very annoying to other road users and businessmen due to lack of adequate facilities, this has led into a

MAP 2:3:1

MATATU AND K.B.S. BUS TERMINALS

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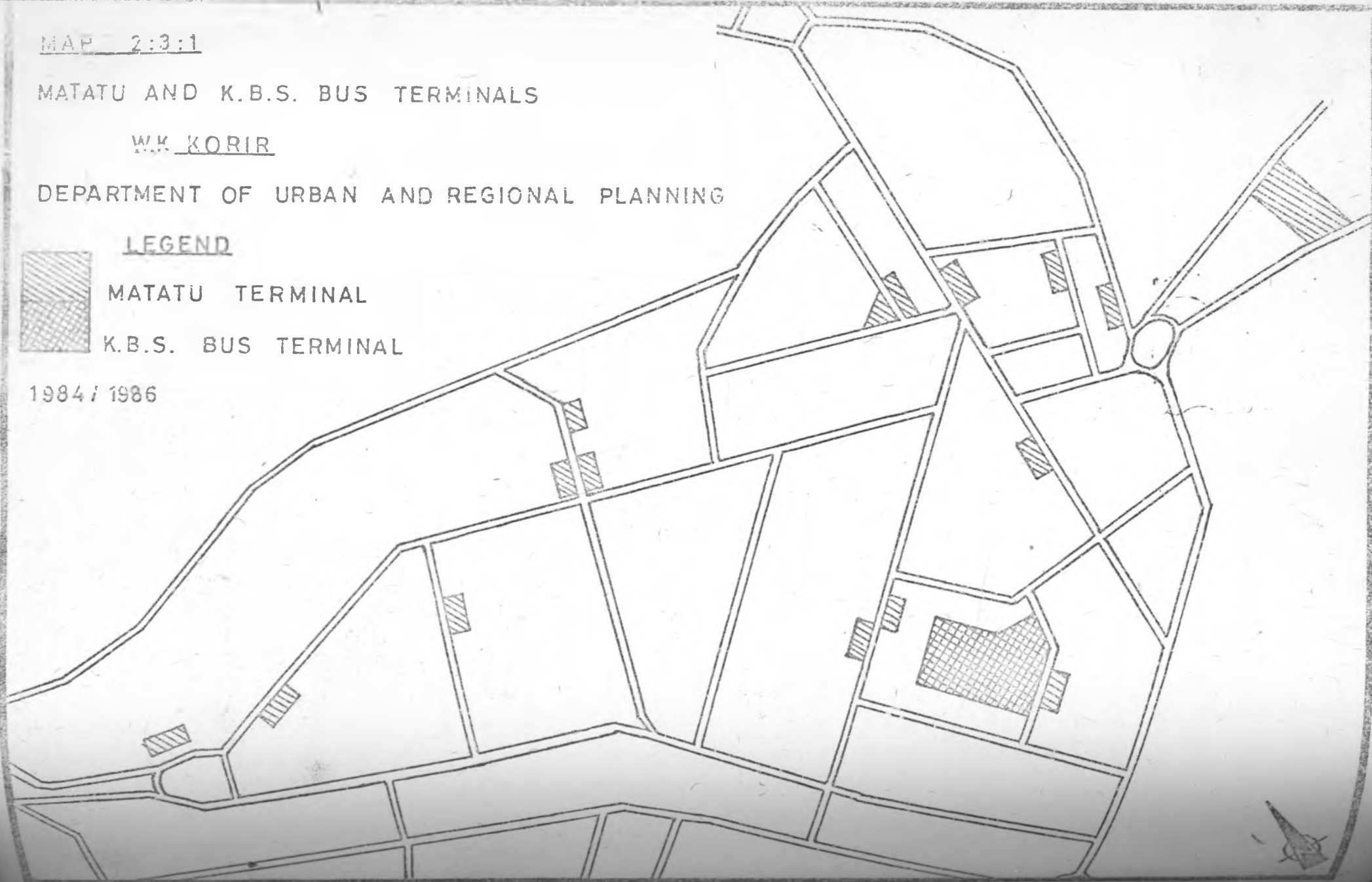
LEGEND



MATATU TERMINAL

K.B.S. BUS TERMINAL

1984 / 1986



ploriferation of illegal matatus parks within the city centre which in turn leads in obstruction of traffic, blocking of some lanes, blocking of businesses and the like.

Thirdly is the aspect of providing public transportation equipment and machinery, which are the buses, matatus and taxis. This is an aspect in transportation that is solely left to the free market. In other words, any one person or groups of persons, a company or a co-operative are free to acquire and operate any of the public service vehicles provided that they comply with the statutory and legal requirements where such legal provisions exist in the legislative statutes of Kenya. On this aspect the Government of Kenya has not involved itself in the acquisition, operation or management of the public service vehicles. However in 'Nairobi Metropolitan Growth Strategy' report by the Nairobi Urban Study Group, it is recommended that the Government, through Nairobi City Council buy a controlling share of the main city transit system - the Kenya Bus Service limited. This was supposed to be a major step towards the eventual Government ownership of the system; but to date this is still on the proposal stages. Where other transportation systems are concerned, the Government almost wholly owns

the haulage and car hire firm - the Kenatco Transport Company. Where gaps, due to lack of public interest in the provision of public service vehicles exist, private enterprises provide for the capital, management and enterprises. This provision is largely from local sources except a few foreign owned.

Fourthly is the traffic rules, regulations, laws and such like control measures that supplement each other in order to facilitate proper highway usage and most of all the safety of all the road users and property. The Central Highway Authority is charged with the overall responsibility of all the roads in the country. The authority has a set of regulations aimed at the protection of the roads which every road user is expected to observe. It can therefore be argued that the authority plays a very important role in facilitating a sound transportation network, this is especially so, considering the fact that both the construction and the maintenance of roads are capital intensive. It is actually the effectiveness of this authority that makes the Government realise its objective of directing emphasis towards upgrading and maintenance of the unpaved roads already in place as clearly spelt out in the 1984/88 Development

plan. This is particularly so in that the more effective the authority is, the less funds will be spent on road maintenance and the more funds will be available for meeting the Government objectives on the improvement or expansion of the road network. Transport Licensing Board, on the other hand, is charged with the responsibility of issuing all types of operating licences to all vehicles indicating the nature of operation. In addition there is the Traffic Act which is the regulatory control measure upon which any misconduct from any road user is punished.

In the following sections, the relevant parts of the legislation concerning control, ownership and operation of motor-vehicles in Kenya is reviewed.

TRAFFIC ACT - Chapter 403, Revised Edition, 1962.

Part II, Section 5 (1) and 5 (2) of this Act indicates the procedure of registration of vehicles and who is given access to such records. The registrar shall keep records of all motor vehicles and trailers registered in Kenya, and shall cause every licensing officer to keep records of all vehicles registered by him.

"Vehicles records maintained by the registrar or a licensing officer shall be open for inspection by any Police officer, any collector of customs and the Chairman of Transport Licensing Board, who shall be entitled to copy any records free of charge".

Section 6(1) "No person shall possess a motor vehicle or trailer, other than the vehicle exempted from the provision of this Act". This part of the Act indicates clearly that all the vehicles and trailers must be registered, failure of which is punishable by law. It is therefore the procedure to be followed in the registration of all vehicles; a provision which is applicable to all motor vehicle owners, private or public.

Section 6(3) "A Licensing Officer, before he registers, any motor vehicle or trailer, may verify all the particulars in the form of application, and may, if he thinks fit, send the vehicle to an inspector for examination in order to satisfy himself that the vehicle is in a fit and proper condition for the purpose for which it is intended to be used and to conform in all respects to the provision of this Act". This particular section is aimed at controlling

the use of vehicles and their roadworthiness. It is this section of the Act that prevents one from converting the use of a vehicle to something else other than what it was registered for.

Section 6 4 "If any application is made to the register for any commercial vehicle or trailer, the load capacity of which has not been declared by the manufacturer of the chassis, a licensing officer shall not register the vehicle or trailer until an inspector has determined its load capacity, and such determination shall be final". This section of the Act is of particular importance where public transport vehicles are concerned for it determines the actual carrying capacity of the vehicle. For example the Kenya Bus Service Limited buses are licensed to carry a total of 105 passengers with 49 passengers seated and 56 passengers standing. However due to the shortage of Public transport means in Nairobi, it has been very difficult for the traffic police section to fully enforce this section of the act. It is therefore possible to find some of the public transport means in Nairobi carrying passengers that are double the licensed carrying capacity.

Section 95(2)(e)) "No public service vehicle licence (T.L.B.) shall be issued in respect of any motor vehicle which is intended to be used as a taxi-car, unless such a vehicle has been registered as a taxi-car under any by-laws in force in a municipality or township." These two provisions are meant to control the ownership and usage of public service vehicles. It can also be argued that these provisions give the municipality or a township the power, through their appropriate by-laws, to regulate the number of such vehicles in a certain area or route, and in providing adequate supplementing facilities. This is actually why the operation of matatus in Nairobi has experienced such difficulties in terms of supplementing facilities, especially the provision for parking places. Currently the provision for matatu parks, especially in the city-centre, cannot meet the demand; this resulted from the fact that for a long time, until 1984, matatus were considered as illegal public transport means and was therefore not included in the Nairobi City Council by-laws. Now matatus are considered an integral part of public transport in Nairobi and the Nairobi City Council are taking the appropriate measures to provide for the supplementing facilities such as parking.

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Section 10 "Any person who contravenes or fail to comply with any of the provisions of this part shall be guilty of an offence and liable on first conviction to a fine not exceeding one thousand shillings or to imprisonment to a term not exceeding three months, and on each subsequent conviction to fine not exceeding two thousand shillings or to imprisonment for a term not exceeding six months or to both such fines and such imprisonment." This clearly spells out the type of punishment that can be executed to the road users who fail to observe the provisions of this part of the Act. However, most of the road users, especially the public transport operators, while not observing the provisions of this Act, particularly section 10, like taking risks of not being got by the police. This risk sometimes leads into high speed and can result in serious accidents, or may involve an unexpected grand tour of Nairobi, which causes delays, resulting from attempts to avoid the traffic police check points.

Part XI - Public Service Vehicles.

Section 95(1) "No persons shall own, drive or be in charge of any public service vehicle on a road, unless there is a force in relation to such vehicle a public service vehicle licence issued under this part."

Section 100(b) "The registrar shall in respect of any public service vehicle determine the maximum number of a passengers, whether sitting or standing, and the weight of baggage or goods allowed to be carried at any time on such vehicle or on any vehicle of a similar class or description:

1. Provided such determination shall have regard to the provisions of this Act with regards to construction, seating capacity and weight.
2. If any public service vehicle carries more persons, baggage or goods than it is licenced to carry, the driver, the conductor and the owner of such vehicle shall each be guilty of an offence and liable to a fine not exceeding two thousand shillings:
3. Provided that the owner shall not be guilty as a foresaid if such offence is committed without his knowledge or consent and if he took all reasonable precautions to prevent it." The provisions of this section of the act is aimed to further enhance Part X 1 of the 'public service vehicle' which is actually geared towards ensuring the safety of the passengers and other

road users. The traffic police section should employ some measures that will facilitate the effective enforcement of these provisions.

2.4 REVIEW STUDIES:

The most important and comprehensive planning and transport study that has been done, in Nairobi is the 'Nairobi Metropolitan Growth Strategy', a study that was carried out by the Nairobi Urban Study Group in 1971. It can be argued that the study has become the backbone of the Nairobi City Council's transportation matters since its adoption in 1974. In carrying out the study, the group identified the following key problems:

- that there was no progressive increase in the road capacity on radial routes as the central area is approached.

- that there was no satisfactory circulation system around the central area;

- that there was an insufficient linkage between the industrial area, the central area, and the low income residential area;

- that there was a widespread vehicular/pedestrian conflicts particularly within and to the East of central area;

that there was a widespread lack of adequate pedestrian facilities;

that there was no comprehensive parking policy resulting in a widespread misuse of available road space; and

that there was high accident rates throughout the city, due to the mixed usage of road space and heavy vehicular/pedestrian conflict.

All of the above problems can be attributed to failure in keeping pace with the transport demands and the traffic growth. There are two major causes to this failure namely, the lack of financial resources and the lack of a co-ordinated approach to tackle the identified problems in a global and comprehensive way. In an attempt to design an alternative transportation system for Nairobi, the Nairobi Urban Study Group considered a number of objectives as follows:

1. the provision of a system capable of meeting the maximum demands for trips by all modes at the end of the century at reasonable levels of service;

2. to design the system to embody maximum flexibility, so that it may be easily extended or adapted to cater for alternative or subsequent development;
3. to design and operate the system such that maximum efficiency is achieved by providing for maximum cost, while minimizing damage to the environment.

In order to realize these objectives, the study adopted some design criteria such as maximum utility of existing transportation infrastructure, addition of the existing road network, making the most efficient utilization of possible mass transportation systems, and a minimization of walking distance between residential and employment areas to major transit routes in order to limit the need for feeder bus services. Upon completion of the study, the group came up with five major recommendations as follows:

1. A policy on restraint on the ownership and usage of private cars in Nairobi should be adopted in association with the measures to encourage the use of public transportation. The group argued that this policy could be achieved at a suitable level by increasing the importation duty and

purchasing tax on private cars to a combined figure of 140 percent, together with an increase of the Road Fund Licence fee from 200 shillings to 400 shillings and an increase of 90 cents on the tax on fuel per litre. They also recommended that a system of rebates should be devised for licenced public transport and commercial operators. Most parts of this particular recommendation have already been implemented such as a stiff car importation duty that sometime exceed the actual market value of the vehicle, high costs on motor vehicle fuels, and the recent introduction of road tolls on some major highways, the latter being a measure that involves the road users directly in contributing towards the maintenance of such roads. It can be argued that all these arrays of tactics are geared towards deterring the extensive ownership and usage of the private car. Whereas, at the same time it can be argued that the implementation of this policy has fallen short of the stipulated goal- the reduction of private car ownership and usage. A reflection of this is very evident in the 'New Registration of Road Vehicles 1975-1984,' Table 1.1.2 in Chapter one; this is especially the case since 1981 in that while the overall registration of new vehicles started experiencing a downward trend

the registration of private cars actually started an upward trend. This has been the case despite the deterrent measures that have already been employed. There is need, therefore, to further stiffen these measures and maybe introduce more if this policy is to be effective in realizing the stipulated goal.

2. The Group recommended a progressive reduction in public transport fares which was to be made as the services are increased and patronage rises. This recommendation was aimed at eventual provision of public transport on an 'at cost' basis. The Group further recommended that the Nairobi City Council should establish a semi-autonomous Transport Authority or Department for controlling all public transport operations in the City as well as for the operation of public off street car parks, parking metres, traffic regulation and the like. The Authority, through the Nairobi City Council, should obtain an interest in the Kenya Bus Service Limited with the ultimate prospect of a total ownership of the company. While this may be a sound recommendation, it lacks the most important aspect that would lead to its implementation; that

is, making the operation of this company more of an amenity than its current disamenities. The currently prevailing disamenities of the company's operation prompt the would-be user to resort to other means of transportation when costs can be accommodated; in majority of the cases the public resorts to private automobiling thus multiplying the already felt problem of vehicular traffic congestion. It can also be argued that the fares charged by the company per trip, especially during peak periods are relatively high, not to mention the congestion in the vehicles themselves which makes one very uncomfortable. These are the kinds of problems that may have contributed towards the difficulties of implementing these recommendations; there have been proposals made only.

3. The Group also recommended that the working hours in the central areas be staggered so as to spread the traffic peak over a considerably longer period. In addition a comprehensive car parking policy should also be established within which free parking would be abolished and parking charges progressively increased from Kshs. 2.50 per day to Kshs. 5.00 per day by 1978 for off-street parking, and parking metre charges also be increased to at least Kshs. 1.00 per hour in

all prime locations by 1975, coupled with the metering of all the remaining on street parking. The staggering of working hours does not necessarily go a long way in solving the problem of vehicular traffic congestion nor congestion inside the public transport vehicles. It may actually do the reverse of the initial stipulated goal, besides disrupting the lives of many urban dwellers in terms of travelling arrangements. Take an example of a family with one car that is used by all members for transportation purposes; that is husband and wife to work and children to school. Staggering of working and/or school hours will be a big inconvenience for this family both financially and in terms of energy that has to be expended and time that is actually wasted on the road. It would probably necessitate this family to undertake six trips instead of the usual two trips, and this would actually multiply rather than ease the problem of vehicular traffic congestion. If looked at this way, this portion of this recommendation is in itself a self-defeating purpose.

Currently, the parking charges in the city-centre for off-street parking is Kshs. 5.50 per day, for example, from 7.00 a.m. to 1.00 p.m. the

off-street parking charges is Kshs. 3.00 and from 1.00 p.m. to 5.00 p.m. the off-street parking charges Kshs. 2.50. The metred parking charges follow three main concentric zones (See Map 2.4.1 below) with the inner zone being the prime location - the city core being the 'Red' and the parking charged is Kshs. 2.00 per hour. It is followed by the 'Green' zone with the parking charge of Kshs. 1.00 per hour. There is also the 'Grey-Blue' zone with a parking charge of 50 cents per hour. This goes to show that the most parts of this recommendation except for the staggering of working hours, has been implemented and in some cases even beyond the actual recommendation itself.



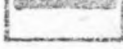
4. The fourth recommendation involved immediate steps that were to be taken to ensure the provisions of segregated bus-way routes which were to be in accordance with the recommended transport plan for 1979 and 1985. It included land reservations being ensured for the development of the anticipated requirements incorporated in the recommended long-term strategy. This particular recommendation may not be the most appropriate one to undertake especially for the developing countries, for it is highly capital-intensive. Besides, this strategy has been tried in some cities such as Toronto but some difficulties were experienced

MAP 2:4:1

NAIROBI METERED ZONES



LEGEND

-  Red Metre Zone
-  Green Metre Zone
-  Blue/Grey Metre Zone

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in getting majority of the road users not to use the designated bus-lanes during peak periods. This goes to show that there is need to segregate other traffic lanes and the bus-lanes by actually constructing a dividing island and the expansion of inadequate bus routes. Here the Group should have considered a recommendation that would have facilitated an efficient public transportation for Nairobi. A provision of an efficient public transport alone would go a long way in solving the problem of vehicular traffic congestion than the mere provision of a segregated bus way routes.

5. The fifth of the Group's recommendation was steps taken to ensure the provision of roads in accordance with the recommendation of the transport plan for 1979 and 1985. It also included appropriate land reservation in respect of requirements incorporated in the long-term strategy coupled with the provision of land for further car parks recommended within the Central Area and the New Secondary Centres. While this recommendation is a sound one, it should also have included the expansion of some routes which are currently over-utilized and very congested during peak periods.

All the above recommendations on transportation planning are dependent on both the economic and demographic forecasts of the Study Group and on the specific recommendations with regard to spatial location of the future areas of residential, industrial and commercial development. Since 1974 when Nairobi City Council adopted the recommendations of the Nairobi Urban Study Group, a number of sectorial studies have been carried out in order to establish the feasibility of the implementation of the recommendations. The four most important of these documents are as follows:-

1. The Nairobi Central Area Study which was carried out by Nairobi City Council in 1974 and 1975. The principal concern of the study was the establishment of the pattern of the Central Area development to the year 2000 consistent with the upper limits of 100,000 jobs as was proposed by the Nairobi Urban Study Group. This study led to the formulation of a Central Area parking policy as had been recommended by the Nairobi Urban Study Group. The study went further to examine various alternatives of the Central Area traffic networks with the view of improving traffic flow. However, the study did not consider the effects of the proposed changes of the public transport details.

3. The Nairobi Passenger Study report which was done by the Transport Management Service in 1977. The study set out to examine from the operators point of view, the implication of a City Council or a public take-over of the Kenya Bus Service Limited. However, due to the complexities of the issues involved, the Kenya Government decided to re-examine the recommendations, of both Nairobi Urban Study Group and that of Transport Management Services. The Transport Management in their study also included evaluation of future fleet requirements and the need of depots and facilities. They also made some policy recommendations with regard to the role of matatu operation and a possible format for the proposed Nairobi Transport Authority.
3. The Nairobi Bus lane and Busway feasibility which was undertaken by P.G. Park-Poy and Associates, Pty. was carried out in 1977. The study sought to establish the feasibility of a network of busways along the same lines as recommended by Nairobi Urban Study Group report. The original busway recommendation was modified so as to facilitate a cheaper and a more flexible combination of busways and buslanes which the study recommended following the main corridors of demands as was identified by the Nairobi Urban Study Group. This particular recommendation

has not been implemented despite the feasibility study; the fact that it is a very capital intensive may be the reason behind its lack of implementation and also the fact that it may not actually be the ideal solution to the transportation problems in Nairobi.

4. The matatu transport of Nairobi study was carried out by the Nairobi City Council in 1977. The study was geared towards the establishment of the role and the extent to which its operation affects the city. Upon this establishment the study recommended that there be an establishment of a new public light bus company coupled with other measures aimed at improving the safety and operation of the matatu services.

Following this recommendation, Central Bureau of Statistics conducted a pilot survey with attempts to measure the contributions of matatus/mini-buses towards Gross Domestic Products. This survey was conducted early 1983 and it only involved those Matatus/Minibuses starting and terminating within the Nairobi City boundary. The findings were very positive and in 1984, through an Act of Parliament, all matatus/Mini-buses were required to obtain a Public Service Vehicle (P.S.V.)

licence in order to operate. This was the first time that the matatus/mini buses were incorporated in Gross Domestic products, and in the same year 1984 it contributed well over 440 million shillings; to date, matatus/mini-buses have been appreciated for handling a significant share of passenger road transportation.

In their concern for Human Settlement, United Nations, in their fifth session held in Nairobi in 1982, in one of their agendas, considered 'Transport for Urban and Rural Areas, with Emphasis on Groups with Limited Resources.' This report indicated that the urban poor generally prefer locating themselves centrally, within the proximity of employment places in-order to minimize transportation expenses. It also recognised the fact that as a city grows, the urban poor are often forced, because of shelter costs or the lack of space, to locate far away from the centre. Nairobi is no exception to this, especially when one considers the proximity of places like Kawangware, Mathare Valley, Kibera and the like where most of Nairobi's Urban poor lives, to industrial area, where most of them work. This means that most of these urban poor are forced to walk for long distances to and from work for they cannot afford the use of public transport. Basing their arguments on the fact that the choice of the means of travel

is strongly influenced by its availability and the income brackets, United Nations recommended that instead of investing on new roads, road improvements, and traffic management equipments, investments should be geared towards a better use of the existing facilities through pricing and regulatory policies. It was the view of the United Nations that the vast majority of the urban population in the developing countries will, on account of their income levels, have no option but to rely on walking, bicycling or some form of public transport for the foreseeable future. That current urban transportation policies are geared mainly towards road investment and traffic management schemes aimed at meeting current and expected demands for motor traffic. That such policies, a part from diverting resources away from measures which might better service the majority, generally make travel conditions worse for the urban poor, thus reducing their ability to contribute to the economic development. It was therefore, their strong recommendation that the Government take some measures aimed at improving urban transport facilities and services for those with limited resources. In stressing the important role of the public transport they highlighted the following points:

1. that priority should be given to traffic - engineering and management measures that increase the functional capacity of the existing street system, together with institutional and organizational measures to improve the efficiency of bus-fleet operation;
2. that new roads construction should only be considered when the measures in number (i) above are insufficient, when specific links in the road network are missing, when it is justified by Urban Or Regional Development Strategies or, when special facilities such as bus-lanes are required;
3. that priorities should be given to projects that will improve public transport services;
4. that public transport improvements should be oriented towards services in, or used by people from low income areas.

All of the above studies can be argued to have concluded with sound policy recommendations on transportation. However, most of the recommendations, for one reason or the other, have not been effective

in earning the City of Nairobi an efficient transportation system. In other words, those policy recommendations that have been implemented have not gone along way in solving the transportation problems. Whereas the policy recommendations that have not been implemented may have not addressed themselves fully to the situation in Nairobi and the country as a whole in terms of the levels of economic development, hence were too costly for the Government to implement. As a result, the transportation situation in Nairobi is currently, as indicated in Chapter 1.2 - statement of the problem; the public transport means are highly congested and for the most part unreliable and unsafe, this in turn prompts the would be users to resort to other means of transportation when costs can be afforded. In most cases the alternative means of transport chosen is private motoring which further complicates the problems of vehicular traffic congestion and the transportation system in general. The answer to the transportation problems in Nairobi may as well lie in the provision of not only better amenities but also better economical advantages in the public transport system for it to compare better with private cars or other means of transportation. It is hoped that this study based on the 5 stipulated objectives - Chapter 1.3,

will uncover the major problems associated with transportation system in Nairobi, thereby coming up with effective policy recommendations which will go a long way in solving the transportation problem in Nairobi.

CHAPTER THREE

COMPETITION BETWEEN PRIVATE AND PUBLIC TRANSPORT

3.1 ORIGIN OF URBAN TRANSPORT

Man throughout History has made various advances in his urban transportation; each time trying to seek more freedom and mobility, at the same time trying to ease his movement with respect to road transportation. At one stage in human settlements the urban area was structured in such a way that all the land uses were within a reasonable and acceptable walking distance "the pedestrian city". Following this, man employed the use of horse-carts for easier and cheaper form of transportation. This facilitated the expansion of the urban areas for man could live further away from the downtown area and be able to commute with relative ease. This can be argued to have been the stage that paved the way for the evolution of the "commuter city". At a later stage, which may be termed as the third phase of transportation advancement, man employed yet another means of transportation, the train, which facilitated faster movement than the horse-cart. The train was used interchangeably with the horse-cart as supplementary means of transportation. This is the stage which actually established or set the foundation of the commuter-city, which in the real sense marked the beginning of the industrial revolution. In the fourth phase of road transportation advancement,

man employed the use of yet another means - the motor-car, which further intensified the evolution of the commuter-city while promising man a higher degree of freedom and mobility. The motor-car, to-date, can be argued to still promise man a higher degree of freedom and mobility in that it gets him wherever he wants to go when he wants to go and at the most convenient time possible. However, the latter is now questionable, the time factor, that is; the motor-car may still get man wherever he wants to go when he wants to go but the extensive ownership and usage in nearly all urban areas today, Nairobi included, and the cost that has to be expended in terms of energy and space, can be argued to have drastically reduced the time factor that was originally promised by the motor-car. Barbara Ward in her book - 'Home of Man' argues that a consideration of the use and misuse of the motor-car is central to a saner use of space and resources. That if all the movements within the city favoured the motor-car our cities will be victims of the same transportation problems being suffered by cities such as Dallas and Los Angeles in the United States of America. In such cities, already more than half the total city's land area has been taken up by roads, and parks not to mention the suspended spaces. She points out that in such cities, once the vehicles join the solid commuting

convoy, their owners are estimated to get only about six per cent of useful work out of each gallon of gasoline. The rest is lost to the idling of engines and polluting emissions. Nairobi being a rapidly growing city may soon be a victim of the same problems, unless something is done about the transportation problem. Instead of it being the "City in the Sun", as is commonly known, it may soon be known as the "Traffic Jam City" or "the City that Promises to Get You Nowhere in Time".

3.2 LAND USES

Like in any other Urban area, there are basically three major land uses in Nairobi: Residential, Commercial and Industrial. It is within these three types of land uses that various activities take place within any given period, that is, the rush to work in the morning, to lunch and back to work in the afternoon, and the rush home or to recreation centres in the evening. It can actually be argued that all journeys begin and terminate at the place of residence. It is also true that man has to work for a living in order to be able to put bread on the table for the family. Holding these two statements to be true, it only goes to show the importance of the three types

of land use (residential, commercial and industrial) in any urban area. They are important in that residential areas provide the urbanites a place to call home, while commercial and industrial areas, are the major places of employment. Taking commercial and industrial areas as one place of employment, that is, and residential areas as the place of residence, the two places act like two points of a trip, for example Point "A" and point "B". Trips are therefore made from point "A" to Point "B" and vice-versa in the morning and evening. It is these trips that in most cases cause unbearable and unnecessary delays in that the trips are undertaken about the same time and often heading in one direction, this is especially the case with the city of Nairobi. The City of Nairobi has taken a concentrated trip attraction structure in terms of the places of employment and this type of structure tends to pull all traffic towards a common centre irrespective of the locations of the residential areas. The locations of the three types of land uses is therefore a very crucial area in planning for an urban area especially so with respect to transportation, people will somehow have to make it from point "A" to point "B" and vice versa. The important question to ask here is how this will be done without much disruption, taking into consideration the limitedly available resources

and the concern for the environment.

A concentration of commercial and industrial activities results in one trip attraction centre - the place of work. This is the type of city structure that Nairobi has taken, for example the city centre and the industrial area. This means that nearly all the convoy of traffic are heading towards one common centre from all the residential areas; this sometime causes unbearable vehicular traffic congestion especially as one approaches the attraction centre. Barbara Ward may as well have been right when she argued that while leaving home, for the motorist, that is, may still be a matter of free choice but once the drivers join the convoy of traffic both energy and useful work hours are literally wasted not to mention environmental pollution and destruction. The residential areas in Nairobi surrounds the city centre and industrial area as shown in Map 3.2.1 below. As was noted earlier Nairobi's population is currently estimated at about 1.2 million. All these people are housed in four main residential areas, North, South, East and West of the city centre and the Industrial Area. A large majority of the population reside in the high population -density areas scattered to the East and to the North-East of the city centre. The population

NAIROBI LAND USE MAP

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Kamithi Prisons

Kahawa

Kabete

Muthaiga

Dandora

Parklands

Nairobi Airport

Industrial Area

Karuri and
Lengata

Karura







Prisons

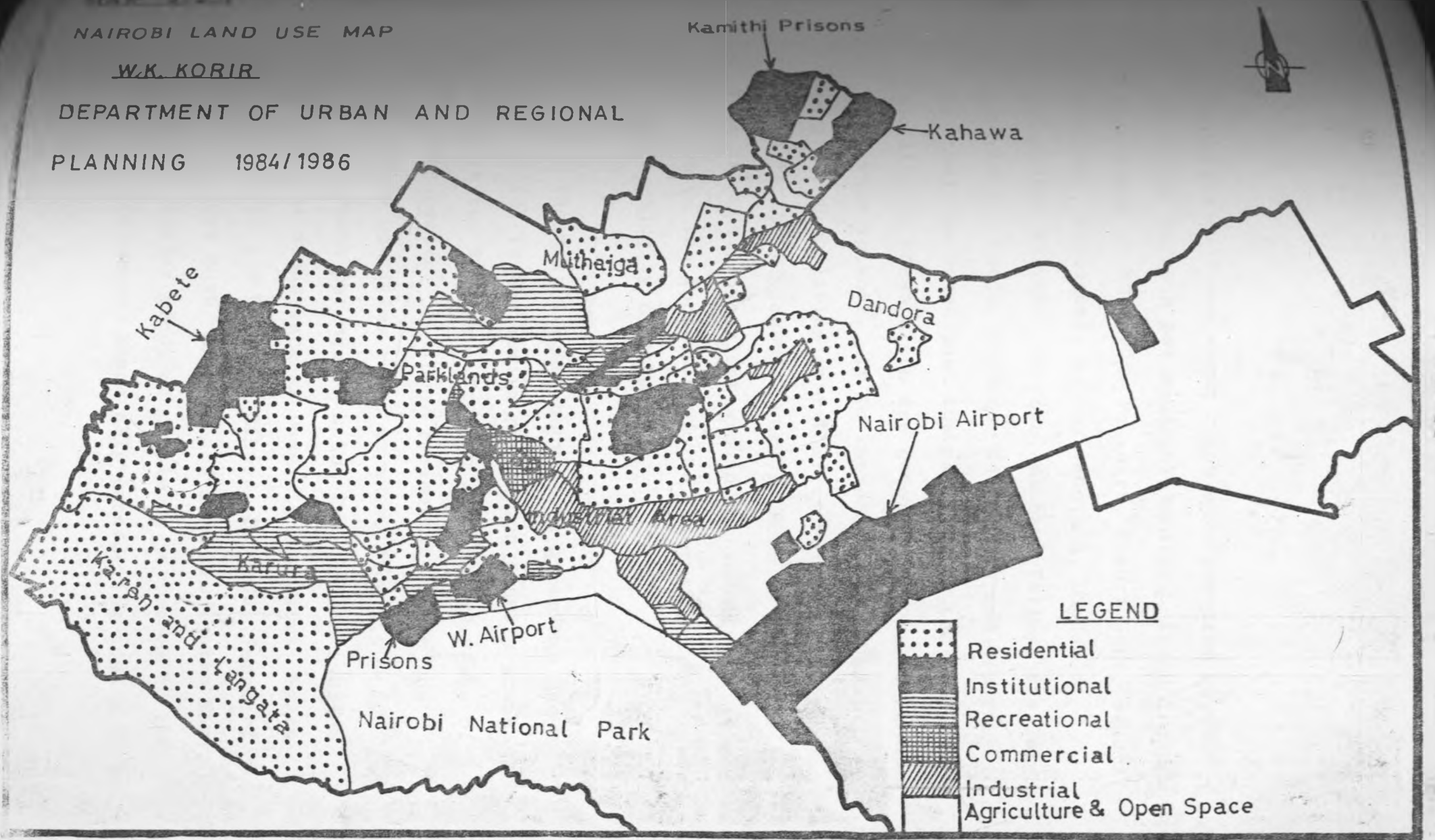
W. Airport

Nairobi National Park



LEGEND

-  Residential
-  Institutional
-  Recreational
-  Commercial
-  Industrial
-  Agriculture & Open Space



densities in these areas range anywhere from 10,000 to 30,000 persons per square kilometre. These include such areas as Muthurua, Makadara, Shauri Moyo, Bahati, Kaloleni, Makongeni, Maisha, Mbotela, Doonholm, Jerusalem, Maringo, Jericho, Mathare Valley, Eastleigh, Kariobangi, Umoja, Dandora, Kawangware and Kibera. It should be noted that the majority of the people who live in these areas are generally poor and in most cases walk to work. It is therefore not unusual to find them living or rather crowding themselves as close to their places of work as much as possible. This is mostly prevalent around the industrial areas and around the locations of the informal sectors where a large majority of them work.

The next largest population group are those that reside in the medium population density areas found in the Northern, Eastern and Western parts of the city-centre. In these residential areas the population densities range anywhere from 1,000 to 10,000 persons per square kilometre. These include residential areas such as Pangani, Parklands, Ngara to the North and West and Kibera, Otiende, Jamuhuri Langata, Buru Buru, Kimathi and Harambee to the East. These particular group of people as portrayed by the place of residence, especially considering that a large

majority of them work in the city centre, can afford to commute to and from work by bus or by private motoring. These are the middle-income groups as the place of residence implies. The last, but not least, group of people is the high income group which resides in the low population density areas. This particular group prefers to reside in the outskirts of the city. In Nairobi, the low population density areas are found in the far North and West of the city centre. These include places like Muthaiga, Kitisuru, Kyuna, Loresho, Kileleshwa, Lavington, Nairobi South B, Nairobi South C, Karen and Langata. The population density in these areas ranges from 0 to 1,000 persons per square kilometre. As this group prefers to live far away from the city centre it also prefers private means of transportation, they are the well-to-do group of people.

3.3 ROAD NETWORK

According to the Ministry of Transport and Communications, as indicated in the 1979/'83 Development Plan, the Kenya road transport system consists of a network of roads ranging from little more than trails accessible only in the dry season to well engineered multi-lane tarmac highways. This road system is

divided into classified and unclassified facilities; the classified being all the roads sections under the official responsibility of the Ministry of Works, Housing and Physical Planning. Currently, there is a total of 150,600 kilometres of road network of which 50,600 kilometres are classified and 3,200 kilometres being special purpose roads. Here the Government of Kenya deserves much credit for the improvement it has done on the road network. This is especially so in that at independence, there were some 1,811 kilometres of bitumenized roads and by 1978, only 15 years after independence, the bitumenized road network had more than doubled to some 4,331 kilometres.

The classified road network system is subdivided into five official classes as follows:

1. Class 'A' - International Trunk Roads;
These are roads that link centres of International importance and cross International boundaries, or terminate at International ports. These include such roads like Nairobi-Mombasa road-Uhuru Highway-Waiyaki Way, Murang'a-Thika, Airport Roads and the like.

2. Class 'B' - National Trunk Roads ; These are roads that connect centres and/or areas of National Importance.

3. Class 'C' - Primary Roads ; These are roads that connect important provincial centres to each other and/or any major administrative centre in the country . and/or to higher class roads. These include such roads like Kiambu road, Limuru road, Ngong road Langata road ; ,Komo Rock road and the like.

4. Class 'D' - Secondary Roads ; These are roads that link locally important centres to each other and/or to more important centres or to higher class roads. These include such roads like Kamiti road, Kabete Road, Kikuyu Road and the like.

5. Class 'E' - Minor Roads ; These are the roads that provide connections to minor centres in the rural areas, and provides for internal circulation and accessibility.

In addition to the five major categories of classified roads, there are other roads which are usually identified

with the economic services they provide. These include the "Special Purpose Roads" which serves agricultural, tourism and settlement areas.

The included Map 3.3.1 of Nairobi showing the road network density depicts three main concentric zones around the central area. This also, to a larger degree, reflects the various stages of the city development over the years. Firstly, is the high density zone with a road network density of over 61 kilometres per square kilometre. These include areas such as the central area, Ngara, Pangani, Parklands, Westlands, the medium population density residential areas of Eastlands, secondly is the medium density zone with a road network density of between 21 and 60 kilometres per square. These are mostly found in the middle income residential areas, within the city and in the industrial area. Thirdly is the low density zone with a road network density of less than 20 kilometres per square kilometre. This zone includes all the outer areas within the city boundary. Strikingly the dividing line between this zone and the medium density zone, traces fairly accurate with the old city boundary'. This goes to show that the road network development was originally confined within the 'old city boundary' especially before the



LEGEND



High Density

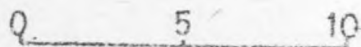
Medium Density

Low Density

M A P 3:3:1

N A I R O B I ROAD DENSITY MAP IN Km./ Sq.Km.

SCALE



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REGIONAL PLANNING

1984/1986

city boundary extension in 1963. It can also be argued that these three zones necessarily follows the land use pattern in Nairobi thus reflecting the different stages of development in the city over the years. One notable conclusion that can be drawn from the road network density map is that the commercial, industrial and the higher population density areas has the highest road network density. This to a larger degree reflects the intensity or the magnitude of interactions in these areas. It also implies that the types of land uses in the outskirts of the city does not warrant a high density road network due to the limited activities there; note that these areas are usually of low population densities. It can be, therefore, concluded that the higher the population density and/or the magnitude of interaction of an area, the higher the land use intensity and therefore the higher the road network density.

3.4 MODAL SPLIT IN NAIROBI

According to Nairobi Urban Study Group (N.U.S.G.), in Nairobi the people who either own or have cars use them to the full, and the rest of the population make their choices between walking and public transport in accordance with the financial circumstances of the

individual. In their study, N.U.S.G. found out that a predominance of journeys were made on foot over all other modes of transport. From the distribution of total daily trips by each mode, the group found out that 38 percent of trips are made by private automobile, 14 percent by public transport, 2.6 percent on bicycles, 44 percent on foot and 1.4 percent accounted for other means of transport. The distribution of total daily trips by journey purpose such as work trips, school trips and business trips indicated that in Nairobi the majority of trips are by far made for essential purposes. Those essential trips accounted for a total of 87 percent of the total daily trips; this is to a larger degree reflects the general low income of the majority of the population which is also reflected by the low number of non-essential daily trips. It can also be argued that since the trips to and from work are somewhat fixed and that an increase in the income will increase the total daily travel, this increase on the daily travel will necessarily be on the non-essential trips. It is to be expected therefore that the distribution of trips by purpose in Nairobi will change as more non-essential trips are made with the rise on the income levels.

The study also analysed the distribution by travel mode for particular trip purposes, for example, work trips, school trips, shopping trips, social trips and other trips. It was found that work trips and personal and firm trips are very similar in their distribution. Some 35 percent made on foot, 46 percent by car drivers and car passengers and 15 percent by bus. School trips were somewhat of a special case in that 25 percent were made by private automobiles; this percentage is rather high and considering the fact that school trips are made during the morning rush-hours, this further compounds the problems of vehicular traffic congestion during these periods. The rest of the school trips were made as follows; 60 percent on foot, 11 percent by bus and 0.5 percent on pedal cycles. Shopping trips which are of much less importance in terms of total trips are largely divided between walking which accounted for 48 percent and private transport which account for 41 percent; only 8 percent use buses. Social trips is another special case with a large majority of trips made by private transport, which accounts for 60 percent. This is followed by trips made on foot which accounts for 37 percent and bus trips only accounting for 9 percent. This to a larger degree portrays the unsafety and

unreliability of the public transport in Nairobi especially in the late hours of the evening when most of those on social trips are homebound from their various social places; this is with the assumption that most of the social trips are made in the evenings, for example after work. It is also apparent here that as the importance of the trip purpose decreases, the use of private transport increases. This actually goes along with the supposition that the less abled population make much less non-essential trips restricting themselves and their limited resources only to essential trip making.

3.5 MODAL CHOICE BY PURPOSE

The N.U.S.G. found out that the distribution by mode for car owners and non-car owners, had a variation in modal choice for different purpose of travel, as income increases. In the case of car owning households, there appears to be a direct substitution between walking and private transport as higher income is realized, this substitution being more pronounced with the work related trips as compared with shopping, social and school related trips. Public transport, on the other hand have a more or less static share of around 10 percent, of the total shopping and school related trips, and a steady decline share

falling from 10 percent to practically zero in the case of work related trips. The non-car owning households, on the other hand, undertake their trips by walking. This varies accordingly with the income levels from 95 to 50 percent for school and shopping trips, while work trips varies between 90 and 30 percent. There is more substitution here between walking and public transport as income increases, this is especially the case with the work trips. The share of public transport trips, on the other hand, increase steadily as income rises, ranging between 5 percent and 20 percent of trips for all purposes.

Car owning, on the other hand, households show an almost direct substitution between walking and private transport as distance increases. This is especially so with school and shopping trips; for work trips, this same substitution occurs only upto a distance of 3 kilometres, while beyond this distance, over 90 percent of trips are made by public transport. here, public transport is only responsible for 5 percent of the work trips irrespective of the distance

corresponding road network increment and/or expansion. In other words, the road network cannot cope with the volume of traffic demanding to be committed onto them. This in turn not only wastes the energy that has to be expended but also wastes what would have otherwise been productive hours not to mention the frustrations involved all of which in different capacities slacken the overall development of the country.

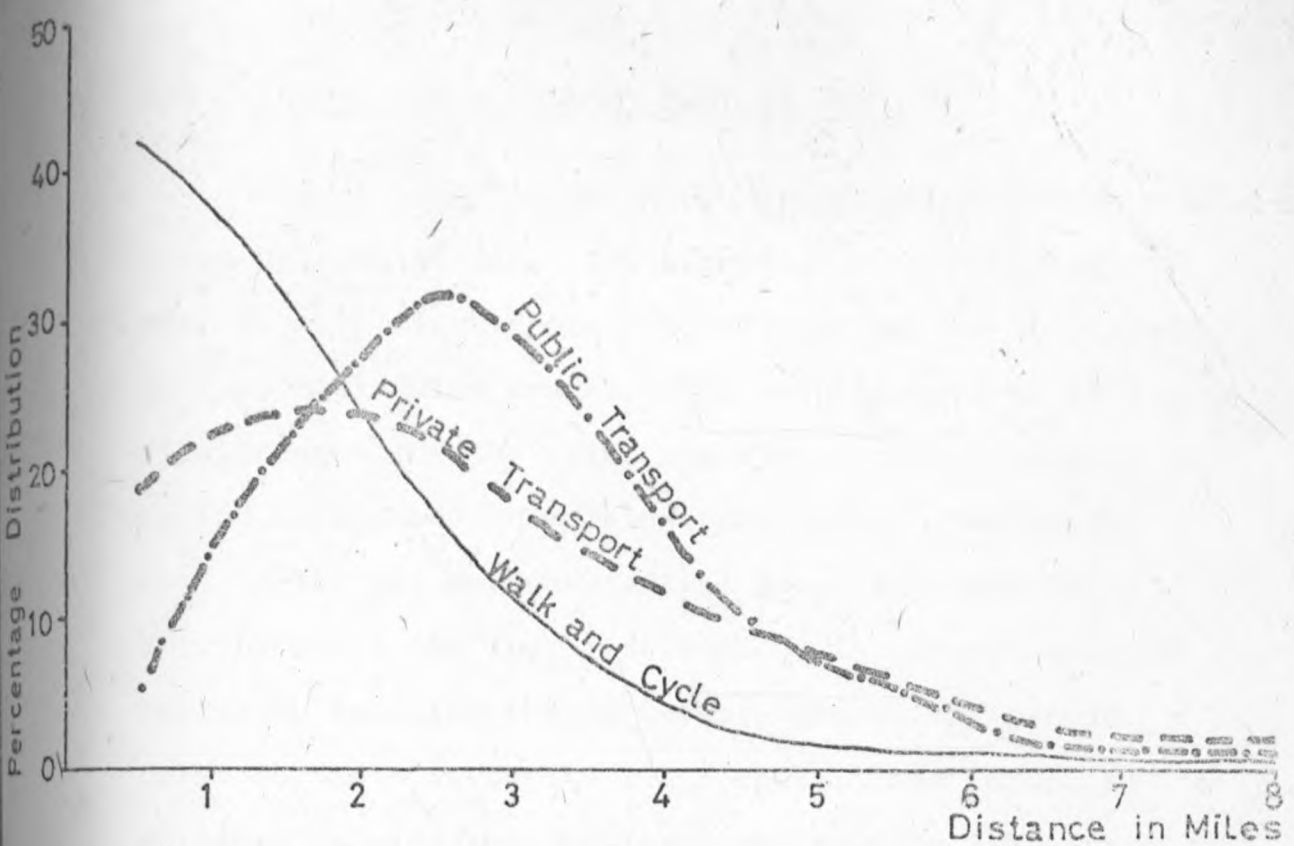
Most of the roads in Nairobi were laid out and constructed before independence in 1963, a time at which African population were restricted from living within the old city boundary let alone owning an automobile. It can therefore be concluded here that the road network in Nairobi was only designed to meet the Whiteman's and the Indians' transportation demands. It can also be argued that, upon independence, the Kenyan Government has experienced some difficulties in expanding these roads or construct new ones to meet the current transportation demands because of other pressing development issues coupled with the fact that road expansions or constructions are very labour and capital intensive. The main National objective where transportation network is concerned, as spelt out in the 1974/1988 National Development Plan has been to facilitate a transportation network and a transportation system that would keep the transportation

and is responsible for between 10 and 20 percent of school and shopping trips. The non-car owning households, on the other hand, shows that the substitution is smaller but between walking and public transport upto a distance of 7 kilometres after which the share of public transport trips declines. This is probably due to the influence of private transport trips. A notable fact here is the high percentage of trips made on foot over relatively long distances. For example, walk trips accounts for 50 percent for upto 6.5 kilometres and the share at a distance of 13 kilometres is still as high as over 20 percent. Interestingly too is the fact that the proportion of walking is slightly lower in the case of short work trips. For example 50 percent for a distance of upto 5.5 kilometres and 30 percent for a distance of upto 13 kilometres of work related trips are made on foot.

To complete the data on trip lengths, Figure 3.5.5 is the included frequency distribution for the three major modes for example, walking, public transport and private transport. It is evident that a vast majority of the trips fall within the range of between 0 and 8 kilometres. Majority of work trips is noticed in the lower distance ranges, with some 70 percent being below 3.2 kilometres and over 85 percent

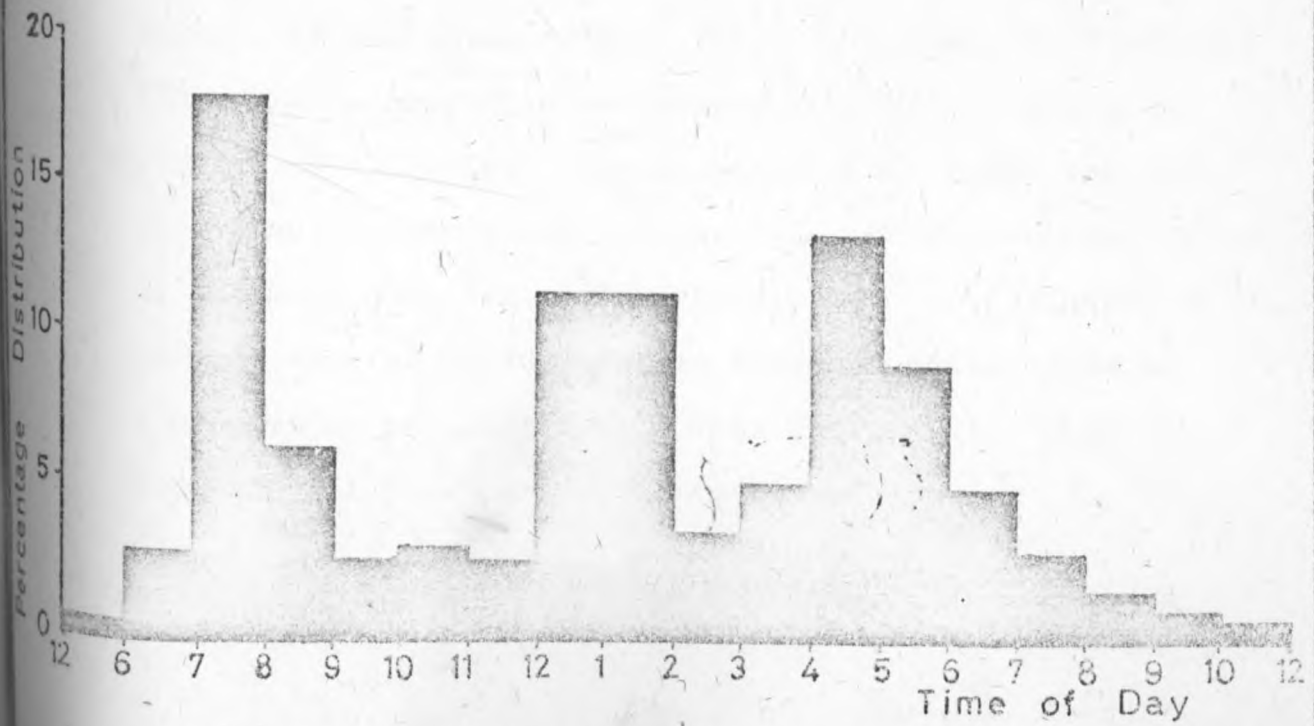
being below 4.8 kilometres. Although the percentage of walk trips fall rapidly with increasing distance, it compares well with the other two modes even at long distances. Public transport trips have a lower distribution of trips in the shorter distance range, with less than 25 percent occurring below 3.2 kilometres. Public transport trips are at their peak, at 30 percent between 3.2 kilometres and 4.8 kilometres and then it falls sharply with increasing distance. From the above two modes it can be concluded that non-car owners tend to walk upto a distance of 3.2 kilometres and tend to transfer to public transport as distance increases. It can also be concluded that the continuation of significant frequencies of walk trips over long distances may be attributed to financial constraints, otherwise all walking trips over a distance of 3.2 kilometres would transfer to public transport. The distribution of private transport trips can be seen to be much more even. Almost 2.3 percent occur over short distances of upto 3.2 kilometres and falls to 20 percent between 3.2 kilometres and 4.8 kilometres, the levels of trip making by all modes is very small, being lead by private transport, followed by public transport and lastly by walking.

FIGURE 3:5:5 TRIP LENGTH FREQUENCY BY MODE - 1970



Source: Nairobi Urban Study Group, Volume II

FIGURE 3:6:1 TRIP DISTRIBUTION BY TIME OF DAY - 1970



Source: Nairobi Urban Study Group, Volume II

3.6 TRIP DISTRIBUTION BY TIME OF DAY

Figure 3.6.1 above shows the distribution of total trips by time of day. The significance of morning rush-hour is clearly evident, accounting for 18 percent of the total daily travel. The evening peak is of less significance for the trips are spread over a longer period as opposed to morning peak trips. Noteworthy here is the non-day substantial peak, this may be attributed to the fact that some of the people go home for lunch and also the fact that most of the people drive to their favourite lunch spots. The amount of movement outside these major peaks is very low, consistent with the generally low level of trip making for non-essential purposes. In terms of distribution of trips by time of day for different purposes, pronounced peaking is dominated by work and school trips which accounts for 65 percent of the total trips. These two types of trips can therefore be argued to be largely responsible for the peaking of all trips. Shopping and other trips are much more evenly distributed. It can also be argued here that as income rises, travel for shopping and social purposes can be expected to increase in terms of quality and as a proportion of all travel. This in turn will tend to increase off-peak period movements.

4.1 COMPETITION BETWEEN MATATUS AND K.B.S. BUSES

The two types of public transport (Matatus and the K.B.S buses) compete very stiffly with each other over passengers all in the name of a higher net return for the day. This type of competition increases the risk of getting involved in accidents and the consequences that come with them. In theory the K.B.S. buses are supposed to stop only at the designated bus stages; this is in order to avoid obstruction and/or blockage of traffic lanes which cause traffic jams. However, this is not the case any more; the stiff competition has forced the K.B.S. buses to stop anywhere on the road especially to pick up passengers. One may wonder why the drivers of the K.B.S. buses are that aggressive but this is because of a bonus - system which has been introduced by the K.B.S. Limited. This is a system where every bus operating on any given route is expected to turn in a fixed amount for the day or for the shift; the fixed amount is based on carried out surveys and analysis of every K.B.S. bus routes. Any amount that is over and above the fixed amount is to be shared equally between the drivers and the conductors.

Matatus on the other hand being small and flexible can stop anywhere on the road to pick up or drop-off passengers. As a matter of fact they are so flexible

that at times they can drop somebody with heavy luggage at his door-step for an agreed fee. This, to a larger degree can be said to have made matatus more attractive than the K.B.S. buses which in turn have tended to have attracted the K.B.S. buses to pick-up passengers anywhere on the road. However, it should be noted here that currently there is no legal provision for the matatus to use the K.B.S. designated bus stages. It can therefore be argued that the matatus, now being recognized as an integral part of public transport have the right of stopping anywhere since proper facilities have not been made available for them. It is actually interesting that matatus have not been legally allowed to use the K.B.S. bus stages and yet they both operate in basically the same routes. In the survey it was found out that matatus have also adopted the bonus system of the K.B.S. Limited whereby some of the matatu owners have set a fixed amount to be turned in on daily basis and what is over and above is shared between the conductors and the drivers. The more the passengers and the more the trips made per day the more the bonus, so that both the matatus and the K.B.S. drivers have to be very aggressive in order to get more bonus. It should also be noted that the bonus earned is on top of a fixed salary in majority of the cases. On very rare cases, the matatu owners

requires the driver to pay a fixed sum each day and use the remainder for minor repairs, petrol/diesel and wages for himself and the conductors.

This type of stiff competition normally results in overspeeding, careless driving, road obstruction, overloading and poor maintenance, to name just a few - all of which are accident prone. These accidents, which can actually be reduced to the minimum, result in great losses in terms of human lives and property. It also involves the rushing of passengers when boarding or alighting which in some cases have caused serious bodily harm to some of the passengers and in some cases has resulted in fatal accidents. The rushing for and of passengers makes one wonder whether the drivers and the conductors really know that they are, actually dealing with human lives and not merchandise that can be replaced in case of any loss over an accident. The same goes for the frustration inside the two types of public transport resulting from overloading. At the same time the fare remains the same whether you are being crushed to death or sitting comfortably. Their high and dangerous speed does not help either, especially when a corner is being negotiated; let alone the fact that it is both a nuisance and dangerous to

other road users. It is actually very unfortunate that with all the dangers and all the discomforts involved, the public still have to board and travel in them daily for they have no other choices.

According to the study by Ian Barwell 1979 of the Matatu Public Transport sector in Nairobi, it was noted that it is cheaper and more profitable to purchase a second-hand vehicle for the purpose of matatus; this contributes much to the matatus unroad-worthiness. It was noted that it is difficult under the present condition to realize an immediate profit with a new vehicle. The major reason for the lower profitability of a new matatu were noted as follows:

1. High initial purchase price coupled with high interest rates for the loans borrowed towards the purchase. The repayment period is also too short, for example, only 18 months; this is irrespective of whether the vehicle is in operation or is in the garage. In other words, the financiers conditions are too rigid. Under favourable conditions the owners of the new matatus have to wait very patiently for 18 months in order to realize any reasonable profit. These factors alone are enough to discourage the

matatu owners from investing on preventive maintenance of their vehicles in order to keep them roadworthy and to extend their life. Let alone the fact that it discourages many from investing on a new matatu all together.

2. High insurance premiums and the fact that most of the financiers force the buyers to insure with a firm that they would not have otherwise chosen. In most of the cases these firms charge very high insurance premiums whereas some other firms (insurance) would have charged less premiums. The two reasons above force the owners of the new matatus to be very aggressive and competitive. The strategy undertaken here is to jam as many passengers in the vehicle and to speed up in order to make as many trips as possible. Unfortunately all these are done at the expense of the comfort and safety of the users who in most cases have no other better means of transport to choose from.

1.2 CONGESTION IN MATATUS AND K.B.S. BUSES:

The K.B.S. buses are licensed to carry only 105 passengers, 49 of whom are seated and 56 standing. However, during rush hour periods the carrying capacity

is doubled in some cases with some of the passengers hanging on the doorsteps of the bus from outside. This is simply because there is no more room inside the bus. One may choose to ask here whether these people hanging on the bus from the door step, have actually boarded the bus or not. The answer according to any K.B.S. bus conductors is that they have boarded for they have to pay exactly the same fare as that of the passenger who was lucky enough to secure a seat inside the bus. All these go to reveal the fact that there is acute shortage of public transport operating in Nairobi. The present shareholding in the K.B.S. Limited is 75 percent United Transport Overseas Limited (U.T.O) and 25 percent Nairobi City Council (N.C.C.). It can therefore be said that the K.B.S. Limited is a foreign investment geared towards profit-making rather than provision of an efficient public transport for the City of Nairobi. This is portrayed by the fact that the fleet of buses has remained about the same since its inception as if the population of Nairobi had a growth rate of zero percent or the death rate is the same as the birth rate. The limitations to the bus fleet increase that was portrayed by the company was that:

1. Since December 1976 the Overseas controllers of the Company U.T.O have been denied any local borrowing.
2. No Government guarantees against foreign currency risks are available to support borrowings from overseas.

These are not all that convincing, they are mere gimmicks. U.T.O. has to come up with other ways of increasing their fleet unless their strategy is to exhaust the current fleet and then withdraw their contract. In which case both the Government and the City Commission should find other alternative public transportation for Nairobi. As a matter of fact, U.T.O's sincerity to their contract should be questioned for it is very inadequate and inefficient.

Matatus are no different from the K.B.S. buses in terms of congestion inside the vehicles. The table below shows the carrying capacities of various matatus depending on their sizes and their crush capacities, and also the carrying capacity based on weight.

TABLE 4.2.1 OVERLOADING POTENTIAL OF MATATUS'

VEHICLE	PAY LOAD CAPACITY KG.	CAPACITY WT. BASIS	SEATED CAPACITY	CRUSH CAPACITY
Chevrolet Luv	1,050	14	12	17
Datsun 1500	900	12	14	19
Mazda B1600	1,075	14	14	19
Peugeot 404	1,010	13	12	17
Toyota Hilux	1,280	17	14	19
Nissan E20	1,110	16	15	20
Nissan E20 (Long Chassis)	1,055	14	18	24
V.W. Kombi	915	12	15	20
Colt Canter 2½	2,240	35	18	27
Isuzu Elf TLD 23	2,380	34	18	27
Nissan Caball	1,820	26	18	25
Toyota Stout	1,615	23	14	19
Colt Canter 4	3,360	49	24	34
Isuzu Elf TLD 53	2,655	39	24	34
Rosa - Bus	3,010	44	25	37

Source: Nairobi City Council: Report on 'The Matatu Public Transport Sector in Nairobi' by Ian Barwell, (Page 20)

The crush passenger carrying capacity is very common during rush hour periods and in some cases, the crush capacity is exceeded. This is when, like in the case with the K.B.S. buses, some passengers are hanging outside the vehicle. In order to get or jam the vehicle to the crush passenger carrying capacity it normally requires two conductors; one in the inside and the other on the outside. The conductor inside the vehicle is busy making sure that every little room is used and constantly singing "kaa square", meaning sit squarely in order to make room for more passengers. The conductor on the outside is busy trying to convince any hesitant-passengers to board the matatu claiming that there is plenty of room in the vehicle.

This overloading in both of the two public transport is very uncomfortable and unsafe for the users. This is especially so considering that the users are any one from young children on their mothers' laps, school children to pregnant women and the elderly. Boarding these vehicles, especially the matatus, is not as crucial as getting-off (alighting). At the point of origin, the passengers are literally begged to board the vehicle by the conductors, especially

during off-peak periods. But as soon as the fare to destination is paid the same conductor becomes a total stranger harrasing the passengers to alight quickly upon arrival at their various destinations. The passengers in turn afraid of not being dropped at their proper destinations have no choice but use force, that is, to fight thier way out thereby knocking some of the passengers in the process. The K.B.S. buses are even worse where boarding and alighting is concerned especially during rush hour periods. The drivers normally do not wait long enough for the passengers to board for they know the passengers fight their way to board all the same. The struggle by passengers to board the bus at times result in serious passenger accidents. Alighting during this period is yet another major task for the passenger. Sometimes the rear-view of the driver is completely blocked so that it becomes a matter of guesswork for the driver to begin moving after passengers drop off. This also results in many serious accidents some of which are fatal. It is not a probability that the driver can begin taking off with a passenger's foot on the outside and the other inside the bus, but it is a reality. But why all these risks? One may want to ask. They are all attributed to the shortage of public transport

and improper scheduling. Missing one bus in some routes may necessitate a waiting duration of upto 1 hour before the next one comes and even so there is no guarantee that there will be room which means departure becomes a matter of uncertainty. It is this uncertainty that prompts the passengers to rush and fight for the K.B.S. buses and matatus coupled with the fact that they have no better alternative means.

4.3 ROADWORTHINESS OF MATATUS AND K.B.S. BUSES:

Most of the matatus and the K.B.S. buses are unroadworthy, and this is the reason why it is not unusual to find a K.B.S. bus or a matatu which is broken down along the road. Here again, those who suffer most are the passengers. In most such cases, the matatus return the full fare to all the passengers aboard, leaving them to use any other means that come along. The problem here however, is that during rush hour periods, nearly all the public transporters fill up passengers at the point of origin thus making it difficult to get other means upon such break-downs and the uncertainty of getting home is increased. The situation is even worse with the K.B.S. buses. Here, in the event of a break-down, the fare is not returned, instead, the passengers have to wait for the next K.B.S. bus. The already obtained bus tickets act as evidence to the next conductor that the fare has already been

paid to whatever destination one is going. This means the waiting duration is even longer especially during rush-hour periods; the passengers may have to wait for even 2 to 3 hours or rather until the rush-hour period is over. It should also be noted here that the K.B.S. bus drivers and conductors do not particularly like picking up passengers from a broken down bus for this has some negative effect on their bonuses. In the event that they can get away with it, they will just pass by without stopping. On top of all these inconveniences, the unroadworthiness of the two types of public transport may be very dangerous to both the passengers and other road users. Unroadworthiness can actually cause very serious road accidents some of which may be fatal.

The K.B.S. limited cited some problems they experience in their operation which may be the reason for the unroadworthiness of their vehicles. They are as follows:

1. Difficulties in obtaining spare parts to be used for rehabilitation of their buses.
2. Shortage of skilled manpower for reclamation of parts from their 16 buses which they currently use for spare parts and for maintenance of the current fleet of buses.

3. Small capacity to move the public within a very short time, for example, during peak periods, and yet they have an obligation in this respect.

One wonders whether all these are reasons enough to warrant unroadworthiness and the consequences that come with it.

The analysis done by Ian Barwell indicate that under the present loan and insurance conditions, it is more profitable to purchase a second-hand vehicle rather than a new one to be used as a matatu. This in itself is a direct contribution towards unroadworthiness. Purchasing of a new matatu on the other hand is almost impossible. The potential buyer has to meet the following conditions:-

1. A down-payment of 40 to 50 percent of the total start-up cost is required.
2. Agree on a repayment period of 12 to 18 months with no defaulting.
3. An interest rate of between 14 and 19 percent of the original loan for the entire term.
4. The finance company requires an opinion from the potential buyer's bank on his ability to repay the loan within the specified time.

5. The vehicle has to be registered and insured jointly in the name of the purchaser and the financing company.
6. And the finance company chooses the firm that the vehicle is to be insured with.

Accessibility to finance company loans is therefore very highly restricted for the potential buyers have to demonstrate financial stability coupled with meeting the above conditions. In essence it renders matatu business only possible for the well-to-do who can demonstrate financial stability. This in itself is a self-defeating purpose if we consider that the matatu operation was/is supposed to help the "small man" make his ends meet while offering him and the unemployed full-time employment. The "small man" cannot meet the required conditions let alone demonstrate financial stability. They therefore resort to purchasing second-hand vehicles thus contributing directly towards road unworthiness. It can also be argued that road unworthiness of vehicles is a number one road killer in our midst.

4.4 MATATUS' AND K.B.S. BUSES' CONTRIBUTION TO TRAFFIC JAM

The stiff competition between matatus and the K.B.S. buses by itself contributes much towards vehicular traffic congestion and traffic jams. This is particularly so because their competition involves careless driving, over-speeding, pulling in and out of lanes with dangerous overtaking, and sudden stoppings to pick up or drop off passengers. All these not only cause traffic jams, but also increases the rate of wear and tear of other vehicles due to constant sudden stops and also increases the rate of energy consumption coupled with the discomfort and other disamenities that prompt would-be users to resort to other means of transportation. It is only the unfortunate ones, who have no better alternative means of transportation and cannot afford private means, that continue using the two types of public transport simply because they have no choice. One has to somehow make it to work in order to be able to lay bread on the table for the family. The would-be users who are able to resort to other means of transportation in most cases opt for private automobiling thus adding more vehicles to the already congested roads. Those who resort to motor-cycling, bicycling or even walking still contribute towards

vehicular traffic congestion in their own capacity and magnitude. Beside personal desire for freedom and higher degree of mobility which private means of transportation promises, it can still be argued that the disamenities of the two types of public transport coupled with the dangers involved in using them are directly responsible for the number of private automobiling on the road. It can also be argued that the number of private automobiles on the road continue to increase and operate the way they currently do. This is irrespective of any restrictive measures imposed on the importation of private cars. After all, nothing can compensate for any human life; and in the same token no restriction can stop one from ensuring for his own safety.

There is absolutely nothing wrong with one seeking for his own freedom and a higher degree of mobility in terms of transportation. However, it becomes a major concern both to the Government and the local authorities when supporting facilities such as roads, parking spaces, controlling devices and the like cannot easily be provided for or when such facilities have to be provided for at the expense of the environment and distant beauties. It is at this point when the Government and local authorities

have to employ some measures to curb the rate of increase of private means of transportation such as very stiff car importation duty that at times may be more than the actual value of the car.

However, measures of this nature alone do not change the situation for it would only trigger the idea of 'survival for the fittest'. - Any one will pay any amount of money to secure his own safety whenever it can be afforded. It would therefore be of importance to understand the reasons behind the many private means of transportation on the roads. Once this is understood and solved, it will go a long way in solving the problem. With the situation in Nairobi one need not go any further than the diamenities of public transportation. Private means of transportation can actually be said to be a means of ensuring personal safety among other reasons.

The road network in Nairobi can no longer cope with the demand. As a matter of fact, most of the roads if not all are totally overutilized, for example, Uhuru Highway within the city boundary and Outer Ring roads no longer serve their original purposes but are merely part of the streets within the city boundaries. Roads such as Juja and Langata are extremely congested during rush-hour periods

meaning that these roads were not designed to carry such heavy traffic. where means of transportation is concerned, it can be argued that there is a competition between private and public means of transport over the road network, the latter being very notorious. Those using private means are usually in a hurry to, may be, drop their children in school, drop their spouses at work and make it to work themselves in time. Public transport operators, on the other hand, are in such a hurry to pick up as many passengers as possible within a very short time, that is, the rush-hour period conflicting interest over the road network exist, especially so since the road network cannot cope with the demand. The result of these conflicts are the road accidents that quite often feature in the daily newspapers. Refer to table 5.7.1 for Accident Statistics for the period of 1977 to 1985 for Nairobi only. As the table indicates, majority of the road accident victims are the pedestrians and the passengers.

CHAPTER FIVE

ANALYSIS AND EVALUATION OF THE PROBLEM OF VEHICULAR TRAFFIC CONGESTION

5.1 DATA COLLECTION

In any study undertaken, it is always very important to understand the existing situation in order to come up with some sound conclusions and hence sound policy recommendations. It is in this regard that a field survey was conducted between August and September of 1985 to collect relevant and appropriate information. The majority of Nairobi residents commute to and from work by public transport; this therefore formed the most important part of data collection, the passenger interview survey, that is. This part of data collection, Questionnaire 5.1.Q 1 (Appendix) entailed direct interviewing of some 200 respondents. For example, 100 respondents along Langata road and the other 100 respondents along Juja road. The respondents included those who were travelling in either matatus or K.B.S. buses and those on various bus stages along the two selected routes. It was also found necessary to interview some 200 private car owners, Questionnaire 5.1 Q 2 (Appendix) who use the two selected routes. For example, 100 respondents from the residential areas along Langata route and the other 100 respondents from the residential areas along Juja route. Because of the costs incurred from the energy that has to be

expended, these particular respondents suffer most from the consequences of vehicular traffic congestions, especially during peak periods a time at which everyone either wants to get to work or wants to get home.

The field survey also involved gathering of relevant and appropriate data and information from the Ministry of Transport and Communication, Nairobi City Commission, the Kenya Police - Traffic Section (Nairobi area), and the management and operators of both the matatus and the K.B.S. limited. A questionnaire 5.1 Q3 (Appendix) was included to further supplement data and relevant information gathering from the latter, matatus and K.B.S. limited. The questionnaire was basically geared towards obtaining relevant and appropriate data and information such as the the number of vehicles currently operating in Nairobi, their financial implications and the like, with special reference to the two selected routes.

5.2 PUBLIC TRANSPORT USERS RESPONSE

According to the conducted survey, it was found that 96 percent of the respondents travel less than 1 kilometre from the house to where they catch a K.B.S. bus or a matatu. Whereas, only 4 percent have to walk more than 1 kilometre for the same. The

distance daily travelled to the place of work or to destination and the time taken upon boarding the means used varied from less than 5 kilometres to over 15 kilometres and from less than 30 minutes to over 60 minutes respectively. The percentages were as follows:

1. Distance Daily Travelled to Destination:

i) Less than 5 kilometres	42.5%
ii) Between 5 and 10 kilometres	25.0%
iii) Between 10 and 15 kilometres	18.5%
iv) Over 15 kilometres	14.0%
Total	<u>100.0%</u>

2. Time Taken to Destination Upon Boarding means used:

i) Less than 30 minutes	67.5%
ii) Between 30 and 60 minutes	25.0%
iii) Over 60 minutes	7.5%
Total	<u>100.0%</u>

The above percentages imply that a large majority, 67.5 percent, of Nairobi residents have to travel less than 10 kilometres to their respective places of employment or to their respective destinations. Under normal conditions, this distance of 10 kilometres or less should take at the very most 15 minutes by public transport considering the fact that they make various stops along the way to pick-up or drop-off passengers.

However, the percentages of the time taken by the means used to destinations, indicates that a large majority of the public transport users, 92.5 percent, takes upto 60 minutes to get to their various destinations. This only goes to portray the difficulties associated with the selected routes because of vehicular traffic congestion. A further question was asked in this respect in order to get the opinion of the public transport users on the time taken by the means used to destination. 58 percent of the respondents considered the time taken to be very long or just long, while 42 percent considered it okay for they felt that there was nothing much that could be done about the situation. As a matter of fact, most of the 42 percent of the respondents portrayed the fact that irrespective of the current magnitude of the problem of vehicular traffic congestion they would prefer private means of transportation to public transport means. In terms of waiting time for the means used, half of the respondents, 50 percent, felt that it was short, while the other 50 percent felt that it was very long or just long. It should be pointed out here that nearly all the 50 percent of the respondents who considered the waiting time for the means used to be short were those from along Juja road where there is either a matatu or a K.B.S. bus every 5 minutes.

A large majority of the respondents, 75.5 percent, that is, preferred travelling by K.B.S. buses as opposed to 24.5 percent who preferred travelling by matatus. In terms of safety, 100 percent of the respondents considered the K.B.S buses to be safer than matatus. However, when it came to speed, 82.0 percent of the respondents considered matatus faster. A further question asked the respondents as to why they choose their preferred means of transport. The response was as follows:

Reasons for choice of means used:-

i	Safety reasons	58.0%
ii	Speed (faster)	30.5%
iii	No other choice	<u>11.5%</u>
	Total	<u>100.0%</u>

It was also found that a large majority of the respondents, for example, 92.5 percent, make only two trips per day; that is, leaving the place of residence in the morning and only returning in the evening. Only 7.5 percent of the respondents made 4 trips per day; these are the respondents who can make it home for their lunches. It can also be argued that the percentage of those who can make it home for their lunches would be much higher if the public transport means were efficient and running on schedule. The financial implications on the undertaken trips were as follows:

1.	Peak Periods Fares to Destination:-		
	i	Less than Kshs. 3.00	37.0%
	ii	Kshs. 3.00 and over	<u>63.0%</u>
		Total	<u>100.0%</u>
2.	Off-Peak Periods Fares to Destination:		
	i	Less than Kshs. 3.00	90.0%
	ii	Kshs. 3.00 and over	<u>10.0%</u>
		Total	<u>100.0%</u>
3.	Total Fares per Day:-		
	i	Less than Kshs. 6.00	47.5%
	ii	Kshs. 6.00 and over	<u>52.5%</u>
		Total	<u>100.0%</u>

This goes to show that a large majority of the respondents, 52.5 percent spend over Kshs.120.00 per month on fare alone. The rest of the respondents, 47.5 percent, spend less than Kshs. 120.00 per month on fare. The above amount of Kshs. 120.00 spend on fare was computed with the assumption that there are four weeks in one month and that there are five working days in one week. If this amount of Kshs.120.00 is taken to be the average amount spend on fare per month, it will mean that the minimum wage earner of Kshs. 556 per month spends about 22.0 percent of the salary on fares per month. This percentage may be too high considering that there are other expenses for

basic subsistence. The question to ask here is whether the public transport users are getting their money's worth for the services they get from the means used. In terms of travel comfort and vehicular traffic delays the responses were as follows:-

1. Travel Comfort Inside the Means Used:

i	Comfortable	10.0%
ii	Congested	20.0%
iii	Very congested	70.0%
		<u>100.0%</u>

2. Traffic Delays Along the Way:

i	Okay	15.0%
ii	Bad	30.0%
iii	Terrible	55.0%
		<u>100.0%</u>

3. Most of the undertaken trips were for work or work related purposes as follows:-

	Purpose of Trip	52.0%
i	Work purposes	52.0%
ii	Business purposes	19.5%
iii	School and other purposes	28.5%
	Total	<u>100.0%</u>

Majority of these trips terminate at the city-centre and industrial area, meaning that a large majority of the respondents either work or run business in these two locations. The percentages were as follows:

Location of Trip Termination;

i) City Centre or Industrial area	77.5%
ii) Other locations	<u>22.5%</u>
Total	<u>100.0%</u>

It should be noted here that the city-centre and the industrial area were taken as one location for the two are actually in the same location, for example, the downtown area of Nairobi. The above percentages also goes to indicate the concentration of business and employment in one location. This is one of the major contributory factors towards congestion in not only the two types of public transports but also of vehicular traffic congestion. All the working forces and the businessmen heads for one central location from all corners of the city at the same time. The results of these are nothing less than congestion of pedestrians on the roads, congestion inside the public transport means, and vehicular traffic congestion on the roads, not to mention congestion in the elevators with everyone wanting to get in the office or the work place on time.

Most of the respondents preferred to do their shopping around their places of work and around their places of residence. The percentages in this respect were as follows:

Preferred shopping Area:

i) Downtown (place of work)	58.0%
ii) Place of residence	35.5%
iii) Other places	6.5%
	<hr/>
	100.0%
	<hr/>

The 6.5 percent who preferred doing their shopping elsewhere other than their places of work or their places of residence indicated that they did their shopping once or twice in a month. They therefore preferred shopping around, over the weekends, for cheaper places such as the market places.

In terms of places of leisure, some of the respondents preferred downtown area. The most common reason given for this was that after work, one can watch a movie, talk with friends over a cup of tea or coffee and the like, while at the same time waiting for congestion to ease inside the public transports and/or on the roads. Here the percentages were as follows:

Preferred places of Leisure:

i) Downtown area	52.5%
ii) Place of residence	22.5%
iii) Other places	25.0%
	<hr/>
	100.0%
	<hr/>

It should be noted here that most of the 52.5 percentage of the respondents who preferred downtown as their place of leisure, stay in town after work for their kinds of entertainments. The 22.5 percent of the respondents who preferred their places of residence for their leisure, are actually those who either did not have the time or did not care much for leisure. The other 25.0 percent of the respondents who preferred elsewhere for their leisure indicated that they go out for entertainments once or twice in a month and mostly during the weekends. The public transport users' questionnaire would not have been complete without asking the respondents what means they would prefer if they were given the opportunity and the existing transportation in Nairobi. The responses were as follows:-

Means preferred, Given the opportunity:-

i) Private automobiling	67.5%
ii) Public transport	24.0%
iii) Motor cycle	6.5%

iv) Pedal cycle	1.0%
v) Walking	1.0%
Total	<u>100.0%</u>

The 67.5 percent of the respondents who preferred private automobiling only goes to confirm that the disamenities and the dangers involved in the use of the two types of public transports prompts the would be users to resort to other means of transportation whenever costs can be accommodated. Those who preferred motor or pedal cycling suggests the fact that if proper facilities were provided for these two means of transport they would opt to using them for the sake of their own comfort and safety. Note that currently there are no provisions for these two types of transport means on the road network. The 1 percent of the respondents who preferred walking indicates that if they were given a chance to live within the proximity of their work places, they would prefer to walk to and from their places of work. In general, the 76.0 percent of the respondents who preferred other means of transportation other than public transport goes to say much about the disamenities and the dangers involved in their uses. This in turn leads one to ask whether the city of Nairobi has a problem of vehicular traffic congestion or a problem of congested and accident-prone public transport

means. It may be true that the two problems currently exist, but it can be argued that the latter problem triggered the prevalence of the other. If the two types of public transports in Nairobi were running efficiently and were safe, clean, and comfortable, the magnitude of the vehicular traffic congestion problem would be much less.

5:3 NEW FINDINGS

The article on the K.B.S. Limited which appeared in the Daily Nation of Thursday, July 31st 1986 indicated their immediate move to withdraw their services to peri-urban towns which have always had the services of the K.B.S. The public transport company argued that their move was triggered by the directive from the Ministry of Transport and Communications, through the Police and the Registrar of Motor Vehicles, requiring their buses to carry only seated passengers along the affected routes. The directive was actually geared towards a nationwide campaign to curb the number of road deaths in the country at large. The K.B.S. Limited's move, in this regard, may be portraying the motive behind the provision of their services - a profit making undertaking irrespective of the dangers that the users may be exposed to in the process. It would seem that the company is only interested in realizing as much profit as possible at the expense of the users' safety and

comfort or convenience.

In response to the transportation crisis on the affected routes and towns, the Kenya Railways Corporation made an historic move by launching commuter train services between Nairobi and peri-urban towns. The trains operate in the morning and evening rush hours. This type of response will go a long way in solving the public transportation problems not only on the peri-urban towns but also within the city. The launching of commuter train services is in itself a step in the right direction for in the long run it will be much cheaper than buses or matatus in meeting public transportation demands and in solving the current problem of vehicular traffic congestions.

5.4 PRIVATE CAR-OWNERS RESPONSE

In overall the private car-owners claimed that they owned their vehicles for personal and family safety in terms of transportation. They indicated that the current public transport means in Nairobi were unsafe, unreliable and too congested for one to ride in, especially for the school children.

85 percent owned only one vehicle and the other 15 percent owned two vehicles or more. The average daily distance covered here was found to be between 31 and 40 kilometres. It should be noted here that part of the daily distance covered includes distances covered looking for parking and detours from vehicular traffic congestions along otherwise, direct routes to destination. The percentages were as follows:-

Distance Daily Covered:

i	0 to 20 kilometres	4.0%
ii	21 to 30 kilometres	28.5%
iii	31 to 40 kilometres	41.0%
iv	41 to 50 kilometres	19.5%
v	51 kilometres and over	<u>7.0%</u>
	Total	<u>100.0%</u>

Private car owners also claimed that they waste much of their valuable time on the road due to vehicular traffic congestions. Some of them claimed that the waste upto 60 minutes or more on the road daily. This means they have to start their trips to work early in order to make it to work on time; this defeats the purpose of owning private means of transportation for convenience when mobility is considered. The term "time wasted" is used here to mean the total time taken from the place of origin to destination during peak

periods less the time normally taken during off-peak periods or with normal traffic flow. The findings here were as follows:

Peak Period Time Wasted:

i	0 to 15 minutes	12.0%
ii	16 to 30 minutes	31.0%
iii	31 to 45 minutes	37.5%
iv	46 to 60 minutes	17.5%
v	61 minutes and over	2.0%
	Total	<u>100.0%</u>

The fuel consumption increases with increasing distances and the idling of engines due to vehicular traffic congestions. 31 percent of the private car owners spend less than Kshs. 30.00 per day on fuel consumption, while 37 percent spend between Kshs. 31.00 and Kshs. 45.00 per day. The other 32 percent of the private car owners spend over Kshs. 45.00 per day on fuel consumption.

A large majority of the private car owners, for example, 92.5 percent, felt that the vehicular traffic delays during peak periods in Nairobi was/is terrible and a total waste of otherwise very productive hours. That the time one takes from the point of origin to destination is exceptionally too long. Majority of

these respondents also indicated that the road network carrying capacity was inadequate. The response percentage in this respect, were as follows:

Road Network Carrying Capacity:

i	Okay	9.0%
ii	Narrow	57.0%
iii	Too Narrow	34.0%
		<hr/>
		100.0%
		<hr/>

Of the 200 private car owners respondents, 65.0 percent either had parking facilities at their places of work or somehow had access to parking. Whereas the other 35.0 percent had to provide for their own parking wherever they can find one. It is some of these 35 percent of the private car owners that infringe on the limitedly provided pedestrian facilities in the city centre for their own parking. They are also the ones who claimed that they not only waste valuable time on the road but also waste time of upto 45 minutes looking for parking. Most of these private car owners, 80.0 percent, once they park their vehicles, leave them there for the whole day. The other 20.0 percent, required their vehicles during lunch-hour breaks or as their nature of work required.

5.5 K.B.S. SERVICES FOR LANGATA AND JUJA ROUTES

Currently the K.B.S. bus services for Langata and Juja routes are as indicated in Tables 5.5.1 and 5.5.2 respectively below. Langata routes, with the indicated destinations, has a total of 10 buses per hour, whereas Juja route has a total of 61 buses per hour. It should be noted here that the scheduling of buses does not take into consideration peak or off-peak periods. In other words, the scheduling of buses is the same throughout the day's operation. This is an issue that the K.B.S. Limited should really look into; the demand for buses during off-peak periods is much less than the same demand during peak periods. More buses should therefore be scheduled during peak periods and less buses during off-peak periods. This is especially so on such routes like Langata where public transport users complained bitterly about the poor scheduling of buses. The buses running on Langata route via Kenyatta National Hospital featured as the worst in terms of scheduling. The users indicated that in some cases one has to wait for it for upto 2 hours; unfortunately too, there are no supplementing matatus along this route. The public transport users along Juja route did not have much to complain about where scheduling of buses were concerned.

Table 5.5.1: K.B.S. BUSES SCHEDULE FOR LANGATA ROUTE

BUS No.	FREQUENCY (MIN.)	BUSES PER.HR.	DESTINATION
14	20	3	Otiende-City Centre - Kariobangi
15	20	3	Otiende-City Centre -Kariobangi
24	60	1	Karen-City Centre
34	30	2	Otiende-City Centre J.K.I. Airport
125	60	1	Ongata Rongai- City Centre

The transport manager of K.B.S. Limited indicated that they were experiencing some problems in their operation. These problems were cited as follows:

1. the unavailability of spare parts coupled with the skilled man-power shortage to reclaim the spare parts from their 16 old buses set aside for spare parts

2. the shortage of drivers; that the trained drivers' turnover is very high. K.B.S. Limited train most of their drivers; however, in most cases most of the trained drivers upon obtaining their driving licences join other private firms.

Table 5.5.2: K.B.S. BUSES SCHEDULE FOR JUJA ROUTE

BUS No.	FREQUENCY (MIN.)	BUSES PER.HR.	DESTINATION
6	5	12	City Centre-Eastleigh
9	5	12	City Centre-Eastleigh
14	20	3	Otiende-City Centre-Kariobangi
15	20	3	Otiende-City Centre-Kariobangi
17	60	1	Kangemi-City Centre-Njiru
28	10	6	Kibera-City Centre-Kariobangi
30	30	2	K.N. Hospital-City Centre-Kariobangi
32A	20	3	City Centre-Dandora
40	15	4	K.N.Hospital-City Centre- - Dandora
41	15	4	Ngummo-City Centre-Dandora
42	20	3	Ayany-City Centre-Dandora
46	20	3	Kawangware-City Centre-Huruma
47A	60	1	Lavington-City Centre-Kariobangi South
48	20	3	Lavington-City Centre-Huruma
49	60	1	Lavington-City Centre-Kariobangi South

Source: K.B.S. Limited, Transport Section.

3. the inadequate carrying capacity to move the public within a very short time, for example, during peak periods coupled with the delays on the roads due to vehicular traffic congestion; everyone moving towards one direction - the city centre and at about the same time.

The Transport Manager also indicated that they are now in the process of providing late bus services along the routes that shows enough demand for these services. He argued that prior to 1982 they were operating 24 hours bus services; however, after 1982 the demand for it became negligible for majority of the public were home early in the evening; the services were therefore withdrawn. Asked about peri-urban transport services the transport manager said that the demand was very high and that it was also a courtesy service to the Nairobi City Council to help in solving the housing problems and congestion within the city. The services were geared towards encouraging some of the people, working within the city, to live in the outskirts of Nairobi and be able to commute back and forth with relative ease and cheaply. It should be noted here that majority of the public transport users preferred the K.B.S. buses to matatus for mostly safety and the cheaper rates in terms of fares charged.

5.6 MATATUS SERVICES FOR LANGATA AND JUJA ROUTES

According to the Matatu Owners' Association in Nairobi area, there are about 720 licenced matatus which are registered with the association and over 300 unlicenced matatus operating within Nairobi. However, the figures given are in contrast with that of Nairobi City Council Survey which was carried out in 1976. In their survey, Nairobi City Council found out that there were a total of 1,400 matatus operating within the city and carrying approximately 63,500 passengers per day. These figures imply that in 1976 one matatu carried about 50 passengers per day. This in itself would render matatu operation a profitless undertaking. The current figures, by far, surpasses those of 1976. The conducted survey indicated that there are 60 and 140 matatus currently operating along Langata and Juja routes, respectively. Note, these are only those licenced matatus which are registered with Matatu Owners Association. It was also found that on the average one matatu makes about 20 trips per day. Using an average of 20 passengers per trip, one matatu carried about 400 passengers per day. This means that the licenced matatus (720 in number) carries approximately 288,000 (720 x 400) (passengers) per day; this does not include the number of passengers carried by the unlicenced matatus operating within the

city. The above figures go on to show the important role the matatus play in supplementing the K.B.S. buses in meeting the public's transportation demands. However, currently the matatus do not have adequate facilities provided for them such as parking facilities, especially in the city-centre and passengers pick-ups and drop-offs stages along operation routes. It should be noted that currently matatus are not legally allowed to use the K.B.S. bus stages even though they basically operate along the same routes.

Asked about the problems experienced in the provision of public transport within Nairobi, the Matatu Owners Association pointed out the following:

1. Bad reputation instilled by the non-members of the association who operate matatus within the city. In most cases they operate unroadworthy vehicles and do not obey the traffic regulations and laws. Their operation is a bad image for all the operating matatus.
2. Insurance premiums and interest rates are too high to cope with and at a very short repayment period. This in turn makes the matatu owners to be very aggressive in order to make ends meet.

In most cases there is no time to take the vehicle for proper service for it would interfere with the daily returns. Note, this is a contributory factor to road unworthiness.

3. The lack of recognition by the Ministry of Transport and Communications, Nairobi City Commission and the Nairobi Police Traffic Section. This means that the Association's recommendations or complaints are not taken seriously by those concerned.
4. The need to make it mandatory for all the matatus in operation to become members of Matatu Owners Association in order to facilitate easy control and a good reputation for matatu services. This will also facilitate safety for the users.
5. Financiers forces the potential buyers to insure their vehicles with insurance firms which they would have otherwise not be chosen. These insurance firms charges very high premiums.
6. Inavailability of spare parts forces the matatu owners to operate unroadworthy vehicles for they cannot wait for the spare parts to be availed.

The vehicle will be in operation while waiting for the spare parts. It should be pointed out here that in the long run, the public transport users are the ones who suffers the most from the above problems. It is a high time that the matatus are recognized and treated as an integral part of public transport in Nairobi and supplementing facilities should be provided for accordingly.

5.7 CAUSES OF ACCIDENTS

Nairobi area traffic police gave the following as the major causes of accidents:

1. Overspeeding
2. Careless and reckless driving
3. Driver's impairment
4. Pedestrians' carelessness
5. Vehicular road obstruction, especially by the K.B.S. buses and the matatus when they stop along the road where there are no provisions for bus stages. It has also been noted that road obstruction prevails when too many buses or matatus arrive at one stage at about the same time.
6. Road obstruction due to the break-down of vehicles along the roads where there are no provisions for side parking.

7. Failure of drivers to give proper signals, for example, giving proper signal to indicate a turn.
8. Sudden stops especially at high speeds, for example, on the high way.
9. Road unworthiness which is a very common case with the two types of public transport, K.B.S. buses and the matatus.

Refer to Table 5.7.1 for further details on road accidents within Nairobi from 1977 to 1985. It is very clear from the table that a large majority of the accident victims, be it fatal, serious or slight injuries, are the pedestrians and the passengers.

The traffic police also pointed out very clearly that everybody in Kenya, be it a driver or a pedestrian has equal right-of-way. It is therefore necessary that both the car owners or drivers and the pedestrians have to obey traffic laws and regulations. However, the authorities concerned and the car owners or the drivers seem to think otherwise. Firstly, the car owners in Nairobi use the limitedly provided pedestrian facilities within the city centre. The car owners park their cars on the provided pedestrian side-walks claiming that they could not find a parking spot anywhere. This forces the pedestrians to go to the

street in order to get around the parked vehicles which is rather dangerous especially during rush-hour periods. The car owners who infringe on the pedestrian facilities should be severely punished. They are actually obstructing the pedestrian's right of way.

In order to ensure road safety for all the traffic police man some dangerous spots such as roundabouts even though traffic control devices are already provided; this is done especially during rush-hour periods. It is the attitude of drivers that warrants the police manning such spots. Most drivers are always in a hurry and tend to think that they have more right-of-way than other road users or tend to think that they are the only ones on the road. These type of drivers normally disregard all the traffic laws and regulations and the right-of-way at roundabouts. Secondly, during rush hour periods the traffic lights computers are not efficient enough to substitute human judgement. This is especially so considering the volumes of traffic in Nairobi demanding to be committed onto various routes at about the same time. It is therefore not unusual, during rush-hour periods, to find three types of control, for example, round about, traffic lights and police officers. This is especially the case around the city-centre where the problem is acute. All these types of traffic controls supplement each other in order to ensure safety for all the road users.

Table 5.7.1 : ACCIDENT STATISTICS FOR NAIROBI AREA ONLY - 1977 - 1985

DESCRIPTION	1977	1978	1979	1980	1981	1982	1983	1984	1985
TOTAL NUMBER OF ACCIDENTS	2,304	2,534	2,695	2,238	2,288	2,806	2,632	2,814	2,759
<u>PERSONS KILLED AND INJURED</u>									
Killed	304	321	372	336	371	308	295	281	251
Seriously Injured	595	714	1,064	879	868	1,036	947	881	905
Slightly Injured	1,405	1,499	1,615	1,632	1,435	1,462	2,040	1,518	2,262
<u>DRIVERS</u>									
Killed	53	54	47	28	36	36	21	32	24
Seriously Injured	138	195	216	200	177	195	159	185	179
Slightly Injured	158	307	453	429	320	314	428	445	481
<u>MOTOR CYCLISTS</u>									
Killed	2	7	4	5	13	6	9	12	2
Seriously Injured	51	46	72	61	60	93	85	74	52
Slightly Injured	50	89	130	102	132	132	137	211	95

DESCRIPTION	1977	1978	1979	1980	1981	1982	1983	1984	1985
<u>PEDAL CYCLISTS:</u>									
Killed	8	16	13	7	10	16	10	8	6
Seriously Injured	53	49	76	48	72	105	62	58	42
Slightly Injured	82	152	98	112	100	137	139	208	89
<u>PEDESTRIANS</u>									
Killed	189	179	248	236	248	200	200	175	172
Seriously Injured	274	260	423	374	363	335	412	357	407
Slightly Injured	569	553	446	532	496	431	714	786	929
<u>PASSENGERS</u>									
Killed	27	65	60	60	64	50	55	54	47
Seriously Injured	148	164	267	196	196	308	229	208	225
Slightly Injured	151	398	498	457	387	447	622	718	668

DESCRIPTION	1977	1978	1979	1980	1981	1982	1983	1984	1985
<u>PERSONS OVER 16 YRS.</u> <u>OF AGE:</u>									
Killed	291	298	344	403	337	286	275	254	218
Seriously Injured	481	585	746	648	598	773	700	708	747
Slightly Injured	1,214	1,305	1,281	1,176	1,144	1,115	1,584	1,182	1,902
<u>PERSONS UNDER 16 YRS.</u> <u>OF AGE:</u>									
Killed	13	23	28	33	34	22	20	27	33
Seriously Injured	117	129	235	231	270	263	247	178	158
Slightly Injured	191	194	427	456	291	347	456	336	360
<u>VEHICLES RESPONSIBLE</u>									
Cars and Utilities	888	821	1,142	960	1,090	1,104	1,202	1,075	1,372
Buses, Lorries, Taxis and matatus	385	363	568	520	203	408	514	612	549
Motor and Pedal cyclists	70	92	113	128	142	186	180	159	100

Source: Nairobi Police; Traffic Department.

5.8 PROBLEMS IDENTIFIED:

Various problems were identified throughout the study and in the process of data analysis which were either contributing directly or indirectly towards the problem of vehicular traffic congestion in Nairobi. In broad terms, these problems can be looked at in five categories; for example, public transport inadequacy in meeting public transportation demands; inadequate provision of vehicles and pedestrians facilities within the city-centre; increasing number of private cars irrespective of any measures taken to deter the increase; road network designed carrying capacity and the locations and the arrangements of the various land uses. These five broad categories can be looked at separately as follows:

1. Problems Relating to the Two types of Public Transports

Two major problems were identified with the two types of public transports in Nairobi. Firstly, is that they compete with each other very stiffly. Secondly, both cannot meet the public transportation demands. These two problems in turn create other problems which directly or indirectly contribute towards the problem of vehicular traffic congestion in the city as follows:-

- i) the stiff competition between the two types of public transport leads to high and dangerous speed likely to cause accidents. This renders the two public transports unsafe for both the users and other road users. This in turn gives a very bad image of the public transport in Nairobi and acts as a deterrent to the would be users. The deterred, would be users somehow have to undertake their various daily trips, they therefore resort to other means of transportation any one of which in different capacity contributes towards the problem of vehicular traffic congestion. It was also found that the stiff competition between the two types of public transport contributes much towards road unworthiness which indirectly contributes towards vehicular traffic congestion. The stiff competition does not allow the owners time to take their vehicles for services.
- ii) the inadequacy of the two types of public transport in meeting the public transportation demands leads to a total waste of what otherwise would have been productive hours, not to mention the frustrations involved. This leads to overcrowding inside the public transport vehicles for everyone wants to save a little time.

It also makes the public transport users to rush for and fight over any public transport means that comes along, especially during rush-hour periods. As a matter of fact, it is not very unusual in Nairobi to see some of the commuters riding on the outside of the public transport means. In other words, riding while hanging on the door-steps which is actually dangerous. These public transport users do not have much choice; they either waste hours and hours waiting for the rush-hour periods to be over or crowd themselves in any available public transport means. This shortage of public transport means in Nairobi and the frustrations involved prompt the would be users to resort to private means of transport whenever costs can be accommodated. This in turn further complicates the problem of vehicular traffic congestion.

2. Problems of Inadequate Provisions of Vehicles and Pedestrians Facilities within the City-Centre,

Currently, the facilities provided for vehicles and pedestrians in the city-centre are not adequate; the latter being more acute problem than the other. The provided facilities for private cars cannot

meet the demands any more due to the constant increase in the numbers of private cars without a corresponding increase on supplementing facilities. The provision for pedestrians facilities in the city-centre is almost negligible; this is especially so in that the city-centre is a pedestrian city by itself. Even the private car owners, in the city-centre, becomes pedestrians in one way or the other.

i) the inadequate provisions of private vehicles facilities in the city-centre lead to a wastage of valuable time looking for parking and also leads to a misuse of other land uses. As a matter of fact, data analysis in this respect indicated that those who do not have parking facilities provided for them at their work places spend anywhere from 10 to 45 minutes looking for parking. This inconveniences defeats the whole purpose of owning a vehicle for better mobility. When such car owners cannot find any parking and are already late for work, they create their own parking on the side-walks or on the pavements. This problem is so acute that it currently seem as if both the side-walks and the pavements have been accepted as supplementary parking facilities.

ii the inadequate provision of pedestrians facilities in the city centre also leads to a wastage of time and is also frustrating to the pedestrians because of the congestion in the limitedly provided facilities. As if this was not enough of a problem, the private car-owners infringe on the limitedly provided pedestrian facilities, thus causing total pedestrian obstructions. This necessitates the pedestrians to go onto the street in order to get around the obstruction. This in turn causes delays for, not only to the pedestrians but also to all other road users, not to mention the dangers involved, especially for the pedestrians. Data analysis of the conducted survey indicated that about one third of the victims killed in road accidents are the pedestrians. This can be argued to be the results of inadequate pedestrian walkways.

3. Problems Relating to Increasing Number of Private Cars:

Problems relating to the high rates of car increase can be attributed to the problems associated with the public transportation in Nairobi which have already been highlighted. It is no wonder, therefore, that the numbers of private cars are always on the increase despite any measures that have been employed to deter the potential buyers. It would be wrong in Nairobi to

think that private car-owners enjoy freedom and higher degree of mobility promised by the private car. Instead, they are safer than those using public transport means; as a matter of fact, majority of private car-owners indicated that they would actually use public transport means if they were safe, efficient and not too congested.

4. Problems Relating to Road Network Designed
Carrying Capacity

Most, if not all, the road network in Nairobi can no longer cope with the volume of traffic using them. As a matter of fact, most of the roads have lost the meaning and the purposes originally attached to them. These have occurred due to ever increasing number of automobiles on the roads. The volume of traffic that exceed the designed road carrying capacity increases the amounts of wear and tear of the road thus necessitating constant repairs. It can be argued here that the various land uses that were not in existence and probably had not been planned for when the road network and the carrying capacity was designed have contributed much to these problems.

5. Problems Associated with the Locations and Arrangements of Various Land Uses

The major problem that was identified as regards the locations and arrangements of the various land uses was that of the centralization of the places of employment, the city-centre and the industrial areas, that is. This in turn pulls all the traffic from all corners of the city towards one focal point at about the same time - morning rush-hours. It was also noted that other land uses such as residential areas are put up or planned for in various appropriate areas without due regards or consideration to the designed road network carrying capacity in those areas. A very good example of this is Langata route which currently ranks very high in terms of vehicular traffic congestion during rush-hour periods. Currently there are constructions going on on two separate residential sites, yet no consideration has been given to Langata route carrying capacity. The factors associated with the locations and arrangements of the various land uses and the like contributes much towards the acute problem of vehicular traffic congestion in the City of Nairobi.

CHAPTER SIX

POLICY RECOMMENDATIONS, SUMMARY AND CONCLUSION

6.1 POLICY RECOMMENDATIONS

In the proceeding chapters, the problem of vehicular traffic congestion in Nairobi has been highlighted with special reference to K.B.S. buses, matatus and private cars as the major contributors to the problem. Upon analysis, it was also found that other factors in different magnitudes and capacities contribute to the problem. They included, the locations and arrangements of various land uses such as places of work and places of residence, the road network designed carrying capacity, the road users, break-down of vehicles along the way, obstruction from public transport means by stoping along the roads where there are no provisions for bus stages, violation of traffic laws and regulations, inadequate transport supplementing facilities and the like.

It was also found that it was the dangers involved in the use of the two public transport means (K.B.S. buses and matatus), their disamenities, their inadequacies in meeting public transportation demands and the like that forces the would be users to resort to other means of transportation whenever costs can be accomondated. It was also found out that in most cases majority of the would be users resort to private automobiling which in

turn multiply the problem of vehicular traffic congestion. Public transport users' survey indicated that 76 percent of the respondents would opt to private automobiling if they had the opportunity, despite the already acute problem of vehicular traffic congestion within Nairobi. Data analysis of the private car owners, on the other hand, indicated that majority of them felt that it was very expensive to run a car in Nairobi due to the costs incurred in the energy that has to be expended, parking charges and the like coupled with the frustrations involved, because of vehicular traffic congestions and careless driving by other road users, especially the two public transport means and inadequate supplementing facilities, especially in the city-centre. These same majority of the private car-owners indicated that they would opt to using public transport if they were safe, adequate and were not too congested for it would be a cheaper means of transportation. This seems to confirm the fact that mobility is actually getting somewhere to do something and that the means actually used is of secondary importance.

It was also found that the centrality of the places of employment was another major contributory factor to the problem. Analysis of data collected

portrayed the fact that the concentration of the places of employment in the city-centre and the industrial area was also largely responsible for the problem of vehicular traffic congestion in that it pulls all the traffic from all corners of the city towards one focal point - the down-town area thus intensifying the problem.

Data analysis of the whole survey together with personal observations has formed the basis of knowledge of the problem of vehicular traffic congestion in Nairobi upon which the preceding policy recommendations and planning proposals were made. It was the overall objective of the study to identify the problems that governs vehicular traffic congestion in Nairobi; this was done in the proceeding Chapter 5, sub-topic 5.8. It was also part of the objectives to suggest ways of solving the identified problems. Policy recommendations based on the identified problems highlights the ways on which the problem could be solved; the implementation proposals are detailed in section 6.2. The recommended broad policy approaches are as follows:-

1. Manage, improve and organize the two types of public transport.

2. Increase the numbers of the two types of public transport means.
3. Regulate the competition between the two types of public transport.
4. Regulate the conditions attached to the purchase of a vehicle for the purposes of a matatu.
5. Impose stricter conditions on the private car-owners within the city-centre.
6. Impose stricter enforcement of traffic laws and regulations.
7. Eliminate the conflict between vehicular and pedestrian traffic.
8. Create and improve pedestrian facilities and shopping precincts.
9. Restrict employment opportunities in the city-centre and the industrial area.
10. Provide and improve traffic control devices on busy intersections.
11. Promote road safety education and awareness.
12. Provide commuter train services to supplement the K.B.S. buses and the matatus.

6.2 PLANNING PROPOSALS:

The last parts of the study objectives were the suggestions of means in which the identified problems could be solved or rather the means in which the policy recommendations could be realized. In other words, planning proposals suggests means or implementable means in which the recommended policies can be achieved. The identified planning proposals were as follows:

1. The management, improvement and organization of the two types of public transport can be done by establishing and improving the facilities which supplement the two means of public transport. This particularly applies to the matatus for they have no provisions for dropping-off or picking-up passengers along the routes they operate. This can be done by legally allowing the matatus to use the K.B.S. bus stages. Matatu parks should also be adequately provided in the city-centre within easy reach of the users and easily accessible to the city core. K.B.S. limited should strictly adhere to their bus schedules. They should also post the schedules of their buses along the operating routes and in the city centre so as to limit the amount of time wasted in waiting for one. This way, the public can schedule themselves around the bus schedules.

2. Public transport means can be increased in two ways. Firstly, is by K.B.S. limited abiding by their contract of public transport provision in Nairobi; this particularly applies to the United Transport Overseas limited who owns the bus company. They should be made to re-invest the realized profits back on the improvement of their services such as increasing their bus fleet to cope with the public transportation demands. Secondly, the conditions attached to the loans borrowed for the purposes of purchasing a matatu should be relaxed and the current down-payment of upto 50 percent should be reduced to may be 20 percent. The interest rates of the original loan for the whole term should also be relaxed coupled with an extension of the repayment periods. Provisicns should also be made to halt and/or extend repayments in the event that the vehicle is garaged and the owner has no other means of meeting the loan repayment. This in turn would create a more realistic atmosphere for those interested in investing in the provision of public transport. This will also go a long way in solving the problem of competition between the K.B.S. buses and the matatus. It will also ensure safety of the users in that the matatus will have no valid reasons to operate in such high and dangerous speed the way they currently do. There will be enough public transport means in Nairobi, therefore even K.B.S. buses will have no reasons to rush the way they currently do.

3. Stricter enforcement of traffic laws and regulations can be imposed on the private car owner in the city-centre by severely punishing those who do not abide by them. The same should apply to those operating unroadworthy vehicles and those private car owners who infringe on the pedestrian facilities as their supplementary parking. Parking charges should also be increased to the point that it surpasses the convenience of driving to work; at the same time plenty of parking facilities should be made available at much cheaper rates on the outer towns within the city boundary where one can abandon the car and be able to commute to the city-centre by public transport with relative ease.

4. Vehicular and pedestrian conflicts can be eliminated by providing pedestrian fly-overs on critical places such as major intersections and popular street crossovers. Street precincts at these points will help in forcing those who would have otherwise chosen to cross the street rather than using the fly-over. Pedestrian facilities should be clearly indicated where they are provided and more be provided on pedestrian cross-overs and spots, this is especially in the city-centre. More precincts for pedestrians should also be provided in the city-centre to further safeguard the infringement of the private car-owners on these facilities. Pedestrians

right-of-way should also be incorporated with the traffic control devices at the major intersections and popular pedestrians cross-overs, especially in the downtown area.

5. Restriction of employment opportunities within the city-centre and the industrial area can be realized by limiting or directing any new investments such as whole sale shops, small scale workshops and manufacturing, petrol filling stations and the like to locate in the shopping centres within the residential areas. This would in turn decentralize the employment opportunities to the residential areas. Small scale offices should also be encouraged to locate on these areas, especially those who operate after working hours. New industrial investment should also be encouraged to locate in the already identified new industrial sites such as Ruaraka and Dandora.

6. Improved traffic control devices on busy intersections can be provided by installing traffic lights on these intersection and better regulation of the existing ones.

7. Road safety and awareness can be promoted through the daily News papers, radio and television. It can also be promoted by incorporating it into the school programmes.

8. Provision of commuter train services can be done by utilizing the existing railway-line thus providing services to the residential areas, work places and peri-urban towns within the proximity of the railway-line. This will in turn go a long way in solving the transportation problem in the city especially for the urban poor from such places like Kibera who trek to and from industrial area where they work. It should be noted that in the long run commuter trains will be much cheaper than K.B.S. buses or matatus, meaning that a large majority of the urban poor will be able to accommodate the costs. The recent historic move by the Kenya Railway Corporation by launching commuter trains to the peri-urban towns like Thika and Limuru is a step in the right direction. The provision or the extension of such services within the city, for example to the Kibera Community and the industrial areas during the morning and evening rush-hours should not be too difficult to implement.

6.3 SUMMARY AND CONCLUSIONS:

Vehicular traffic congestion is an acute problem facing most, if not all, the urban areas today. This is more so in the developing countries, where the number of Automobiles are always on the increase without

corresponding road network increment and/or expansion. In other words, the road network cannot cope with the volume of traffic demanding to be committed onto them. This in turn not only wastes the energy that has to be expended but also wastes what would have otherwise been productive hours, not to mention the frustrations involved all of which in different capacities slacken the overall development of the country.

Most of the roads in Nairobi were laid out and constructed before independence in 1963, a time at which African population were restricted from living within the old city boundary let alone owning an automobile. It can therefore be concluded here that the road network in Nairobi was only designed to meet the Whiteman's and the Indians' transportation demands. Upon independence, the Kenyan Government has found it difficult to expand these roads or construct new ones to meet the current transportation demands because of other pressing development issues. It should also be noted here that road expansions or constructions are very labour and capital intensive. The main National objective where transportation network is concerned, as spelt out in the 1974/1988 National Development Plan has been to facilitate a transportation network and a transportation system that would keep the transportation

costs and travel time at the minimum. Emphasis here is laid on the extension of the existing transportation network to the deficient rural areas some of which are very resourceful. This is also geared towards the facilitation of easy communication throughout the country.

The emphasis laid to the extension of the transportation network to the deficient areas is of very significant importance; this is especially so considering the fact that Kenya is largely an agricultural country. It is therefore a policy approach in the right direction if Kenya is to be self sufficient in terms of agricultural production in meeting domestic demands and even producing surpluses for export purposes. It was with due consideration of this policy approach that the study was undertaken.

The overall objective of the study was to find a solution or to suggest ways and means of solving the problem of vehicular traffic congestion in Nairobi. Emphasis were laid on the three major means of transportation used by Nairobi residence in their daily trips, for example, the private automobiles, the K.B.S. buses and the matatus. The conducted field survey and personal observation formed the basis of knowledge of

the problem as it currently exist. It is only at this point that sound and realistic policy recommendations and implementable planning proposals could be made thus satisfying the overall objective of the study.

The principle problem that was identified as the cause of vehicular traffic congestion in Nairobi was the inability of the current public transport means to meet the public transportation demands coupled with the risks involved in their uses; this is because of their unroadworthiness coupled with the rush in order to make as many trips as possible for a higher days' returns. This in turn has prompted and will continue to prompt the would be users to resort to other means of transportation any one of which, in different magnitudes and capacities, contributes to the problem of vehicular traffic congestion. It should also be noted that a large majority of the would be users resorts to private automobiling when costs can be accommodated, despite any measures that may be imposed with the intensions of deterring an extensive ownership and usage of private automobiling. Personal safety here is a matter of great concern to all and will be protected by individuals under all costs as long as it can be afforded. Analysis of the data collected from the private car owners survey indicated that a lar

majority of them would not hesitate to use public transport means if only they were safe, reliable and not too congested for this would be much cheaper for them than using their private cars. This seems to confirm the fact that mobility is actually getting somewhere to do something and that the transportation means used is of secondary importance.

Throughout the study, with due consideration of the above factors, it was found out that in order to solve the problem of vehicular traffic congestion in Nairobi the two types of public transport means has to be managed, improved and organized. It was also found out that an introduction of commuter train services to supplement the two types of public transport means during rush-hour periods will be an added asset. It is hoped that the policy recommendations and the planning proposals that the study has come up with will go a long way in solving the problem of vehicular traffic congestion in the city of Nairobi.

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APPENDIX

VEHICULAR TRAFFIC CONGESTION STUDY QUESTIONNAIRE 5.1.01

RESPONDENT-PASSENGER

1. Location of place of residence -----
2. Distance of place of residence to the place of work ----- Km.
3. Total time daily taken from place of residence to the place of work ----- min/hr.
4. Distance from house to the bus/matatu stop ----km/mt.
5. Cost of the trip during peak periods Kshs.-----
and during off peak periods Kshs. -----
6. Mode of transport normally preferred: K.B.S. bus -----
Matatu ----- Private car ----- other (specify)-----
reason for the choice -----
7. Give your opinion on the following:
 - (i) Waiting time for public transport:
Short ----- Long ----- too long -----
 - (ii) Time taken by the mode used to destination
short ----- long ----- too long -----
 - (iii) Congestion of passengers in public transport
modes comfortable ----- congested -----
too congested -----

(iv) Delays due to traffic congestion during
peak periods: Okay ----- bad -----
terrible -----

8. Purpose of daily trip ----- location of
purpose -----
9. Number of trips undertaken per day -----
10. Total costs of trips undertaken per day Kshs-----
11. Location of where shopping is normally done -----
How often is shopping done -----/wk/mnth.
12. Location of the usual place for leisure -----
13. Given the opportunity what mode of transport would
you personally prefer to use?walking -----
bicycling ----- motor-cycling-----K.B.S.-----
bus ----- matatu ----- private car -----
14. Do you own any of the above modes? Yes ----- No -----
If Yes, Specify -----

VEHICULAR TRAFFIC CONGESTION STUDY QUESTIONNAIRE 5.1.02

RESPONDENT - PRIVATE CAR OWNER

1. Number of vehicle(s) owned ----- type(s) of
vehicle(s) ----- make of vehicle(s)-----
of vehicle(s) ----- engine capacity -----
2. Reasons for owning the vehicle(s):
(i) -----
(ii) -----
(iii) -----
3. Major uses of the vehicle(s), distances and time taken:

Major uses	Distance in Km.	Time Taken	
		Peak	Off peak
to and from work			
drive children to school			
Shopping and leisure			
long safaris			
other (specify)			

4. Average distance covered ----- km/day/wk/mnth/yr.
5. Vehicles rate of fuel consumption ----- litres/
----- km.
6. Average fuel consumption ----- litres/day/wk/mnth/yr.
7. Fuel cost diesel/petrol Kshs.----- /Litre

8. Give your opinion on the following:

(i) Delays due to vehicular traffic congestion during peak periods Okay ----, bad -----
terrible -----

(ii) Time taken from place of residence to destination during peak periods: short -----
long -----, very long -----

(iii) Road carrying capacity narrow -----
too narrow -----

9. Accessibility to parking facilities Yes -----;No -----

10. Number of times parking required -----/day/wk/month.

11. Duration of stay ----- min/hr.

12. Waiting duration for parking space -----min/hr.

13. Parking space capacity ----- vehicles.

14. Reasons for not using public transport:

VEHICULAR TRAFFIC CONGESTION STUDY QUESTIONNAIRE 5.1.03

RESPONDENT(S) - K.B.S. LTD. & MATATU OWNERS A SOCIATION

I. Particulars of Public Transport Vehicles:

1. The number of buses/matatus currently licenced to operate in Nairobi -----, Number of unlicenced -----
2. Daily scheduled services -----
3. Size of vehicles (average) ----- Kg. wt.
4. Designed passenger capacity (average) ----- persons.
5. Life expectancy of each vehicle (average)-----persons
6. Number of vehicle replacement -----/mnth/yr.;
number of displacement-----/month/yr.

II. Operational Costs:

1. Fuel consumption (diesel/petrol)-----litres/
day/wk/month.
2. Fuel cost Kshs. -----/litre.
3. Repairs and maintenance costs Kshs.-----/day/
wk/month/yr.
4. Drivers and conductors salaries Kshs.-----/wk/
month/yr.
5. Other staff salaries Kshs -----/wk/month/yr.
6. Charges and other costs:
 - (i) Licence fee Kshs -----/day/wk/month/yr.

- (ii) Insurance fee Kshs. -----/day/wk/month/yr.
- (iii) Parking fee Kshs. -----/day/wk/month/yr.
- (iv) Association fee Kshs. -----/day/wk/mnth/yr.
- (v) Traffic violation fines Kshs.----/day/wk/mth./yr.
- (vi) Other (specify) ----Kshs. -----day/wk/month/yr.

III. Parking Facilities

1. Number of parking spaces in the city centre---
Location(s) -----
2. Number of times parking is required/vehicle---day/wk.
3. Duration of stay in the parking space---min/hr.
4. Time wasted waiting for parking space ----min/hr.
5. Parking space(s (carrying capacity -----

IV Selected Routes Services Information

1. Number of vehicles assigned to the following routes:
 - (i) (----- route; peak periods -----; off
peak periods -----
 - (ii) ----- route; peak periods ----: off
peak periods -----
2. Trip origin -----; destination -----
3. Number of trips per vehicle (average) (-----/day.
4. Operational frequency----- vehicles.every-----
min/hr.
5. Length of the trip ----- km.

6. Time taken during peak periods -----min/hr.;
during off peak periods-----min/hr.

V. Economical Returns:

1. Fares paid by users on the above selected routes in
Kshs.

Users	Route (i)		Route (ii)	
	Peak	Off peak	Peak	Off Peak
Adults				
School Schildren				
Children				

2. Returns per vehicle Kshs -----/day/wk/month/yr.