SOME THOUGHTS ON INTRA-URBAN TRANSPORT PROBLEMS IN ETHIOPIA: THE CASE OF THE *ANBASSA* CITY BUS TRANSPORT

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ABSTRACT:*The study focuses on achieving the following objectives: examination of the city bus transport network structure; association between the demand and supply of the city bus transport services; investigation of the relationship between the population of Addis Ababa and the demand for the transport services; examination of the temporal and spatial variations of the volumes of passengers; and identification of the major city bus problems.*

The road network of Addis Ababa has mainly a radial development pattern. It forms a dense network in the north-south direction and there is absence of direct connections. At present there are 325 buses and 75 route lines functioning in the capital city. There are significant variations of passenger flows between peak and off-peak hours and, according to the days of the week, the months of the year, and the years. Similarly there are considerable variations of passenger traffic flows between the bus terminals.

The major city bus problems are: traffic congestion; road traffic accidents; financial constraints; population growth and physical growth of Addis Ababa; and unmet peak-hour transport needs and long waiting time.

The problem

Transportation is the conveyance of people, goods and information from one place to another. In other words, it is the relocation of people, goods and information over space. The forms which transport take are highly variable and range from simple carriage by animals and humans to highly sophisticated carriers such as jumbo jets and super tankers.

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In general road transport is regarded as the most flexible, relatively cheap and convenient mode of transport used by most people everyday. It is particularly suitable for short and medium distance travels (Bamford 1978).

The movement of people has various purposes. According to Bamford (1978) these can be grouped into seven broad divisions: journeys to work (movement of persons to their places of work); commercial travel for the sake of business; journeys to school by children and students; journeys for shopping and personal business; journeys for social and entertainment purposes; journeys to home; and journeys for which there is no specific purpose other than to be with or assist some other person.

Transportation is one of the basic requirements for the proper functioning of societies. It permits the specialization of activities to achieve grater productivity and efficiency. Hence the economic growth of any society in any part of the world is associated with the availability of transport.

Transportation demand is highly related to the movement of people from one place to another. It is on account of this that demand is often considered to be the determinant of transport route locations (Dimitrious 1990). The supply of transport facilities such as buses and taxis is a response to this demand.

The rapid growth of cities has been accompanied by an increased need for urban transport. Unlike small cities or towns where it is possible to reach every point on foot or by bicycle within a reasonable time, large cities require motorized transport systems to permit the movement of people and goods between various locations. In large cities transport provides linkages between places of residence and employment and specialized urban-based activities such as industrial and commercial activities. Transport facilities harmonize the widely-stretched residential, working, shopping and the other areas. Such harmonization is brought about by the movement of people from place to place. The extent of a multi-purpose urban transport system and the level of interaction offered by its component parts are more important for Third World development than any degree of technological modernization (Dimitrious 1990).

Transportation and urbanization are inseparatble. It is an important factor for the location and internal structure of cities. Transportation influences the size of towns and the movement of people and commodities within and outside urban areas. The morphology of a city is also affected by the street patterns. Thus there are cities that have radial patterns, non-integrated street patterns and circular structures.

Moreover the mode and quality of public transport affect the settlement of urban dwellers and growth or decline of business areas, cultural and recreational opportunities and relationships between cities and their suburbs.

The cost of transport affects urban expansion. A lower transport cost permits access over large areas and hence facilitates low-density development. Residents can live further away and hence the city expands spatially. Thus large urban areas result from the availability of low-cost transport systems.

The variation in land values is partly accounted for by the role of transport. For instance, the high property values in the central city areas are largely due to the location of the sites where there are major transport networks. But it should be understood that the beneficiaries of transport development are not only the city centres; suburbs are also becoming important sections of cities owing to their proximity since land values also rise there (Hartshorne 1988). Thus transport contributes not only to uni-centered urban development but also to multi-centered urbanization.

As a result of increasing urban population and the changing way of life, urban transport problems such as rapid traffic growth are generated primarily in the large cities of Third World countries. Such cities, especially those found in Africa, are mostly capital cities like Addis Ababa. These cities are required to perform numerous and complex functions and hence are confronted with many difficult problems such as inadequate transportation. To satisfy the growing demand of traffic in the large cities of the Third World countries, a large amount of investment is needed for road construction and maintenance. But owing to the lack of such investment there exists a shortage of adequately maintained transport facilities. Closely associated with the growth of urban traffic is the shortage of

parking space because the streets are narrow and little off-street parking space is provided. In consequence, cars are parked on foot-paths and on any available corner causing danger, damage and inconvenience (Johannest 1993). As a result of narrow streets, little parking space, growth of traffic and badly maintained foot-paths there is a problem of congestion resulting from the movement by pedestrians and cyclists in the large Third World cities.

Moreover most Third World cities use mixed traditional and modern transport technologies. As a result the fast-moving motorized vehicles share the use of the road with the slow-moving human-powered and animal-drawn vehicles. This situation often leads to traffic conflict, road congestion and road safety problems in such cities.

Another urban transport problem in Third World cities is ineffective traffic management and enforcement. This has resulted in the following specific problems: widespread poor driver behavior; inadequately maintained vehicles and infrastructure; absence of sufficient road signs and markings; growth of uncontrolled street activities; inadequate traffic enforcement; numerous pedestrians; and mixed traffic conditions. These problems have contributed to the significant rise of traffic accidents in Third World cities (Dimitrious 1990).

This study attempts to investigate some aspects of the urban transport problems taking the *Anbassa* City Bus transportation as a case study. The detailed objectives of the study are provided hereunder.

THE OBJECTIVES

The objectives of the study include the following:

1. To examine the *Anbassa* City Bus transport network structure in relation to the spatial coverage of the city.

2. To explore the association between the existing demand and supply conditions of the city bus transport services.

3. To investigate the relationship between population growth of the city and the demand for bus transport services.

4. To examine the temporal and spatial variations in the volume of passengers transported by bus.

5. To identify some of the major problems that hinder the smooth functioning of the city bus services.

This study is based on secondary data. The data are analyzed by employing various descriptive and inferential quantitative methods.

THE NATURE Of ROADS IN ADDIS ABABA AND THE *ANBASSA* CITY BUS OPERATIONAL LINES

The Nature of Roads in Addis Ababa

Addis Ababa was founded in 1886 by Emperor Menelik II. After the establishment of the capital, many modern innovations, such as roads, telephone lines, printing presses, banks and modern schools were introduced. The city center was in the original market zone now occupied by the municipality building (EMA 1984).

During the Fascist occupation, a network of well constructed roads, radiating from Addis Ababa and connecting the capital to the main administrative regions, was built. To facilitate the growth of Addis Ababa, development activities tended to move to the southern parts of the city where the terrain is relatively flatter than elsewhere. In 1984 the limits of Addis Ababa enclosed an area which stretched for more than 20 kms from east to west and for over 25 kms from north to south and the city area covered over 400 square kms (EMA 1984). At present, Addis Ababa has a total population size of 2,112,737 (CSA, 1998). Of these, about 40 percent resides in the densely-populated *Tekle Haimanot* area and around *Merkato*.

The city of Addis Ababa is surrounded from the northwest to the northeast by the *Entoto* Hills. As a result, the expansion of the city is largely towards the southern,

southeastern and eastern directions. Therefore, the most important directions of traffic in future transport networks will be towards these parts of the city.

The structure of the road network is highly influenced by topography, the nature of housing and building characteristics. The layout of the roads follows the natural contours rather than a deliberate engineering design. In consequence, there are numerous intersections, ups and downs and zigzags which create many problems for vehicular mobility (NUPI 1988).

In general, the roads of Addis Ababa are classified into three categories. The following table describes types of the roads and their dimensions by category.

Table 1
Types of Roads their Lengths and Widths in Meters

Types of Roads	Lengths (M)	Widths (M)
Primary Roads		
Express Ways	-	60
Arterial Streets	3,708	50-60
Sub-Arterial Streets	76,369	30-40
Secondary Roads		
		20-30
Collector Streets	99,601	10-20
Local Residential Streets	92,568	
Tertiary Streets		
Local Street		8-10
Total	272,246	

Source: National Urban Planning Institute (NUPI), 1988. Street Maintenance Report on Addis Ababa, Addis Ababa.

The primary roads are those which are designed to connect the principal sectors of the city. In other words, they are the main channels of movement. They include express ways, arterial streets and subarterial streets. The secondary roads are intermediate roads whose chief function is to connect the primary roads. Hence, they create interconnections between the primary roads. They consist of collector and local residential streets. Tertiary roads are found at the *Kebele* level

and provide door-to-door services. Such roads may be asphalted or gavelled or they may be simply natural roads. They serve as final destination points for the various establishments (NUPI 1988).

The road network of Addis Ababa has mainly a radial developmental pattern. It forms a dense network in the north-south direction. There is an absence of direct connections, particularly in the east-west direction. The designs of the roads are not satisfactory and there are many intersections. The arterial network includes all asphalted roads. The local streets are often in poor conditions. The streets between houses are narrow, unpaved and usually damaged by the heavy rains. Most of them serve as pedestrian ways. The way houses are constructed does not allow for the expansion of roads to acceptable standard sizes. As a result, vehicular access is limited. Inaccessibility makes services for emptying septic tanks, fire brigade operations, ambulance services and garbage collection nearly impossible in a large part of the city.

Lack of space for houses has resulted in a higher density of functions on the roads. In many areas roads are the only place for children to play, and for people to walk. Roads also serve other functions which the home fails to accommodate such as drying grain, washing clothes. They are also used for meeting places and cultural ceremonies such as mournings (AMPPO 1984).

The *Anbassa* City Bus Operational lines

Definitions of Operational Lines

In Addis Ababa, the main public transport services are provided by the *Anbassa* City Bus Organization. In order to provide relatively effective services, the Organization uses certain operational lines. These consist of depots, terminals, bus stops and bus routes.

A depot is a place where buses are maintained, washed and kept at night. There are two depots located at the *Shegolle Meda* and *Yeka*.

A terminal is a major or minor bus station in the city which serves both as a point of origin and destination of buses. In other words, a terminal is the entry or exit point of a bus in a transport network. A terminal is selected on the basis of population density of the surrounding areas and commercial, governmental and recreational activities which have a high demand for transport services.

A bus stop is a point in a transport network where buses load and unload passengers. The number of stops differs from route to route and some bus stops are common for many buses since there is overlapping of routes. The number of bus stops on a bus route for a single journey ranges from ten to fifteen.

The *Anbassa* City Bus Organization selects bus stops on the basis of certain criteria. Firstly, the number of passengers at a specific bus stop is considered. Levelness of the land surface and distance from traffic lights are also used as selection criteria (ACBO 1991-1997). A bus route is the way or track taken by a transport vehicle such as a bus. Each route network has its own departure and destination points.

Detailed Examination of Bus Terminals and Route Networks

Bus Terminals

The *Anbassa* City Bus transport services are distributed from three major terminals and five minor terminals.

The three major terminals are: *Addis Ketema*, *Menelik II* Square and *Legehar*. *Addis Ketema* or *Merkato* was selected as the largest terminal in Addis Ababa since it serves the *Merkato* which is the largest market area in the country. Numerous people from the various regions of the country flock daily to this Market. In addition, the largest inter-urban bus terminal is found in this area. Added to this is the presence of a high population density in the area. In view of all these factors, twenty five bus routes which account for 57 percent of all bus routes, radiate from Addis *Ketema* and branch in all directions of the city with a daily assignment of more than ninety buses. The route lines that radiate from

Addis Ketema include route numbers 2,4,7,8,12,13,15,16,17,18,20,21,22, 23,24,26,28,29,30,34,39,40,41,43,and 44.

Legehar or the Railway Station is the second largest terminal in the city. The reasons are the presence of many governmental organizations, several schools, big hotels and the national football field where many people spend their weekends. Furthermore, in this area there is a sub-interurban bus terminal that serves the eastern and southern parts of *Shewa*. Six route lines numbers 1, 25, 27, 31, 32, and 42, radiate from this terminal with a daily assignment of thirty-seven buses. This is 14 percent of all the route lines in the city

Menelik Square or *Arada Giorgis* is the third major terminal. It was selected as a terminal since, as the oldest settlement area of Addis Ababa, it is one of the main shopping areas of the city. In addition, it houses government offices, courts, schools, big hotels, cinema halls, the *Ager Fikir* theater, the main fire brigade, the Municipality and St. George church. Five route lines numbers 3, 5, 14, 37, and 38, radiate from this terminal. They account for 11 percent of all the route lines in the city and the number of buses that depart from this terminal is 25.

In addition, there are five minor terminals, namely: *Mesalemia, Piazza, Arat Kilo, Semien Gebaya* and *Filweha*. These terminals were selected on the basis of the high population densities of the surrounding areas and the nature of their locations which serve as turning points for other areas. The *Arat Kilo* terminal serves route 33, *Messalemia* serves route lines 11 and 35, *Filweha* serves route line 36, *Semien Gebeya* serves route 6 and *Piazza* serves routes 9, 10 and 19..

More detailed information about the origins and destinations of the bus routes is provided in Tables 2, 3 and 4. Figure 1 shows the entire route network structure of the *Anbassa* City Bus transport services. At present, there are a total of 75 route lines.

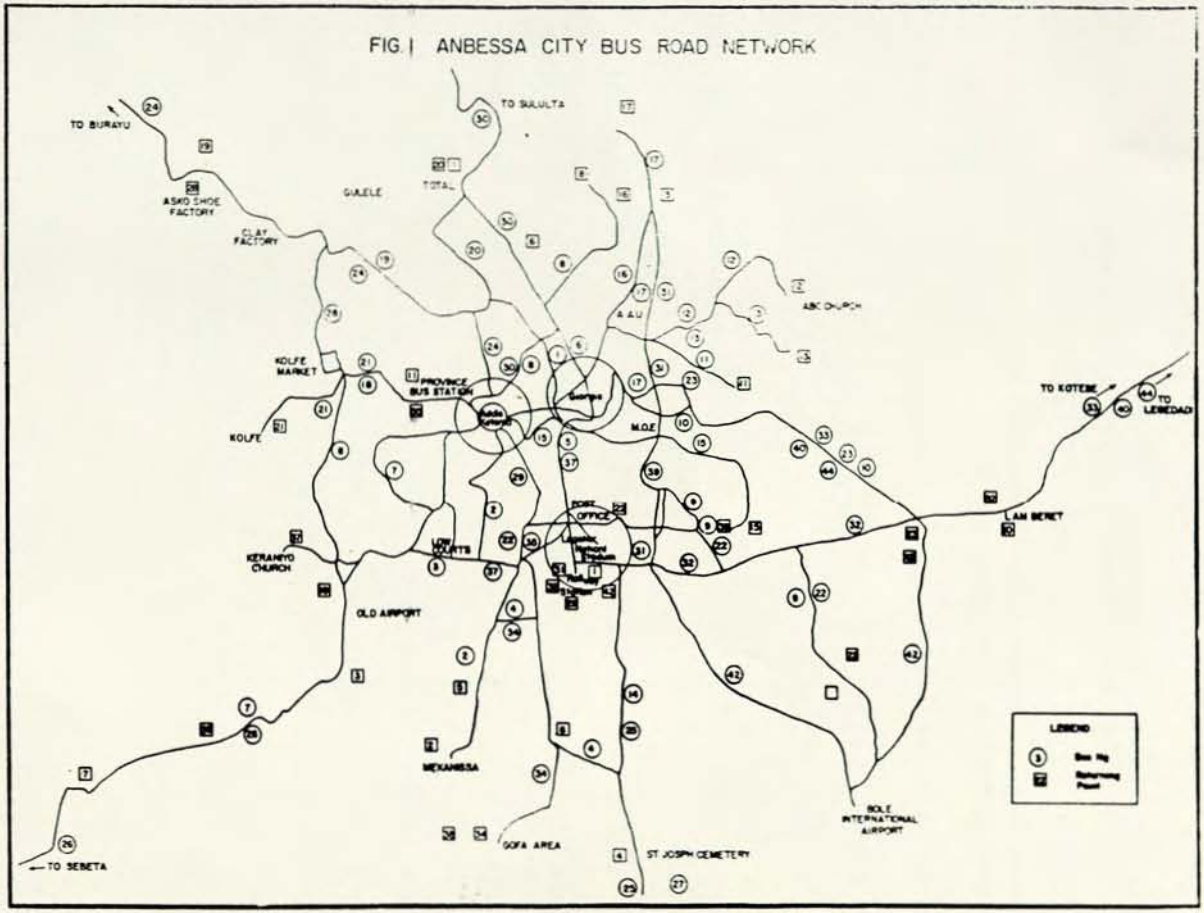


FIG.1 ANBESSA CITY BUS ROAD NETWORK
TO BURAYU
ASKO SHOE FACTORY
CLAY FACTORY
TO SULULTA
TOTAL
GUELE
A.A.U
ABC CHURCH
KOLFE MARKET
KOLFE
PROVINCE BUS STATION
M.O.E
TO KOTEBE
TO LEMEDADI
LAM BERET
POST OFFICE
KERANIYO CHURCH
OLD AIRPORT
MEXANISSA
GOFA AREA
ST JOSPH CEMETERY
BOLE INTERNATIONAL AIRPORT
TO SEBETA
LEGEND

Table 2
Bus Route Numbers and their Destinations for the Major Bus Terminals

Bus Route Numbers	Bus Terminals (Departure Points)	Destinations
2	*Addis Ketema*	*Mekanisa*
4	" "	*Addis Goma*
7	" "	*Repi*
8	" "	*Kechene*
12	" "	*Ferensay Legasion*
13	" "	*Bela*
15	" "	*Aware*
16	" "	*Shiro Meda*
17	" "	*Shiro Meda*
18	" "	*Old Airport*
20	" "	*Total Gojjam Ber*
21	" "	*Fetno Derash*
22	" "	*Bole High School*
23	" "	*Megenagna*
24	" "	*Burayo*
26	" "	*Sebeta*
28	" "	*Asko*
29	" "	*Ehil Gotera*
30	" "	*Sululta*
34	" "	*Gofa Sefer*
39	" "	*Kazanchies*
40	" "	*Karra*
41	" "	*Iyesus*
43	" "	*Menagasha*
44	" "	*Legedadi*
3	*Menelik II* Square	*Total Jimma Ber*
5	" "	*Dil Gebeya*
14	" "	*Ehil Gotera*
37	" "	*Keranio Church*
38	" "	*Gofa Sefer*
1	Railway Station	*Total Gojjam Ber*
25	" "	*Akaki Beseka*
27	" "	*Addis Goma*
31	" "	*Shiro Meda*
32	" "	*Lam Beret*
42	" "	*Megenagna*

Source: Addis Ababa City Bus Organization, Planning Division (1991-1997). Various Unpublished Reports, Addis Ababa.

Table 3

Bus Route Numbers And Their Destinations for the Minor Bus Terminals

Bus Route Numbers	Bus Terminals (Departure Points)	Destination
11	*Mesalemia*	*Menelik II* Hospital
35	*Mesalemia*	*Kirkos*
9	*Piazza*	*Bole* High School
10	*Piazza*	*Lam Beret*
19	*Piazza*	*Asko*
33	*Arat Kilo*	*Kotebe*
6	*Semien Gebeya*	*Karra*
36	*Filweha*	*Tesfa Dirigit*

Source: Addis Ababa City Bus Organization, Planning Division, (1991-1997). Various Unpublished Reports, Addis Ababa.

Table 4
Bus Route Numbers and Their Destinations for the New Bus Terminals

Bus Route Numbers	Bus Terminals (Departure Points)	Destinations
45	*Giorgis*	*Dil Ber (Total)*
46	*Gergi*	*Kazanchies*
47	*Merkato*	*Shegole*
48	*Piazza*	*Bole*
49	*Megenagna*	*CMC*
50	*Megenagna*	*3 Kutir Mazoria*
51	*Legehar*	*Bihere Tsigie*
52	*Gergi*	*Merkato*
53	*Sidist Kilo*	*Bole*
54	*Legehar*	*Gofa (Mebrat Hail)*
55	*Ferensai*	*Ayer Tena*
56	*Shiro Meda*	*Saris (Addis Goma)*
57	*Legehar*	*Kara*
58	*Legehar*	*Dukem*
59	*Giorgis*	*Woira Sefer*
60	*Legehar*	*Debre Zeit*
61	*Legehar*	*CMC*
62	*Legehar*	*Alem Gena*
63	*Legehar*	*Bole (Michael)*
64	*Megenagna*	*Sidist Kilo*
65	*Shola Gebeya*	*Kotebe (Gebrael)*
66*	*Giorgis*	*Birchiko Fabrica*
67	*Legehar*	*Mekanisa*
68	*Balcha (Mexico)*	*Menelik Hospital*
69*	*Shiro Meda*	*Kolfe (Fetno Derash)*
70	*Kazanchies*	*Ayer Tena*
71	*Balcha*	*Bole (Hibreteseb Timirt Bet)*
72	*Legehar*	*Saris (Adisu Sefer)*
73	*Legehar*	*Atana Tera (Kolfe)*
74	*Merkato*	*Gurd Shola*
75	*Sidist Kilo*	*Gotera*

* Safety Buses (Working only During Peak Hours).

Source: Addis Ababa City Bus Organization, Planning Division (1991-1997). Various Unpublished Reports, Addis Ababa.

Assignment of Buses, Single Trip Distances and Bus Fares

The assignment of buses is determined by the demand for bus services. For instance, until April, 1994 only one bus was assigned to route number 37; until July 1995 for route number 4 the number of buses assigned was six; and until March, 1995 route number 24 had three buses. But at present, the bus assignment has been revised owing to changes in demand. Accordingly the bus assignments for route numbers 37, 4 and 24 are 2, 5 and 2, respectively.

Table 5 shows bus route numbers, assignment of buses, trip distances, time taken, number of bus stops and bus fares. As expected, the distribution of buses varies from one route to another. A high bus concentration is observed in the central parts of Addis Ababa while the distribution in the peripheral areas is sparse. The variation of bus distribution ranges from 1 each for routes 43 and 44 to 14 each for routelines 3 and 6.

The bus travel time also varies among route lines. It ranges from 28 minutes for route 8 to 65 minutes for route 43 (Table 5). In general, the bus travel time is affected by the nature of roads, traffic volume and the number of bus stops.

Table 5
Bus Route Numbers, Assignment of Buses, Single Trip Distance Time Taken, Number of Bus Stops, and Bus Fares

Bus Route Numbers	Number of Buses Assigned per day	Single Trip Distance (KM)	Single Trip Journey Time (MIN)	Number of Bus Stops in A Single Trip	Bus Fares (*Birr*)
1	2	15.4	60	16	0.25
2	4	9.1	36	20	0.25
3	14	8.8	39	18	0.25
4	5	12.3	49	22	0.25
5	2	8.0	36	18	0.25
6	14	9.8	39	21	0.25
7	5	11.8	45	15	0.25
8	2	5.5	28	16	0.25
9	5	9.4	37	21	0.25
10	3	8.8	34	16	0.25
11	3	6.6	33	15	0.25
12	7	6.7	32	19	0.25
13	3	8.5	35	14	0.25
14	5	6.9	32	17	0.25
15	3	7.4	34	12	0.25
16	2	5.3	29	19	0.25
17	5	9.0	39	13	0.25
18	3	8.9	31	21	0.25
19	6	9.1	34	15	0.25
20	2	6.3	29	11	0.25
21	2	5.0	27	18	0.25
22	5	10.2	40	23	0.25
23	10	10.4	42	22	0.25
24	2	14.7	48	29	0.45
25	7	18.7	57	30	0.50
26	6	22.7	54	19	0.50
27	8	7.5	33	19	0.25
28	5	8.5	34	22	0.25
29	4	7.0	38	10	0.25
30	3	24.0	64	20	0.25
31	10	7.2	34	17	0.25
32	6	7.4	30	17	0.25
33	8	9.6	37	22	0.25
34	4	9.6	39	20	0.25
35	3	6.3	37	12	0.25
36	4	10.0	34	18	0.25
37	2	11.4	36	18	0.25
38	2	8.3	34	14	0.25
39	4	6.3	31	14	0.25
40	2	20.0	38	14	0.25
41	3	6.2	34	17	0.25
42	3	6.0	57	24	0.25
43	2	30.0	60	24	1.00
44	2	38.0	65	24	1.00

Table 5 cont.

Bus Route Number	Number of Buses Assigned per day	Single Trip Distance (KM)	Single Trip Journey Time (MIN)	Number of Bus Stops in a Single Trip	Bus Fares (*Birr*)
45	2	5.5	26.00	NA	NA
46	4	8.5	35.00		
47	2	6.1	29.00		
48	2	8.5	35.00		
49	3	8.5	21.00		
50	6	9.8	45.00		
51	2	7.4	35.00		
52	3	14.0	55.00		
53	2	9.2	35.00		
54	2	7.2	37.00		
55	2	13.7	60.00		
56	2	13.1	50.00		
57	2	13.8	50.00		
58	2	34.0	75.00		
59	2	8.5	32.00		
60	4+2*	45.0	87.00		
61	2	13.7	45.00		
62	2	18.0	60.00		
63	2	8.5	37.00		
64	2	7.8	32.00		
65	2	6.5	32.00		
66	2*	7.3	33.00		
67	2	5.9	30.00		
68	2	7.2	33.00		
69	2*	11.3	40.00		
70	2	10.4	44.00		
71	2	6.7	35.00		
72	2	8.5	38.00		
73	3	7.1	40.00		
74	2	10.8	48.00		
75	2	8.5	33.00		

* For Peak Hours Only

Source: Addis Ababa City Bus Organization, Planning Division (1991-1997). Various Unpublished Reports, Addis Ababa.

The *Anbassa* City Bus Organization started offering its transport services in Addis Ababa in 1943. For the last twenty years the bus fare for a single trip was *Birr*.0.15. But since 1993 the bus fare for a single trip was set as follows: for an average distance of 8.25 kms, the bus fare is *Birr* 0.25; for 14.7 kms *Birr* 0.45; for 20.65 kms *Birr* 0.50 for 24.5 kms *Birr* 0.65 and for 30 kms *Birr* 1.00.

According to this new tariff, the single trip bus fare is *Birr* 0.25. But the single trip bus fare to the satellite towns ranges from *Birr* 0.45 to *Birr* 1.00. Thus, the bus fare to *Burayu* is *Birr* 0.45, to *Sebeta Birr* 0.50, to *Akaki Birr* 0.50, to *Sululta Birr* 0.65; to *Menagasha Birr* 1.00 and to *Legedadi Birr* 1.00. However, there is an exceptional student bus fare. On working days, students can travel on a single trip up to 6 p.m by paying *Birr* 0.15.

The distance covered by each bus is of course not the same. There are short and long distances. The short distances are found within the city while the long distances are associated with those buses that serve the peripheral areas of the city. The working time for buses runs from 6:30 AM to 8:30 PM.

MAXIMUM CAPACITY AND DEMAND FOR BUS TRANSPORT AND THE ASSOCIATION BETWEEN POPULATION GROWTH AND DEMAND FOR CITY BUS TRANSPORT

Maximum Capacity and Demand

Normally the demand for goods in the market within a specific period of time is highly dependent on the supply. In other words, when there is a large supply of certain goods in the market then the demand for these goods decreases. But if there is a shortage, the demand increases. This method cannot be used to study the *Anbassa* City Bus transportation since the supply of the operational buses is almost always the same every day of the week.

Therefore, the maximum capacity method has been used to show the demand for bus transportation in Addis Ababa. According to Meyer (in Mulugeta 1980), transport experts often assert that passenger accommodation at peak hours and

maximum load points should be based on 200 percent of the seat capacity for rail vehicles and 150 percent for buses.

For the purpose of this study, it is assumed that the maximum load factor should be 200 percent of the seat capacity of a bus. The city buses of Addis Ababa have a maximum seat capacity of 28. Therefore, according to the world standard, the maximum number of passengers to be transported by a city bus is 56. Beyond this a bus is described as being overloaded. When this method is applied to the *Anbassa* City transport the following results have been found.

Table 6
Maximum Capacity and Demand for Bus Transport

	(A)	(B)	(C)	(D)	(E)
Month	Number of Single trip journeys	Number of passengers	Maximum limit of passengers (AX56)	Actual maximum excess (B-C)	Excess (%) (D/C X100)
September	57.844	6900.891	3239.264	3661.555	113
October	57.348	6672.151	3211.488	3460.663	108
November	52.306	6048.458	2929.136	3119.322	107
December	49.651	5731.206	2780.456	2950.750	106
January	50.059	5609.155	2803.304	2805.851	100
February	49.575	5676.910	2776.200	2900.710	105
March	49.925	5736.170	2795.800	2940.370	105
April	42.550	5111.998	2342.368	2769.630	118
May	41.828	5092.419	2342.368	2750.051	117
June	41.602	4855.308	2329.719	2525.596	108
July	42.182	4846.112	2362.192	2483.92	105
August	39.277	4559.584	2199.512	2360.072	107

Source: Addis Ababa City Bus Organization, Planning Division (1991-1997). Various Unpublished Reports, Addis Ababa.

Column "C" indicates the maximum limit of passengers which should be transported by a bus according to the world standard. Column "D" provides the excess passengers again on the basis of the world standard. Column "E" shows the excess passengers as a percentage (i.e. the number of passengers transported by the *Anbassa* City Bus beyond the maximum limits). During the twelve months in question, the number of passengers transported by the city bus exceeded the maximum limit of the world standard, hence revealing the presence of overloading. Of all the months, the minimum excess (i.e. 100 percent) was recorded in January and the maximum (i.e. 118 per cent) in April. The excess number of passengers confirms the existence of a very high demand for bus services in the city of Addis Ababa.

The Association between Population growth and Demand for City Bus Transport

In large cities, the majority of the people require a low-cost means of transport to satisfy their daily needs. In Addis Ababa, for instance, the various means of transport and their users indicated in percentages for 1985 were as follows: private cars (7.6), taxis (10.0), city buses (11.9), and walking (70.5) (NUPI, 1988).

It is logical to assume that when the urban population increases there is a corresponding increase of daily trips. This implies that as the urban population grows there should be a concomitant growth of the city bus transport services. To test this hypothesis two variables, namely: population of Addis Ababa and number of bus passengers for eleven years (1985-1995), were correlated using the Spearman's Rank Correlation Coefficient method. The data are provided below:

Table 7
Population of Addis Ababa and Number of Passengers Transported (1985-1995)

Year	Population of Addis Ababa ('000)	Number of Passengers Transported ('000)
1985	1464.907	75802.024
1986	1526.542	71652.328
1987	1589.176	83075.982
1988	1654.327	103938.103
1989	1722.098	140593.694
1990	1792.599	140453.552
1991	1865.942	119401.249
1992	1942.244	106170.249
1993	2023.107	102700.588
1994	2104.226	97856.674
1995	2190.167	71230.499

Source: Addis Ababa City Bus Organization, Planning Division (1991-1997). Various Unpublished Reports, Addis Ababa.
Central Statistical Authority (CSA), 1985. Census Supplement 1, A.A.

The formula of the Spearman's Rank Correlation Coefficient is stated as:

$$R = 1 - \frac{6\Sigma D^2}{N(N^2 - 1}$$

Where: R = Coefficient or Rank Correlation
D = The difference between ranked pairs
N = The number of pairs

The value of R is 0.07 and the coefficient of determination (R^2) is 0.49 percent indicating the presence of a very weak positive association between population growth and number of bus passengers. This shows that the growth of the population of Addis Ababa is not accompanied by a commensurate increase in bus services.

TEMPORAL AND SPATIAL ANALYSES OF PASSENGER TRAFFIC FLOW

Temporal Analysis of Passenger Traffic Flow

Passenger Traffic Flow During the Hours of the Day

On account of the variation of the volume of passengers during the different hours of the day there are peak hours and off-peak hours for the demand of transportation.

In Addis Ababa schools start at 8:00 A.M. and governmental offices at 8:30 A.M. The schools close at 5:00 P.M. and the governmental offices at 5:30 P.M. In addition to these, there is a change of shift in schools from 12:00 noon to 1:00 P.M. As a consequence, there are two major peaks, consisting of the morning and evening peaks and one minor peak, namely the noon peak.

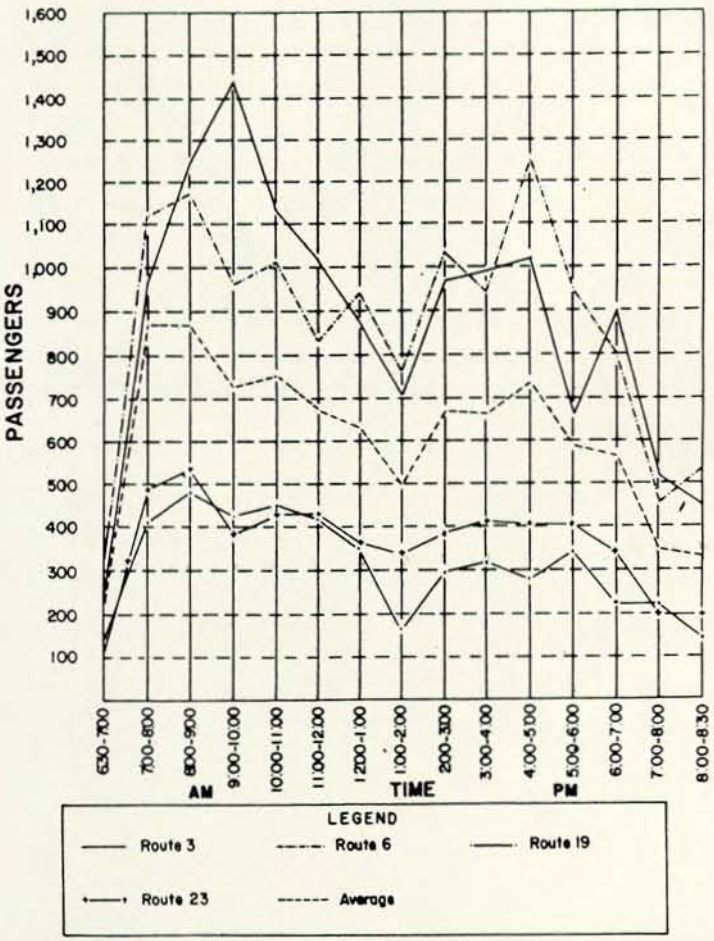
There is in general a sharp rise in the passenger traffic flow between 6:30 A.M. and 9:00 A.M. and between 3:00 P.M. and 6:00 P.M. These sharp rises are the

result of morning and evening peak hours for all workers and students. And there is a sharp decline of the passenger traffic flow between 9:00 A.M. and 3:00 P.M, since most workers and students are in and around their respective work places and schools. There is a very sharp decline of passenger traffic flow from 6:00 P.M. to 9:00 P.M. during which period most work places are closed and all bus services stop functioning. Examine Figure 2 below for further details. Consider for instance in some detail the variations of passenger traffic flows along Route Line 3. This line starts from the center of the city and crosses many governmental organizations such as the General Post Office, National Bank of Ethiopia, National Theater, Commercial School, Headquarters of the Ethiopian Police Force, Ethiopian Road Authority, *Black Lion* Hospital, *Gebremariam* School, Technical School, Police Hospital, *Lideta* High Court and Faculty of Technology (Southern Campus).

However, it must be stated clearly that even though there were significant variations in passenger traffic flows during the peak and off-peak hours, there existed in general heavy passenger traffic flows throughout the 14 hours of bus service movement.

FIG.2 NUMBER OF PASSANGERS IN TWO WORKING DAYS

(MONDAY AND WEDNSDAY)



Passenger Traffic Flow During the Days of the Week

The second aspect of the temporal dynamics is concerned with the pattern of passenger traffic flows during the days of the week. The purposes of movement in the city vary with the days of the week since people move from place to place to satisfy their needs such as journeys to work, market, and centers of religion, recreation and entertainment during the different days of the week. As a result, the volumes of passengers vary according to the days of the week. This is demonstrated in Figure 3 below.

According to this Figure the largest volumes of passengers were transported on Saturday. The main reason for the Saturday peak is the fact that this day is the most important market day of the city. On Saturdays, therefore, people from every corner of the city as well as from the surrounding areas travel to the market centers, especially to the *Markato* or *Addis Ketema* in order to sell or purchase commodities of various types. The main factor for the Sunday peak is the fact that as this day is a weekend, thousands of people flock into such places as centers of religion, recreation and entertainment.

Note that the passenger traffic flows for the other days of the week are more or less constant. An attempt was also made to determine quantitatively the extent of the association between the days of the week and the number of passengers transported per day. The relevant data are provided in Table 8 below.

FIG.3 AVERAGE PASSENGER TRAFFIC FLOW : THE DAYS OF THE WEEK SEPTEMBER 1996

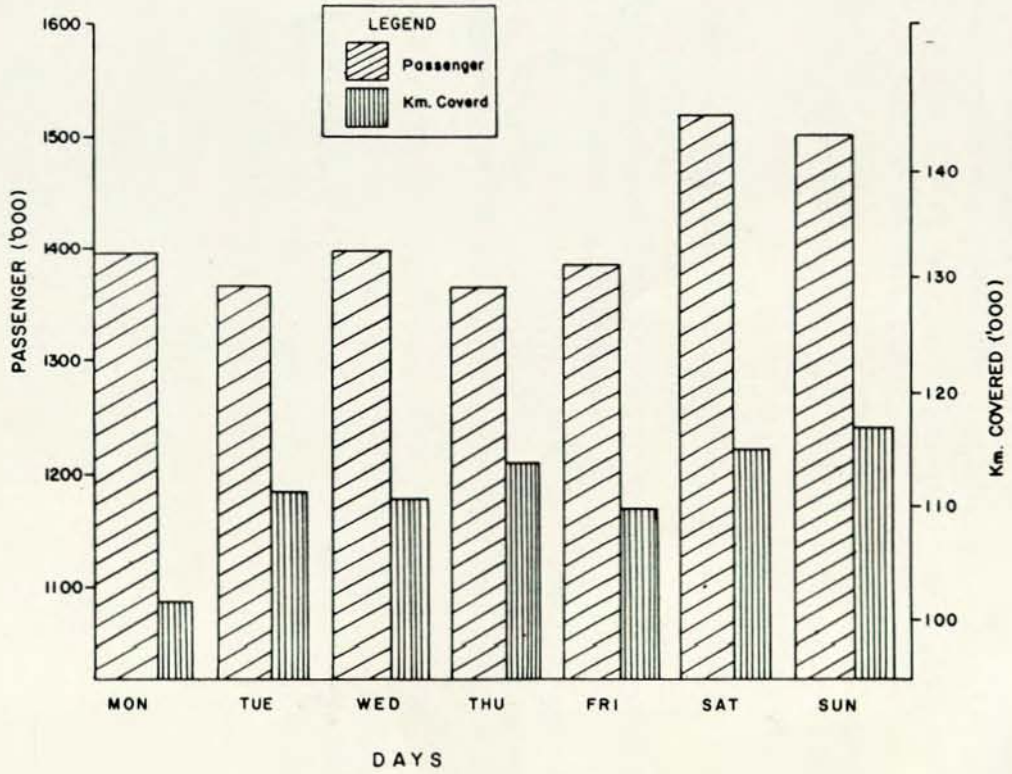


Table 8
The Association Between Days of the Week and Number of Passengers Transported

Serial Number (X)	Days of the Week	Number of Passengers Transported ('000) (Y)
1	Monday	1397.1875
2	Tuesday	1369.7125
3	Wednesday	1402.7525
4	Thursday	1369.7775
5	Friday	1386.4050
6	Saturday	1518.7175
7	Sunday	1502.3425

Source: Addis Ababa City Bus Organization, Planning Division (1991-1997). Various Unpublished Reports, Addis Ababa.

The following Karl Pearson's formula was utilized for the computation of the coefficient of correlation:

$$r = \frac{\Sigma XY}{\sqrt{X^2 Y^2}}$$

Where:

r = Pearson's Coefficient of Correlation
y = Dependent Variable
x = Independent Variables

The Pearson's Coefficient of Correlation was computed to be 0.71 suggesting the existence of a high level of positive association between the days of the week and the number of passengers transported per day. The Coefficient of Determination (r^2) was slightly over 50 percent indicating that 50 percent of the variation in the

number of passengers transported perday was explained by the days of the week and the remaining 50 percent by the other factors.

Monthly Passengers Traffic Flow

The volume of passengers transported also varies from month to month owing to a variety of mostly unknown reasons. One very well known reason for the variation of the volume of passengers is the changing nature of the seasons in the country. In the dry season, low income-people usually prefer walking to using buses when they wish to travel to places located at short and medium distances. However, in the rainy season, owing to the heavy rains, such people use mostly buses to reach places located at short and medium distances.

Figure 4 shows the monthly variations of passengers transported. The figure reveals a general decline in the number of passengers transported from October to June during the period in question. The high volume of passengers in the month of October must have been an anomaly since it cannot be explained satisfactorily. One cannot explain it by the extension of the rainy season since September's share was much lower.

Annual Passenger Traffic Flow

The volumes of passengers vary from year to year for reasons that are not too clear. An attempt was made to portray the annual variations of the volumes of passengers during the period 1985-1995. In general, the volumes of passengers during the period in question indicated an increasing trend. The highest numbers of passengers were recorded in 1989 and 1990. The main reason for this rise, among possible other reasons, is the increase in the number of buses by 158 between 1987 and 1990. Further details are shown in Figure 5. But in 1998 the total number of buses that were in operation had reached 325 (i.e. 265 DAF Buses and 60 Mercedes buses).

FIG.4 AVERAGE MONTHLY PASSENGER FLOW 1991-1992

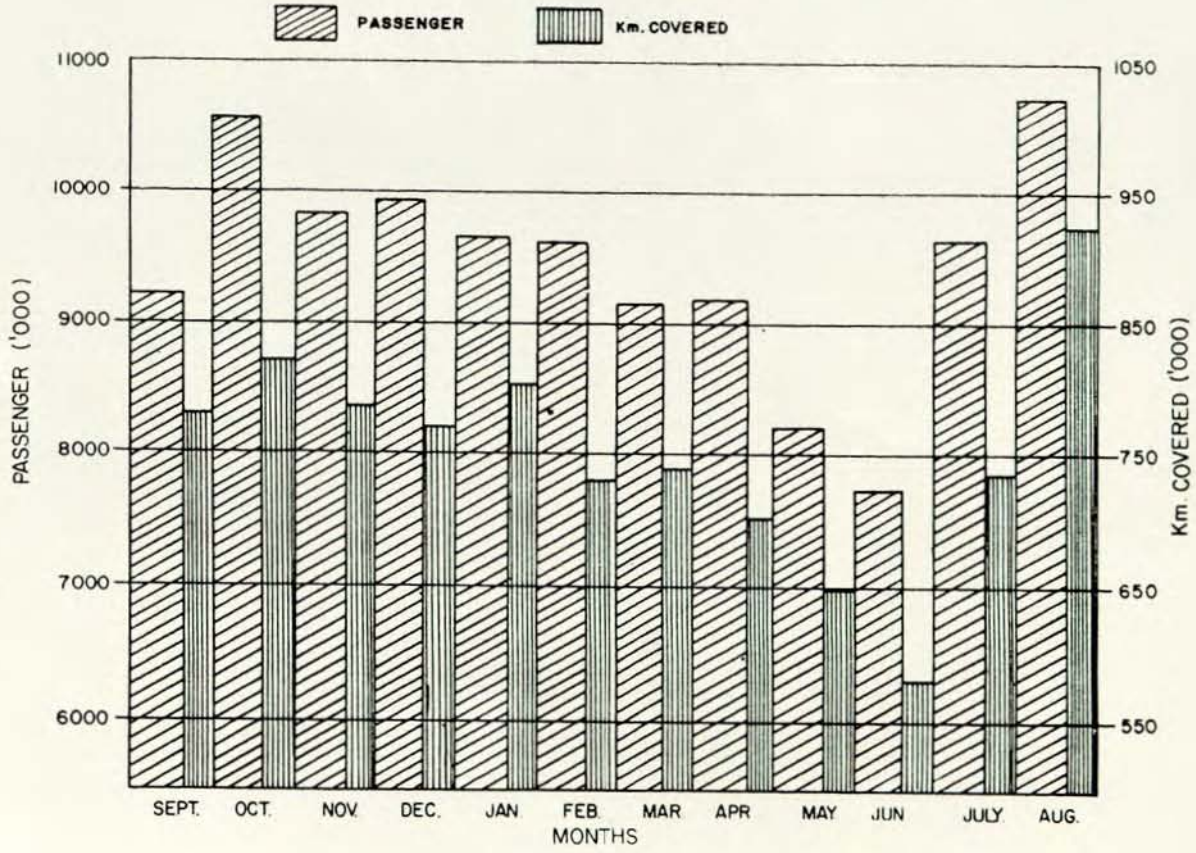
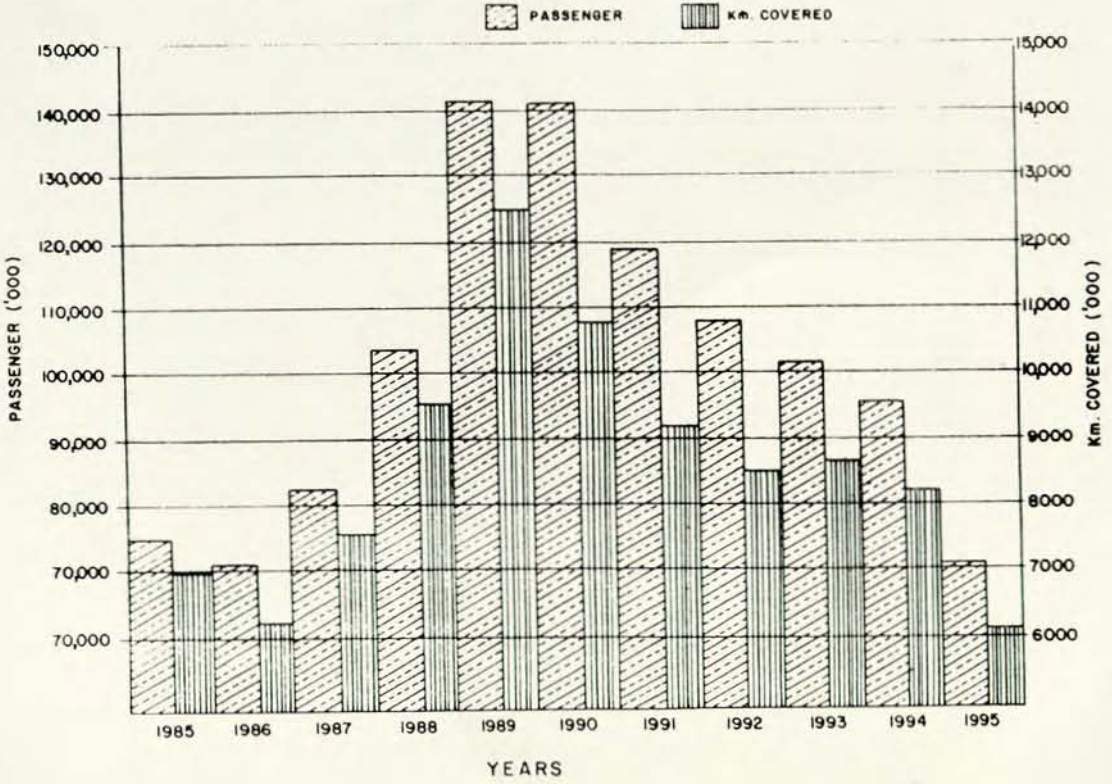


FIG 5 ANNUAL PASSENGR TRAFFIC FLOW 1985-1995



Spatial Analysis of Passenger Traffic Flow

In addition to the temporal variation in passenger traffic flows there exists a spatial variation of passenger traffic flows. In Addis Ababa there are various zones, that are categorized as administrative, educational, industrial, commercial and residential. On account of such functional variations, people move constantly from one zone to another. As a result, the volume of passengers also varies in accordance with the demand of the services provided by the respective zones.

The following Table presents the spatial variations of route assignments of buses and passenger traffic flows for each Terminal of the *Anbessa* City Bus for September, 1996.

Table 9
Spatial Variations of Route Lines Assignment of Buses, and Passenger Traffic Flows (September, 1996)

Terminal	Total Number of Route Lines from Each Terminal	%	Total Number of Buses Assigned	%	Passenger Traffic Flows ('000)	%
Addis Ketema	25	56.8	103	48.8	1,669.436	39.2
Arat Kilo	1	2.3	8	3.8	337.390	7.9
Filweha	1	2.3	4	1.9	65.018	1.5
Menelik II Sq.	4	9.1	23	10.9	410.384	9.6
Piazza	3	6.8	14	6.6	383.638	9.0
Railway Station	6	13.6	37	17.5	884.759	20.8
Semien Gebeya	2	4.5	16	7.6	369.979	8.7
Mesalemia	2	4.5	6	2.8	135.167	3.2
Total	44	100.00	211	100.00	4,255.768	100.00

Source: Addis Ababa City Bus Organization, Planning Division (1991-1997). Various Unpublished Reports, Addis Ababa.

The above table demonstrates that the *Addis Ketema* Terminal was the undisputed leader in terms of the number of routes, the total number of buses assigned, and the passenger traffic flows. The Railway Station Terminal was second in terms of these three measurements. It is, therefore, clear that these two Terminals dominated the configuration of the bus transport surface thus resulting in a gross spatial disequilibrium.

An attempt was made to indicate the accessibility of bus routes to the people that reside in the various parts of Addis Ababa. In other words the aim was to arrive at the time or distance required to reach the nearest bus route line. According to the assumption of one study, people need 10 to 13 minutes to travel about 0.5 km. [ENEL, 1993] On the basis of this assumption an Accessibility Map (Figure 6) was produced based on a map with a scale of 1:45,00. Figure 6 shows in general in the central parts of the city people can reach the nearest bus route line by walking much less than 0.5 km. This means that people residing in these areas have a very high accessibility to the city bus services. Nevertheless, as one goes away from the central parts of the city people are forced to walk for more than a kilometer to reach the nearest bus route line. This suggests that people living in the peripheral areas of the city have less access to the city bus services and must therefore walk on average for more than 20 minutes to travel to the next bus route line.

MAJOR PROBLEMS OF THE *ANBASSA* CITY BUS TRANSPORTATION

Traffic Congestion

Traffic congestion is produced when the number of vehicles is in excess of the capacity of the route system to carry those vehicles. The main reasons for traffic congestion include: (a) the mix of the old and new means of transport; (b) the growth of the city population, physical size of city and the number of vehicles; and (c) the nature of the roads.

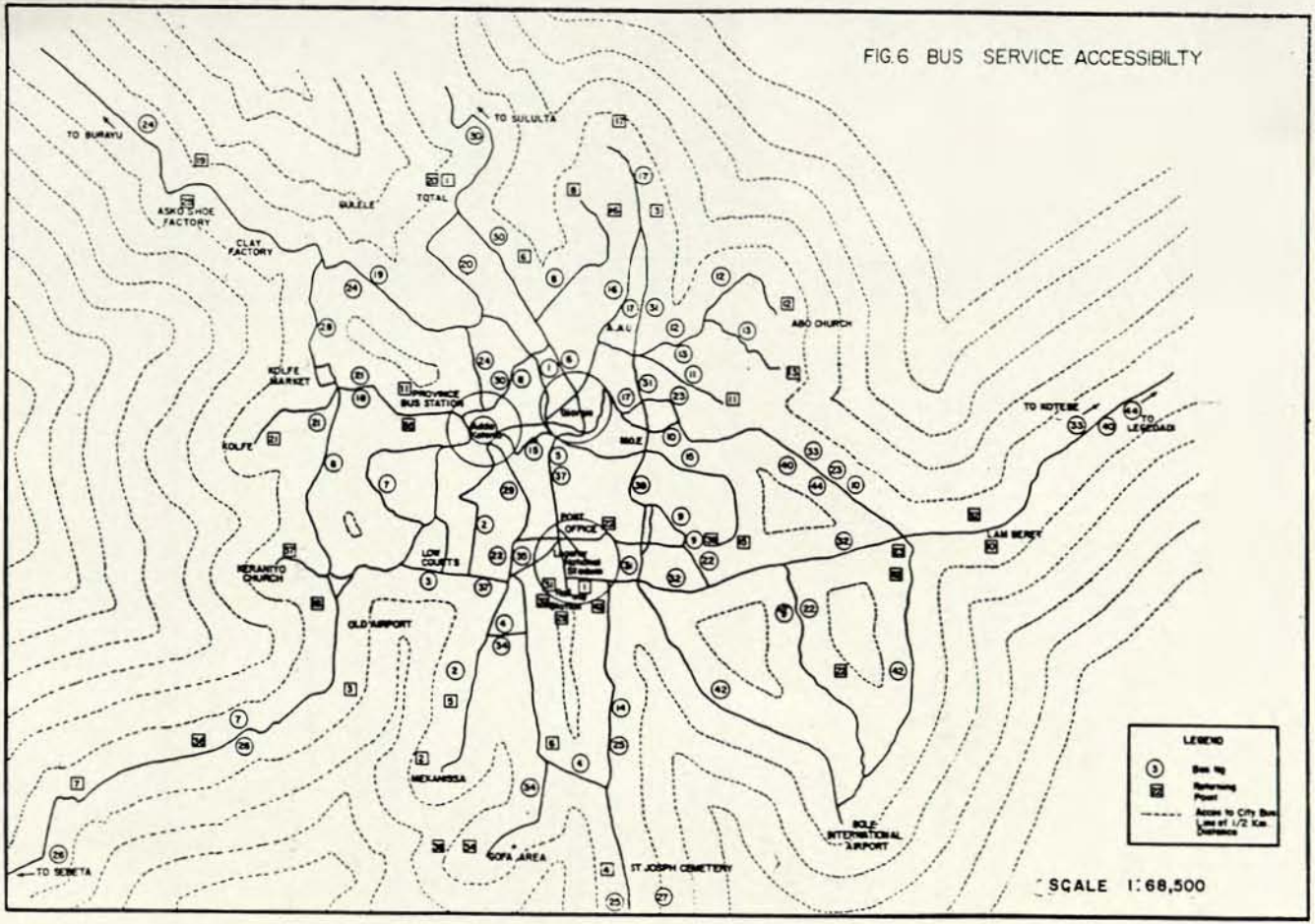


FIG.6 BUS SERVICE ACCESSIBILTY
TO BURAYU
TO SULULTA
ASKO SHOE FACTORY
CLAY FACTORY
BAZELE
TOTAL
ABO CHURCH
A.A.U
KOLFE MARKET
PROVINCE BUS STATION
KOLFE
BOLE
TO KOTEBE
TO LEGEDADI
POST OFFICE
LAM BERET
LOW COURT'S
MEKANISSA
OLD AIRPORT
GOFA AREA
IT JOSEPH CEMETERY
BOLE INTERNATIONAL AIRPORT
TO SENETA
LEGEND
SCALE 1:68,500

The Mix of the Old and New Means of Transport

The road space of Addis Ababa is shared by vehicles such as buses, taxis cars and motor cars, and pedestrians and donkeys. This situation has led to a grave problem of traffic congestion.

Growth of Population, Physical Size and Number of Vehicles

In the 1920s, the population of the city of Addis Ababa was estimated at 60,000. Since then, the population has been increasing significantly. Between 1936 and 1989, the population grew 25 times. According to the 1984 Census of Population and Housing, the population was slightly more than 1.4 million growing at the rate of 3.5 percent. At present the population of the city is estimated at 2.2 million.

In the 1920s the area of the city was estimated to be 33 km^2. The area grew to 223.6 km^2 in 1984. In 1990 the area of the city was 518.7 km^2 indicating that the physical size of the city increased about 22 times in a period of only six years. Moreover, the physical size of the city has expanded considerably in a short span of time in an unplanned manner. This has resulted in many grave transport problems such as traffic congestion.

The rapidly growing population of the city requires a commensurate growth of transport services of various types. Consider for instance the magnitude of the number of passengers transported daily in Addis Ababa and the purposes for the movements which are provided in Tables 10 and 11 below.

Table 10
Number of Passengers Transported Daily in Addis Ababa By Mode of Transport (1980)

Mode of Transport	Number of Passengers Transported Daily	Percent
Private Car	156,000	7.6
Bus	243,500	11.9
Taxi	206,000	10.0
Walking	1,446,300	70.5
	2,051,800	100.00

Source: National Urban Planning Institute (NUPI) 1985. Urban Passenger Transport Study, Addis Ababa

Table 11
Purposes of Trips in Addis Ababa (1984)

Purpose	Number of Passengers Transported Daily	Percent
Work/Business	368,800	18.0
Education	450,500	22.0
Recreation	126,300	6.1
Health	14,600	0.7
Shopping	101,900	5.0
Return Home	959,500	46.0
Other purposes	30,200	1.5
Total	2,051,800	100.00

Source: National Urban Planning Institute, 1985. Urban Passenger Transport Study, Addis Ababa.

During the study period, the total number of people that moved daily was 2,051,800, a size about forty percent of the people moved daily to satisfy their work, business and educational needs. The majority, seventy percent, moved by walking followed by those who took buses (nearly 12 percent) and taxis (10 percent).

The rising number of vehicles has also contributed significantly to the worsening congestion problem. This is partly explained by the apparent lack of control on the entry of vehicles into the city. For instance, in 1991/92 the total number of inspected and registered vehicles in Addis Ababa was 53,590. The figure grew to 61,056 in 1993/94 and to 149,000 in 1995/96. The majority of the vehicles that are imported to the city are private commercial and private home vehicles. As these figures indicate, the import of vehicles is growing at a staggering rate.

The Nature of the Roads

Most of the existing roads of Addis Ababa were designed and constructed more than half a century ago. Owing to the rapidly increasing population of the city and the consequent rising demand for transport facilities, the existing roads should have been improved in addition to constructing new ones. But as this has not been accomplished the existing routes cannot accommodate the current number of vehicles and the innumerable pedestrians.

Most Third World road transport networks evolved in a simple radial form extending outward from the central cities. The existing roads of Addis Ababa radiate from the core area to the peripheral regions particularly to the west, southwest, south, east and northern directions comprising five major route lines. There are no additional branch routes from the earlier trunk routes and similarly no adequate direct interconnections exist among the major and minor parts of Addis Ababa. For example, if one wishes to travel from *Shola* to *Merkato* there is only one radial road. Therefore, the radial nature of the roads, combined with the absence of additional branch routes, creates concentration of vehicles on the existing radial roads and makes transport expensive and travel-time long.

Absence of adequate and regular road maintenance is another major contributor to traffic congestion. The major purposes of road maintenance include: to retard the rate of deterioration of roads; to lower the cost of operating vehicles in the city by providing a satisfactorily smooth-running surface; to keep roads open to traffic and pedestrians; and to minimize traffic congestion, accidents, transport costs, travel time and the like.

However, the status of road maintenance in Addis Ababa leaves much to be desired. The main cause of this is insufficient investment earmarked for road maintenance. According to the study made by National Urban Planning Institute five-year street maintenance cost for Addis Ababa were estimated at about *Birr* 69 million which is decidedly beyond the budgetary limits of the city [NUPI, 1985].

In addition, there exist other constraints like inadequate management, inadequate co-ordination among the various authorities involved in road maintenance and insufficient trained man-power that have contributed to the under-maintenance of roads in Addis Ababa.

In sum, poorly maintained roads, excessive parking controls, absence of well-developed terminals, and absence of off-roadside parking places have resulted in grave traffic congestion and accidents.

Road Traffic Accidents

There are four types of traffic accidents interms of their consequences. These include loss of life (death), light injury, heavy injury and property damage.

The gravity of road accidents manifests temporal and spatial variations. Table 12 and 13 below show the magnitude of the road accidents' and the types the accident victims. The number of property damage was the highest (65.3%) in 1994/95 and workers shared the highest incidence (41.7 %) of the accidents during the same year.

Table 12
Magnitude of Road Traffic Accidents

Year	Fatal	%	Heavy	%	Light	%	Property Damaged	%	Value of Property Damaged (*Birr*)	Total No. of Accidents	Total No. of Damaged vehicles
1992/93	178	4.4	317	7.8	700	17.2	2868	70.6	6,672,256	4063	2911
1993/94	271	8.6	306	9.8	635	20.3	1925	61.4	5,810,192	3137	2977
1994/95	120*	7.1	170	10.1	296	17.5	1103	65.3	4,252,296	1689	1587
Yearly Average	189.7	6.1	264.3	9.2	543.7	18.3	1965.3	67.7	4,068,283	2963	2491.7

* Up to February 1995 only

Source: Addis Ababa Traffic Police (1991-1997), Various Unpublished Reports, Addis Ababa.

Table 13

Types and Number of Road Accident Victims

Year	Students	%	Workers	%	Farmers	%	Unemployed	%	Unknown	%	Total
1992/93	379	31.7	513	42.9	28	2.3	236	19.8	39	3.3	1195
1993/94	318	26.8	543	45.8	23	1.9	251	21	52	4.4	1187
1994/95*	149	24.2	290	47.1	9	1.5	139	22.6	29	4.7	616
Yearly Average	282	27.6	448.6	45.3	20	1.9	208.6	21.2	40	4.1	999.0

* Up to February 1995 only

Source: Addis Ababa Traffic Police (1991-1997), Various Unpublished Reports, Addis Ababa.

Table 14 below indicates the temporal or hourly variations of road traffic accidents. The largest numbers of road traffic accidents occurred during peak hours.

Table 14
Distribution of Road Traffic Accidents by Hour in Addis Ababa (1994/95) (for 6 months)

Hours	No. of Road Accidents
0100-0200	9
0200-0300	6
0300-0400	4
0400-0500	8
0500-0600	23
0600-0700	41
0700-0800	105
0800-0900	134
0900-1000	125
1000-1100	99
1100-1200	112
1200-1300	96
1300-1400	112
1400-1500	111
1500-1600	118
1600-1700	103
1700-1800	117
1800-1900	80
1900-2000	92
2000-2100	83
2100-2200	37
2200-2300	35
2300-2400	29
2400-0100	14
Total	1689

Source: Addis Ababa Traffic Police Office (1991-1997), Various Unpublished Reports, Addis Ababa.

The spatial variations of road traffic accidents are presented in Table 15 hereunder. The government office areas had the highest number of road accidents (48.4%) followed by residential areas (17.3%), recreation areas (14.7%) and market areas (14.0%).

Table 15
Distribution of Road Traffic Accidents by Area of Accidents in Addis Ababa (1994/95 for 6 months)

Areas of Road Accidents	No of Road Accidents	%
Peripheral settlements	1	0.01
School surroundings	31	1.8
Factory surroundings	17	1.0
Churches and Mosques	37	2.2
Market areas	237	14.0
Recreation areas	249	14.7
Hospital area	7	0.4
Government Office areas	818	48.4
Residential areas	292	17.3
Other areas	-	-
	1689	100.0

Source: Addis Ababa Traffic Police Office (1991-1997), Various Unpublished Reports, Addis Ababa.

The types and number of accidents caused by the *Anbassa* City Bus are presented in Table 16 Below.

Table 16
Types and Number of Accidents Caused by *Anbassa* City Bus (1990)

Types of Accident	Number	%
Bus accidents with other cars	297	24.7
Bus accidents with other buses	72	6.0
City bus passengers injured	544	45.4
Pedestrians injured	86	7.2
City Buses damaged due to accident	164	13.7
Other property damage	31	2.6
Injured wild animals	4	0.4
Total	1198	100.0

Source: Addis Ababa City Bus Organization, Planning Division, (1991-1997) Various Unpublished Reports, Addis Ababa.

The largest number of accident (45.4%) were city bus passenger injury followed by big bus accidents with other cars (24.7%). This is, therefore, clear evidence as far as road accidents are concerned that the share of the *Anbassa* City Buss Transport was quite substantial.

The possible causes of the road traffic accidents in Addis Ababa include: number of motor vehicles, health conditions of passengers exposed to accidents, type of vehicles, age of drivers, educational standard of drivers, service age of vehicle, movement conditions of accident victim, level of driving license, technical defects and nature of roads.

An attempt was made to ascertain the association between the dependent variables(Y) (i.e. total number of road traffic accidents) and three independent variables (X_i), (i.e, the total population of Addis Ababa (X_1), number of new motor vehicles registered (X_2) and number of new driving licenses issued (X_3). The data are presented in the following Table.

Table 17
Association Between Road Traffic Accidents in Addis Ababa and Three Independent Variables

Year	Total Population of Addis Ababa	No. of Motor Vehicles Registered	No. of New Driving Licenses Issued	Total
1982	1,792.599	4,213	7.151	0.767
1983	1,865.942	5,574	11.208	0.928
1984	1,942.244	7,191	25.400	1.370
1985	2,023.107	7,251	22.353	1.204
1986	2,104.226	8,001	21.735	1.924
1987	2,190.167	9,677	21.828	2.065

Source: Addis Ababa City Bus Organization, Planning Division (1991-19197). Various Unpublished Reports, Addis Ababa.
National Transport Corporation (1982/83). Study on Addis Ababa Transport Service, A.A.
NUPI 1988. Street Maintenance Report on Addis Ababa.
NUPI 1988. The Urban Transport Services with the Masterplan, Addis Ababa.

The Multiple Regression Equation that was used for the level of association is as follows:

$$Y = -3.3 + 0.002\ X_1 + 0.122\ X_2 - 0.008X_3$$

The Coefficient of Multiple Correlation was computed to be 0.90 and the Coefficient of Determination was 81%. The value of 0.90 suggests the presence of a very high association between the dependent and independent variables. The Coefficient of Determinations confirms that 81% of the variations of road traffic accidents were explained by the three independent variables in question and the remaining 19% by other factors.

Financial Problems

As Table 18 portrays the *Anbassa* City Bus Transport organization had a total of 260 buses of which only 137 buses were operational. 43.1% of the total were under maintenance and 4.3% were not operational. In other words, nearly half of the total fleet size was in disuse.

Table 18
Fleet Size of *Anbassa* City Bus Transport Organization and Their Conditions (1995)

Bus Type and Model	Fleet Size	Year of Purchase	Service Years	Technical Conditions		
				Opera-tional	Under Maint-enance	Unopera-tional
Fiat 331 A	44	1980	15	11	25	8
Volvo B-7-F	50	1983	12	14	36	-
Mercedes 630 A	6	1977	18	2	1	3
Man	1	1983	12	-	1	-
DAF	1	1986	9	1	-	-
Mercedes 360A	40	1986	9	27	13	-
Mercedes 360A	98	1987	8	68	30	-
Mercedes 360A	20	1990	6	14	6	-
Total	260			137	112	11

Source: Addis Ababa City Bus Organization, Planning Division, (1991-1997). Various Unpublished Reports, Addis Ababa.

In consequence, between 1985 and 1987 the Organization experienced serious losses. This is borne out by Table 19 below. The table reveals that since nearly all the buses are over age they are not likely to render services

much longer. It is on account of this that the revenues of the Organization are much less than its expenses. This implies that the insufficient number of the operational buses coupled with old age, frequent bus breakages, diminishing revenue and lack of spare parts are among the most significant problems that are threatening the life of the Organization.

Table 19
Profit and Loss Statement of the *Anbassa* City Bus Transport Organization (1985-1987)('000 *Birr*)

Year	Income	Expense	Profit	Loss
1985	28,338	29,682	-	1,344
1986	29,828	31,324	-	1,496
1987	26,343	27,481	-	1,138

Source : Addis Ababa City Bus Organization, Planning Division, (1991-1997). Various Unpublished Reports, Addis Ababa.

Incommensurate Population and Physical Growth of Addis Ababa

As mentioned earlier, Addis Ababa is growing rapidly both in population and physical extent. But the physical growth of the city together with the attendant increasing infrastructural needs are not commensurate with the growth of the population. Hence, most of the infrastructure such as public bus transport, which are concentrated mostly in the central parts of the city, are not adequate for the newly inhabited peripheral areas of the city.

Admittedly the *Anbassa* City Bus Transport Organization has increased its total route lines to 44. However, this in no way satisfies the ever - increasing transport needs of the city dwellers owing to the rapidly increasing population.

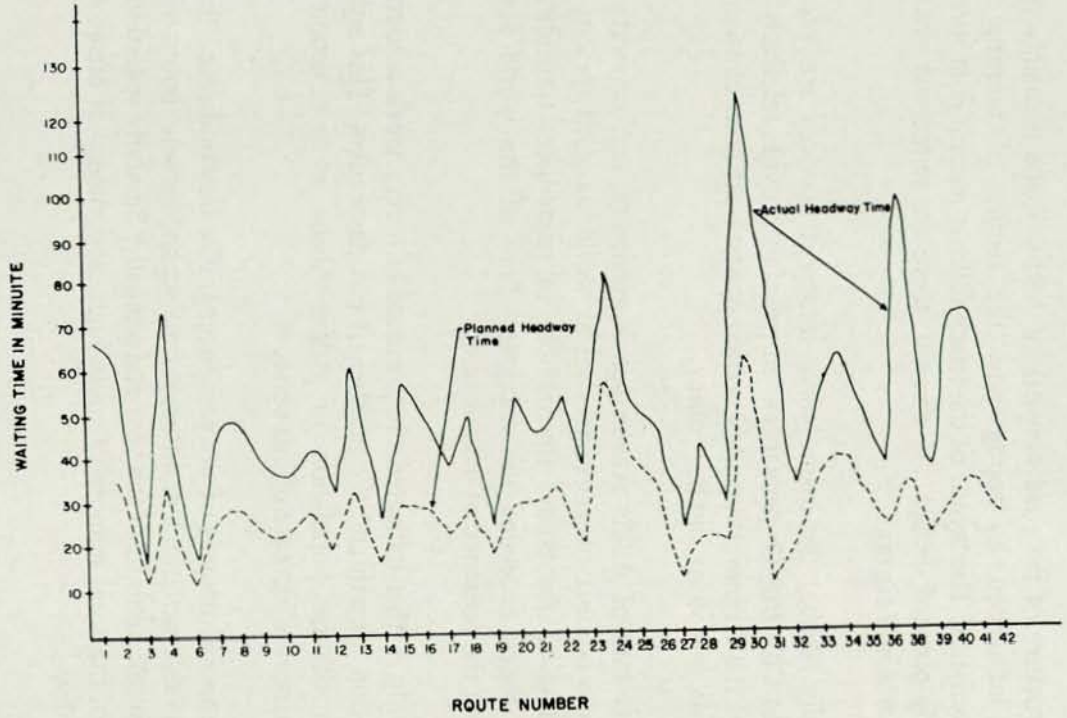
Unmet Peak-Hour Transport Demand and Long Bus Waiting Times

During the morning, noon and evening peak hours the demand for public transport is considerably high as compared with the demand during the off-peak hours. In recent years, this demand is very far from being met. Furthermore, this problem is aggravated by the fact that out of the already highly insufficient operational buses some are diverted to contract services during peak hours.

Another grave problem is the long passenger waiting time. As Figure 7 below manifests, there is a wide gap between the planned and the actual headway times. While the planned headway time to catch the next bus is 10 to 60 minutes, the actual headway time ranges from 40 to 120 minutes.

Moreover, there are in sufficient usable shelters at bus stops to protect the waiting passengers from the strong sunshine and heavy rainfall.

FIG.7 PLANNED AND ACTUAL WAITING TIME SINCE 1982/83 BUDGET YEAR



CONCLUSION AND RECOMMENDATIONS

The structure of the road network of Addis Ababa is mainly radial which is highly influenced by topography, the nature of housing and building characteristics. The layout of the roads follows natural contours rather than a carefully planned design. As a result, there are numerous intersections, ups and downs and zigzags.

In Addis Ababa, the main public transport services are provided by the *Anbassa* City Bus Organization. In order to provide relatively effective, bus services the Organization uses certain operational lines consisting of depots, terminals, bus stops and bus routes.

The city bus of Addis Ababa has a maximum seat capacity of 28. The maximum number of passengers set as world standard for city buses is 56. According to the study, the number of passengers transported by Addis Ababa buses exceeded the maximum limit of the world standard, hence revealing the presence of over-loading.

The study further indicated the presence of a very weak association between population growth and the number of bus passengers. This signifies that the growth of the population of Addis Ababa is not accompanied by a commensurate increase of bus services.

The temporal analysis of the passenger traffic flow indicated the existence of considerable variations at different time scales, namely: hours of the day, days of the week, months of the year and annually. Similarly spatial variations were noted in the total number of route lines, assignment of buses and passenger traffic flows.

Finally, the study pointed out the major problems that confront the *Anbassa* City Bus Transportation. These included: traffic congestion; road traffic accidents, financial problems; incommensurate population growth and physical growth of Addis Ababa; and unmet peak-hour transport demands and long-bus-waiting-time.

This author firmly believes that the deep-seated transport problems of the city cannot be solved easily as their solutions are likely to involve a very costly redevelopment endeavour. What is perhaps feasible is to adhere strictly to the existing Master Plan of the City and guide the future growth of the city in an orderly manner.

The radial nature of the city's road network, with limited interconnections, has led to the concentration of the traffic flow in a few areas. The ring-road scheme, which now appears underway, is likely to spread out the traffic load thus easing to some extent the traffic congestion within the city.

Another recommendation that this writer wishes to put forward concerns the policy on the import of vehicles to the country in general and to Addis Ababa in particular. The quantity and quality of the imported vehicles do not appear to be determined by the city's poor road conditions and the ever-growing population. Consequently, the import of vehicles to the city should be looked in light of the citiy's problems.

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