

Figure 6.8.4 Traffic Signalled Intersections

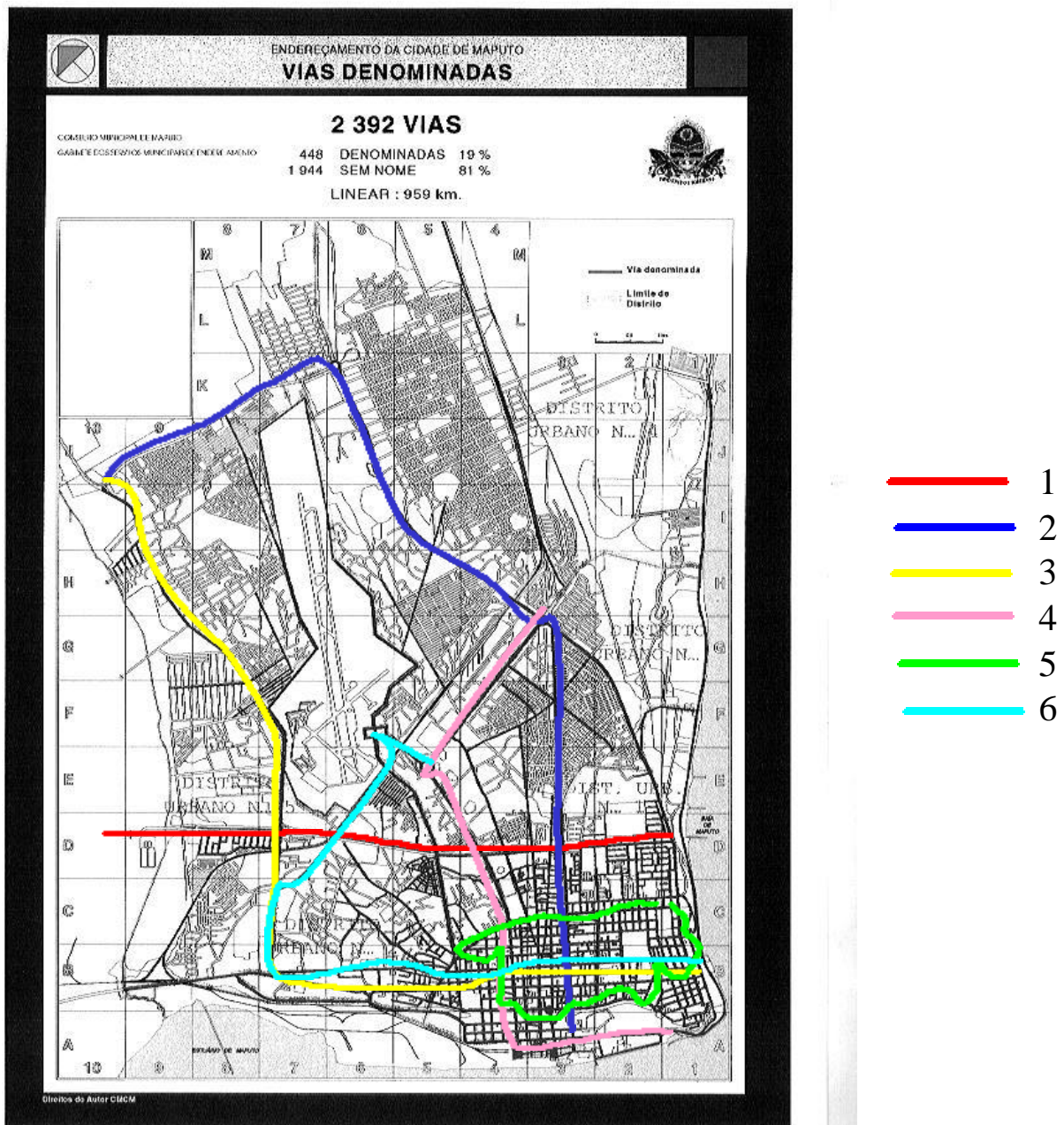


Figure 6.8.5 Journey Time Routes

Plates : Surveyors on Av 24 de Julho, December 2000



Plates : Examples of buses

Minibus or Chapa



Midibus, Medio or Chapa



Big bus, Grande, or Machimbombo



CHAPTER 7
TRAFFIC SURVEY RESULTS

CHAPTER 7 : TRAFFIC SURVEY RESULTS

7.1 ORIGIN – DESTINATION SURVEYS

Table 7.1.1 lists the numbers of different types of vehicles interviewed. At each location the numbers of cars and goods vehicles interviewed were compared to the traffic count and corresponding expansion factors produced in order to create the O-D tables. The O-D data were coded into 40 origin-destination zones, of which 32 are internal to the City of Maputo and 8 were external, effectively representing external cordon crossing points.

Table 7.1.1 Vehicles Interviewed in O-D Surveys

Vehicle Type	No. of interviews	%
Car	1889	80.1
Minibus	11	0.5
Midibus	14	0.6
Big bus	4	0.2
Light Goods	82	3.5
Medium Goods	214	9.2
Heavy Goods	60	2.6
Motor Cycle	76	3.3
Total	2320	100.0

Table 7.1.2 lists the average numbers of passengers carried by each vehicle type

Table 7.1.2 Passengers Per Vehicle Surveyed

Vehicle Type	No. of passengers
Car	2.1
Bus	23.1
Light Goods	2.4
Medium Goods	4.0
Heavy Goods	3.7
Motor Cycle	1.3
All Goods vehicles	3.6

Table 7.1.3 lists the journey purposes of cars interviewed in the survey. A higher proportion of car drivers than bus passengers are traveling to and from work, reflecting the greater participation in employment of car owners. The proportion of trips made for education was observed to be very low because the surveys were carried out during the school holidays.

Table 7.1.3 Journey Purpose of Car Drivers

Purpose	%
Work	57.2
Education	1.8
Shopping	5.4
Employers business	15.1
Personal business	15.7
Sport/leisure	2.0
Social	1.4
Other	1.4
Total	100.0

Reported frequencies of trip making are listed in Table 7.1.4. Almost two-third of respondents made the same trip 5 to 7 times per week, reflecting a similar proportion of trips made to and from work.

Table 7.1.4 Trip Frequencies

Frequency	%
5 to 7 times per week	63.6
3 to 4 times per week	7.6
1 to 2 times per week	14.7
Less than once per week	14.1
Total	100.0

Of the 1,889 car drivers interviewed, 1,405 (75.6%) reported that they had off street parking available at their homes.

At each location expansion factors were calculated, being the ratio between the number of interviewed vehicles and the corresponding traffic counts. These factors were then used to expand origin-destination pairs at the survey locations. These were then aggregated for input into the Origin-Destination (O-D) tables. O-D tables were prepared separately for cars and goods vehicles. The expansion factors are shown in Table 7.1.5

Table 7.1.5 Expansion Factors

Survey Location	Station Name	Expansion Factor - Cars	Expansion Factor - Goods
1.1	Matola Road	75.4	42.5
1.2	Machava Road	104.3	66.0
1.8	Catembe Ferry	1.2	70.5
2.1	Av. de Mozambique	85.0	93.7
2.3	Largo de Deta	45.6	36.0

Survey Location	Station Name	Expansion Factor - Cars	Expansion Factor - Goods
2.4	Av Accordos de Lusaka	19.5	69.3
2.6	Av Julius Nyerere	36.5	82.6
3.1	Av 24 de Julho	72.7	56.1
3.2	Av de Trabalho	33.5	74.3
3.3	Av. de Angola	50.0	68.0
3.4	Av Accordos de Lusaka	100.6	71.4
3.7	Av. Vladimir Lenine	66.7	42.8
3.8	Av. Julius Nyerere	72.4	84.9
3.9	Av de Marginal	50.4	93.4
4.9	Av Forces Popular Liberacao de Mozambique	45.6	69.3

7.2 JOURNEY TIMES

Individual stage times for each route are shown in Appendix 2. Total journey times for each of the six routes are shown graphically in Figures 7.2.1 to 7.2.6

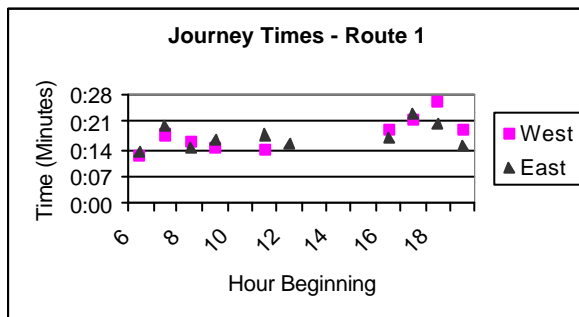


Figure 7.2.1

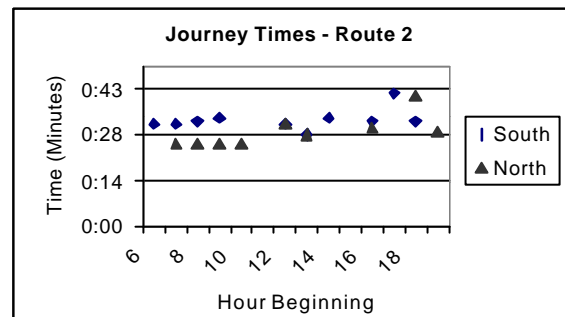


Figure 7.2.2

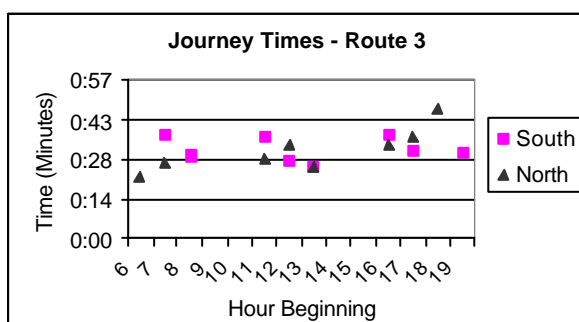


Figure 7.2.3

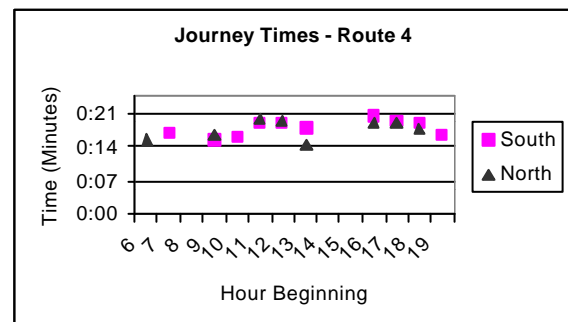


Figure 7.2.4

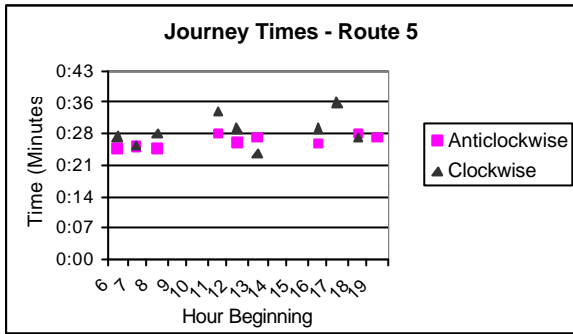


Figure 7.2.5

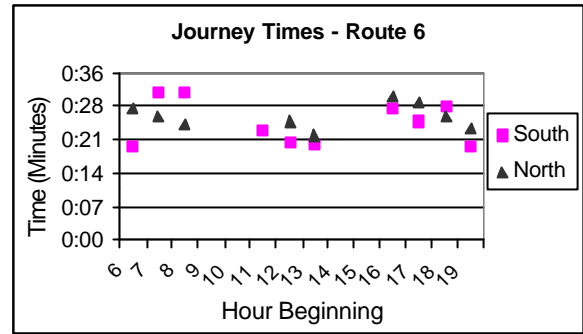


Figure 7.2.6

For most of the routes there is a general tendency for evening peak journey times to be higher than in the morning. Typically, inter peak times are lower than in the peak hours.

Using traffic count data from locations where journey time routes passed it is possible to make an estimate of average speeds in the city. Total vehicle-kilometres and vehicle hours (for private cars) were calculated for 19 survey points across the city, and for the five survey points within the city centre. The resulting average speeds are shown in Table 7.2.1.

Table 7.2.1 Average observed traffic speeds, km per hour, Maputo, 2000

Area	Morning Peak	Inter Peak	Evening Peak
City – wide	30.2	31.7	26.2
City Centre	22.9	20.9	21.7

The results in Table 7.2.1 confirm that traffic speeds are lowest in the city as a whole in the evening peak. Inter peak traffic speeds are slightly higher than those in the morning peak. However, for the city center the data show that traffic speeds are lowest during the inter-peak period, although the variation across the day is fairly small. This is a common phenomenon in city centres. Assuming that average speeds before the morning peak and after the evening peak are around 37 kph, the average speeds over the 16 hour day is estimated to be 31.3 km per hour.

7.3 TRAFFIC COUNTS

Results of traffic counts are given in detail in Appendix B. A summary of daily counts is shown in Table 7.3.1

Table 7.3.1 Results of Major Traffic Counts, 0500 to 2100 (16 hours)

Survey Point	Road	Location	Cars	Mini-Bus	Midi Bus	Big Bus	Light Goods	Medium Goods	Heavy Goods	Total	PCU's
1.1	Matola road	City Boundary	9,796	652	1,507	368	155	1,437	446	14,361	17,703
1.2	Nachava Road	City Boundary	7,511	1,481	1,125	213	150	1,160	405	12,045	15,204
1.3	Rua 5.579	Zona Verde	708	331	73	5	655	156	29	1,957	3,018
1.4	Marracuene Road	Zimpeto	1,712	912	799	377	1,559	789	213	6,361	10,017
1.5	Marracuene Road	Junction of Rua 5.780	397	686	243	0	647	293	55	2,321	3,800
1.6	Rua 4.755	Mahotas	244	2	2	0	683	83	4	1,018	1,805
1.7	Av da Marginal	Junction with Rua 4.680	273	182	22	0	281	37	3	798	1,227
1.8	Catembe Ferry		38	0	11	0	62	33	46	190	339
2.1	Av De Mozambique	Railway Line	7,824	2,434	3,042	467	1,183	988	266	16,204	21,661
2.2	Machava Road	Railway Line	9,223	709	674	75	418	1,152	316	12,567	15,220
2.3	Largo de Deta	Railway Line	4,927	768	239	101	80	632	79	6,826	8,187
2.4	Av Accordos do Lusaka	Railway Line	4,124	58	156	121	2,459	528	64	7,611	10,790
2.5	Rua 4.029	Railway Line	342	19	11	0	303	53	3	731	1,112
2.6	Av Julius Nyerere	Railway Line	4,237	4,672	811	788	2,684	1,062	135	14,389	21,483
2.7	Rua 4.680	Railway Line	91	0	0	0	205	38	2	336	586
3.1	Av 24 de Julho	Av Tanzania	12,285	842	1,683	622	231	705	110	16,478	19,118
3.2	Av de Trabalho	Av Tanzania	2,784	663	1,177	33	1,238	445	27	6,367	9,048
3.3	Av De Angola	Av Marien Ngoubai	8,800	2,640	550	86	417	729	78	13,300	16,186
3.4	Av Accordos do Lusaka	Av Marien Ngoubai	14,188	5,964	556	366	582	883	105	22,644	27,688
3.5	Av Milaga Mabote	Av Marien Ngoubai	715	12	13	0	283	49	6	1,078	1,435
3.6	Av Manhangelena	Av Marien Ngoubai	1,791	103	34	0	739	69	4	2,740	3,637
3.7	Av Vladimir Lenine	Av Mao Tse Tung	11,813	2,974	325	79	21	333	31	15,576	17,658
3.8	Av Julius Nyerere	North of Kwame Nkrumh	12,459	1,308	137	101	1,449	200	48	15,702	18,206
3.9	Av da Marginal	Club Navale	4,532	16	7	4	1,119	135	53	5,866	7,213
4.1	Av Julius Nyerere	Juntion of Rua 4.750	2,683	2,490	2,893	319	3,321	1,232	278	13,216	20,995
4.2	Av de Mozambique	Junction of Rua 5.500	2,283	2,528	634	336	2,103	694	80	8,658	13,342
4.3	Av Marien Ngoubai	West of Vladimir Lenine	6,723	1,854	169	70	1,593	322	65	10,796	13,863
4.4	Eduardo Mondlane	West of Vladimir Lenine	15,564	4,406	1,949	506	348	253	13	23,039	27,096
4.5	Av 24 de Julho	West of Vladimir Lenine	11,048	353	1,577	371	3,115	468	39	16,971	21,816
4.6	Rua da Radio	West of Vladimir Lenine	2,114	7	32	28	690	73	14	2,958	3,784
4.7	Av 25 de Setembro	West of Rua da Imprensa	13,560	345	311	193	266	510	105	15,290	16,613
4.8	Av Vladimir Lenine	Junction of Rua Soveste	8,180	4,490	370	78	1,044	230	30	7,642	18,221
4.9	Av FPLM	Junction of Rua Soveste	4,017	4,420	635	390	220	876	152	14,164	14,705
4.11	Maria Mutola		1,716	1,574	368	250	1,429	589	103	6,029	9,288
4.12	Av Kenneth Kaunda	Nandos	12,039	958	234	131	185	283	107	13,937	15,185
4.13	Machava Road	2M Brewery	2,984	802	914	120	46	832	230	5,928	7,976
Total			203,725	51,655	23,283	6,598	31,963	18,351	3,744	336,094	435,226

3 cordons or screenlines were defined as follows :

- External Cordon– around the city boundary
- Outer Screenline – following the railway
- Central Area Cordon – around the city center (outside Av Mao Tse Tung, Av Marien Ngoubai and Av de Tanzania)

Traffic counts across these cordons are shown in Table 7.3.2. Figure 7.3.1 shows the proportions of total traffic in the city crossing these lines.

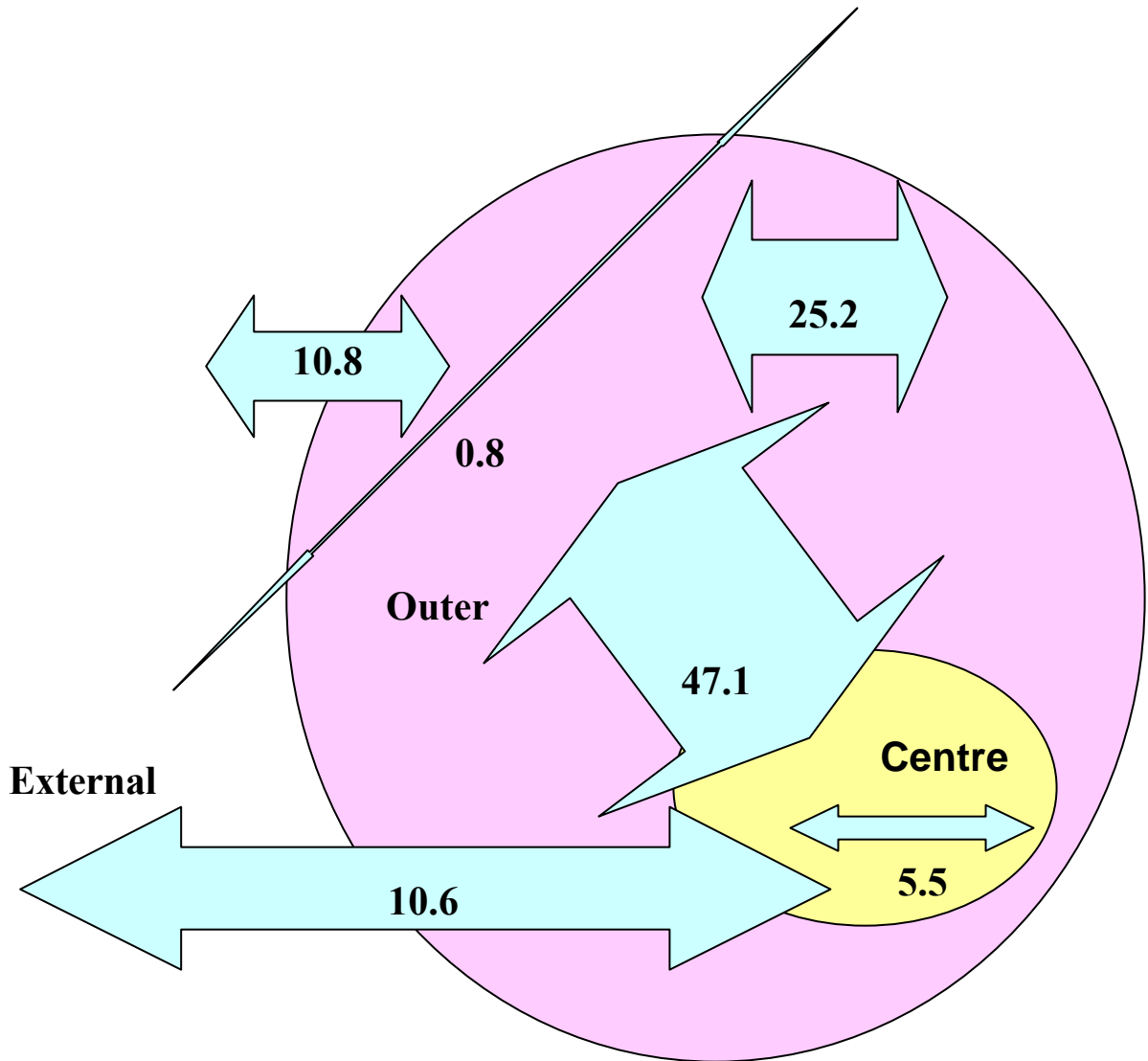


Figure 7.3.1 Percentages of Daily Traffic Crossing Screenlines

Table 7.3.2 Cordon Crossing Traffic Volumes, 0500 to 2100 Hours

Cordon	Total Vehicles	Total PCU's
External	39051	53115
Outer	58563	79039
Central	99751	120189

24 hour counts were carried out 4 sites : each direction on Av Eduardo Mondlane and Av Vladimir Lenine (locations 4.4 and 3.7). Resultant traffic volumes are shown in Table 7.3.3

Table 7.3.3 Results of 24 Hour Traffic Counts (total vehicles)

Site	Eduardo Mondlane westbound	Eduardo Mondlane eastbound	Vladimir Lenine northbound	Valdimir Lenine southbound	Total
24 hours	14075	15883	14915	14106	58979
16 hours	12908	14592	13623	13193	54136
12 hours	10794	11924	10763	11547	45028
Ration 24 to 16 hours	1.090	1.088	1.095	1.069	1.086
Ratio 16 to 12 hours	1.196	1.224	1.266	1.143	1.206

7.4 HOURLY TRAFFIC VARIATIONS

Figures 7.4.1 to 7.4.4 show the variation in traffic volumes in the central area over the day.

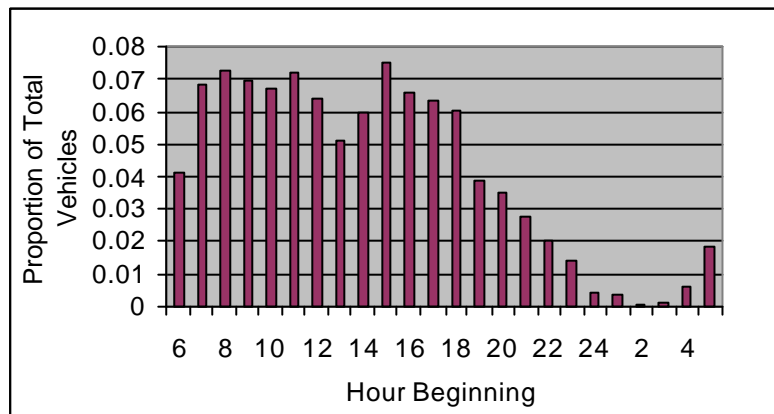


Figure 7.4.1 Hourly Variation in Total Traffic Volumes, Central Area of Maputo

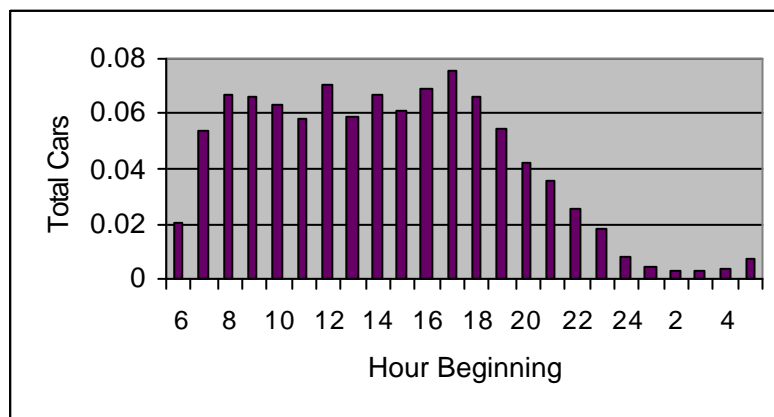
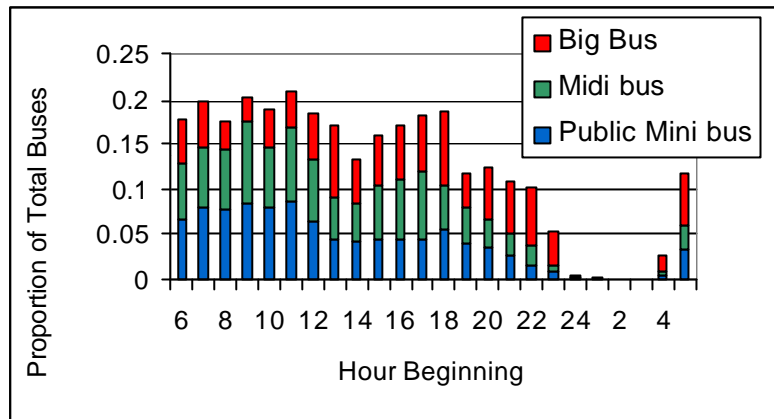


Figure 7.4.2 Hourly Variation in Private Car Traffic, Central Area of Maputo



Figur7.4.3 Hourly Variation in Bus Traffic, Central Area of Maputo

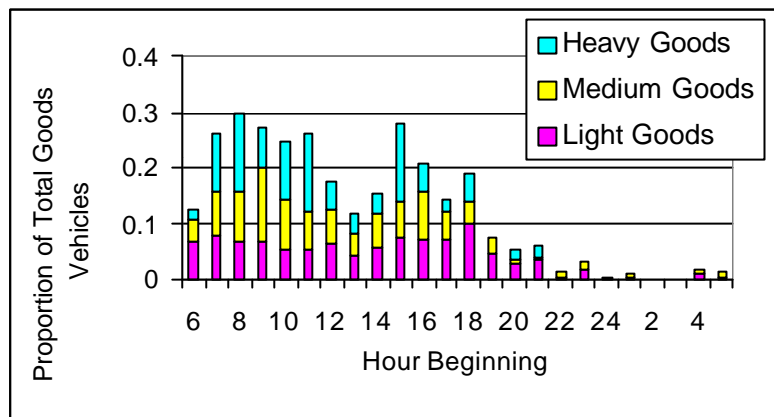


Figure 7.4.4 Hourly Variation in Goods Traffic, Central Area of Maputo

The peak hour for traffic movements in the central area was found to be 1500 to 1600 hours when around 7.5% of the daily movements take place. This peak hour also represents 8.2% of the 16 hour total traffic volume. However, the traffic profile between 0700 hours and 2000 hours is relatively flat with little variation. There is a drop in goods vehicle movements between 1200 and 1500 hours related to the tendency of many businesses to close for part of this time.

Figures 7.4.5 to 7.4.8 show the hourly variations in traffic outside the city centre. The data are taken from sites 4.1 and 4.2 (Av de Mozambique and Av Julius Nyerere, in the north of the city).

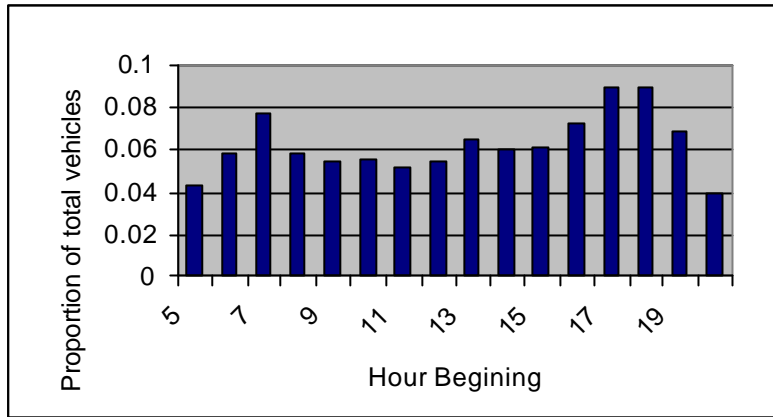


Figure 7.4.5 Hourly Variation in Total Traffic, Outer Area of Maputo

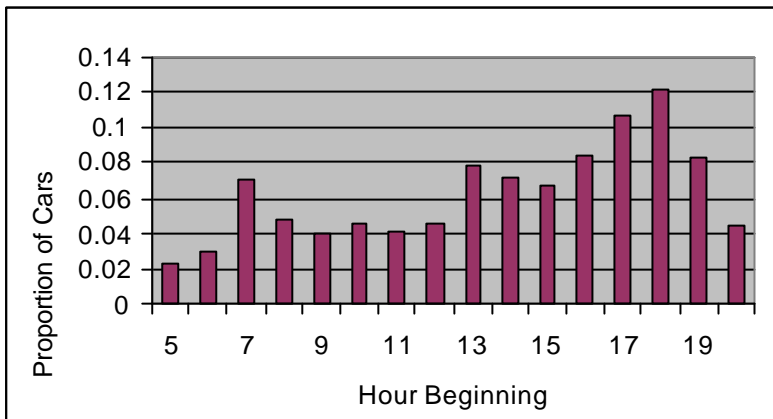


Figure 7.4.6 Hourly Variation in Car Traffic, Outer Area of Maputo

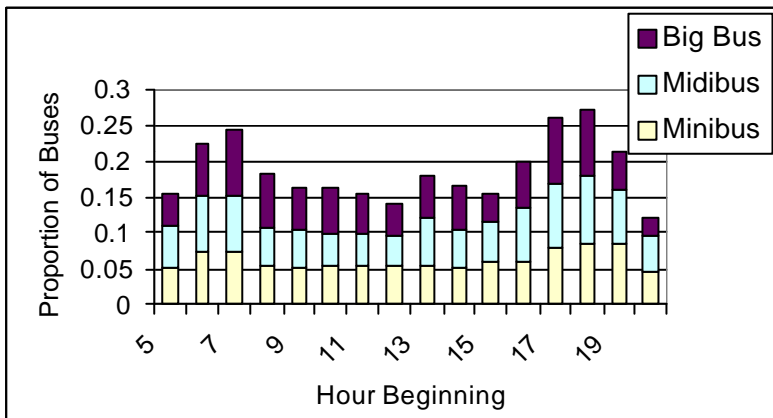


Figure 7.4.7 Hourly Variation in Bus Traffic, Outer Area of Maputo

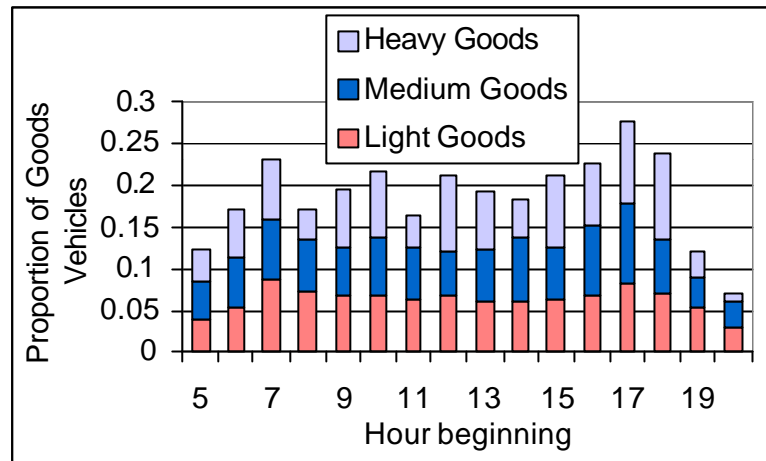


Figure 7.4.8 Hourly Variation in Goods Traffic, Outer Area of Maputo

Outside the central area the peak hour for traffic movements is 1700 to 1800 hours during which 9% of the 16 hour total takes place. The pattern in outer Maputo is more peaked than in the central area, with distinct morning and evening peaks. However car traffic is even more peaked than for other vehicles with the evening peak accounting for 12% of the 16 movements, compared to 7% for the morning peak.

Figure 7.4.9 shows the composition and variation in traffic crossing the External Cordon during the day. Again, the peak hour is observed to be 1700 to 1800 hours and the peak time is effectively two hours (1700 to 1900 hours). In contrast the morning peak lasts only one hour (0700 to 0800 hours).

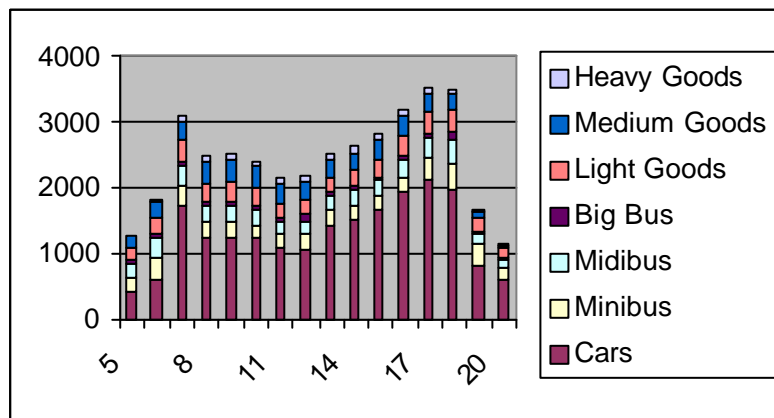


Figure 7.4.9 Variation and Composition of External Cordon Crossing Traffic, 0500 to 2100 hours

Figure 7.4.10 shows the distribution of traffic crossing the External Cordon. 71% of the traffic entering and leaving Maputo has origins or destinations in Machava, Matola or beyond. Thus there is a very strong east-west movement of traffic entering and leaving the city.

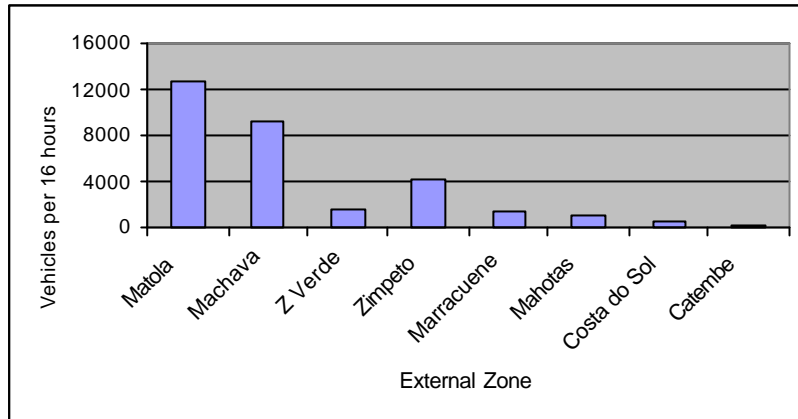


Figure 7.4.10 Car and Goods Traffic by External zone, 0500 to 2100 Hours

7.5 RESULTS OF TRAFFIC LIGHT SURVEYS

Where queues developed at traffic signals the saturation flows, or flows at capacity on each arm can be observed. These flows are the maxima that can be accommodated by each junction under current operations and signal timings and are later input to the traffic model. Saturation flows for each road are set out in Table 7.5.1. At some junctions flows did not reach capacity, and these are noted.

The majority of junctions in the city center operate at or close to capacity for some part of the day. The theoretical capacity of these junctions is severely reduced by :

- Opposing right turns
- Parked vehicles close to stop lines
- Uncontrolled stopping of Chapas

These problems can be resolved by improved traffic management and junction design, and this will release significant extra capacity without major infrastructure works.

Table 7.5.1 Saturation Flows at Signalled Intersections

Signal No.	Link	Junction with	Saturation Flow (vehicles per hour)
1	Av 24 de Julho	Av de Tanzania	1208
1	Av de Tanzania	Av 24 de Julho	608
4	Accordos de Lusaka	Marien Ngoubai	1032
4	Marien Ngoubai	Accordos do Lusaka	676
5	Av Karl Marx	Marien Mgoubai	616 *
5	Marien Ngoubai	Av Karl Marx	352 *
6	Vladimir Lenine	Marien Ngoubai	588 *
6	Marien Ngoubai	Vladimir Lenine	536 *
7	Eduardo Mondlane	Albert Lithuli	1412
7	Albert Lithuli	Eduardo Mondlane	808 *
8	Eduardo Mondlane	Guerra Populare	1024
8	Guera Populare	Eduardo Monlane	892
9	Eduardo Mondlane	Karl Marx	1456
9	Karl Marx	Eduardo Mondlane	1032
11	Eduardo Mondlane	Amilcar Cabral	1140 *
11	Amilcar Cabral	Eduardo Mondlane	856
13	Av 24 de Julho	Albert Lithuli	1404
13	Albert Lithuli	Av 24 de Julho	904
14	Av 24 de Julho	Guerra Populare	1220
14	Guerra Populare	Av 24 de Julho	968
15	Av 24 de Julho	Karl Marx	1308
15	Karl Marx	Av 24 de Julho	1356
16	Av 24 de Julho	Valdimir Lenine	1104
16	Valdimir Lenine	Av 24 de Julho	724
17	Av 24 de Julho	Amilcar Cabral	1268
17	Amilcar Cabral	Av 24 de Julho	756
18	Av 25 de Setembro	Guerra Popular	908
18	Guerra Poulare	Av 25 de Setembro	892
19	Karl Marx	Av 25 de Setembro	608 *
19	Av 25 de Setembro	Karl Marx	924
20	Vladimir Lenine	Av 25 de Setembro	924
20	Av 25 de Setembro	Valdimir Lenine	800
21	Samora Machel	Av 25 de Setembro	1076
21	Av 25 de Setembro	Samora Machel	648 *
22	Salvador Allende	Eduardo Mondlane	1188 **
22	Eduardo Mondlane	Salvador Allende	1184
24	Av de Angola	Rua da Machava	592
24	Rua da Machava	Av de Angola	632
25	Accordos do Lusaka	Rua da Machava	1048
25	Rua da Machava	Accordos do Lusaka	764

* Less than saturation flow, observed maximum

** Just below saturation flow

Of particular concern at present are the two signaled intersections on the Rua da Machava. These operate at capacity for long periods of the day, and this has exacerbated since the opening of the Portagem on the Matola Road which has caused traffic to divert to the Rua da Machava. It is anticipated that the dualling of Rua da Machava will significantly increase capacity at these junctions, and this should be a priority project.

It is of concern that most traffic signals in Maputo offer little protection to pedestrians. Typical two-stage junctions never operate with all-red phases and so pedestrians are always at risk from moving traffic. Even the recently installed traffic signals tend to offer a pedestrian green man coincident with turning vehicles. This creates immediate conflict. In the short term it is recommended that the green man flashes in order to indicate this, and in the longer term signals be re-timed to allow safer pedestrian facilities.

Table 7.5.2 shows the maximum queue lengths observed at congested junctions in the city.

Table 7.5.2 Maximum Queue Lengths at Congested Junctions

Approach	Junction	Direction	Time	Queue (Vehicles)
Av 24 de Julho	Av de Tanzania	Westbound	14:17	20
Eduardo Mondlane	Amilcar Cabral	Westbound	17:30	23
Av 24 de Julho	Albert Lithuli	Northbound	17:33	32
Guerra Populare	Av 24 de Julho	Southbound	7:27	23
Karl Marx	Av 24 de Julho	Southbound	18:30	24
Av 24 de Julho	Vladimir Lenine	Eastbound	12:20	32
Av 24 de Julho	Amilcar Cabral	Eastbound	9:17	18
Av 25 de Setembro	Guerra Populare	Eastbound	16:19	23
Av 25 de Setembro	Karl Marx	Eastbound	12:24	17
Vladimir Lenine	Av 25 de Setembro	Southbound	9:20	16
Av 25 de Setembro	Samora Machel	Eastbound	17:46	15
Eduardo Mondlane	Salvador Allende	Eastbound	10:27	16
Av de Trabalho	Av de Tanzania	Westbound	17:21	11
Rua da Machava	Accordos do Lusaka	Eastbound	8:08	26
Rua da Machava	Av de Angola	Eastbound	9:24	25
Accrodos do Lusaka	Marien Ngoubai	Southbound	17:28	22
Eduardo Mondlane	Karl Marx	Eastbound	13:49	18
Vladimir Lenine	Mao Tse Tung	Southbound	12:19	18
Eduardo Mondlane	Albert Lithuli	Eastbound	8:19	19
duardo Mondlane	Guerra Populare	Westbound	17:29	32

Figure 7.5.1 shows approximate queue lengths at the most congested junctions in Maputo.

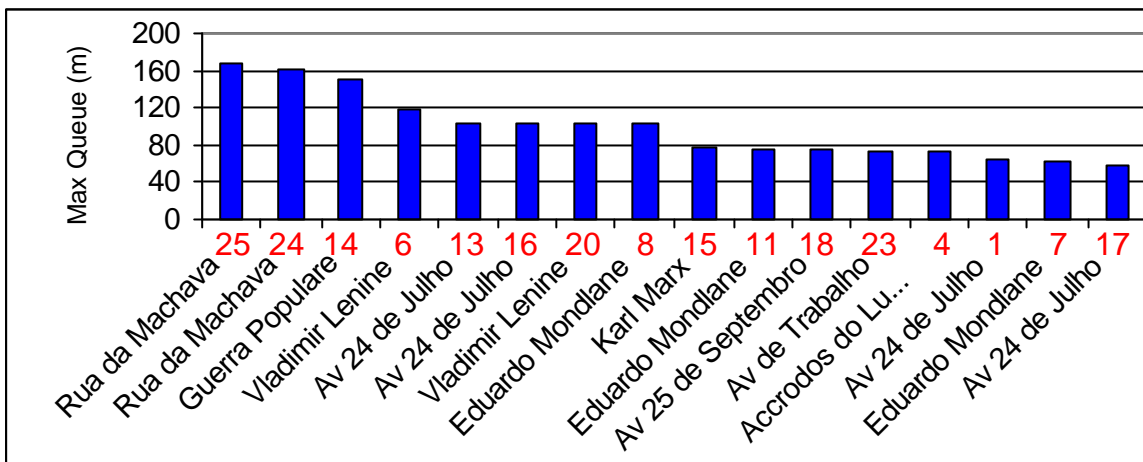


Figure 7.5.1 Maximum Queue Lengths at Congested Junctions

The longest queues were observed on Rua da Machava at its two signaled intersections. Queues tend to be of similar lengths due to the similarities in junction layouts, timings and traffic demand. However, the above queues are short enough in all cases to not cause blocking back at up-stream junctions.

7.6 RESULTS OF BUS OCCUPANCY SURVEYS

The bus passenger occupancy surveys observed 28,125 vehicles at 34 sites, carrying a total of 554,000 passengers. The proportions of vehicles and passengers carried by vehicle types are shown in Figures 7.6.1.

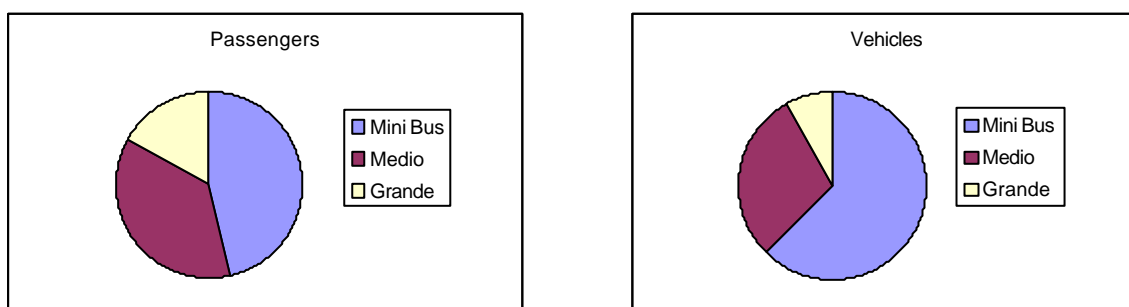


Figure 7.6.1 Surveyed Passengers and Vehicles by Vehicle Type

Around 63% of buses in Maputo are the minibuses, usually with 16 seats but often seen to carry many more than 16 passengers. However, such vehicles account for less than half (46%) of all passengers carried. In contrast the large bus fleet operated by TPM comprises 8% of the total fleet, but carries 17% of all passengers. Average bus occupancies are set out

in Table 7.6.1.

Table 7.6.1 Average Bus Occupancies, Passengers per Vehicle

	Minibus	Midibus	Big Bus
External Cordon	16.4	34.3	62.5
Central Area Cordon	14.7	26.3	32.0
Within CBD	18.0	16.9	28.5
All Buses Surveyed	14.5	25.0	41.1

Table 7.6.2 Average Bus Occupancies, % of Capacity

	% of seated capacity	% absolute capacity
Minibus	97	73
Midibus	88	54
Big Bus	95	50

Minibuses are very highly loaded often to uncomfortable conditions. Although frequencies are high this does not necessarily benefit passengers who are commonly seen to wait as full buses pass by. The minibus network does, however, penetrate residential areas where streets are narrow and pavement conditions poor.

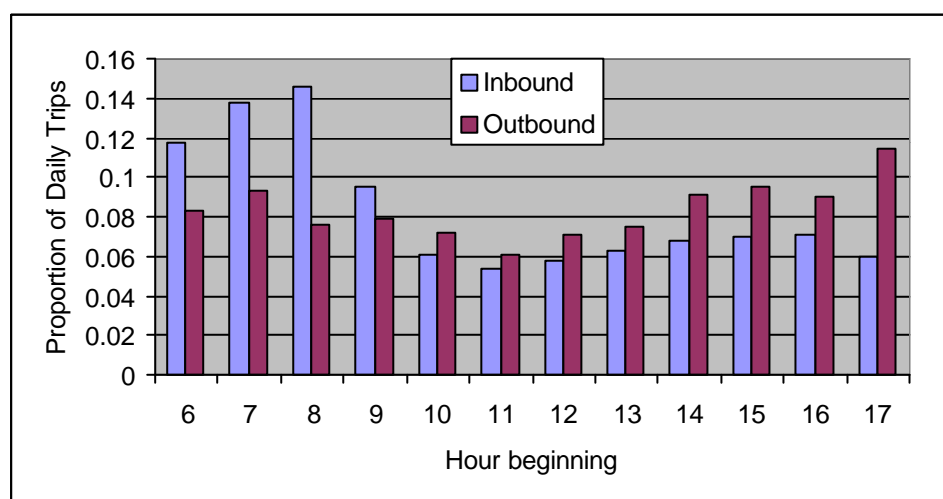


Figure 7.6.2 Hourly Variations of Bus Passengers across External Cordon

Figure 7.6.2 shows the hourly variations of bus passengers crossing the External Cordon. For passengers entering Maputo the peak occurs in the morning with 39% of daily inbound passengers entering between 0600 and 0900. For outbound passengers the evening peak is less marked with the peak hour accounting for 11% of the daily movement, compared to 14.5% for inbound passenger in the morning.

Daily bus passenger movements on major links in the city are shown in Figure 7.7.1. Table 7.6.3 lists 16-hour bus passenger volumes and Table 7.6.4 shows the observed modal splits across cordon lines

Table 7.6.3 Daily (0500 to 2100) Bus passengers on selected links

Road	Daily Bus Passengers
Matola road	94499
Nachava Road	72011
Marracuene Road	67977
Marracuene Road	13800
Av 24 de Julho, at Av de Tanzania	106595
Av de Trabalho, at Av de Tanzania	40941
Av De Angola, at Marien Ngoubai	41775
Av Accordos do Lusaka, at Marien Ngoubai	131669
Av Vladimir Lenine, at Mao Tse Tung	37400
Av Julius Nyerere, at Mao Tse Tung	24745
Av Julius Nyerere, north of Praca dos Combatentes	114494
Av de Mozambique at Inhagoia	54747
Av Marien Ngoubai, at Vladimir Lenine	31558
Eduardo Mondlane, at Vladimir Lenine	169071
Av 24 de Julho at Vladimir Lenine	17270
Av 25 de Setembro	23028
Av Vladimir Lenine, south of Praca dos Combatentes	63166
Av FPLM, at Cruz Vermelha	98821

Table 7.6.4 Modal Shares, % of daily passengers (0500 to 2100 hours)

	Share by Car	Share by Bus
External Cordon	14.1	85.9
Central Cordon	25.5	74.5

7.7 BUS PASSENGER INTERVIEWS

Journey purposes of bus passengers are shown in Table 7.7.1

Table 7.7.1 Journey Purpose of Bus Passengers

Purpose	%
Work	34.3
Education	6.5
Shopping	17.3
Employers business	2.1
Personal business	21.5
Sport/leisure	5.8
Social	8.0
Other	4.6
Total	100.0

As noted earlier, a much lower proportion of bus passenger compared to car drivers were going to/from work, or using transport for their employers' business. However a higher proportion of bus passengers were shopping.

Figure 7.7.1 shows the proportions of passengers at each location waiting to board a *Chapa*, as opposed to the larger buses (*Machimbombo*). There is a lower tendency for use of Chaps in the city centre (Eduardo Mondlane and Rua dos Lusladas), compared to outside (Junta and Praca dos Combatentes).

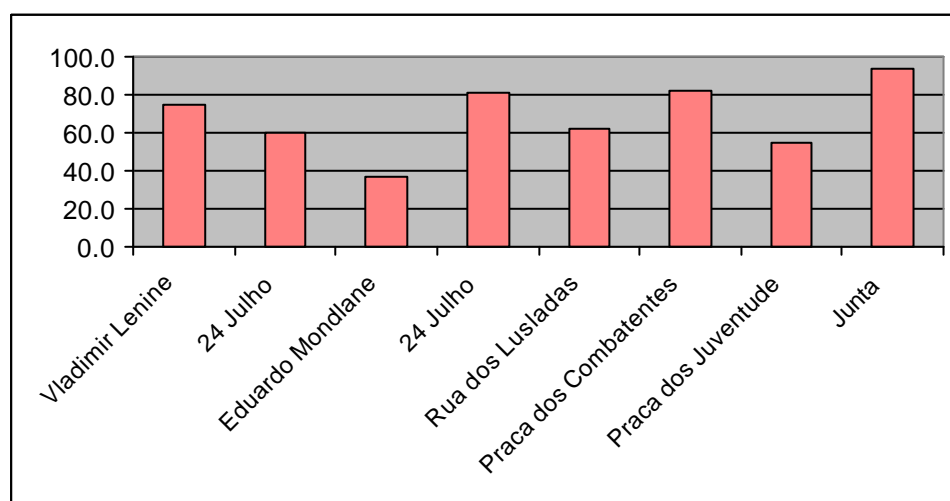


Figure 7.7.1 Proportions of Bus Passengers Waiting for Chapa

Table 7.7.2 shows the numbers of interviewed passengers who expected to use 2 or more buses to complete their journeys. Nearly 40% of passengers used 2 or more buses. The

highest proportion of interchanging passengers (83%) was found at Junta, where buses leave for destinations out of Maputo, and the lowest at Rua dos Luslades (6%), which is a terminal (Museo) for a large number of routes.

Table 7.7.2 Numbers of Buses Used per Journey

Number of Buses	Passengers	%
1	1371	60.6
2	829	36.6
3	64	2.8

The average fare paid per passenger (excluding long distance trips) was 3,900 Mts.

7.8 CAR DRIVER INTERVIEWS

Car drivers at 5 locations were asked how much they pay for parking. Table 7.8.1 lists the results. The costs quoted include security and other informal payments.

Table 7.8.1 Average Parking Fees at Selected Locations

Location	Interviewed Drivers	Average Parking Fee (per day) Mts
Mercado Centrale	273	4662
Interfrace, Av 25 de Julho	194	2786
Av Mao Tse Tung (Nando's)	89	3326
Praca 25 de Junho	155	6668
Lago de Deta, Aeroports	224	10473
Total	935	5780

7.9 EFFECT OF THE MATLA ROAD PORTAGEM

After the surveys were carried out, tolls were introduced on the newly improved Matola Road. In order to assess the effect of this both the Matola Road and Machava Road were re-surveyed in February 2001. Total traffic volumes on the two roads were less than 2% different between the two surveys. There were significant variations in the shares of traffic on the two roads, as shown in Table 7.9.1.

Table 7.9.1 Shares of Traffic Using Matola Road before and after Opening of Portagem

Vehicle Type	% before	% after
Car	56.6	57.9
Minibus	30.6	24.0
Midibus	57.3	40.7
Large Bus	63.3	59.6
Light Goods	50.8	55.2
Medium Goods	55.3	19.9
Heavy Goods	52.4	29.2
Total	54.4	48.9

The effect of the toll on private cars (7,500 Mts, or US\$ 0.42) was negligible. In fact the share on the Matola Road may have increased slightly because of the reduction in congestion caused by the completion of the roadworks. However, there was significant effect on small and medium buses (Chapas), many of whom appeared to have re-routed to avoid the toll (25,000 Mts, or US\$ 1.39). The effect on medium and heavy goods vehicles was even more startling. Around 900 medium goods and 200 heavy goods vehicles appeared to divert to avoid the toll. The toll is 25,000 Mts for medium goods and for heavy goods.

7.10 AXLE LOADS

Table 7.10.1 and Table 7.10.2 list the average and maximum loads carried by goods vehicles surveyed in December 2000.

Table 7.10.1 Loads Carried by Goods Vehicles Unit: tonnes

Vehicle Type	Average Load	Maximum Load
Light Goods	2.0	6.0
Medium Goods	2.9	12.5
Heavy Goods	9.2	26.0

Table 7.10.2 Axle Loads of Goods Vehicles Unit: tonnes

Vehicle Type	Average Axle Load	Maximum Axle Load
Light Goods	1.5	3.5
Medium Goods	2.95	7.8
Heavy Goods	4.7	7.8

CHAPTER 8
*ESTABLISHMENT OF
SOCIO-ECONOMIC FRAMEWORK*

CHAPTER 8 : ESTABLISHMENT OF SOCIO-ECONOMIC FRAMEWORK

8.1 THE PRESENT CONDITION

8.1.1 Population Trend

1) Total Population

The census of Mozambique is carried out in 1980 years and 1997. Although the vital statistics is announced by National Institute of Statistic every year, those data should be used on the basis of this, because the reliability of census result is highest.

According to the census, the population of Maputo city was 550,000 people in 1980, but the one increased to 967,000 people in 1997. The rate of increase exceeds largely the 1.84% of population rates of increase of 3.37%, which is the average rate of whole country per year as shown in Table 8.1.1.

Table 8.1.1 Population Growth in Maputo , Matola and Mozambique

	1980 in thousand	1997 in thousand	1980-1997 Per annum %
Maputo City	550	967	3.37
Matola City	206	425	4.35
Mozambique	12,130	16,534	1.84

Source : 1980 - Structural Plan of the Maputo Metropolitan Area Vol.
1997 – 2nd General Census of Population and Habitation 1997

2) Population in terms of the area

As for the increase in population of Maputo city, the one of District No.4 and No.3, No.5 is the high growth rate to District No.1. This reason is obviously the trend of suburbs-ization of population.

Besides, the average population rate of increase of Matola city is exceeding Maputo city average and city area expansion is going on in Matola city area as shown in table 8.2.2.

Table 8.1.2 Population distribution in Maputo and Matola

	1980	1997	1980-1997 Per annum %
Maputo City	550,000	966,837	3.50
District 1	134,000	154,284	0.83
Center	117,000	133,759	0.79
Catembe	13,000	15,853	1.17
Inaka	4,000	4,672	0.92
District 2	118,000	162,750	1.91
District 3	110,000	210,551	3.89
District 4	78,000	228,244	6.52
District 5	109,000	211,008	3.96
Matola City	206,000	424,662	4.35
District 1	76,000	175,873	5.06
District 2	65,000	116,716	3.50
District 3	64,000	132,073	4.35

Source : 1980 - Structural Plan of the Maputo Metropolitan Area Vol.

1997 – 2nd General Census of Population and Habitation 1997

3) Employment population

According to the census in 1997, the employment population of Maputo city is 29,000 people and the employment rate is 31.1% as shown in Table 8.1.3. The employment rate of the city area is lowering a little bit in comparison with farm village area in Maputo Province. As for the constitution in terms of the sector of employment population, the commerce is biggest with 35.9%, the next one is administration relation as shown in Table 8.1.4.

Table 8.1.3 Employment Proportion in 1997

	Maputo City	Maputo Urban	Province Rural
Population	966,837	505,858	300,321
Employment	300,959	145,634	128,526
Employment Proportion	31.1%	28.8%	42.8%

Source : 2nd General Census of Population and Habitation 1997

Table 8.1.4 Employment by Sectors in Maputo City

	Employment	Proportion %
Total	300,959	100.0
Agriculture, Fishery	28,985	9.6
Mining	6042	2.0
Industry	29,527	9.8
Energy	2,426	0.8
Construction	18,538	6.2
Transportation , Communication	21,371	7.1
Commerce	108,123	35.9
Service Administration.	38,748	12.9
Others	36,607	12.2
Unknown	10,592	3.5

Source : 2nd General Census of Population and Habitation 1997

8.1.2 City Planning

1) City Planning System in Maputo City

The land law of Mozambique claims that land ownership should be belonged to nation (the government), and rights transferred to citizens should be limited to the right merely to utilize the land. Regulations for land use control based on the city planning are also included in the land law.

Since the vested right which is admitted in the land law after 10 years of utilization hinders public interest, urban land law for urban areas is still just under consideration of the diet, not carried out yet.

2) Master Plan in Maputo City

City planning in Maputo consists a general plan and a detailed plan. The general plan is overall plan for the land use and infrastructure, such as trunk roads and parks. Precise plans for the land use and infrastructure in neighborhood areas are described in the detailed plan to the extent of access roads to each residence.

Although the urbanization in Maputo city has been proceeding along with the city planning, many areas which the city planning does not cover have been developed. The city planner calls them as “spontaneously occupied areas”, and is amounted to a half of residential area of Maputo city. In contrast to the plannd areas where roads to each residence are well provided, in spotaneously occupied areas roads are narrow and road network is not sufficciently formed.

Current city planning in Maputo city is based on the Master plan established in 1969. As the

master plan did not suite the circumstances so far, master plan was revised in 1985, but not authorized by the government. Structural Plan formed by World Bank in 1998-1999 is expected to be authorized as the next master plan.

8.1.3 Land Use

Land use pattern in Maputo City is characterized by C.B.D. that covers the former urban area , and urban area expanding towards the north and the west as shown in Table 8.1.5.

C.B.D. extends its area to 4 km from the east to the west, and 3 km from the north to the south. Major commercial and administrative centers are concentrated in C.B.D.

Commercial centers except for C.B.D. are located along the arterial roads and around the intersection of the arterial roads. Among these centers, Praça Combantentes and G.Dimitrov are majour commercial centers.

Lands for economic activities such as manufactures, transportations and constructions are located in the area along the Maput port, P.F.L.M., the area along with the road to airport, and the areas along with E.N.1.

Other areas are utilized as the residential areas with small commercial plots for residents.

Table 8.1.5 Present Land Use

	Urban	Suburban	Spontaneous	Public	Garden	Green/ Vacant	Total
Area ha	762.3	2,416.4	2,201.7	812.7	52.2	767.1	7,014.1
Proportion %	10.9	34.5	31.4	11.6	0.7	10.9	100.0

Source: ENDEREÇAMENTO, Excluded Catembe , Inaka

Population density in urban districts varies from 151 per./ha in C.B.D. to more than 200 per./ha in district 2 and district 3 which are adjacent to C.B.D., and to 130 per./ha in district 4 and district 5 which are located in the outskirts of the city. Re-markably, density in some spontaneously occupied areas adjacent to C.B.D. reaches to more than 350 per./ha as shown in Table 8.1.6.

Table 8.1.6 Present Population Density in Maputo City

	Residential Area ha	Population	Density Person/ha
Maputo City	6,244	946,312	151.5
District 1 *	1,133	133,759	118.0
District 2	687	162,750	236.9
District 3	1,043	210,551	201.8
District 4	1,811	228,244	126.0
District 5	1,570	211,008	134.4

Source: Population-General Census of Population and Habitation 1997

Residential Area-ENDEREÇAMENTO

*: Excluding Catembe, Inaka

8.1.4 Bus Services

1) Public Transportation

The detail of the public transportation system is described in the Chapter 4.8.

Types and numbers of buses owned by T.P.M. are shown in Table 8.1.7. At present, T.P.M. has 145 buses but only 60 buses are operated.

Table 8.1.7 Type and Number of Buses by TPM

Type	Capacity	Number
Man	110	20
Mercedes 317	83	15
Mercedes 1724	90	34
Avm Daf	101	35
Iveco	75	41
Total		145

Source: T.P.M.

Origins and destinations for the bus routes are shown in Table 8.1.8.

Table 8.1.8 Bus Routes Operated by TPM

No.	Origin	Destination	Distance km
1	PÇA TRABALHADORES DOS	MAGOANINE(via polana)	16.0
2	PÇA TRABALHADORES DOS	MAGOANINE	16.0
3	PÇA TRABALHADORES DOS	COSTA DO SOLO	14.0
4	MUSEU	AEROPORT	8.3
5	MUSEU	MAHOTAS	16.0
6	MUSEU	HULENE	13.0
7	PÇA 25 DE JUNHO	PÇA DOS TRABAL	12.0
8	PÇA TRABALHADORES DOS	PÇA DOS COMBATENTES	9.0
9	MUSEU	ESTADIO DA MACHABA	13.0
10	MUSEU	ZIMPETO(via jardin)	22.0
11	PÇADOS TRABALHADORES	ZIMPETO(via hulene)	21.0
12	ALTO-MAE	GEORGE DIMITROV	10.0
13	MUSEU	MALHAZINE(via jardin)	17.5
14	MUSEU	MALHAZINE(via hulene)	17.5
15	PÇADOS TRABALHADORES	MALHAZINE(via jardin)	16.5
16	PÇADOS TRABALHADORES	MALHAZINE(via hulene)	16.5
17	MUSEU	ZIMPETO(via jardin)	22.0
18	MUSEU	FOMENTO	16.5
19	PÇADOS TRABALHADORES	ZIMPETO(via jardin)	21.0
20	PÇADOS TRABALHADORES	MAHOTAS	17.0
21	ANJO VOADOR	CINEMA 700	16.5
22	PÇADOS TRABALHADORES	CIDADE DA MATOLA	21.0
23	PÇADOS TRABALHADORES	BIRRO DA LIBERDADE	16.0
24	PÇADOS TRABALHADORES	MACHABA SOCIMOL	18.0
25	PÇADOS TRABALHADORES	PATRICE LUMUMBA	16.0
26	ANJO VOADOR	TEXLOM	22.0
27	MUSEU	TEXLOM	23.0
28	MUSEU	BIRRO DA LIBERDADE	17.0
29	ANJO VOADOR	FMENTO	15.0
30	MUSEU	CDADE DA MATOLA	22.0
31	MUSEU	MACHAVA SOCIMOL	19.0
32	MUSEU	PATRICE LUMUMBA	17.0
33	MUSEU	CNEMA 700	16.5
Total Operating Distance			553.8

Besides these licensed minibus services as shown in the Table 8.1.9, number of unlicensed (illegal) minibuses are operated in Maputo, which occupy 15-20% of total minibuses. Bus fare is fixed at 3,000Mts. irrespective of distance.

Table 8.1.9 No. of Collective Transportation for each Routes

Route	Origin	Destination	No. of Licenses
A	ANJO VOADOR	MALHAZINE	31
B	MUSEU	MALHAZINE	178
C	ANJO VOADOR	ALBASINI	108
D	ANJO VOADOR	HULENE	122
E	ANJO VOADOR	PLACA DOS COMBANTES	179
F	XIPAMANINE	LIBERDADE	34
G	MUSEU	INFULENE	2
H	MUSEU	HULENE	56
I	ANJO VOADOR	CIDADE MATOLA	4
J	ANJO VOADOR	25.DE JUNHO	4
L	ANJO VOADOR	T-3	1
M	MUSEU	BAIRRO JARDIN	48
N	ANJO VOADOR	MACHABA SOCIMOL	17
O	MUSEU	XIPAMANINE	148
P	ANJO VOADOR	XIPAMANINE	151
Q	MUSEU	CIDADE DA MATOLA	43
R	MUSEU	ALBASINI	46
K	MUSEU	CINEMA 700	52
S	ANJO VOADOR	CINEMA 700	4
T	MUSEU	PATRICE LUMUMBA	105
U	PRACA DOS COMBATENTES	XIPAMANINE	148
V	BENFICA	T-3	1
W	PRACA DOS COMBATENTES	BENEFICA	167
X	ANJO VOADOR	MERC. COMPONE	80
Y	BENEFICA	XIPAMANINE	150
Z	BARRO DO JARDIM	PATRICE LUMUMBA	0
AA	DRIVE IN KM 14	XIPAMANINE	49
BB	MACHAVA SOCIMOL	XIPAMANINE	7
CC	HULENE	XIPAMANINE	130
DD	JARDIM	MAVHAVA SOCIMOL	2
EE	MUSEU	JARDIM	40
FF	ANJO VOADOR	JARDIM	10
GG	ANJO VOADOR	COSTA DO SOL	107
HH	ANJO VOADOR	MALHAZINE	48
II	ANJO VOADOR	BENFICA	22
JJ	ANJO VOADOR	PATRICE LUMUMBA	0
LL	MUSEU	BENFICA	369
MM	MUSEU	LIBERDADE	47
NN	MUSEU	MUSEU	1
OO	MUSEU	MACHAVA SOCIMOL	1
PP	ANJO VOADOR	ZIMPETO	4

Route	Origin	Destination	No. of Licenses
KK	MUSEU	AEROPORTE MAVALANE	1
QQ	COSTA DO SOL	BAIRRO JARDIM	1
SS	MUSEU	ZIMPETO	2
Total			2,720

As of 20 Dec. 2000

2) Problems and Issues

- Effects for Road Traffic

It is evident that the concentration of buses along the arterial roads is one of the reasons of heavy traffic congestion. During peak hours, buses stop parallel along the roadside and blockage the traffic flow.

Waiting passengers overflowing from pedestrian way causes traffic jam and accidents.

- Services for Passengers

Due to the unbalance between insufficient supply and growing demand, buses are loading dangerously overcrowding number of passengers, and it sometimes causes fall-accidents.

Passengers cannot easily identify destination and bus route for each bus because of the poor information system.

Passengers are in danger of becoming victim of accident by concentrating buses at bus stops.

Bus service cannot meet the demand of passengers in many wards due to the lack of appropriate road maintenance and condition for bus operation.

- Bus Enterprise

Bus companies in general are not capable to afford to invest in their facilities due to the fact that they are small scale.

To improve financial condition of bus companies, introduction of subsidy system and reappraisal of present fare system should be taken into consideration.

It is essential to clarify the roles of both public and private sectors and to elaborate appropriate financial systems for each sectors.

8.2 FUTURE SOCIO-ECONOMIC FRAMEWORK

8.2.1 Future Population

1) Future Population in Maputo Metropolitan Area

In this study, population estimation in 2010 follows the estimation of 2,416,000 by Maputo Metropolitan Area Structural Plan. Population increase from 2010 to 2020 is estimated by an increase rate of 3.7 % per annum which Maputo Metropolitan Area Structural Plan indicates in its lower increase case, on the assumption that the inflow into metropolitan area will be restrained as shown in table 8.2.1.

Table 8.2.1 Population Forecast in Maputo Metropolitan Area

	Population 2000	Population 2010	2000-2010 per annum	Population 2010	2010-2020 per annum
Maputo Metropolitan Area	1,632,000	2,416,000	4.00%	3,470,000	3.7%

2) Population Distribution in Maputo Metropolitan Area

The estimation of population of each city in Maputo Metropolitan Area in 2010 follows the estimation by Structural Plan as shown Table 8.2.2.

Table 8.2.2 Future Population Forecast in 2010 by “Structural Plan”

	Population 2000	Population 2010	Growth Per annum %	Proportion
Maputo	1,090,000	1,366,000	2.28	56.5%
Matola	473,000	955,000	7.28	39.5%
Province	70,000	97,000	3.32	4.0%
Total	1,632,000	2,416,000	4.00	100.0%

“Province” consists Boane and Marracuene

Population after 2010 in Maputo and Matola is surmised to increase equally on the ground that urbanization in both cities will form a single circular expansion with C.B.D. as its core in 2010. Thus populations in 2020 are estimated by the same increase rate for both cities Table 8.2.3.

Table 8.2.3 Future Population Forecast in 2020

	Population 2000	Population 2010	Population 2020	2010-2020 Growth Per annum %
Maputo	1,090,000	1,366,000	1.960.000	3.7
Matola	473,000	955,000	1.370.000	3.7
Province	70,000	97,000	140.000	3.7
Total	1,632,000	2,416,000	3.470.000	3.7

“Province” consists Boane and Marracuene

3) Population Distribution by Ward

<Population in 2010>

Population increase in Catembe, one of the region in Maputo city area, is estimated at 2.0 % per annum by considering the effect by the population explosion in the city center. Population increase in Inaka, another region in Maputo city area, is estimated at 0.9 % per annum according to its past trend.

Population distribution by each ward in 2010 is estimated by following the estimation by Structural Plan.

<Population in 2020>

Structural Plan considers the appropriate population density for each residential area and assigns density 2010 as follows.

Existing residential area

Area 0 – 5 km from C.B.D.: 40 – 60 households/ha

Area 5 – 7 km from C.B.D.: 20 – 40 households/ha

Area over 7 km from C.B.D.: 10 – 20 households/ha

New developed area

Area 0 – 5 km from C.B.D.: 40 – 60 households/ha

Area 5 – 10 km from C.B.D.: 40 households/ha

Area over 10 km from C.B.D.: 10 – 20 households/ha

Population density in 2020 is assigned as follows based on the concept for efficient land utilization.

Area 0 – 5 km from C.B.D.: 50 – 60 households/ha (excluding C.B.D.)

Area 5 – 10 km from C.B.D.: 40 – 50 households/ha

Area over 10 km from C.B.D.: 35 households/ha

Result of population distribution in district and ward are shown in Table 8.2.4.

**Table 8.2.4 Population Distribution in Maputo and Matola by District
in 2010 and 2020**

	1997	2010	2020	1997-2010 Per annum %	2010-2020 Per annum %
Maputo City	966,837	1,366,000	196,000	2.69	3.68
District 1	154,284	200,800	209,300	2.05	0.42
Center	133,759	174,800	178,300	2.08	0.20
Catembe	15,853	21,000	26,000	2.00	2.00
Inaka	4,672	5,000	5,000	0.90	0.90
District 2	162,750	145,200	176,100	-0.87	1.95
District 3	210,551	193,500	216,700	-0.65	1.14
District 4	228,244	381,100	594,500	4.02	4.55
District 5	211,008	445,400	763,400	5.92	5.54
Matola City	424,662	955,000	1,370,000	6.43	3.67
District 1	175,873	318,400	450,300	4.67	3.53
District 2	116,716	353,200	543,300	8.89	4.40
District 3	132,073	283,400	376,400	6.05	2.88

8.2.2 Future Employment

1) Future Employment in Maputo and Matola

It is assumed that present employment proportion in the Metropolitan area will be stable in future due to the proper balance between demand and supply. The demand is boosted by economic growth and the supply is increased by population inflow. Future employment proportion in Maputo city and Matola city is estimated at 31 % and 29 % respectively by following the present proportion by Census in 1997. Results of estimation of future employment based on the residence in Maputo and Matola are shown in Table 8.2.5.

Table 8.2.5 Employment Forecast by Residential Area

		Maputo City	Matola City	Total
1997	Population	966,837	424,662	1,412,024
	Employment	300,959	* 123,700	424,700
2010	Population	1,366,000	955,000	2,321,000
	Employment	423,000	277,000	700,000
2020	Population	1,960,000	1,370,000	3,330,000
	Employment	608,000	397,000	1,005,000
	Employment Proportion	31%	29%	30%

: Estimated by the Employment Proportion of 29% of Maputo Province.

2) Employment Distribution by Ward

<Present Employment Distribution by Ward>

In Mozambique, reliable figures for employment volume at working places are not available in either Census or other statistics. Due to this, analysis was conducted with the result of OD survey implemented by the Study Team. Employment volume at working places is estimated by adding the inflow and outflow of working persons to the employment at the residence (day-time).

<Future Employment Distribution by Ward>

Employment distribution at working places is estimated based on the land use plan proposed by Structural Plan which includes commercial centers and industry areas as the lands for economic activities. Employment increase is estimated considering the following aspects.

Increase in planned commercial center

Increase in planned industry area

Increase in C.B.D.

Increase in residential area

Results of employment distribution in district and ward are shown in Table 8.2.6.

Table 8.2.6 Employment distribution in Maputo and Matola in 2010 and 2020

	1997	2010	2020	1997-2010 Per annum %	2010-2020 Per annum %
Maputo City	300,960	428,800	570,300	2.76	2.89
District 1	170,320	223,000	281,100	2.09	2.34
Center	163,950	214,900	271,400	2.10	2.36
Catembe	4,920	6,500	8,100	2.17	2.23
Inaka	1,450	1,600	1,600	0.76	0.00
District 2	44,870	50,600	56,800	0.93	1.16
District 3	36,230	41,300	47,300	1.01	1.37
District 4	20,380	38,200	57,800	4.95	4.23
District 5	23,200	69,700	121,300	8.83	5.70
Port,Airport	5,960	6,000	6,000	0.00	0.00
Matola City	123,700	271,200	434,700	6.22	4.83
District 1	51,230	127,900	212,900	7.29	5.23
District 2	34,000	83,800	139,000	7.19	5.19
District 3	38,470	59,500	82,800	3.41	3.36

8.2.3 Concept of Land Use Plan

In order to form a road master plan that is integrated with urban development, it is essential to clarify the concept for urban development. In this study, a land use plan shall be described

based on the “Structural Plan of the Maputo Metropolitan Area” proposed in 1998. Basic philosophy of land use are as follows.

1) Land Use Plan in 2010

Present land use pattern of Maputo city has C.B.D. in the former urban area, while secondary and thirdly commercial centers and economic activity areas are located among the arterial roads in the surrounding area. This present land use pattern will be maintained in 2010.

To alleviate the concentration of commercial and administrative centers in the C.B.D., sub centers accommodated with commercial and service space will be developed around intersection of arterial roads.

Large scale industry will be developed in Matola city in order to supplement the lack of the vast land in Maputo city, where small and medium scale industries will be developed and existing industry will be expanded.

New residential area for the population exceeded from the capacity of the current urban area will be located in the northern area, such as Zimpeto, Magoanie and Mahotas.

In high population density areas among spontaneous occupied areas, resettlement of population will be implemented to acquire a room for infrastructure.

Following measures are needed to realize the land use plan and development.

Amplification of the organization and personnel for urban planning.

To establish a detailed city plan for the areas without any city plan.

Intensification of land use control in the areas without any city plan.

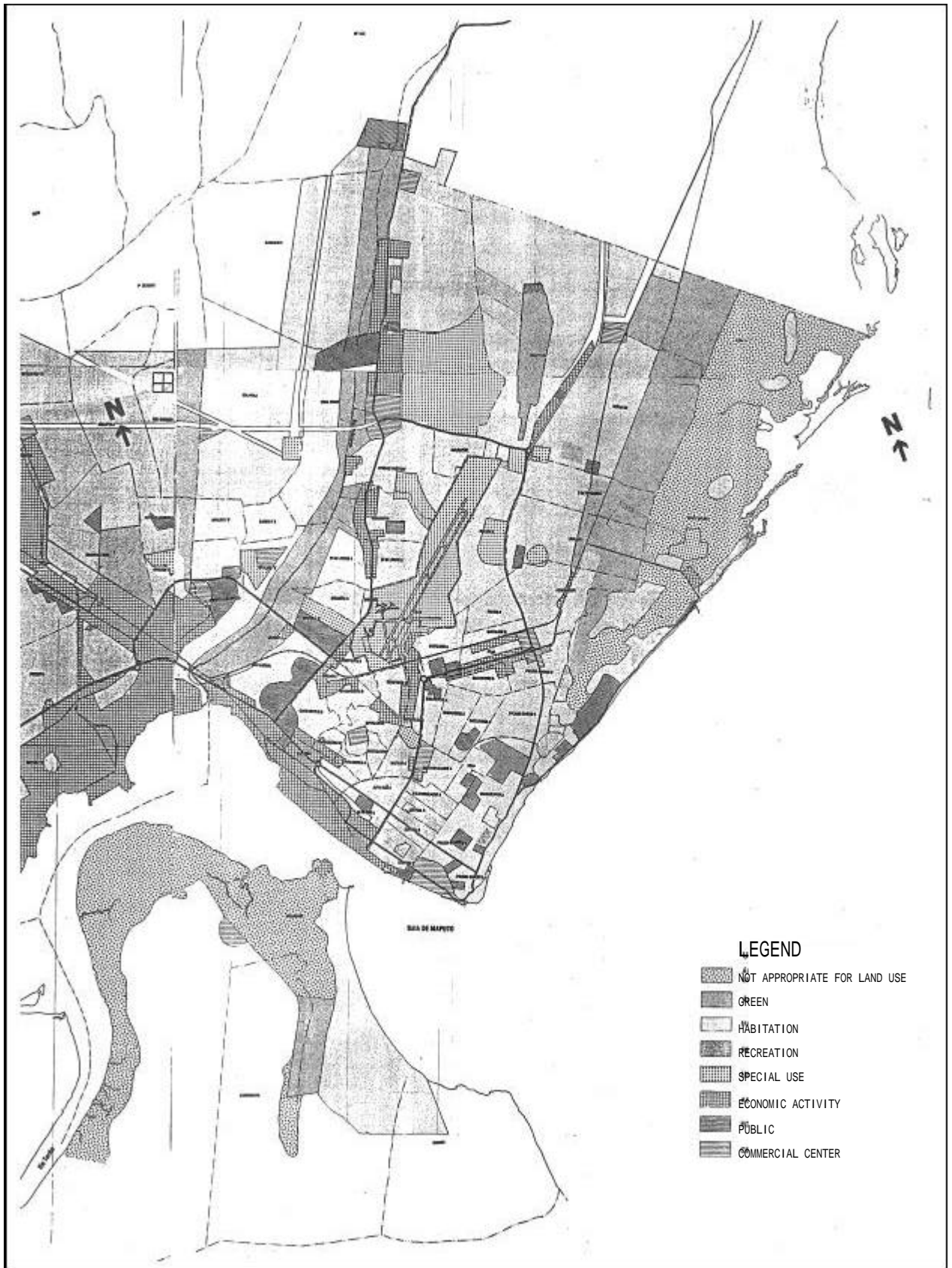
2) Land Use Plan in 2020

Infrastructure development cannot follow up with the urban expansion if the urban area is filled with low density habitation. Therefore, more dense habitation would be introduced in the urban area and the infrastructure will be utilized efficiently. Therefore, land use plan in 2020 shall be generally consistent to the land use plan in 2020.

To realize this concept, measures to enhance condominium residence will be introduced.

Northern habitation area will be converted from present low density to proper density for urbanization, and will become a major residential area in the city.

Urbanization in Catembe is considered within this study, since it will not proceed so far as it depends its transportation with city center to ferry. Construction of bridge between Catembe and city center needs extravagant investment.



**Figure 8.2.1 Land Use Plan in 2010
by the Structural Plan of the Maputo Metropolitan Area**