1.4 Urban Infrastructure

1) *Housing*

The total number of dwelling units in the Greater Cairo Metropolitan Region, according to the 1986 census was 2,489,612. Table 1.4.1 shows the number of dwellings for Cairo Governorate, Giza City, and Shubra Al Kheima City distributed by unit type, ownership type, and present use. Over half of the units in GCR (57%) are rented while 26% are owned.

Table 1.4.1 Number of Dwellings in GCMR by Type

Location	Number of Residential Buildings	Type (%)			Ownership Type (%)			Present Use (%)	
		Apartments	Rooms	Village-Type House	Rent	Owned	Not Registered	Resid.	Vacant
Cairo Gov.	1,734,100	82.2	15.8	0.0	58.1	25.5	13.4	82.8	14.5
Giza City	574,999	86.2	12.0	0.9	52.9	26.8	17.4	80.2	17.8
Shubra Al Kheima City	180,513	83.1	15.0	1.5	52.2	25.6	14.6	84.3	14.6
Total	2,489,612	83.2	14.9	0.3	56.5	25.8	14.4	82.3	15.3

Source: 1986 Census, CAPMAS

In Cairo Governorate about 85% of the dwelling units in the CBD area are rented, however the trend has shifted towards ownership in kisms having newly developed areas, such as 47% in 15th May, 63% in Salam, and 30% in each of Maadi and Heliopolis. In five of Giza City's 6 kisms about 55% of the units are rented, while in the remaining kism of Al Ahram where the development is more recent ownership type is almost equally divided among the three categories.

According to the CAPMAS 1986 census, the number of buildings in Cairo Governorate and Giza City are 408,978 and 115,249 respectively, of which roughly 90% and 95% are used for residential purposes. Fig. 1.4.1 shows the distribution of the buildings by construction year for each of Cairo Governorate, Giza City and Shubra Al Kheima City. From the figure it is clear that during the 20 year period of 1960 - 1979, many buildings were constructed in Giza City and Shubra Al Kheima City (50 and 65% of total buildings in each respectively) confirming the expansion trends towards the outer edges of the region.

In Cairo Governorate, roughly 60% of the buildings located in the CBD and its surrounding area are over 40 years old. On the other hand, in Nasr City 42% of the buildings were constructed in the 1980's, 60% in Salam, 55% in Marg, and 100% in 15th May City. In Giza City's 6 kisms over 60% of all buildings were constructed after 1960, with 40% of Kism Al Ahram's buildings constructed in the 1980's. In both kisms of Shubra Al Kheima City, 86% of the buildings were constructed after 1960.

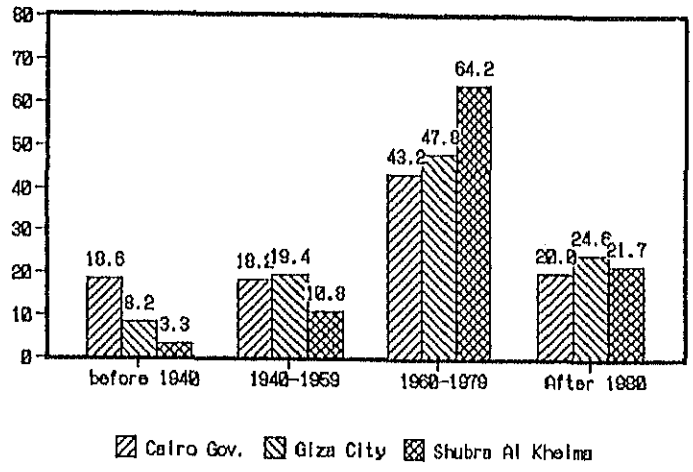


Fig. 1.4.1 Distribution of Dwellings by Construction Year

The period starting from the sixties saw a great increase in the number of informal housing units built in GCR. It is estimated in some reports that over 80% of all housing units built during 1960 to 1981 in GCR had been built without permits, or in other words "informal" housing. This phenomenon is accredited to the fact that the supply in legal housing was very short compared to the demand. These communities spread along arable land northward and eastward, and in some desert areas westwards. Although most of the buildings in such communities are well built and structurally sound, the communities suffer from poor water supply and sanitary drainage facilities, narrow streets, and lack of adequate public transport services.

Another phenomenon, cities of the dead, also arose from the lack of low and middle income residential units and the heavy migration into the city from rural areas. Half a million people (1984 CAPMAS estimate) have taken up residence in the cemeteries east of Cairo City.

Since the 1950's the government has embarked on several programs to construct low income public housing, but its efforts still fall far short of the huge demand. After the 1973 war the private sector became very active in the construction industry, but its efforts were mainly concentrated on medium and high-income housing.

2) Education

With the start of the 1989/90 scholastic year, a new educational system comprising 5 years of elementary stage, 3 years preparatory stage, and 3 years secondary stage shall be introduced in all of Egypt. The first 8 years are compulsory. Following graduation from the secondary school, GCR students may pursue higher education at 4 public and 1 private universities, or 11 institutes located in GCR.

A national Ministry of Education is essentially in charge of all policy matters such as curriculum, teachers' salaries, instructional methods and investments in new facilities. The local governorates are in charge of everyday administration and maintenance of schools such as staff hiring, purchase of small equipment, and actual payment of salaries.

Education is available free of charge up to the university level. Private schooling exists under the supervision of the Ministry of Education, where there is an emphasis on the study of foreign languages in addition to the curriculums taught at public schools. The rates of private and public school students for Cairo Governorate are shown in the following Table 1.4.2.

Table 1.4.2 Distribution of 1987/88 Cairo Governorate Students

(unit: %)

Type	Scholastic Stage		
	Elementary	Preparatory	Secondary
Public	81.9	92.1	70.8
Private	18.1	7.9	29.2

Source: Cairo Governorate Statistics Dept.

Table 1.4.3 shows the number of schools, students, and teachers in Cairo Governorate distributed by district for the scholastic year 1987/88. Statistics show that during the period 1983/84 - 1987/88, elementary and preparatory students increased by 3 - 5% while secondary students number has been declining by 2.5 - 4%.

GCR suffers from a shortage in the number of schools which has forced the Ministry of Education to have many of the schools operate on a two or three shift basis.

Of 13 universities in the country, 5 are located in the GCR. University education is free of charge except for the American University in Cairo which is a private university. Table 1.4.4 shows the number of faculties and students in the 4 public universities in GCR.

Faculties of Cairo, Ain Shams, and Azhar universities are mostly located in the main campuses of each university respectively, while the faculties of Helwan University are distributed in the GCR. Students are accepted in the universities, in the faculty of their choice in accordance with their grades obtained at the secondary school final year, and location of their residence.

Table 1.4.3 Cairo Governorate Schools, Students, and Teachers in 1987/88

District	Elementary		Preparatory		Secondary	
	School	Student	School	Student	School	Student
North	144	79,174	48	40,219	26	39,890
Shubra	122	95,046	37	37,964	10	12,444
East	139	155,370	44	48,813	21	16,701
Wayli	88	40,768	34	14,416	25	23,716
Masr Al Gadida	76	57,967	26	23,977	20	21,929
Zeitoun	157	106,188	59	50,492	28	36,828
Middle	68	33,214	27	16,885	13	10,551
Abdin	35	15,407	15	8,259	12	4,036
West	41	21,528	18	9,424	16	11,463
South	97	48,030	29	22,039	27	26,514
Masr Al Qadima	127	106,157	47	35,039	21	22,568
Helwan	110	80,195	28	28,203	10	13,894
Total	1,204	839,044	412	335,730	229	240,534
Teachers Number		26,585		15,855		16,284

Note : In July 1987, Cairo Governorate was reorganized into 18 districts
Source: Cairo Governorate Statistics Dept.

Table 1.4.4 Students and Faculties in GCR Universities (1987/88)

University	Faculties	Students
Cairo University	20	85,124
Ain Shams University	11	103,631
Helwan University	13	34,577
Azhar University	19	70,143

Source: Cairo Governorate Statistics Dept.

Most students seek to continue their higher education at university, however due to the difficult examinations at the secondary stage final year and the limited number of new students that are allowed to enter universities annually, high and medium specialized institutes are available offering 4 and 2 year courses respectively. Numbers of institutes and enrollment in Cairo Governorate are shown in the following Table 1.4.5.

Of the four universities in the GCR, Azhar University is an Islamic university which provides Islamic studies alongside the usual arts and sciences majors. Azhar University also operates a number of elementary, preparatory, and secondary schools. The number of students attending these schools in the Cairo Governorate are shown in the following Table 1.4.6.

Military and police secondary schools and academies are also located in the GCR, however their numbers and enrollment rates have not been investigated.

Table 1.4.5 Cairo Governorate Institutes' Students (1987/88)

Institutes	Number	Students	Percent of Total Egypt
Higher	4	60,711	44%
Medium	7	16,156	40%

Source: Cairo Governorate Statistics Dept.

Table 1.4.6 Azhar Schools Attendance in 1987/88

Stage	Number of Students
Elementary	26,197
Preparatory	11,213
Secondary	8,433

Source: Cairo Governorate Statistics Dept.

Finally, there is a strong effort on the part of authorities to eradicate illiteracy among the adult population and literacy centers have been established. At present the rate of illiteracy in the GCR is as shown in Table 1.4.7.

In 1986 the illiteracy rate for the GCR was 32%. There has been an improvement in the past 10 years although a gap still exists between male and female illiteracy rates.

Table 1.4.7 Illiteracy Rate in GCMR (population 10 years and above)

(unit: %)

	1976			1986		
	Male	Female	Total	Male	Female	Total
Cairo Gov.	22.2	46.5	34.0	23.3	39.3	31.1
Giza City	22.7	50.4	36.2	24.6	41.0	32.5
Shubra Al Kheima City	29.1	65.8	46.6	14.6	52.2	39.5
Egypt	42.0	71.1	56.3	37.8	61.8	49.3

Source: CAPMAS

3) Electric Power

(1) General

The Egyptian Electric Authority (EEA) of the Ministry of Electricity and Energy supplies electricity to the entire area of the country.

Electricity transmission and distribution system of Egypt is composed of five integrated systems serving Cairo region, Alexandria region, Upper Egypt, Lower Egypt and the Canal area. At the end of 1985, EEA had a total of 39 power plants, the largest installed plant capacity being 2,100 MW of the High Dam. The total installed capacity of the 39 plants was 8,311 MW, of which 2,670 MW or 32.1% was by hydraulic and 5,638 MW was by thermal generation. The total length of electricity transmission line is 7,438 km. The schematic drawing in Fig. 1.4.2 shows the generation and transmission system in the five regions in 1985.

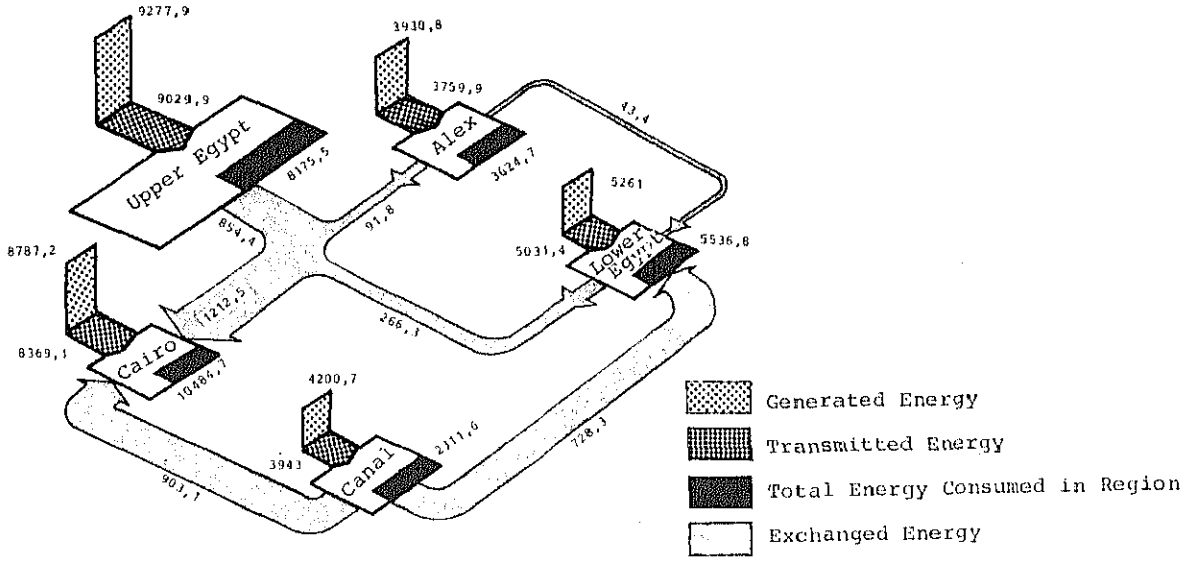


Fig. 1.4.2 Schematic Diagram of Integrated Network

Voltages and frequency for transmission and systems adopted in Egypt are as follows:

- Transmission system: 500, 220 and 132kV, 50Hz
- Distribution system: 66kV, 10.5 kV 50Hz
  380/220V 50Hz (3 phase - 4 wire)

Of the total generated energy in 1984/85, approximately 22% was supplied to factories, 3% for agricultural development, and the remaining 75% was domestic.

The following Table 1.4.8 shows the generated energy of the plants in 1985 operated by EEA by region. From the table it is clear that Cairo Region's share of the total generated energy in 1984/85 was about 30%.

In the past few years, and with the fears of generating output shortage due to the drought in Central Africa and the decrease of the water level of Lake Nasser, behind the High Dam, the Egyptian Government diversified its power plants with the construction of many thermal plants. It is expected that with the introduction of these plants into the service the figures stated above will be changed.

Table 1.4.8 EEA Plants Generated Energy (1985)

Region	Number of Plants	Power generated million kwh	Type
Cairo	11	8787.4	Thermal
Canal	7	4200.8	Thermal
Lower Egypt	6	5261.1	Thermal
Alexandria	8(1)	3930.8	Thermal
Upper Egypt	2	615.1	Thermal
	3	8662.7	Hydroelectric

Note : (1) In 1985 only 6 plants were in operation
Source: EEA 1985 Annual Report

(2) Power Condition in Greater Cairo Region

The following Table 1.4.9 shows the installed capacity of the electric power generation plants in the GCR in 1987.

Table 1.4.9 GCR Power Plants Capacity

Governorate	Generation Plant	Installed Capacity (MW)
Qaliubiah	1. Shubra Al Kheima	945
Giza	2. West Cairo	350
Cairo	3. South Cairo	255
	4. North Cairo	109
	5. Tebbin	95
	6. Helwan	120
	7. Wadi Hof	100
	8. East Cairo	46
	9. Heliopolis	37

Source: Cairo Governorate Statistical Department

In the GCR there are 46 sub-stations, having a total of 166 transformer units.

Of the 33 kisms in Cairo Governorate, in 17 kisms over 99% of the households are connected to the distribution network. According to the 1986 national census, in general electrification rates of the households in Cairo Governorate, Giza City, 6th October City, and Shubra Al Kheima City are 97.6%, 98.4%, 96.4%, and 95.8% respectively. The lowest rate is 88% in Marg, Cairo Governorate, which may be due to the high number of informal housing. The rate of urban households on the national level is 96%, while 87% of total households, rural and urban, are served by electricity. Many of the household dwellings in informal housing areas are illegally connected with electric power.

(3) Electric Supply Charges

The electricity charges rates were changed at the beginning of 1988 in order to conserve energy and eliminate waste by increasing the financial burden upon the consumer. The rates however still remain heavily subsidized. The new tariff is shown in the following Table 1.4.10.

Table 1.4.10 Electricity Tariffs

Amount (kwh)	Domestic Use (LE)	Commercial Use (LE)
0 - 100	1.8	2.1
101 - 200	4.8	5.7
201 - 300	8.6	12.1
301 - 400	12.8	19.7
401 - 500	17.4	28.5
501 - 1000	52.9	78.5
1001 - 2000	152.9	198.5
2001 - 3000	272.9	338.5
3001 - 4000	392.9	478.5

4) Water Supply

The General Organization for Greater Cairo Water Supply supplies the Greater Cairo Region with both potable and raw water. This organization belongs to the Ministry of Housing and Utilities.

The Nile River is the surface water source of potable water for the Greater Cairo area. Also, groundwater supplied primarily from the Nile River is utilized as another water source, which constitutes approximately 11 percent of the total water production. The Ismailia Canal, which connects the Nile River with the Suez Canal, is also a potable water source.

The potable water produced in the Greater Cairo Region in 1987 was 1.03 million cubic meters. Table 1.4.11 shows the water production amount during the last ten years.

Table 1.4.11 Water Production in GCR (1977-1987)

Year	Water Production (cub.m)	Average Daily Production (cmd)
1977 *1	767,882,398	2,103,787
1982 *1	931,068,250	2,550,872
1987 *2	1,030,473,000	2,823,214

Source *1: Production records of GCWSA
Source *2: Cairo Governorate Statistics Dept.

Fig. 1.4.3 shows the locations of the potable water production facilities in the GCR, and Table 1.4.12, the produced amount in each plant during 1987.

The above mentioned table shows that 2.8 million cmd were produced for the GCR in 1987 from 16 plants, 11 of which are treatment plants. In addition to the potable water produced, an amount equal to 10.02 cub.m of raw water was produced in the GCR in 6 locations in 1987. Concerning the water supply network, approximately 60% of the pipes were laid prior to 1971, 12% of which are over 40 years old. The networks old age and rapid

increase in demand have contributed to frequent pipe damages. It was estimated in some reports that there is a 40% loss due to leakage in the network.

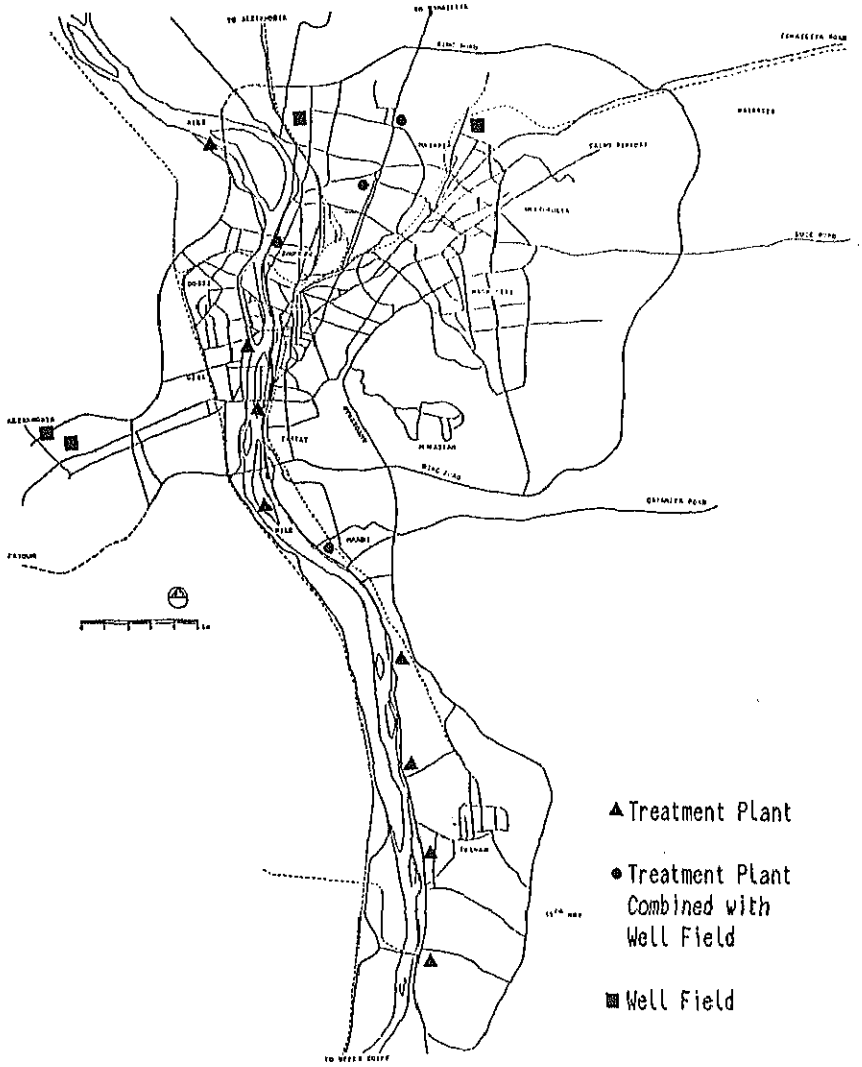


Fig. 1.4.3 Water Production Facilities

The alarming increase in informal housing in areas which are not served by water supply has created many areas where households must rely on public taps or build their own water tanks for water supply.

The following Table 1.4.13 shows the percentages of households served by water supply, as obtained in the CAPMAS 1986 census.

In the kisms of Al Marg, Ahram, Boulak Al Dakrour and Salam, where many informal communities have appeared, the percentages of households connected to water supply network are only 37.9%, 52.5%, 76.8% and 83.5% respectively. Table 1.4.14 indicates the utilization of the total water produced in GCR in 1984.

Table 1.4.12 Water Production by Plant in 1987

(unit: 1000m3)

Plant	Potable Water Production	
	Filtered Water	Well Water
1 Rod Al Farag	211,873	--
2 Shubra Al Kheima	--	15,369
3 Amyriah	125,644	22,529
4 Mostorod	184,840	53,866
5 Al Marg	--	11,574
6 Giza	41,097	--
7 Embaba	67,194	--
8 Gezirat Al Dahab	83,884	--
9 Ahram	--	11,885
10 Jollie Ville	--	5,247
11 Roda	61,401	--
12 Maadi	36,670	1,381
13 Tourah	1,340	--
14 North Helwan	42,151	--
15 Kafr Elw	25,164	--
16 Tebbin	27,344	--

Source: Cairo Governorate Statistics Department

Table 1.4.13 Households Served by Water Supply

(unit: %)

Governorate /City	Rate of Households Served by Water Supply
GCR	
Cairo Governorate	95.1
Giza City	81.9
Shubra Al Kheima	91.5
Total Egypt	73.1
Urban	92.4
Rural	55.9

Source: 1986 Census, CAPMAS

Table 1.4.14 Water Use in GCR (1984)

(unit: %)

Type of use	Rate
Domestic	57%
Industrial	14%
Others	29%

Water tariffs have been raised recently in order to limit the excessive use and waste, however water supply prices are still heavily subsidized by the government.

5) Sewage

Operation and maintenance of sewer facilities for the Greater Cairo Region are undertaken by the General Organization for Greater Cairo Sanitary Drainage, which is under the jurisdiction of the Ministry of Housing and Utilities. The main features for the network in GCR in 1987 were as follows;

- Sewers Network	
Total Length of network	4,600 km
Total length of collectors	117 km
- Main Pumping Stations	
Number	8
Total capacity	180,840 m3/hr
Available working capacity	95,560 m3/hr

A 1985 report on the condition of the sewer network in GCR recommended complete renewal of the network which had been installed during the period following the First World War. The report also stated that the existing network can carry roughly only half of the sewage effluent produced in the region.

For the past 6 years the construction of a major sewage project has been in progress which is scheduled to be completed by 1992. Financed by American and British aid, the project divides the Cairo Region into east and west banks of the Nile River, each with its own waste water treatment plants. Locations of proposed treatment plants and main lines are shown in Fig. 1.4.4.

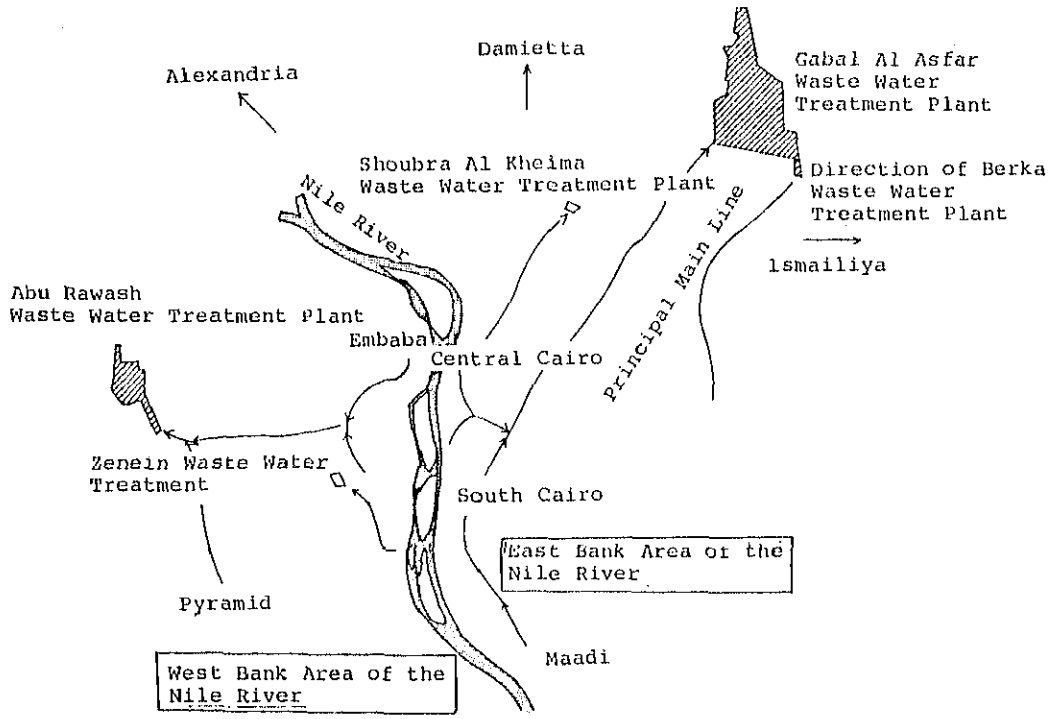


Fig. 1.4.4 Greater Cairo Swerage System Program

2 Person Trip Demand

2.1 Outline of Home Interview Survey of Person Trips

1) Field Survey

In the first phase of the Study (August - December 1987) the person trip survey and its related surveys (screen line survey and cordon line survey) were conducted. The outline of each survey is summarized below.

(1) Person Trip Survey

The purpose of the person trip survey was to get the basic information of: "Residents with what kind of attributes" are moving daily "From Where", "To Where", with "What Purpose" and by "What Mode".

The survey was done by home interview to randomly sampled households, sending trained surveyors who asked necessary items relevant to the above mentioned purpose to each member aged six and over of the household. Sampled households were about 17,000, 0.9% of the total households of approximately 1,940,000 in the Study Area. The home interview survey was conducted on weekdays in early November of 1987. After the completion of home interview survey, coding and data input work was done at CAPMAS.

(2) Cordon Line Survey

The person trip survey covers the movements only of residents in the Study Area, but does not cover the non-residents' movements inside the Study Area.

To get data of trips made by non-residents (residents outside the Study Area), a supplementary survey was made of the vehicles and passengers crossing a cordon line surrounding the Study Area.

A traffic count and interviews of sampled passengers were done at ten points on trunk roads crossing the cordon line and at three ENR stations (Fig. 2.1.1).

At the interviews, passengers' O-D and trip purposes were inquired. Field works were conducted during the same period as the person trip survey, in early November of 1987. The total number of samples was 42,500 passengers, or 7.7% of the total number of passengers crossing the cordon line.

(3) Screen Line Survey

A screen line survey aims at verification and adjustment, when necessary, of the person trip survey results.

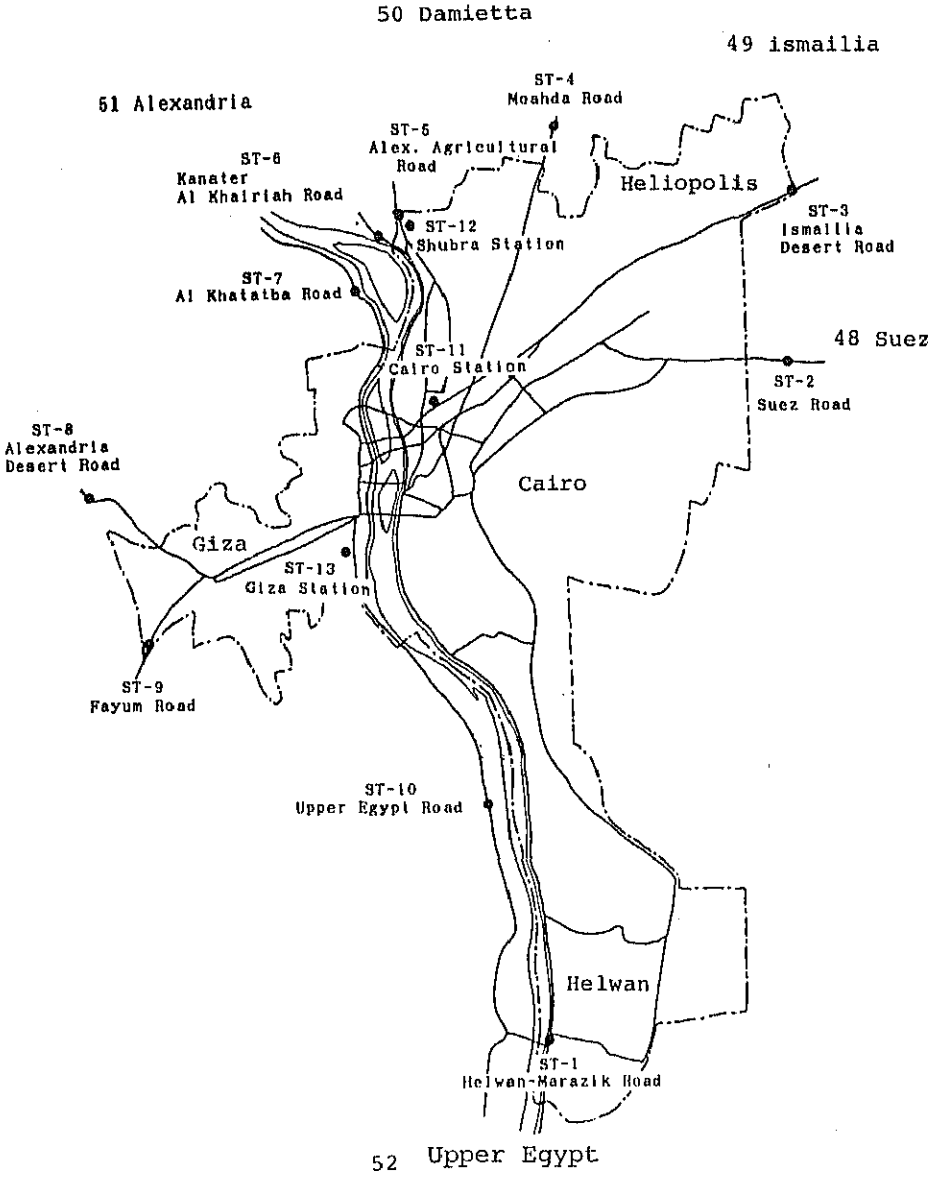


Fig. 2.1.1 Location of Cordon Line Survey

The screen line is an imaginary line drawn so as to divide the Study Area into two parts. To verify the O-D structure of the person trip survey, the estimated volume of traffic crossing the screen line as based on the person trip survey is compared to the actual traffic volume counted on the screen line. For this purpose, traffic and passenger counts were done on six bridges crossing the Nile in December 1987.

The average number of passengers by the type of vehicle was used to convert the person trip O-D volume to traffic volume.

2) Data Processing

(1) Processing Procedure

The data obtained from the PT Survey were expanded and adjusted to screen line traffic prior to analysis, according to the procedure shown in Fig. 2.1.2.

PT data input by CAPMAS were checked by the Study Team and usable data from the effective samples were compiled as the master file.

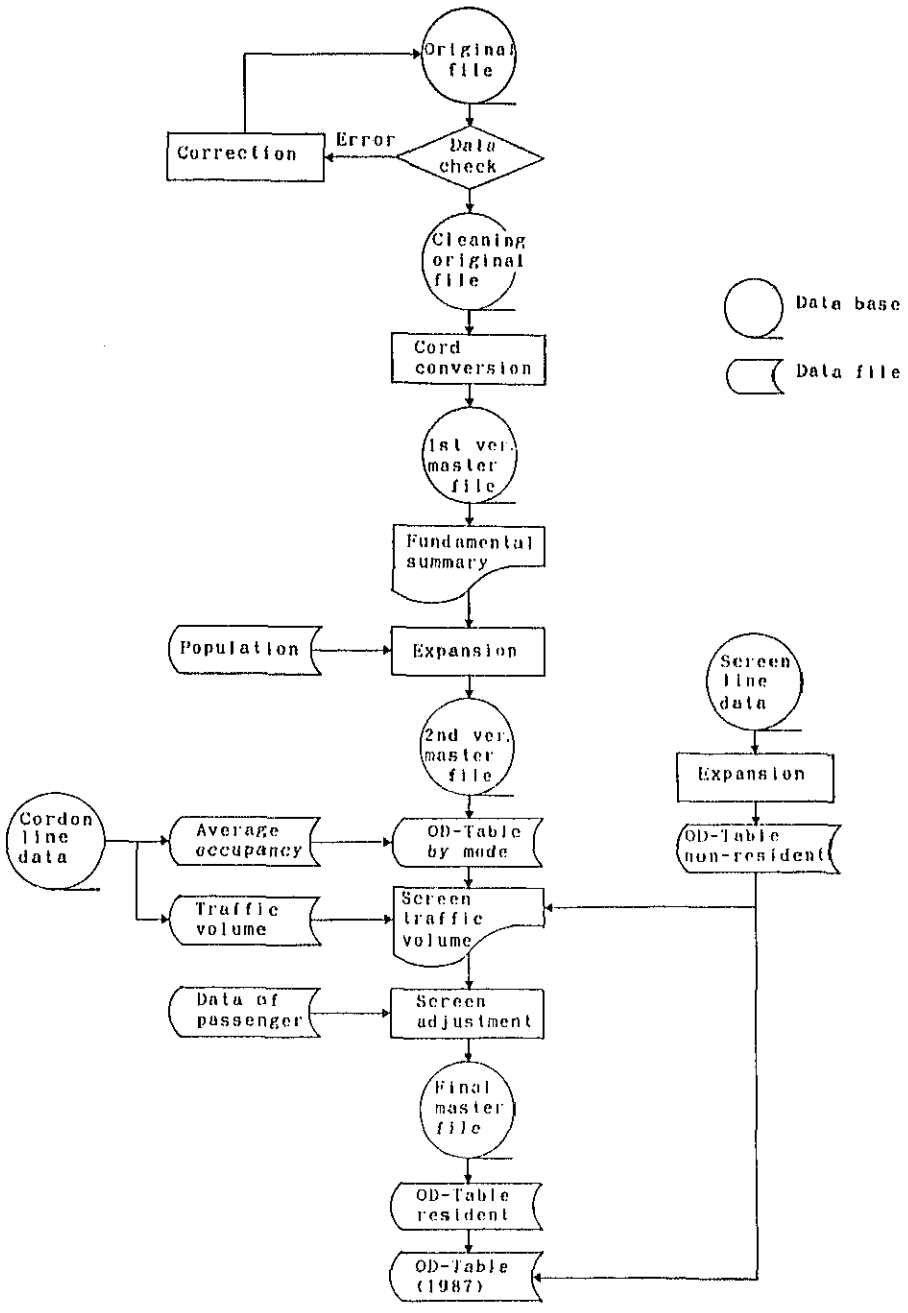


Fig. 2.1.2 Flow Chart of Data Processing

The number of samples in the master file is 15,357 households, with a response rate of 88.4%. The effective sample size is 57,255 persons, which is equivalent to 0.77% of the population in the Greater Cairo Region (7.42 million persons aged 6 years or older).

The effective number of households for each zone is shown in Table 2.1.1.

Table 2.1.1 Effective Number of Households

43 Zones Code	Zone Name	86 Census Gov. Code	86 Census Kism Code	No. of Expected Samples	No. of Effective Samples	Effective Sample Rate (%)
10	Awal Shubra Al Kheima	14	6	700	610	87.1%
20	Thani Shubra Al Kheima	14	7	675	616	91.3%
30	Al Marg	1	36	200	183	91.5%
40	Al Salam	1	31	250	214	85.6%
50	Ain Shams	1	29	750	631	84.1%
60	Mataria	1	24	850	788	92.7%
70	Nozha	1	27	300	243	81.0%
80	Masr Al Gadida	1	26	300	247	82.3%
90	Nasr City	1	25	325	272	83.7%
100	Al Zeitoun	1	23	650	592	91.1%
110	Hadaek Al Kobba	1	22	650	568	87.4%
120	Al Zawia Al Hamra	1	30	575	517	89.9%
130	Sharabiya	1	17	575	510	88.7%
140	Shubra	1	18	250	232	92.8%
150	Al Sahel	1	20	800	743	92.9%
160	Rod Al Farag	1	19	450	412	91.6%
170	Al Wayli	1	21	225	204	90.7%
180	Manshiet Nasser	1	33	225	207	92.0%
192	Al Zaher (Al Zaher)	1	16	175	154	88.0%
193	Al Zaher (Al Sakakini)	1	16			
202	Bab Al Shaaria (Al Chambaky)	1	15	150	129	86.0%
203	Bab Al Shaaria (Al Sawaby)	1	15			
210	Gamalia	1	14	175	146	83.4%
220	Al Darb Al Ahmar	1	13	225	204	90.7%
231	Azbakiah (Orabi)	1	12	100	95	95.0%
232	Azbakiah (Al Faggala)	1	12			
233	Azbakiah (Qolali)	1	12			
241	Moski (Attaba)	1	9	100	90	90.0%
242	Moski (Kom Al Sheikh Salem)	1	9			
251	Abdin (Al Fawala)	1	8	150	138	92.0%
252	Abdin (Al Balaka)	1	8			
260	Boulaq	1	11	250	217	86.8%
270	Zamalek	1	32	75	60	80.0%
281	Qasr Al Nile (Maarouf)	1	10	50	48	96.0%
282	Qasr Al Nile (Garden City)	1	10			
292	Sayedah Zeinab (Khairat)	1	6	450	401	89.1%
293	Sayedah Zeinab (Al Kabsh)	1	6			
300	Al Khalifah	1	7	350	313	89.4%
310	Masr Al Qadima	1	5	525	475	90.5%
320	Basatin	1	34	875	767	87.7%
330	Maadi	1	4	175	160	91.4%
340	15th May, NS8, NS9	1	3	50	39	78.0%
350	Helwan	1	2	825	724	87.8%
360	Al Tebbin	1	1	100	93	93.0%
370	Embaba	21	1	950	851	89.6%
380	Agouza	21	2	375	329	87.7%
390	Dokki	21	3	250	203	81.2%
400	Giza	21	4	500	423	84.6%
410	Boulaq Al Dakrour	21	5	1,225	1,055	86.1%
420	Al Ahram	21	6	525	454	86.5%
	Total			17,375	15,357	88.4%

(2) Expansion of Sample Data

The sample data are expanded to the general population based on zone, sex and car ownership among households.

The characteristics of the general population must be known before the sample data can be expanded. However, only data by zone and sex were available for the population in the Greater Cairo Region, and these were used as the basis for data expansion.

Furthermore, when the sample data were expanded solely on the basis of zone and sex, there was a sizable gap between the number of cars owned, as indicated by the PT data, and the number of cars registered. For this reason, different expansion coefficients were used for car/owning households and non car owning households, in order that the number of cars owned matched the number of cars registered.

(3) Screen Adjustment

Sample data expanded to the general population were compared with screen-line traffic volumes and existing passenger data by mode of transport, in terms of number of trips by mode of transport. In other words, the expanded data for traffic that pass through the screen were adjusted by comparing them with screen-line traffic volumes, and the expanded data for traffic that was not counted in screen line survey were adjusted by comparing them with passenger statistics and the total number of trips in the entire region.

For a given mode of transport, if the expanded volume of traffic crossing the screen line obtained from the PT survey is established as Tp; the volume of traffic obtained from the screen line survey as Ts; the volume of traffic crossing the screen line obtained from the cordon line survey as Tc; and the adjustment coefficient as α , then the relationship between these values can be described as follows:

$$\alpha = (Ts - Tc) / Tp$$

At the same time, for a mode of transport that was not obtained from the screen line survey, if the total number of unlinked trips in the entire region is established as Tu and the volume of traffic obtained from passenger statistics and other data is given as T, then the relationship between these values can be described as follows:

$$\alpha = T / Tu$$

The screen adjustment coefficient obtained from the above calculations was applied to all trips involved in a given mode of transport.

(4) Processing of Cordon Line Survey Data

After verification of data, the original data were compiled into the master file, through the following jobs:

a. Classification of the number of person trips by vehicle type.
b. Calculation of the expansion coefficients by type of vehicles, by survey points and by inbound and outbound traffic.
c. Elimination of the residents' trip data.
d. Adjustment of double counting for through-traffic.

Table 2.1.2 shows the final sample number compiled into the master file, with total traffic volume and effective sampling rate. Here, outbound trips are treated as opposite direction movements of inbound trips.

Table 2.1.2 Sample Number of Cordon Line Survey

	Resident	Non-Resident	Total
Total Trip	225222	324865	550087
No. of Samples	15730	26784	42514
Sample Ratio (%)	7.0%	8.2%	7.7%

Note: For inbound traffic only

2.2 Summary of Trip

1) Number of Trips

(1) Total Number of Trips

The number of trips per day in 1987 made by residents within the Study Area was 13,700,000 and those made by non-residents was 650,000, giving a total number of 14,350,000 trips. Since 95.5% of the total number of trips were intra-regional trip, the Survey Area is regarded to be almost closed in terms of passenger transportation.

Of the total number of trips, 93.4% started and ended within the Study Area, 6.4% either started or terminated outside the area, and 0.2% was transit (see Fig. 2.2.1).

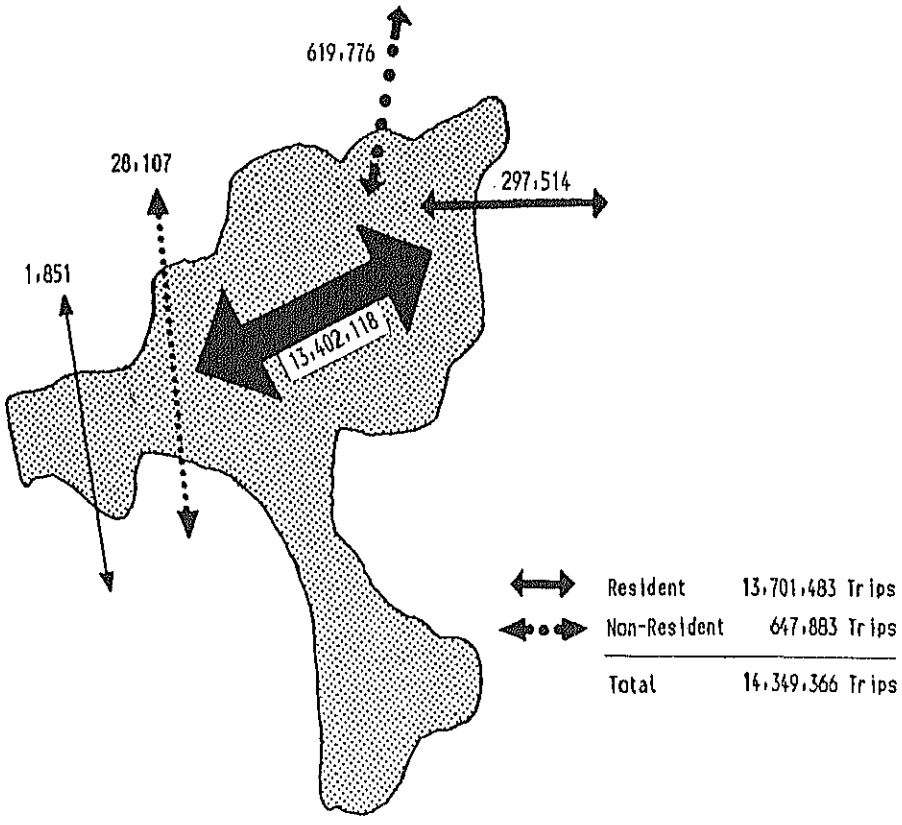


Fig. 2.2.1 Total Number of Trips

(2) Trip Composition by Purpose

As shown in Fig. 2.2.2, the major purposes of trips were "To Home" (48%), "To Work" (21%), and "To School" (18%). These three purposes, which combine to make up 87% of all trips, are trips that take place daily and account for a large proportion of trips

made during the peak hour. Furthermore, the fact that the destination of more than half of the trips were "To Home" indicates that the majority of trips originated from home and that people return home after a visit to one destination without moving to other areas.

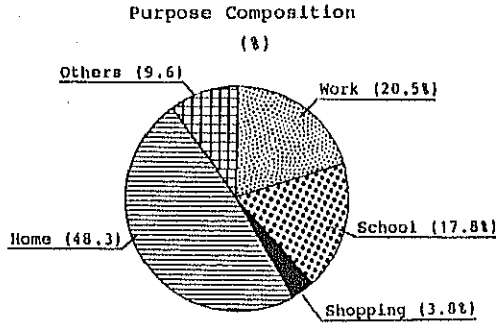
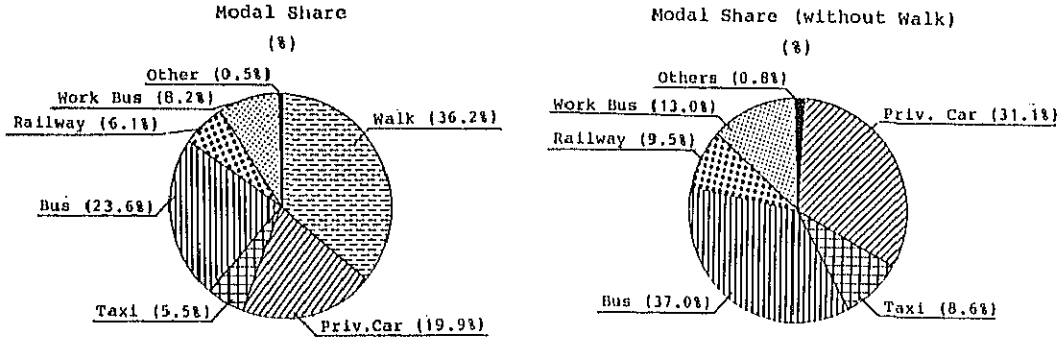


Fig. 2.2.2 Trip Composition by Purpose

(3) Trip Composition by Mode

The composition of trips by mode is shown in Fig. 2.2.3. The figure reveals that walking accounted for the largest number of trips at 36%, followed by buses at 24%, private cars at 20%, and taxis at 6%. When considering the number of trips excluding walking and bicycles, which place only a minimal load on transportation facilities, private cars accounted for 31%, public buses, 37%, taxis, 19%, and private buses, 13%. Use of railways is low at 10% of the total.



(1) All Trips (2) Trips W/O Walk Trips

Fig. 2.2.3 Trip Composition by Mode

2) Trip Production Unit

There are two types of trip production unit: gross and net. While the gross unit is the number of trips per population aged

more than six, the net unit is the number of trips per trip makers, excluding persons who do not go out. Unless otherwise indicated, this report uses the gross unit as the trip production unit.

The trip production unit in the Greater Cairo Region is 1.85, and out-going ratio (the rate at which people go out for various purposes) is 68%. Thus, the net unit is 2.72 (=1.85/0.68).

(1) Trip Production by Age, Sex and Purpose

The trip production unit is 2.2 for males and 1.4 for females, showing a substantial gap depending on gender. This figure shows the reluctance felt by females to go outside, reflecting a typical phenomenon in Arab countries. Such a tendency can be seen more clearly in Fig. 2.2.4, which shows trips by age and purpose. There is little difference between males and females up to high school age, when the purposes are predominantly "To School" and "To Home". However, from the late twenties onwards, trips made by females gradually decline, while those by males rise sharply. In terms of purpose, "To Work" accounts for a high proportion among males, while "To Work", "Shopping", and "Others" are about the same among females. Furthermore, the decline in trips among both males and females in their early twenties is thought to stem from the non-working period immediately after completing schooling.

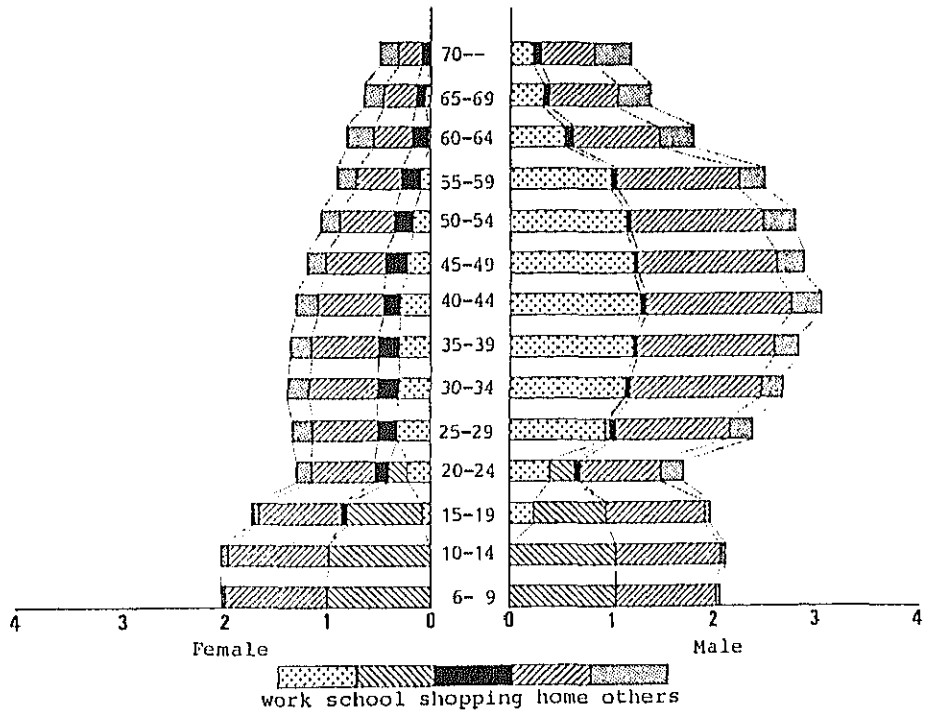


Fig. 2.2.4 Trips Production Rate by Age and Sex

(2) Trip Production by Occupation and Purpose

The trip production unit (Fig. 2.2.5) is high for management personal (4.5) and technical workers (3.4) and low for housewives (0.8), unemployed (0.9), and agricultural workers (0.9).

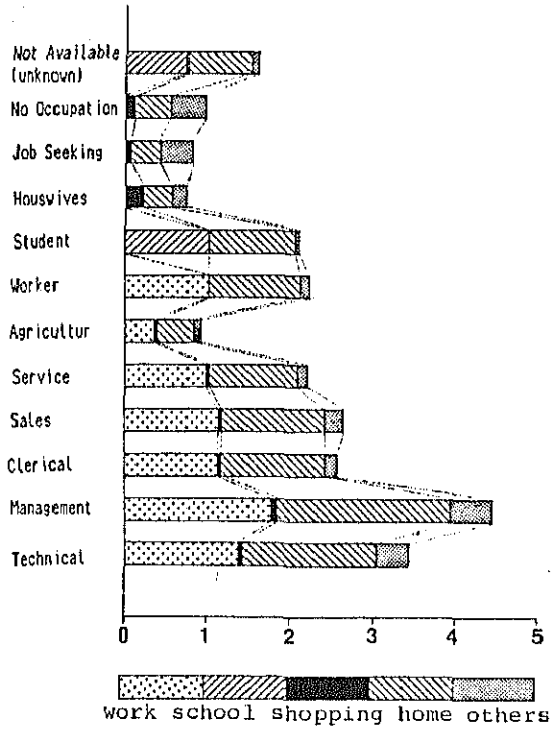


Fig. 2.2.5 Trip Production Rate by Occupation

(3) Trip Production by Industry and Purpose

The trip production unit is highest for those in the finance industry (3.4), as can be seen in Fig. 2.2.6. The figure is lowest among those engaged in agriculture at 1.1, and about equal among workers in all other industries at an average of 2.7.

(4) Trip Production by Income and Purpose

The trip production unit is clearly the highest for households with high income levels (Fig. 2.2.7). In terms of purpose, the higher the income, the greater the rate for "To Work" and "Others." It can be assumed that trips for social purposes make up a considerable proportion of the trips made for "Other" purposes.

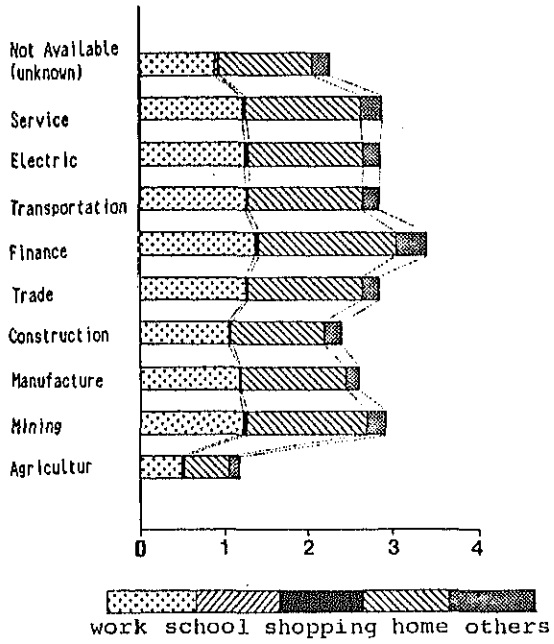


Fig. 2.2.6 Trip Production Rate by Industry

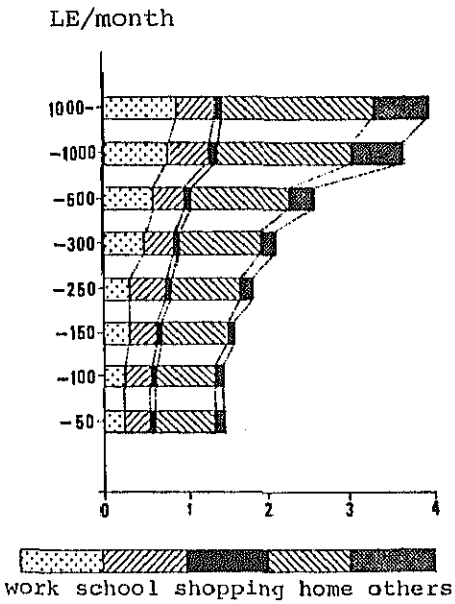


Fig. 2.2.7 Trip Production Rate by Income

(5) Trip Production by Car Ownership and Purpose

The trip production unit for households that own cars is 3.1, while that for non-car owning households is almost half at 1.6 (Fig. 2.2.8). This fact shows that the ownership of a car has a strong influence on the likelihood of going out.

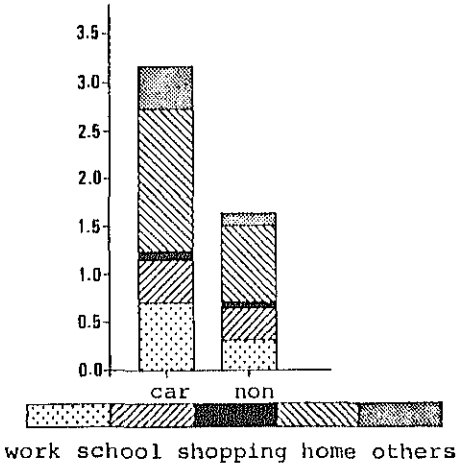


Fig. 2.2.8 Trip Production Rate by Car Ownership

(6) Comparison with Other Cities

Using Table 2.2.1, the trip characteristics in Cairo may be compared with those of some other cities. From the table it is clear that Cairo has a lower trip production rate (gross) and out-going ratio than the other cities. The trip composition by purpose is similar for the cities shown in the table, with Cairo being comparatively low in "Shopping" and "Others" trips. The modal share of "Others" is high in Cairo which is due to the inclusion of the "Work Bus" Share.

Table 2.2.1 Indices of Cairo and Other Cities

1	Name of Country			Japan	Egypt	Colombia	Japan	Paraguay	Panama
2	Name of City			Tokyo	Cairo	Barranquilla	Sendai	Asuncion	Panama
3	Year Surveyed			1978	1987	1983	1972	1984	1980
4	Study Area		(km2)	15,141	642	514	1,641	711	1,076
5	Population		(x1000)	28,775	7,423	1,108	940	858	759
6	Composition		1st	6	4	2	10	3	4
	of Worker by		2nd	36	37	24	26	16	22
	Industry (%)		3rd	58	59	74	64	81	74
7	Car Owning Ratio		(%)	20	18	15	18	33	37
8	Total Trip		(X1000)	66,725	14,350	2,581	2,130	2,169	1,474
9	Trip Generation		(gross)	2.53	1.85	2.69	2.50	2.96	2.41
	Unit (trip/person)		(net)	2.92	2.73	3.04	2.93	3.45	3.20
10	Out Going Ratio		(%)	85.9	67.8	88.0	85.0	85.8	72.5
11	Composition	to Work		13.4	20.5	14.5	13.0	16.7	17.9
	of Purpose	to School		9.7	17.8	16.5	10.0	10.8	15.6
	(%)	to Home		40.6	48.3	48.5	39.0	46.0	43.6
		Shopping		-	3.8	7.4	8.0	8.0	4.6
		Others		36.3	9.6	14.1	30.0	18.5	18.2
12	Modal Share	Walk		33.9	35.5	25.6	39.2	34.6	22.1
	(%)	Bicycle		15.1	0.7	1.4	11.0	2.2	0.2
		Car		24.1	19.9	10.9	28.5	14.8	26.9
		Truck		*	0.2	4.1	*	8.8	6.9
		Taxi		*	5.5	5.0	*	0.3	4.8
		Bus		4.0	23.6	53.0	15.6	38.4	39.0
		Railway		22.8	6.1	-	5.1	0.1	-
		Others		0.1	8.5	0.4	0.6	0.8	0.1

Note: *: Included in Car mode

2.3 Trip Generation and Attraction

1) Generation/Attraction by Zone and Purpose

Table 2.3.1 shows the volumes and rates of trip generation and attraction by purpose in each integrated zone. Fig. 2.3.1 gives the composition of trips generated and attracted by purpose, excluding "To Home".

Table 2.3.1 Trip Generation and Attraction by Zone and Purpose (1987)

Purpose	Work	School	Shopping	Home	Others	Total
1. Generation						
1 Shubra Al Kheima	174685	199488	46542	381071	39963	841749
2 East	313674	321560	67746	497060	115580	1315620
3 Masr Al Gadida	234468	174109	41955	741253	184820	1376605
4 Al Zeitoun	274787	238251	56748	684230	122574	1376590
5 North	381505	383837	75775	688437	160267	1689821
6 Al Khalifah	71980	70836	16360	124655	16167	299998
7 Central	233683	170959	46819	1096225	161443	1709129
8 South	154320	115983	53508	410478	110696	844985
9 Maadi	152874	153178	20193	255303	36073	617621
10 Helwan	139398	146544	19411	378384	35742	719479
11 Agouza	272678	257968	42859	591858	154414	1319777
12 Al Ahram	339578	302551	43289	647861	107862	1441141
Total	2743630	2535264	531205	6496815	1245601	13552515
2. Attraction						
1 Shubra Al Kheima	139128	178369	43848	454132	27027	842504
2 East	135558	244469	61030	796175	77187	1314419
3 Masr Al Gadida	347387	203995	51536	557444	214136	1374498
4 Al Zeitoun	242226	317033	41816	650447	123248	1374770
5 North	190450	336376	70998	965966	128917	1692707
6 Al Khalifah	40606	59003	14329	170476	13367	297781
7 Central	644158	237160	90101	518923	220501	1710843
8 South	157707	137158	46637	405468	95712	842682
9 Maadi	99693	110220	16045	352262	38453	616673
10 Helwan	187197	142935	19126	332757	37247	719262
11 Agouza	226137	236864	31549	680313	149790	1324653
12 Al Ahram	250025	298722	40749	752465	96482	1438443
Total	2660272	2502304	527764	6636828	1222067	13549235
3. Generation/Attraction						
1 Shubra Al Kheima	1.256	1.118	1.061	0.839	1.479	
2 East	2.314	1.315	1.110	0.624	1.497	
3 Masr Al Gadida	0.675	0.853	0.814	1.330	0.863	
4 Al Zeitoun	1.134	0.752	1.357	1.052	0.995	
5 North	2.003	1.141	1.067	0.713	1.243	
6 Al Khalifah	1.773	1.201	1.142	0.731	1.209	
7 Central	0.363	0.721	0.520	2.113	0.732	
8 South	0.979	0.846	1.147	1.012	1.157	
9 Maadi	1.533	1.390	1.259	0.725	0.938	
10 Helwan	0.745	1.025	1.015	1.137	0.960	
11 Agouza	1.206	1.089	1.358	0.870	1.031	
12 Al Ahram	1.358	1.013	1.062	0.861	1.118	
Total	1.031	1.013	1.007	0.979	1.019	

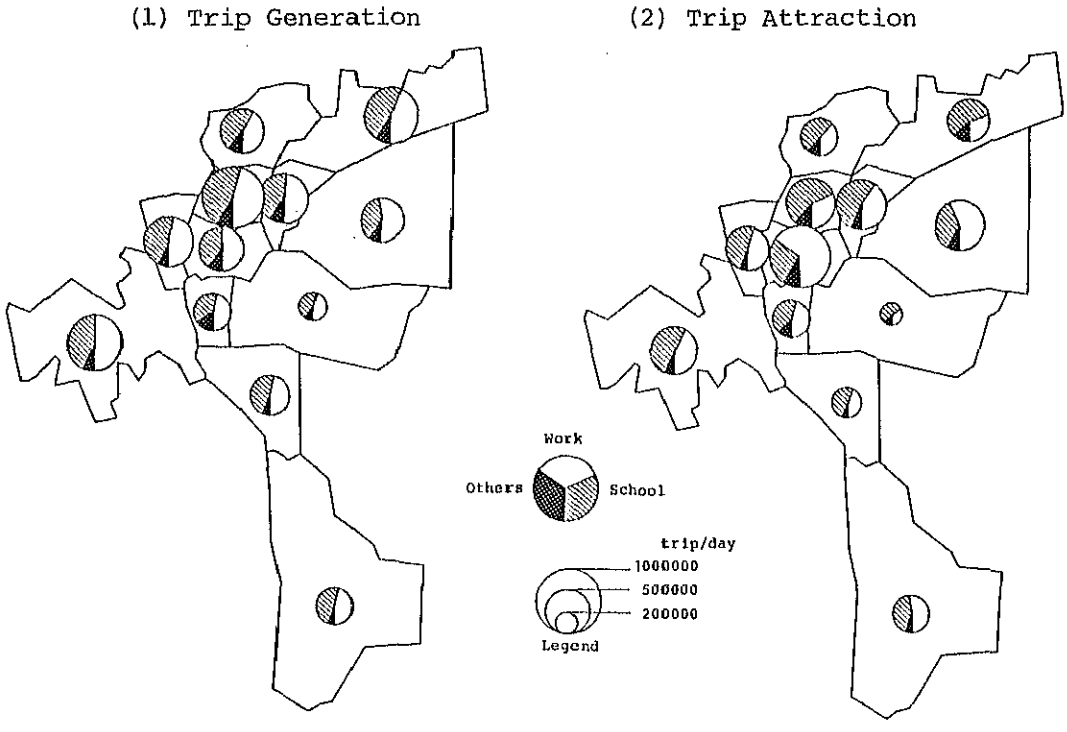


Fig. 2.3.1 Trip Generation and Attraction by Zone and Purpose (1987)

A large volume of trips is generated and/or attracted in zones such as Central and Masr Al Gadida, which are central business districts, and in North, East, Zeitoun, Agouza and Ahram, which are dominantly residential areas.

Trip generation and attraction for each purpose are described below.

(1) To Work

Trips made for the purpose of commuting to work are generated in large volumes from residential areas since this occurrence correlates with the size of the population. The volume of attraction is high in employment areas (business districts, industrial districts). The generation/attraction ratio (trip generation volume divided by trip attraction volume) is relatively high in residential areas such as East and North, indicating that the volume of trips generated is larger than the volume of trips attracted. Conversely, business districts such as Central and Masr al Gadida have a higher volume of attraction than generation, with Central in particular attracting an especially large volume of trips for commuting to work.

(2) To School

The volume of trips generated for the purpose of commuting to school correlates to the size of the population, as with the purpose of "To Work". Since primary and junior high school students generally commute to school within the zone they live, and since the number of primary school students is relatively large, the volume of attraction almost equals the volume of generation in a given zone. Among high school students and university students, there is a certain degree of attraction centered around the business district. Therefore, the generation/attraction ratio is low in Masr Al Gadida, Zeitoun, Central and South.

(3) Shopping

Both the generation and attraction of trips related to shopping correspond with the size of the population. This is thought to be due to the fact that shopping for daily necessities can be accomplished within the zone of residence. However, there is a relatively large volume of attraction in Masr Al Gadida and Central.

(4) Others

The purpose of "Others" trips are mainly social and recreational. The generation of trips for these purposes appears to correspond not only with the size of the population but also with income. In other words, the volume of generation is small in areas such as Helwan and East, where the size of the population is large but the average income is low, whereas the volume of attraction is overwhelmingly large in business districts and surrounding districts.

2) Generation/Attraction by Zone and Mode

The rate of attraction by mode of transport (modal share in a given zone divided by modal share in the entire survey area) is given for each integrated zone in Table 2.3.2.

Characteristics identified in the analysis for each representative mode of transport are as follows:

a. The use of walking is high in residential areas and low in business districts.
b. The use of private cars is high in business districts and low in Shubra Al Kheima.
c. The use of taxis is high in business districts and in surrounding areas, and low in residential areas.
d. The use of buses is high in residential and business districts, where buses are used for commuting to work.
e. The use of railways is high in Helwan and Heliopolis.
f. The rate of work bus (included in "others" mode) is high in Helwan and Maadi.

Table 2.3.2 Concentration Ratio of Attracted Trip by Mode

	Walk	Private Car	Taxi	Bus	Railway	Others
Shubra Al Kheima	1.593	0.222	0.137	1.084	0.150	1.011
East	1.286	0.548	0.967	0.939	1.151	0.856
Masr Al Gadida	0.272	2.560	1.158	0.538	1.251	1.611
Al Zeitoun	0.939	1.116	0.982	0.865	1.374	1.132
North	1.290	0.458	0.861	1.044	1.205	0.787
Al Khalifah	1.462	0.315	0.524	1.238	0.379	0.576
Central	0.770	1.160	1.467	1.217	0.909	0.852
South	1.135	0.740	1.331	1.063	1.113	0.550
Maadi	1.020	0.875	0.673	0.962	1.831	0.948
Helwan	1.053	0.515	0.427	0.616	3.041	1.952
Agouza	0.863	1.438	1.449	1.046	0.079	0.801
Al Ahram	0.995	0.902	0.927	1.345	0.163	0.922

3) Trip Generation by Time and Purpose

Fig. 2.3.2 shows the volume of generation according to the time of generation and purpose. According to this figure, trip generation peaks between 7:00 and 8:00 in the morning for the purpose of "To Work" and "To School" (roughly 2,300,000 trips; peak ratio 16.8%). Thereafter, there is a steady flow of traffic spread out evenly between 9:00 and 21:00, with slight peaks occurring from 12:00 to 13:00 and from 14:00 to 15:00.

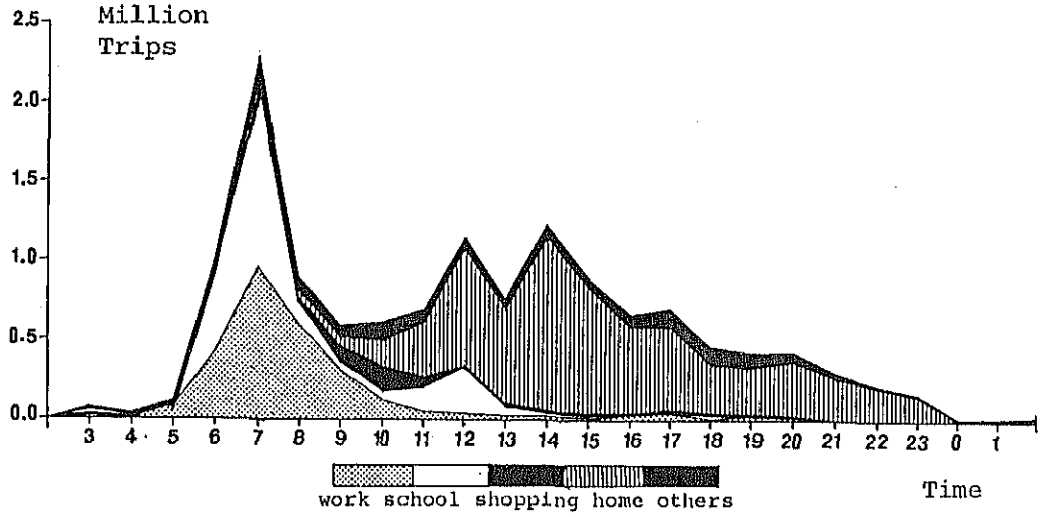


Fig. 2.3.2 Trip Generation by Time and Purpose

In terms of purpose, the generation of "To Work" trips peaks between 6:00 and 10:00, and the majority of such trips is completed before noon.

Trip generation for "To School" peaks between 6:00 and 8:00, the majority of which is accounted for by primary and junior high school students.

The volume of trips generated for "Shopping" purposes peaks between 9:00 and 12:00, after the busiest times of commuting to work and school are over.

Trip generation for returning home starts to increase from 10:00 and continues until 24:00, but the peak occurs between 12:00 and 17:00. In particular, there is a major peak between 14:00 and 15:00.

Trip generation for "Other" purposes is evenly spread out throughout the day.

Fig. 2.3.3 shows the volume of trip generation by time and mode, excluding walking and bicycles. This differs from the pattern for all modes of transport shown in Fig. 2.3.2 in that a peak occurs twice: from 6:00 to 9:00 and from 14:00 to 16:00. This characteristic may be attributed to the fact that the exclusion of walking and bicycle, which are usually used for relatively short distances, means that the movements of lower grade pupils (the majority of whom walk) are in effect excluded. The remaining volume is accounted for mainly by those commuting to work and returning home from work. These two purposes account for the two peaks in the day.

The modal shares remain about the same at all times except during the two peaks, when the share of buses increases slightly.

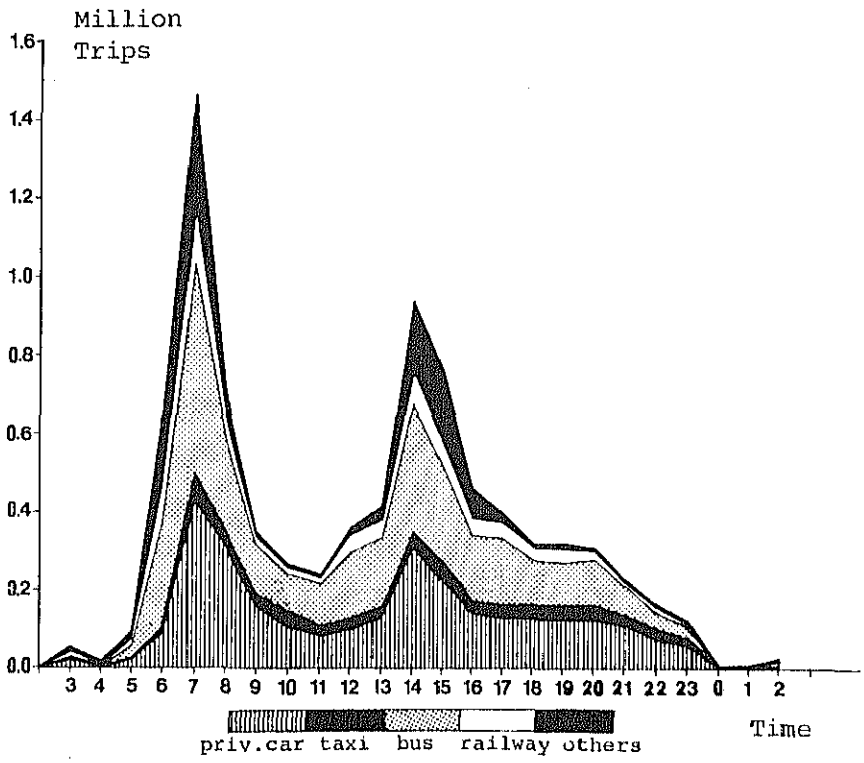


Fig. 2.3.3 Trip Generation by Time and Mode

2.4 Trip Distribution

The distribution of trips (made by residents only) in terms of all purposes and all modes of transport for integrated zones is compiled in an OD table, Table 2.4.1. Fig. 2.4.1 shows trips as a desire line.

Table 2.4.1 Present OD Table (All Purposes, All Modes)

Zone	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)
1)	658446	14199	19649	17489	57165	3501	29025	6162	2703	5016	6736
2)	14707	847125	134200	130682	36186	2079	77591	13886	11733	10804	11217
3)	19437	133710	755039	175018	59035	9656	96646	21224	18180	8139	39721
4)	17748	129500	175672	723813	83332	12080	128393	25485	8243	7719	29782
5)	57183	36722	60200	83161	1135196	3749	167203	23918	10135	33626	39792
6)	4063	2229	9975	12632	4116	179446	38778	17498	13736	4985	3224
7)	28624	78061	95466	126475	171847	38526	721165	87529	59184	24948	164379
8)	6058	13656	20722	26169	23780	17144	89716	452800	67216	20074	36041
9)	2132	11269	18412	9121	10108	13503	60890	66669	349266	30183	13468
10)	5275	10541	8053	7688	32742	5101	25136	20058	31427	541031	10518
11)	6774	12102	37349	28627	40425	3532	163218	36640	13161	10158	810873
12)	5027	9036	30068	19579	22672	6991	106088	62946	26910	18516	137963
13)	0	0	0	0	0	0	0	0	0	0	0
14)	0	0	0	0	0	0	0	0	0	0	0
15)	0	0	0	0	0	0	0	0	0	0	0
16)	603	513	564	2158	1053	106	449	885	805	483	187
17)	1135	6591	3450	1749	2964	557	744	2351	2035	413	1495
18)	7659	4026	2129	2007	2086	310	1098	1384	0	0	1125
19)	5021	3554	1308	3452	5651	122	679	1191	516	1018	3514
20)	2612	1585	2242	4950	4349	1378	4024	2056	1423	2149	14618
Total	842504	1314419	1374498	1374770	1692707	297781	1710843	842682	616673	719262	1324653

Table 2.4.1 (cont...)

Zone	12)	13)	14)	15)	16)	17)	18)	19)	20)	Total
1)	5038	0	0	0	603	1135	7659	5020	2203	841749
2)	9777	0	0	0	513	6172	3744	3514	1690	1315620
3)	31374	0	0	0	275	3769	2129	1521	1732	1376605
4)	18994	0	0	0	2385	2413	2121	3452	5458	1376590
5)	22171	0	0	0	1053	3805	2318	5528	4061	1689821
6)	7017	0	0	0	106	557	310	122	1204	299998
7)	104548	0	0	0	449	856	1466	1166	4440	1709129
8)	63558	0	0	0	563	1916	1716	1333	2523	844985
9)	27346	0	0	0	1143	2305	0	516	1290	617621
10)	18026	0	0	0	297	413	0	896	2277	719479
11)	134964	0	0	0	855	1628	1125	3719	14627	1319777
12)	969039	0	0	0	1258	1129	613	4224	19082	1441141
13)	0	0	0	0	0	0	0	0	0	0
14)	0	0	0	0	0	0	0	0	0	0
15)	0	0	0	0	0	0	0	0	0	0
16)	1399	0	0	0	186	0	0	0	0	9391
17)	1045	0	0	0	0	616	0	0	0	25145
18)	613	0	0	0	0	0	356	0	0	22793
19)	5172	0	0	0	0	0	0	224	0	31422
20)	18362	0	0	0	0	0	0	0	469	60217
Total	1438443	0	0	0	9686	26714	23557	31235	61056	13701483

Note: 1) Trips by non residents are not included
2) Zones 13-15 are prepared for the future new settlement

Of the total number of trips made by residents (13.7 million trips), those which originated and ended in the same integrated zone (intrazonal trip) represent 59.4%; those which involved an area outside of the survey area account for 2.2%; and the remaining 38.4% are inter-zonal trips made within the survey area. In particular, the fact that there are few trips involving areas

outside of the survey area indicates that the Greater Cairo Region is closed in terms of transportation.

A characteristic of the overall trip distribution is that there is a large flow of traffic going to and returning from Central (zone 7) involving all zones. Furthermore, there are large flows of traffic from north-east, and central, to south-west. And there are short trips around Heliopolis (zone 2-4) and around Giza (zone 11-12).

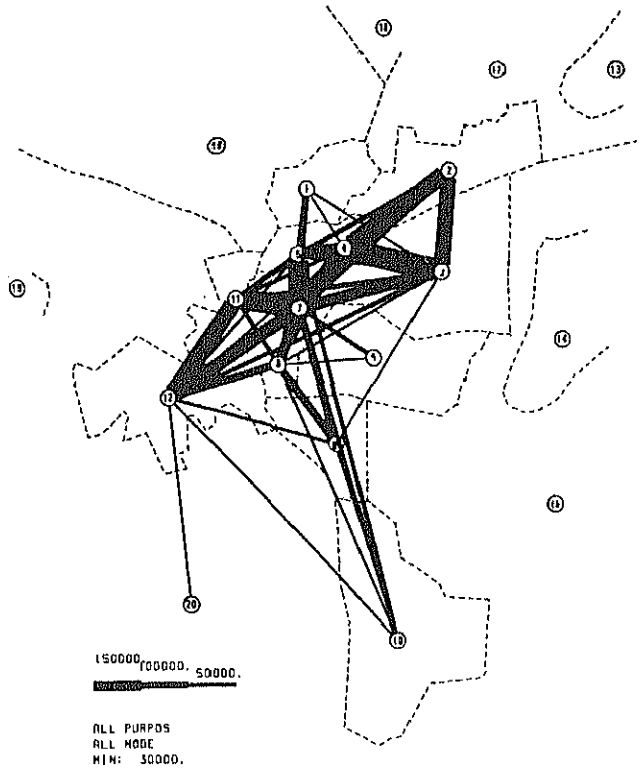


Fig. 2.4.1 Present Desire Line (All Purposes, All Modes)

Figures 2.4.2 and 2.4.3 show the desire lines of "To Work" and "To School" traffic within the integrated zones. These make up the majority of trips.

1) To Work

From Fig. 2.4.2 it is observed that there is a center in Central and Masr Al Gadida, and traffic flow of Heliopolis - Central - Giza.

The link between areas of habitation and areas of employment for workers is shown by integrated zone in Table 2.4.2. First of all, in terms of trip attraction, the rate of employment within the zone of habitation is high in East, North, Khalifah and Ahram, and low in Central and Masr Al Gadida. Many workers commute to these last two areas from other zones. In terms of trip

generation, the rate of employment in the zone of habitation is high in Helwan where many workers commute to work within the zone. Conversely, workers who live in East, North, Maadi commute to work in other areas.

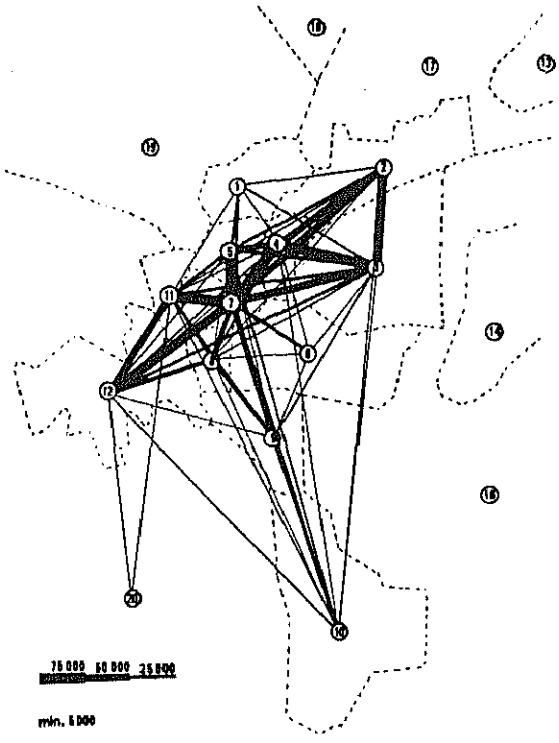


Fig. 2.4.2 Present Desire Line (to Work Purpose, All Modes)

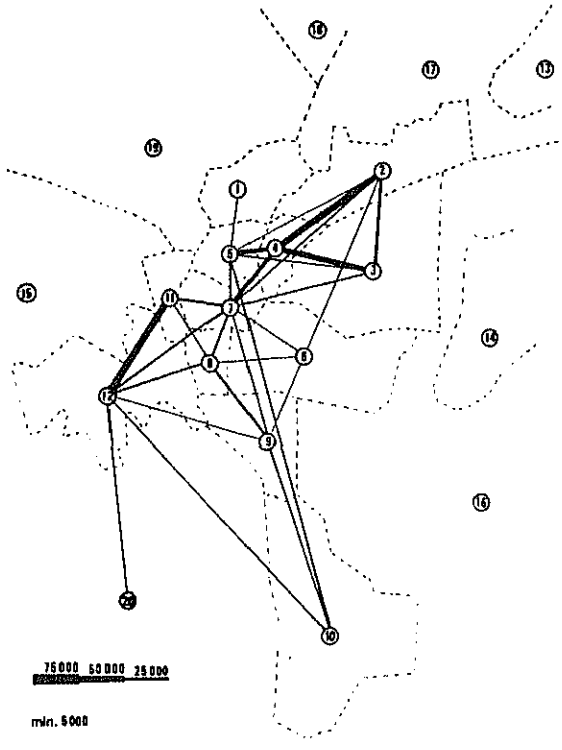


Fig. 2.4.3 Present Desire Line (to School Purpose, All Modes)

2) To School

Fig. 2.4.3 shows that inter-zonal trips made mainly by high school aged students concentrate in Zeitoun and Agouza where there are universities, and Masr Al Gadida where there are various kinds of schools.

The movement of students between areas of habitation and areas in which schools are located is shown by integrated zone in Table 2.4.3. In terms of trip generation, in all zones about 70-80% of all students commute to school within the zone they live. In terms of attraction, students commute to schools in Masr Al Gadida, Central, Zeitoun and South from other zones.

Table 2.4.2 Present OD Table (to Work Purpose, All Modes)

	1)	2)	3)	4)	5)	6)	7)	8)	9)
1) Shubra Al Kheima	94387	3167	11409	6299	13921	996	18169	2234	508
2) East	5182	89841	60360	35920	9214	412	44172	7167	2652
3) Masr Al Gadida	2002	4026	63108	16893	1977	1065	24582	3105	1008
4) Al Zeitoun	3411	9608	34991	87029	7189	309	42442	7842	2377
5) North	14758	5608	25228	24950	130228	1429	87344	10807	3262
6) Al Khalifah	121	866	5664	4689	518	30124	18453	4830	4188
7) Central	1409	2867	11200	11675	5125	1753	122757	7562	4811
8) South	1164	1017	5018	3969	1072	2634	27282	50712	8025
9) Maadi	261	771	7968	2060	2327	2696	28373	19482	56137
10) Helwan	128	0	2058	569	813	660	9032	3766	4896
11) Agouza	1429	569	8613	5617	4248	316	54046	5653	3084
12) Al Ahram	835	1885	13330	6310	3894	1404	44681	15465	3635
Outside	26550	6311	21296	8224	19475	1288	40277	4630	3639
Total	151637	126536	270243	214204	200001	45086	561610	143255	98222
Intra-Zone	62.2	71.0	23.4	40.6	65.1	66.8	21.9	35.4	57.2
Study Area	20.2	24.0	68.8	55.5	25.1	30.3	71.0	61.4	39.1
Outside	17.5	5.0	7.9	3.8	9.7	2.9	7.2	3.2	3.7

Table 2.4.2 (cont...)

	10)	11)	12) Outside	Total	Intra-Zone	Study Area	Outside
1) Shubra Al Kheima	2634	2691	2936	7871	167222	56.4	38.8	4.7
2) East	6131	4469	3481	11983	280984	32.0	63.8	4.3
3) Masr Al Gadida	1435	6353	3903	7529	136986	46.1	48.4	5.5
4) Al Zeitoun	3932	5734	3173	9117	217154	40.1	55.7	4.2
5) North	11517	13461	7699	11935	348226	37.4	59.2	3.4
6) Al Khalifah	1755	1678	2004	1179	76069	39.6	58.8	1.5
7) Central	5589	8710	6763	5578	195799	62.7	34.5	2.8
8) South	6579	7572	9179	3495	127718	39.7	57.6	2.7
9) Maadi	12104	3961	4820	3565	144525	38.8	58.7	2.5
10) Helwan	93483	1256	2349	2596	121606	76.9	21.0	2.1
11) Agouza	4124	93206	13874	9656	204435	45.6	49.7	4.7
12) Al Ahram	5843	28429	151042	13161	289914	52.1	43.4	4.5
Outside	18686	12976	18576	8493	190421			
Total	173812	190496	229799	96158	2501059			
Intra-Zone	53.8	48.9	65.7					
Study Area	35.5	44.3	26.2					
Outside	10.8	6.8	8.1					

Table 2.4.3 Present OD Table (to School Purpose, All Modes)

	1)	2)	3)	4)	5)	6)	7)	8)	9)
1) Shubra Al Kheima	181851	485	1807	3770	9453	360	1546	1002	0
2) East	868	236232	19971	45049	4332	503	7122	1033	434
3) Masr Al Gadida	0	2550	97163	20341	988	92	4863	189	0
4) Al Zeitoun	470	4672	15542	185998	4505	0	13673	704	419
5) North	3495	4664	9296	26527	317374	617	16674	3267	1568
6) Al Khalifah	439	268	318	3038	390	54930	7432	4661	242
7) Central	214	1094	4553	18179	3400	1562	123571	7366	794
8) South	255	119	955	1271	119	1266	8241	87256	2395
9) Maadi	128	2217	2298	2179	135	2822	5852	17595	112283
10) Helwan	122	115	1129	684	3744	0	1726	1729	2534
11) Agouza	307	299	815	2638	540	366	17519	3869	0
12) Al Ahram	0	0	1678	1924	526	0	6844	7498	460
Outside	2185	1185	2175	1441	1175	19	2794	586	154
Total	190334	253900	157700	313039	346681	62537	217857	136755	121283
Intra-Zone	95.5	93.0	61.6	59.4	91.5	87.8	56.7	63.8	92.6
Study Area	3.3	6.5	37.0	40.1	8.1	12.1	42.0	35.8	7.3
Outside	1.1	0.5	1.4	0.5	0.3	0.0	1.3	0.4	0.1

Table 2.4.3 (cont...)

	10)	11)	12)	Outside	Total	Intra-Zone	Study Area	Outside
1) Shubra Al Kheima	402	262	368	7956	209262	86.9	9.3	3.8
2) East	789	453	1337	1536	319659	73.9	25.6	0.5
3) Masr Al Gadida	97	1071	481	1543	129378	75.1	23.7	1.2
4) Al Zeitoun	249	1663	1186	2565	231646	80.3	18.6	1.1
5) North	3493	874	3244	2038	393131	80.7	18.8	0.5
6) Al Khalifah	0	106	1920	895	74639	73.6	25.2	1.2
7) Central	1457	1881	5751	2069	171891	71.9	26.9	1.2
8) South	1505	3347	7216	1175	115120	75.8	23.2	1.0
9) Maadi	2985	0	5022	339	153855	73.0	26.8	0.2
10) Helwan	126939	664	4384	877	144647	87.8	11.6	0.6
11) Agouza	806	179395	18747	2629	227930	78.7	20.1	1.2
12) Al Ahram	1091	28078	248363	8509	304971	81.4	15.8	2.8
Outside	498	1295	4965	249	18721			
Total	140311	219089	302984	32380	2494850			
Intra-Zone	90.5	81.9	82.0					
Study Area	9.2	17.5	16.4					
Outside	0.4	0.6	1.6					

2.5 Modal Split Traffic

1) Modal Split by Purpose

The number of trips categorized by mode of transport and purpose is shown in Table 2.5.1, and the modal split by purpose is shown in Fig. 2.5.1. According to these data, the use of private cars and buses is relatively high for those who commute to work. Few commute to work by walking. The predominant proportion of those who commute to school and go shopping do so by walking; which indicates that the distance of travel is short. The use of private cars and taxis is high among those whose trip purpose falls in the category of "Others", which suggests that trips for this purpose are made by relatively high income earners.

Table 2.5.1 Trips by Purpose and Mode

	Walk	Priv.Car	Taxi	Bus	Railway	Others	Total
Work	533620	709035	125400	839311	171532	380769	2759667
School	1476563	243783	52333	446101	147337	170100	2536217
Shopping	362851	81032	17729	57780	12448	1409	533249
Home	2566086	1283448	338565	1525280	384794	561025	6659198
Others	255172	484602	158977	270276	58867	32113	1260007
Total	5194292	2801900	693004	3138748	774978	1145416	13748338
Work	19.3%	25.7%	4.5%	30.4%	6.2%	13.8%	100.0%
School	58.2%	9.6%	2.1%	17.6%	5.8%	6.7%	100.0%
Shopping	68.0%	15.2%	3.3%	10.8%	2.3%	0.3%	100.0%
Home	38.5%	19.3%	5.1%	22.9%	5.8%	8.4%	100.0%
Others	20.3%	38.5%	12.6%	21.5%	4.7%	2.5%	100.0%
Total	37.8%	20.4%	5.0%	22.8%	5.6%	8.3%	100.0%
Work	10.3%	25.3%	18.1%	26.7%	22.1%	33.2%	20.1%
School	28.4%	8.7%	7.6%	14.2%	19.0%	14.9%	18.4%
Shopping	7.0%	2.9%	2.6%	1.8%	1.6%	0.1%	3.9%
Home	49.4%	45.8%	48.9%	48.6%	49.7%	49.0%	48.4%
Others	4.9%	17.3%	22.9%	8.6%	7.6%	2.8%	9.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

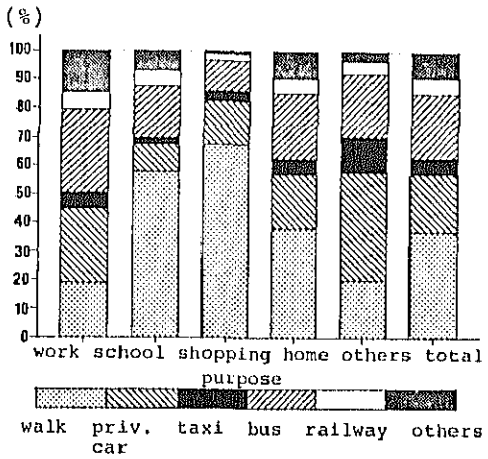


Fig. 2.5.1 Modal Share by Purpose

2) Trip Distribution by Mode

The desire line of major modes by integrated zones are shown in Figures 2.5.2 to 2.5.5. "Walk" trip is used for short distances and it is a small volume between integrated zones.

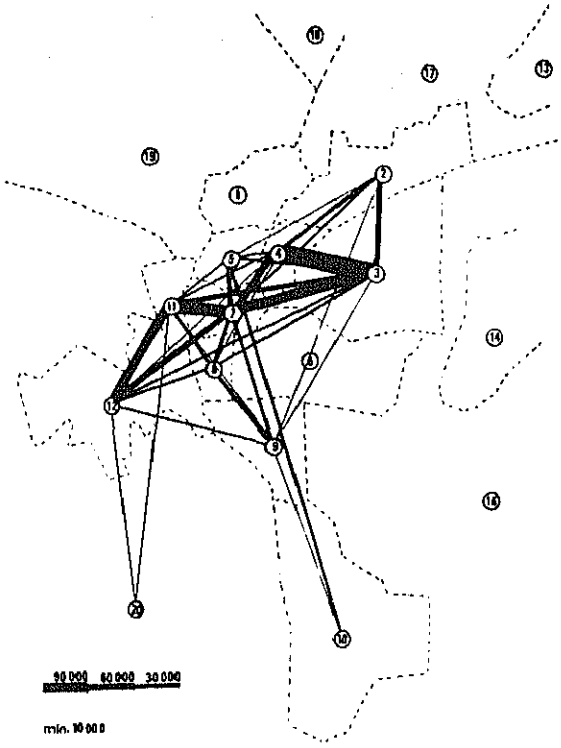


Fig. 2.5.2 Present Desire Line (All Purpose, by Private Car)

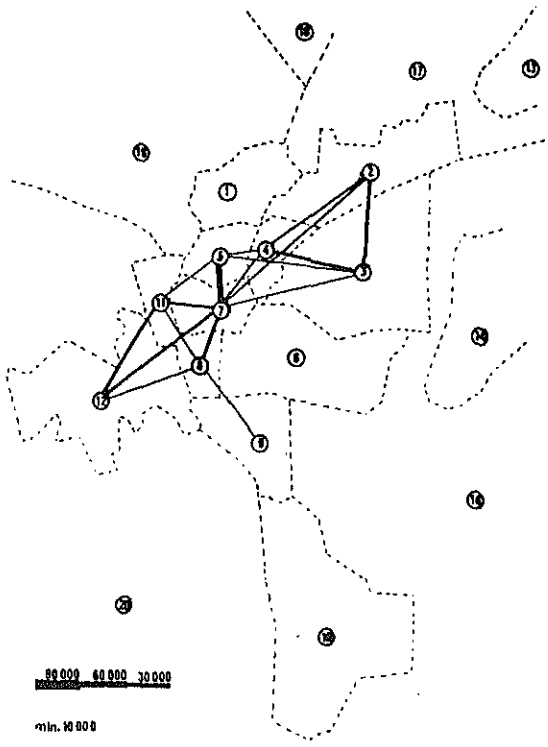


Fig. 2.5.3 Present Desire Line (All Purpose, by Taxi)

The trip flow by "Private Car" forms a big axis from north-east to south-west the same as whole traffic flow mentioned before. In particular, the flow between Masr Al Gadida and Zeitoun are different from the flow of buses.

"Taxi" is used along major traffic flows but is not used in surrounding area. "Bus" flow forms the same axis as whole traffic flow. "Railway" as a part of public transportation, is used along the railway from East to Central, and Helwan - Maadi - South route.

3) Travel Time by Mode

Fig. 2.5.6 shows the modal split by travel time. The following can be derived from this table.

a. The travel time of walking trip is one hour at most.
b. The use of private cars and taxis vary little according to the travel time.

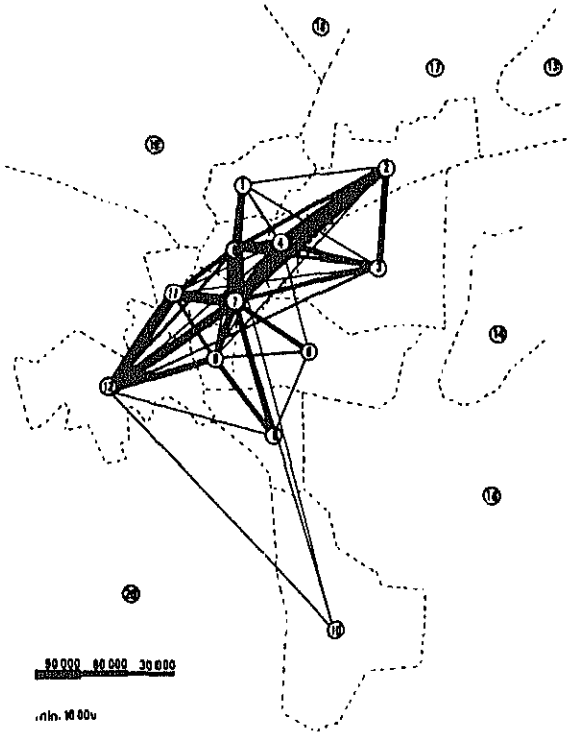


Fig. 2.5.4 Present Desire Line (All Purpose, by Bus)

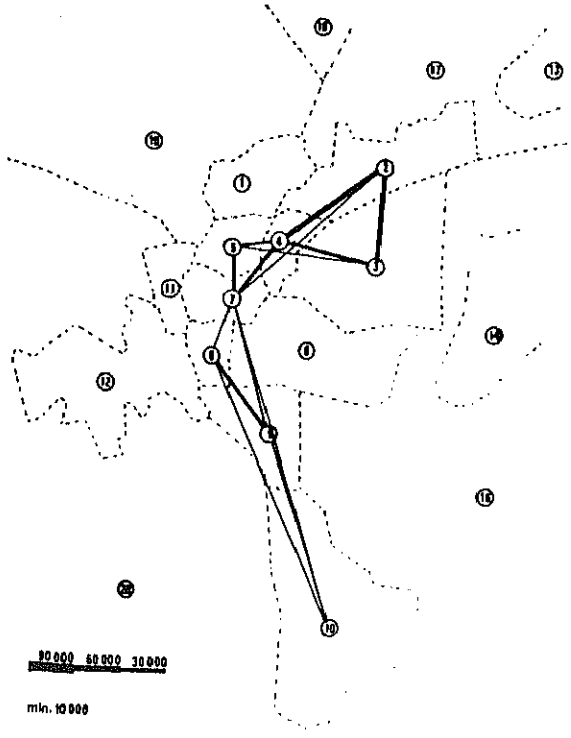


Fig. 2.5.5 Present Desire Line (All Purpose, by Railway)

c. The share of bus usage increases as travel time becomes longer (traveling distance becomes longer).
d. The share of work bus (included in "others" mode) usage remains constant for travel times of one hour or more.

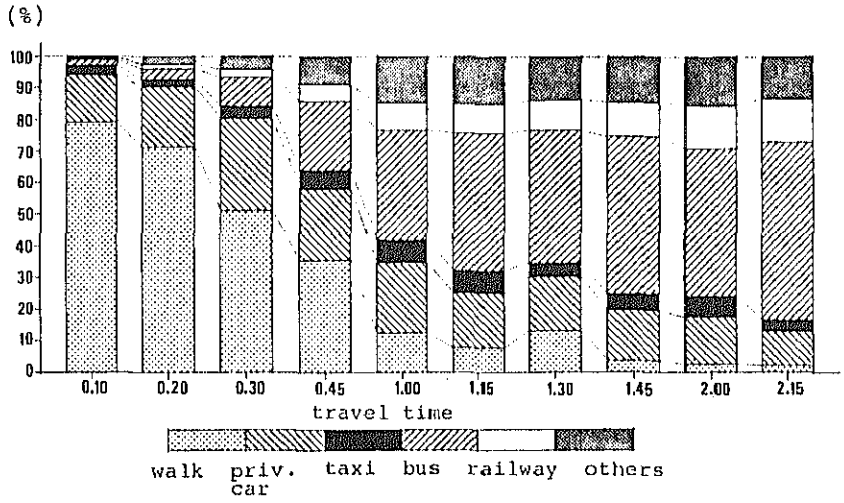


Fig. 2.5.6 Modal Share by Travel Time

Fig. 2.5.7 shows the modal split by traveling distance, as calculated on the basis of the actual distance along main road. The maximum distance of "Walk" trip is 7 km within which the modal share of each mode varies slightly. Over 7 km in distance, the modal share does not vary since there is no walking trip, and this fact indicates that the distance does not affect the modal split other than walking trips.

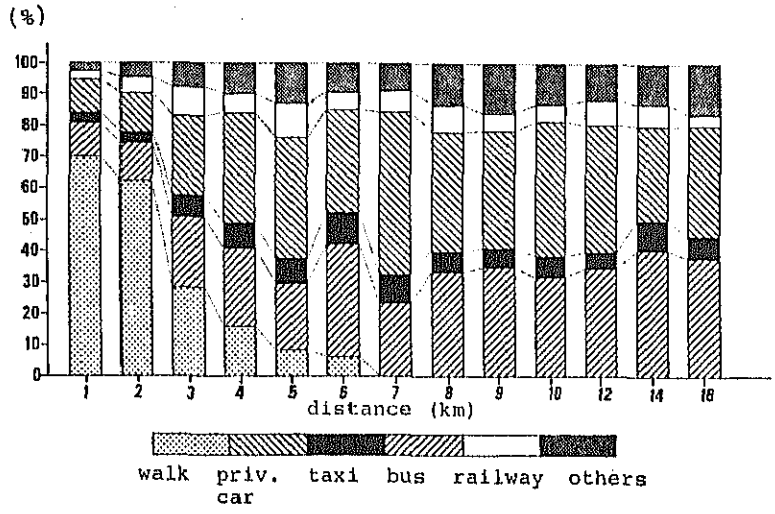


Fig. 2.5.7 Modal Share by Travel Distance

As shown in Tables 2.5.2 and 2.5.3, the average travel time and distance within the Greater Cairo Region are 38 minutes and 5 km respectively. The average traveling distance for all modes of transport combined, excluding walking, is 7 km.

Table 2.5.2 Average Travel Time by Mode

	Trav. Time (min)	Mean Distance (km)
Walk	21.9	1.45
Priv. car	36.3	7.23
Taxi	42.3	5.92
Bus	56.8	6.68
Railway	56.6	7.60
Others	50.8	8.24
Total	38.2	4.94 (7.09)

Note: ( ) Mean Distance w/o Walk

Table 2.5.3 Average Travel Time by Purpose

(unit: min.)

	Trav. Time
Work	45.5
School	29.5
Shopping	25.1
Home	39.2
Others	39.9
Total	38.2

4) Household Characteristics and Modal Split

(1) Modal Split by Car Ownership

Fig. 2.5.8 shows the modal split by household car ownership. Almost 60% of households that own cars use private cars, while non-car owning households inevitably depend on walking or public transportation such as railway and buses.

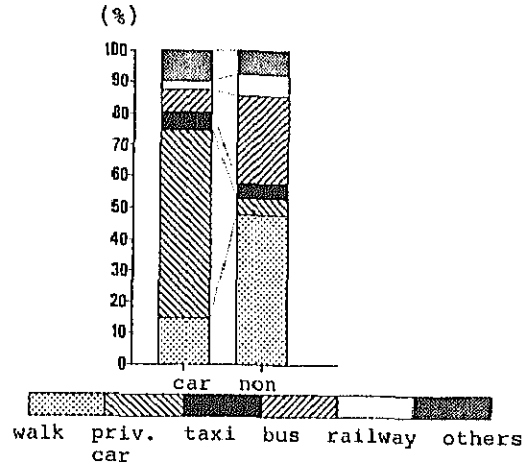


Fig. 2.5.8 Modal Share by Car Ownership

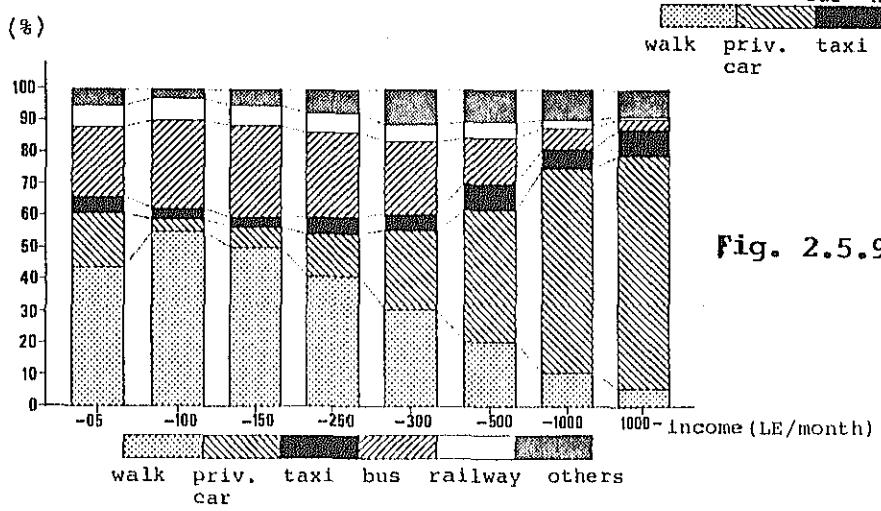


Fig. 2.5.9 Modal Share by Income

(2) Modal Split by Income Bracket

Fig. 2.5.9 shows the modal split by households income brackets. As income rises, trips made by walking decline and trips by private car increase. This is due to the fact that car ownership increases as income grows. In particular, the share of private cars increases rapidly at an income level of more than 300 LE per month; it is from this mark that the rate of car ownership increases sharply. At an income of more than 1000 LE per month, nearly 80% use private cars. The share of buses is constant up to an income of 300 LE per month but declines sharply when income increases above that figure.

3. Road Network

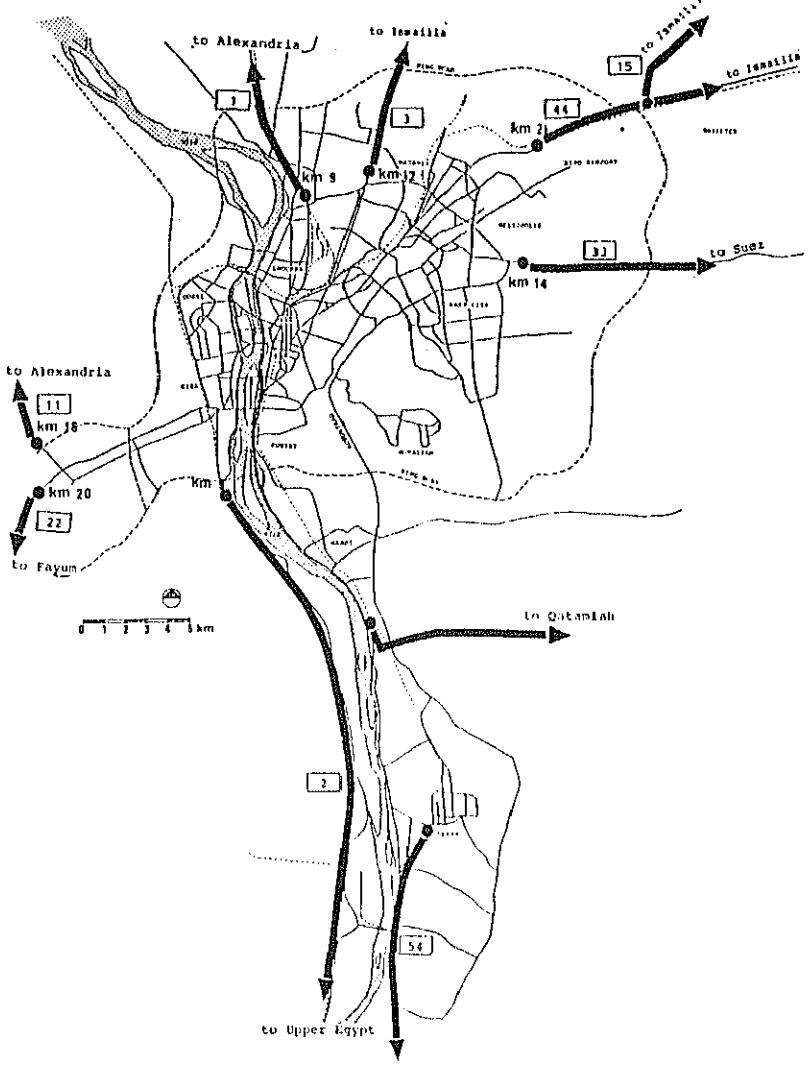
3.1 Present Road Facilities

1) Road Registration

(1) Road Registration System on the National Level

National highways in rural areas are under the jurisdiction of the Ministry of Transport, and the Roads and Bridges Authority under this ministry is responsible for the construction and the maintenance of these highways.

Only highway sections outside the urban area are defined as National Highways. Fig. 3.1.1 shows the starting points, highway numbers and the destinations of these National Highways. The zero



Source: TPA, Ministry of Transport

Fig. 3.1.1 National Highways in the Study Area

point of these National Highways radially extended from Cairo is set at Attaba sq. and the kilometrages of these highways are registered in the Ministry of Transport as shown on the figure. The highway routes within the urban area from the zero point to their starting points on the fringe of urban area are not defined.

(2) Registration of roads in the Urban Area

All the roads in the Cairo urban area are under the jurisdiction of either the governorates or the districts. The roads are registered in the governorates by their names and attached maps. Such information as ROW, length, lane nos., surface type and starting and ending points is not available in this registration form.

The city ordinance for ROW regulates ROW against the new or re-construction of buildings. In the case of Cairo Governorate, such city ordinance was established in 1971, and the city planning section is responsible to issue approval for new building or re-construction. Fig. 3.1.2 shows the city ordinance for ROW in Cairo Governorate. The major roads and their regulated ROW are:

Azhar st. (50 m)
Qalaa st. (50 m)
New road from Bab Al Wazir to Gamaa br. (50 m)
26th July st. to Abou Al Ella and extension to Port Said st. (50 m)
Gueish st. - Abbasseya st. (50 m)
Sekket Al Wayli st. (50 m)
Sekket Al Hadid st. - Gisr Al Suez st. (50 m)
Ahmed Said st. and its extension (50 m)
Abdel Qader Gilani st. (50 m)
Shubra st. (40 m)
Al Teraat Al Boulaqiya st. (40 m)

In Giza and Qaliubiah Governorates, the city ordinances for ROW regulate a rather wide ROW of 40 m - 50 m in the newly developed areas.

The road and bridges sections are responsible for the construction and maintenance of such major arterials in the urban area as Rod Al Farag br., 6th Oct. br. extension (under construction at present) and Salah Salem st. (completed).

The district offices under the governorates are responsible for small maintenance works and cleaning of streets within the districts.

GOPP under the Ministry of Development is responsible for the planning of such arterials related to new settlements surrounding GCMR as Ring Road (partially completed) and Autostrade (completed), and Executing Agency for Greater Cairo Region Project (EAGCRP) is responsible for the construction of these arterials.

Fig. 3.1.2 ROW Width by City Ordinances

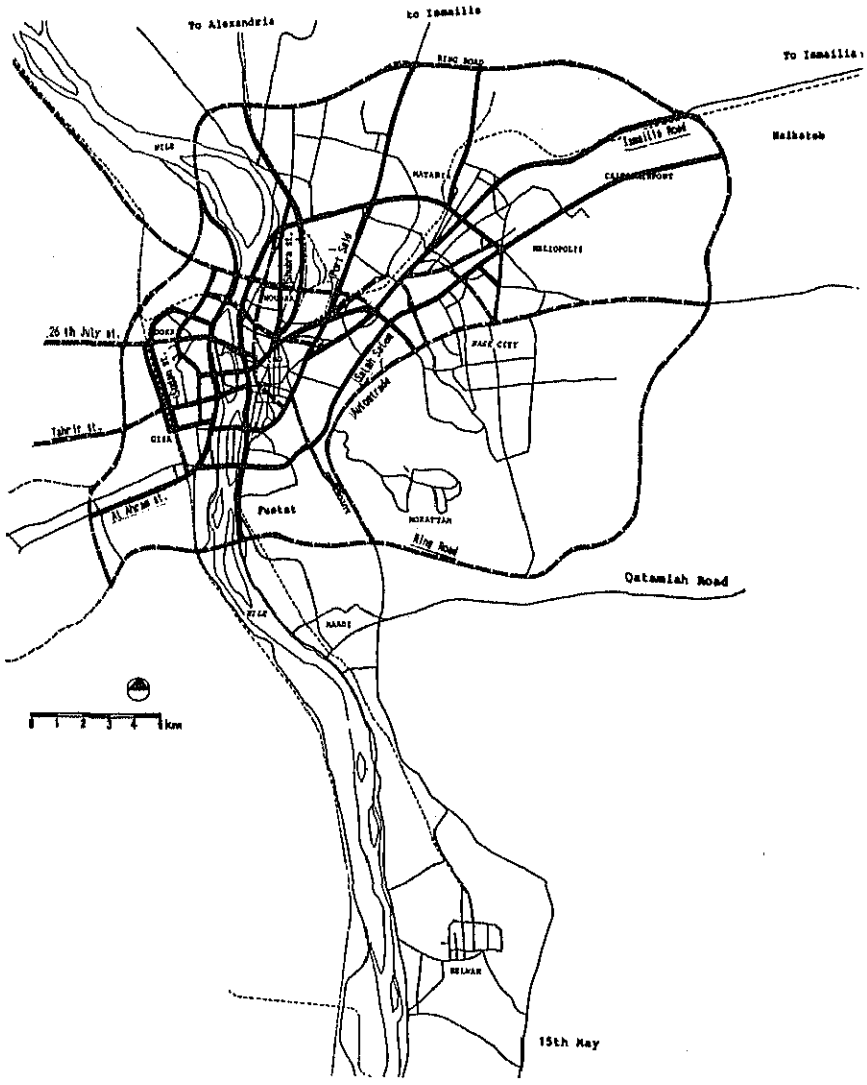
In addition to the agencies concerned with road construction and maintenance in GCMR, the National Agency for Tunnels (NAT) is constructing flyovers on Al Marg - Helwan Regional Metro line to avoid at-grade intersections and achieve high operating speed.

2) Road Networks in the Current Studies

(1) Planning of the Entrances to the Greater Cairo Area, 1976

The arterial road network in the study area taken in the "Planning of the Entrances to the Greater Cairo Area, 1976" is shown in Fig. 3.1.3. The broad lines show the links between nodes, and dotted lines show the proposed roads. In that study, the following roads are identified as major entering roads to the study area.

(1) Cairo - Alexandria Agriculture Road
(3) Sharikat st.
(4) Port Said st.



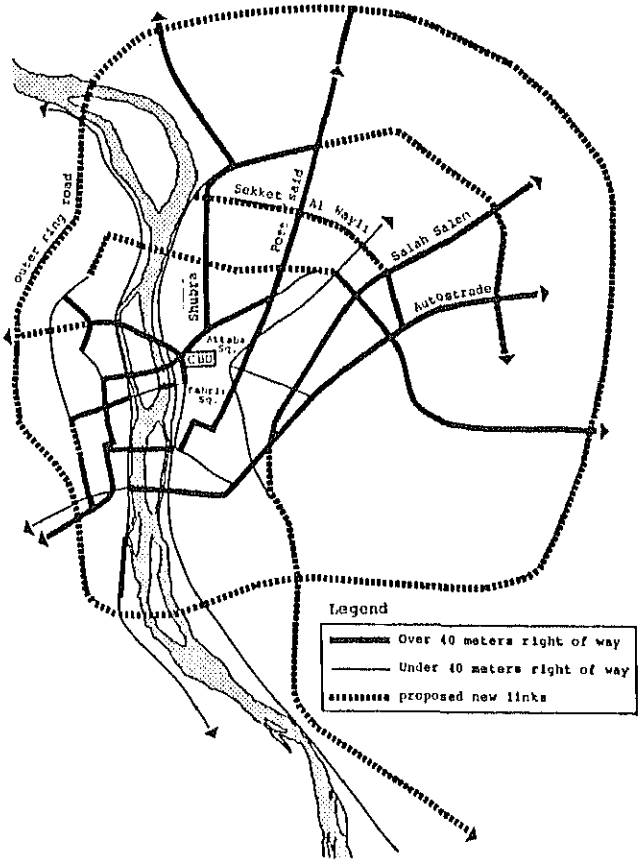
Source: Planning of the Entrances to the Cairo Urban Area, 1976, GOPP

Fig. 3.1.3 Arterial Road Network in Entrances Study, in 1976

(7) Ain Shams st. from Al Marg area
(9) Ismailia desert road
(10) Orouba st. from Airport
(11) Suez desert road
(12) Future Autostrade extension
(15) Autostrade from Helwan
(17) Corniche al Nile from Helwan
(18) Upper Egypt Highway
(20) Ahram st.
(22) Future Tahrir st. extension
(23) Future 26th July st. extension
(25) Future Rod Al Farag br. extension
(26) Al Nile st.
(27) Pesos Drainage road to Nile Barrage

(2) Greater Cairo Region Long Range Urban Development Scheme, 1981

The road network in the "Greater Cairo Region Long Range Urban Development Scheme, 1981" is shown in Fig. 3.1.4. In that study, the arterial roads were classified into two categories by their ROW width.



Source: Greater Cairo Region Long Range Urban Development Scheme, 1981, GOPP

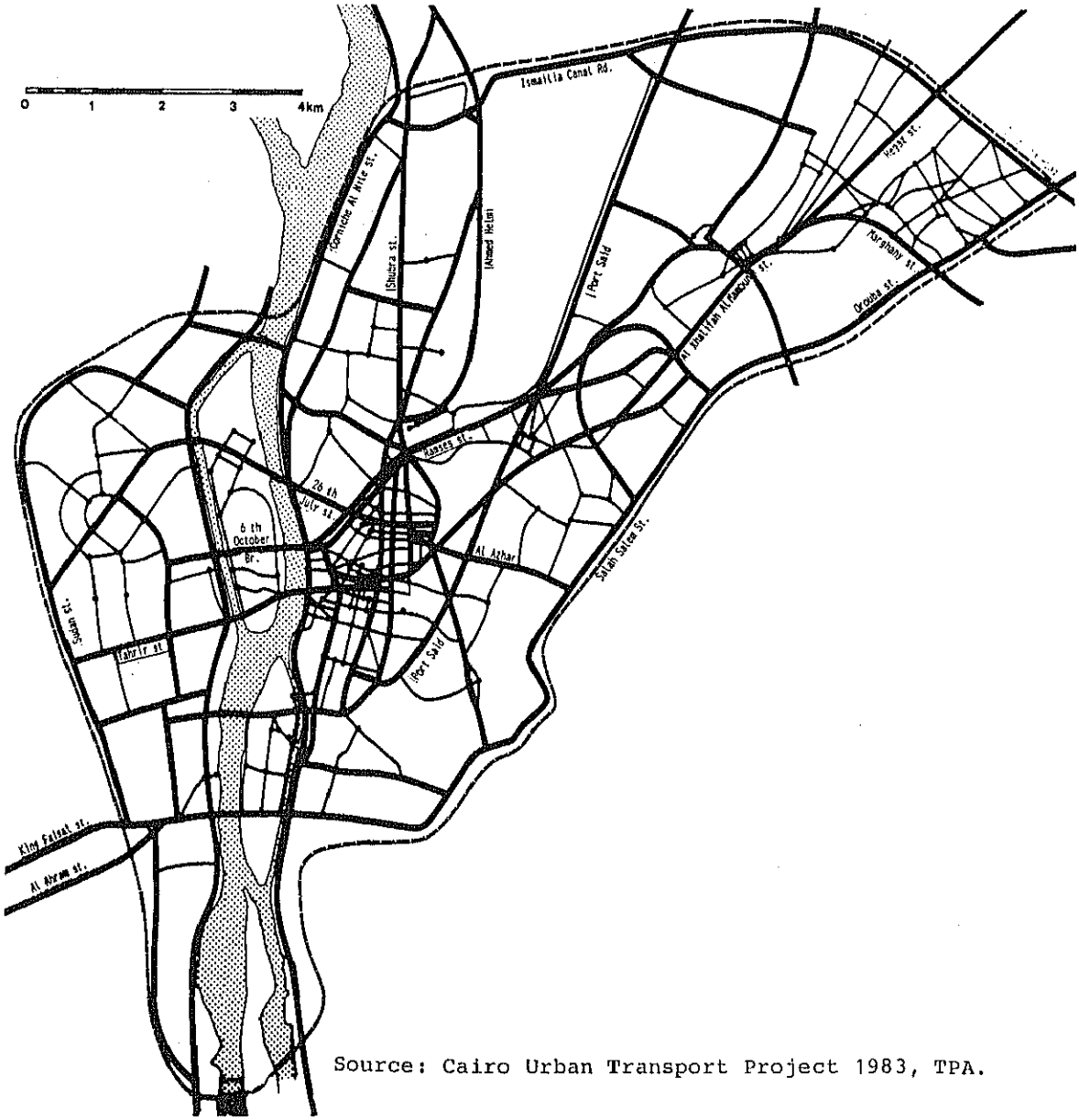
Fig. 3.1.4 Arterial Road Network in Master Scheme, 1981

(3) Cairo Urban Transport Project, 1983

Fig. 3.1.5 shows the road network in the "Cairo Urban Transport Project, 1983" prepared by Cairo University and MIT. The characteristics of the roads in terms of;

- Carriageway width and workable carriageway width,
- Parking condition, and
- Total lane nos. and workable lane nos.,

were compiled in the road inventory form prepared in 1981. At the



Source: Cairo Urban Transport Project 1983, TPA.

Fig. 3.1.5 Arterial Road Network in Cairo Urban Transport Project, 1983

same time, free flow speed and the practical capacity on the different road types in the different land use areas, as the basic data for the network simulation analysis, were calculated as in Table 3.1.1 based on the actual travel time survey and traffic counting.

Table 3.1.1 Travel Speed by Cairo Urban Transport Study, 1983

(1) Practical Capacity per Lane (unit: pcu/h)

	2 Way Arterial		1 Way Arterial		
Parking	No	Both Sides	No	One Side	Both Sides
CBD	640	440	700	525	400
Residential	675		550	525	460
Fringe	800	750	1200	750	700
OBD		330		350	370
Rural Area			1200	700	

(2) Free Flow Speed (unit: km/h)

	2 Way Arterial		1 Way Arterial		
Parking	No	Both Sides	No	One Side	Both Sides
CBD	28	27	32	34	24
Residential	30		50	50	32
Fringe	38	32	45	45	35
OBD		35		35	20
Rural Area			55	50	

Source: Cairo Urban Transport Project, CU/MIT

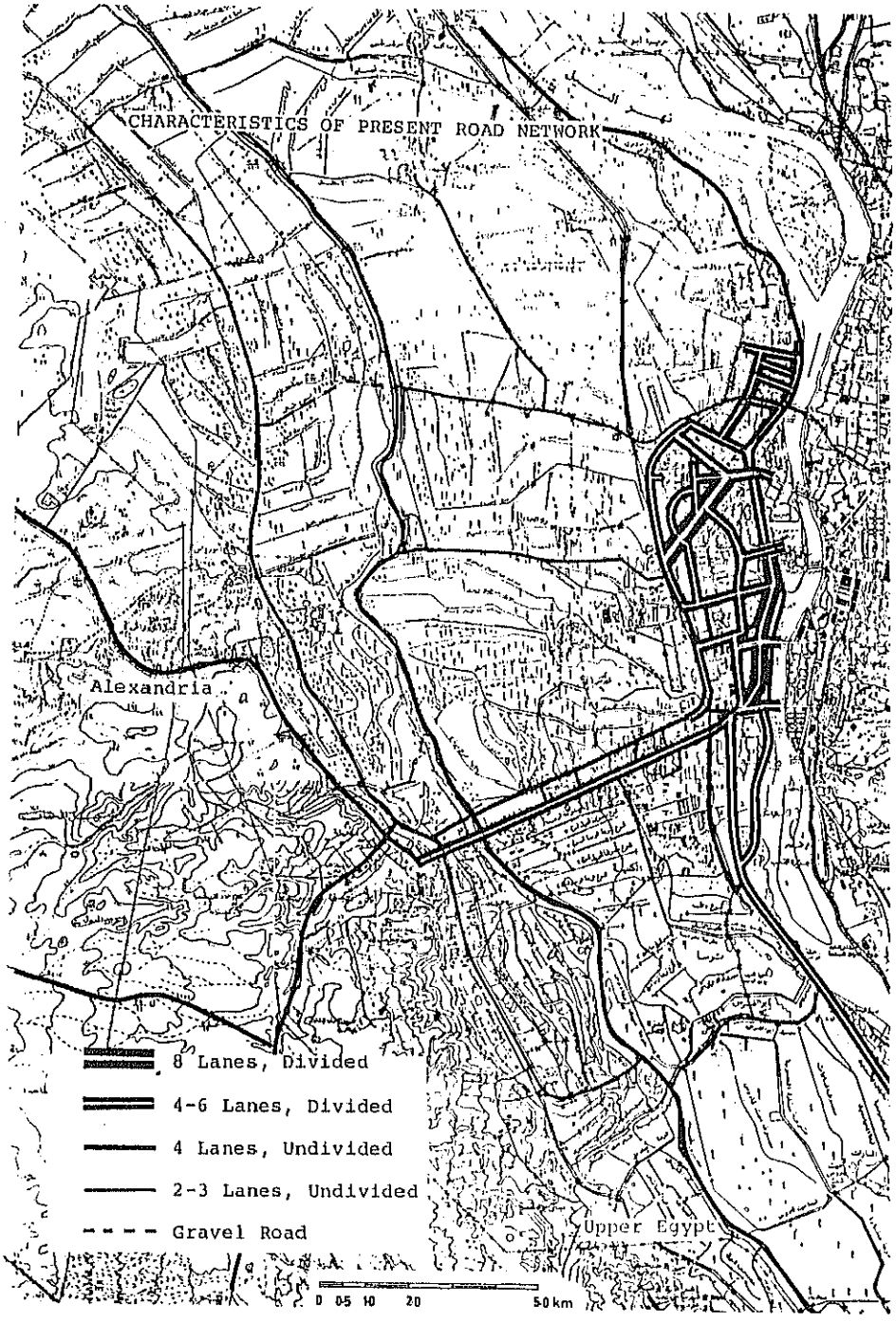
(4) Giza Masterplan Study, 1983

Fig. 3.1.6 shows the road network in "Giza Masterplan Study, 1983". In that study, the roads in Giza Governorate were classified into 5 categories by their lane nos., pavement and whether divided/undivided. The main roads shown by the broadest lines are Corniche st. from 6th October br. to Giza sq. and Gamaat Al Dowel st. from Sphinx sq. to Sudan st.

(5) Second Urban Development Project, 1985

Figures 3.1.7 and 3.1.8 show the arterial road network in "Second Urban Development Project, 1985" sponsored by World Bank for the study area and CBD respectively. The detailed road inventory survey for CBD surrounded by Galaa st., Clot Bey st., Abd Al Aziz st., Tahrir st. and Marriet st. was carried out in that study. The features covered by this road inventory were:

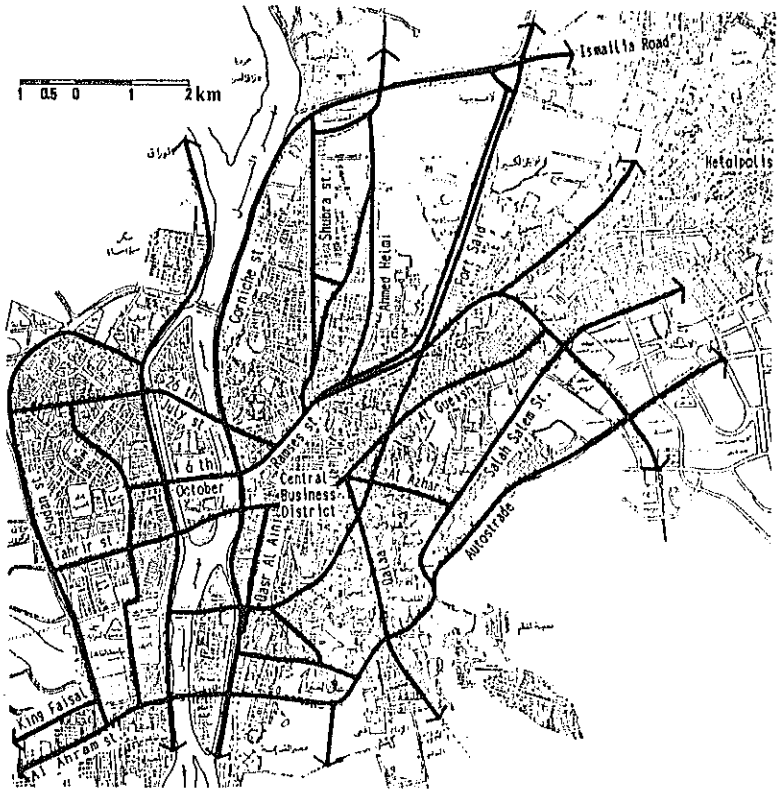
- Curb (type, condition, height of upstand)
- Sidewalk (surface type, size, condition)
- Pavement (distress type, number of travel lanes, locations of parking, direction of travel)
- Catch basins and manholes (condition, alignment)
- Road signs (condition, message shown, lit/unlit)



Source: Giza Masterplan Study, 1983, GOPP

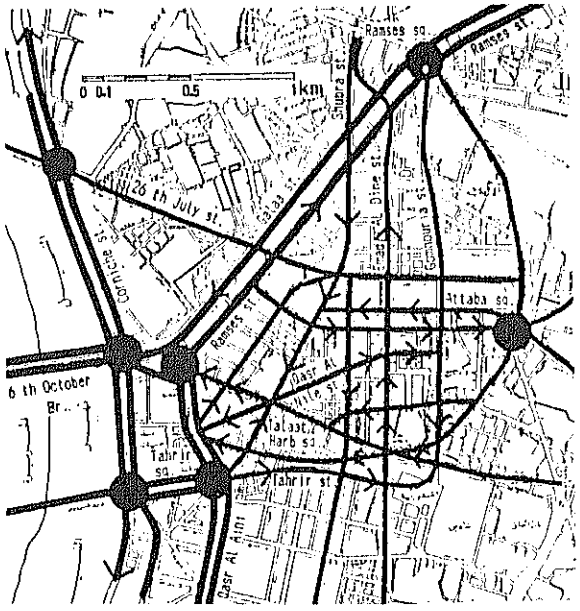
Fig. 3.1.6 Arterial Road Network in Giza Masterplan Study, 1983

This information was recorded in the topographic maps of scale 1/500. However the main task of that study was improvement of CBD traffic circulation, and for the roads outside CBD only development strategy was studied.



Source: Second Urban Development Project, 1985

Fig. 3.1.7 Arterial Road Network in Second Urban Development Project, 1985



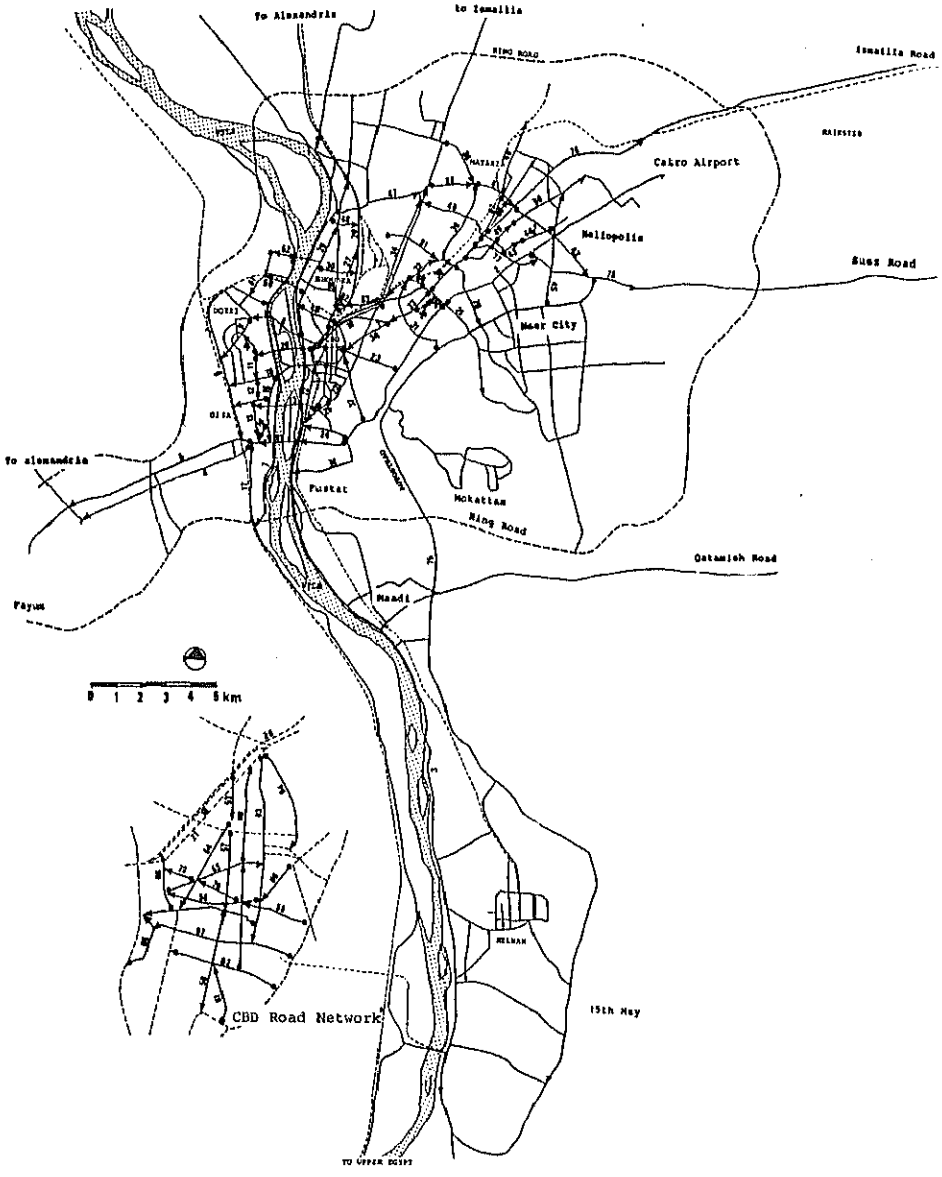
Source: Second Urban Development Project, 1985

Fig. 3.1.8 Arterial Road Network in Second Urban Development Project, 1985 (CBD)

3) Present Road Network

(1) Arterial Road Network

Fig. 3.1.9 shows the arterial road network of this Study. The total length is approx. 350 km. According to the Five Year Plan (1988 - 1992), the total length of the roads in Cairo, Giza and Qaliubiah Governorates are 485 km, 989 km and 712 km respectively.



Source: Study Team

Fig. 3.1.9 Present Arterial Road Network

The physical features of some major roads are shown in Table 3.1.2 and described below. Cross sections of major arterials are shown in Fig. 3.1.10.

- Ramses st./Galaa st./6th October st.

Ramses st., starting from Abdel Moneim Riad sq. at CBD side and extending to Nasr City via Ramses sq. and Abbasseya sq., is one of the main streets with 9.75 km length.

At the section between Abdel Moneim Riad sq. and Ramses sq., the 36 m wide Ramses st., and 32 m wide Galaa st. which runs in parallel north of Ramses st., compose a pair of one-way streets. The newly opened Regional Metro runs under Ramses st. and the 4 lane viaduct of 6th October br. runs on Galaa st. in this section.

At the section between Ramses sq. and Ghamra br. on Port Side st., the extension of 6th October viaduct is now under construction. Only the route to CBD is served for traffic using ramps of this viaduct.

At the section between Ghamra br. and Abbasseya sq., Ramses st. and Sekket al Hadid st. again compose a pair of one-way streets. Misr Sudan flyover was constructed at the intersection with Ahmed Said st. following a proposal in the "Cairo Urban Development Project, 1980". At the Abbasseya sq., a flyover on the square serves straight traffic.

- Salah Salem st./Orouba st./Roda st./Ahram st.

Salah Salem st. starts from the intersection with Corniche Al Nile st., via Citadel and Mokattam hilly area, connects to Orouba st. at the intersection with Ramses st. (Orouba sq.) and extends to the Cairo International Airport, with a total length of approx. 23 km.

In the section between Magra Al Eion intersection and Orouba sq., access is limited only at the intersections with Qalaa st., Azhar st., Ahmed Said st. and Ramses st. where flyovers are provided for the straight traffic and an intersection with the entrance to Mokattam area.

The west end of Salah Salem st. is connected with Roda st. and Giza br. and extends to Ahram st. which is the main street of Giza and connects to Alexandria desert road with a length of 9.2 km.

- Autostrade

The Autostrade starts from Helwan and extends to an intersection with Suez desert road at Nasr City, with a length of approx. 39 km. In the section between Helwan and Mokattam area, the Autostrade runs along the east fringe of Maadi and Helwan

urbanized area and road side access is limited. In the section between the intersection with the extension of Ahmed Said st. and Suez desert road, the Autostrade functions as the main street of Nasr City.

- Gueish st./Abbasseya st./Al Khalifah Al Mamoun st.

Gueish st., Abbasseya st. and Khalifah Al Mamoun st. provide the east-west corridor for the traffic from Roxi sq., the center of Heliopolis, and Attaba sq. in CBD with a total length of 8.4 km.

The section between Attaba sq. to Moshir Ahmed Ismail sq. (Gueish st.) has a ROW of 30 m width, however high road side level of activities and the passing of tram cause unsmooth traffic flow. In the section between Moshir Ahmed sq. and Abbasseya sq., the route is divided into a pair of one-way streets of Abbasseya st. (inbound) and Sarayah st. (outbound).

- Corniche Al Nile st./Al Nile st.

The main road of Corniche Al Nile st. starts from Alexandria Agriculture road along the east bank of the Nile rv. to Marazik br. in Helwan with a length of approx. 38 km. At the west bank of Nile rv., Al Nile st. provides another north-south route from the border of the Study Area in Embaba up to the connection with Upper Egypt Highway in the south of Giza City with a length of approx. 12.5 km.

At the sections from Abdel Moneim Riad sq. to the entrance to Garden City and from Manial br. to the intersection with Qasr Al Aini st., Corniche Al Nile st. is operated as one way.

At the section from Galaa br. to Giza br. in the east bank, the dual 3 lane Giza st. serves the main north-south route instead of Al Nile st. and is connected to Al Nile st. by the underpasses under Galaa br. and Giza br.

- Port Said st./Sad Al Barrani st.

Port Said st. starts from the connection with Ismailia agriculture road and extends to the intersection with Sad Al Barrani st. with a length of 11.2 km. Sad Al Barrani st. connects Corniche Al Nile st. and Port Said st. from Sayedah Zeinab sq. with a length of 1.5 km and ROW width of 18 m.

Only the section between Sayedah Zeinab sq. to the intersection with Sad Al Barrani st. is 2 lane 20 m wide with non-segregated tram line, and the remaining section, except for 0.65 km from the starting point, has 32 m - 36 m ROW with segregated tram line at the center.

The section between the intersections with Gueish st. and Qalaa st. is one of the most congested areas in the Study Area due to the road side commercial activities. At present the tram in this section is not operating because of the sewerage project

under construction and the tram line space is used as car parking.

- Shubra st./Teraat Al Boulaqiya st./Rod Al Farag st.

Shubra st. is the main route from Shubra Al Kheima area to CBD with a length of approx. 6.0 km. The section from Alexandria Agriculture road to the intersection with Rod Al Farag st. has a 40 m ROW and segregated tram line at the center, however at the section from this point to the intersection with Teraat Al Boulaqiya st. the ROW narrows to 22 m with non-segregated tram line, and a one-way system together with Teraat Al Boulaqiya st. (18 m) via Rod Al Farag st. (18 m) is introduced.

- Azhar st.

Azhar st. starts from Attaba sq. and ends at the intersection with Salah Salem st. with a length of approx. 1.5 km and width of 22 m. From Opera sq. on Gomhouria st. in CBD to Khan Al Khalili Market area a dual 2 lane viaduct passes over Attaba sq. and Port Said st. At the intersection with Port Said st., another flyover for the left turn traffic from Salah Salem st. to Sayedah Zeinab sq. is constructed under this viaduct.

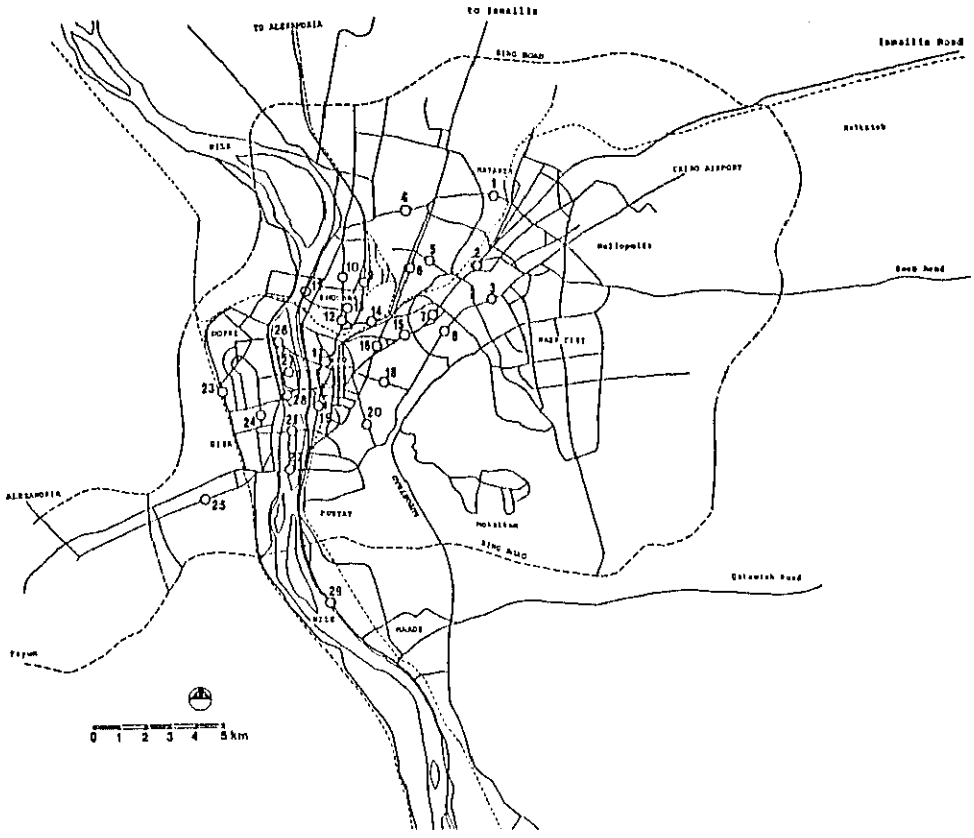


Fig. 3.1.10 Cross Section of Major Arterials

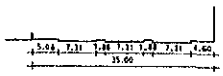
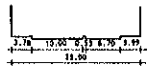
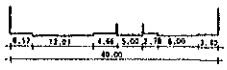
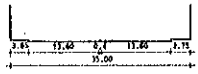
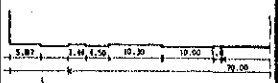
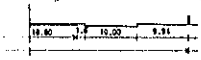
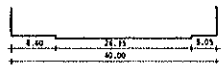
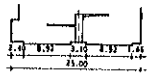
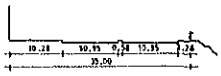
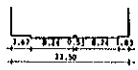
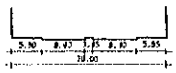
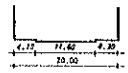
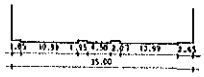
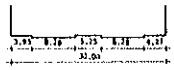
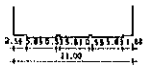
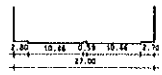
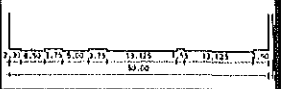
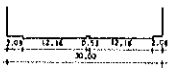
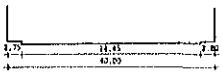
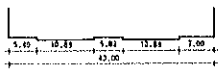
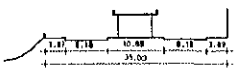
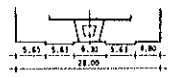
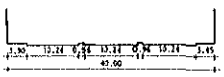
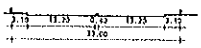
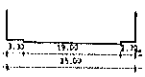
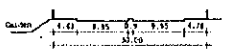
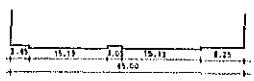
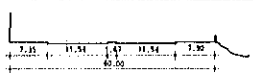
No	Street Name	Cross Section	No	Street Name	Cross section
1	Hakim st.		15	Al Guish	
2	Gisr Al suez		16	Al Khalige Al Masri	
3	Salah Shlem	 	17	Rmses	
			18	AL Azhar	
4	Teraat Al Ismailia		19	Qasr AL Aini	
5	Sekket Al Wayli		20	Al Qalaa	
6	Khalig Al Nasr		21	Abd Al Aziz Al saud	
7	Al Gueish		22	Salah Salem (Al Roda)	
8	Salah Salem		23	Sudan	
9	Ahmed Helmi		24	Al Dokki	
10	Shubra		25	Al ahram	
11	Corniche		26	26th July	
12	Shubra		27	6th October br.	
13	Al Teraa Al Boulagya		28	Al Tahrir	
14	Ramses		29	Corniche Al Maadi	

Fig. 3.1.10 (cont...)

Table 3.1.2 Present Characteristics of Major Arterials

Seq. No.	Road Name/Section	Length (km)	Row Width(m)	Lane No.	One Way System	Inter-section Interval	Road Side Activity
1	SALAH SALEM						
1	Ramses st.-Magra Al Eion st.	7.96	45	D-3		R	L
2	Magra Al Eion st.-Corniche Al Nile st.	2.06	25	D-3		M	M
2	OROUBA						
	Ramses st-Airport	13.00	55	D-3		R	L
3	CORNICHE AL NILE						
1	Alex. Agriculture rd.-Ismailia Canal rd.	2.46	25	D-2		R	L
2	Ismailia Canal rd.-26th July br.	5.75	30	D-2		M	L
3	26th July br.-Tahrir br.	0.90	30	D-2		M	M
4	Tahrir br.-Nile Helton	0.63	20	S-2	O	F	L
5	Nile Helton-Sayala br.	1.10	20	S-2		F	M
6	Sayala br.-Qasr Al Aini	0.75	20	S-2	O	M	L
7	Qasr Al Aini-New Road	2.55	25	D-2		M	M
8	New Road-Marazik br.	23.45	50	D-3		R	L
4	AHRAM						
1	Giza sq.-Zomor Canal	0.75	40	D-3		F	H
2	Zomor Canal-Maryuteya Canal rd.	5.90	40	D-3		R	M
3	Maryuteya Canal rd.-Ahram	0.90	40	D-3		M	M
5	KING FAISAL						
1	King Faisal br.	1.30	25	D-2		R	L
2	King Faisal br.-Manssoureya Canal rd.	5.70	25	D-2		M	M
6	SUDAN						
1	Al Nile st.-Ent. to Embaba Airport	2.60	25	D-2		F	H
2	Ent. to Embaba Airport-Tahrir st.	3.70	25	D-2		M	M
3	Tahrir st.-King Faisal st.	2.30	25	D-3		R	L
7	AL NILE						
1	Rod Al Farag br.-Sudan st.	2.70	20	D-2		M	M
2	Sudan st.-Galaa sq.	3.00	40	D-3		M	M
3	Galaa sq.-Giza br.	2.70	18	S-2		F	H
4	Giza br.-Upper Egypt Highway	4.10	22	D-2		F	M
8	26TH JULY						
1	Clot Bey st.-Gomhouria st.	0.40	30	D-2		F	M
2	Gomhouria st.-Talaat Harb st.	0.50	28	D-2		F	H
3	Talaat Harb st.-Galaa st.	0.45	26	S-3	O	F	M
4	Galaa st.-Corniche Al Nile	1.00	22	D-2		F	M
5	Abou Al Ella br.	0.35		S-2	O	M	L
				D-2		R	L
6	Zamalek	1.00	25	D-2		M	H
				D-2		R	L
7	Zamalek br.	0.18		D-2		R	L
8	Al Nile st.-Sphinx sq.	0.13	95	D-2		M	M
				D-2		R	L
18	TAHRIR						
1	Abdin sq.-Tahrir sq.	1.05	20	S-2	O	F	M
2	Tahrir sq.-Corniche Al Nile	0.42	20	D-2		M	L
3	Tahrir br.	0.35		S-4			
4	Tahrir br.-Galaa br.	0.70	30	D-3		M	L
5	Galaa br.	0.14		S-4			
6	Galaa br.-Sudan st.	2.25	40	D-3		M	M
19	GALAA						
	Ramses sq.- Issaf sq.	1.70	32	S-3	O	M	H
20	6TH OCTOBER						
1	Ghamra br.-Ramses sq.	2.15	9	S-2	O	R	L
2	Ramses sq.-Issaf sq.	1.90	17	D-2		R	L
3	Issaf sq.-Al Nile st.	1.40	38	D-5		R	L
4	Al Nile st.-Al Batal Ahmed Abd Al Aziz	0.63	17	D-2		R	L
21	RAMSES						
1	Issaf sq.-Ramses sq.	1.80	36	S-4	O	R	L
2	Ramses sq.-Ghamra br.	1.95	50	D-3		R	M
3	Ghamra br.-Abbasseya sq.	2.15	21	S-4	O	R	M
4	Abbasseya sq.-Salah Salem	0.83	67	D-2		R	M
5	Salah Salem-Al Gabal Al Ahmar sq.	3.00	50	D-3		M	L
22	PORT SAID						
1	Mosque Abou Al Rish sq.-Sayedah Zeinab sq.	1.00	20	S-2		F	L
2	Sayedah Zeinab sq.-Ahmed Maher sq.	1.70	36	D-2		M	M
3	Ahmed Maher sq.-Zaher st.	2.35	32	D-2		M	H
4	Zaher st.-Abd Al Qader Al Gillani	5.50	22	D-2		M	M
5	Abd Al Qader Al Gillani-Ismailia Canal rd.	0.65	100	D-2		M	L
23	AL AZHAR						
1	Darassah sq.- Manssoureya st.	0.35	34	D-2		M	L
2	Manssoureya st.-Ent. of flyover	0.70	22	D-2		R	H
3	Ent. of flyover-Gueish st.	0.40	22	D-2		R	H
				D-1			
4	Gueish st.-Gomhouria st.	0.40	15	D-2		F	H
				D-1			
24	MAGRA AL EION						
	Salah Salem st.-Corniche Al Nile st.	2.17	28	S-4		F	H
25	AL SAD AL BARRANI						
	Qasr Al Aini st.- Sayedah Zeinab sq.	1.50	18	S-2		F	M
26	AHMED HELMI						
1	Shubra st.-Ahmed Badawi st.	0.70	18	D-1		F	H
2	Ahmed Badawi st.-Al Teraa Al Boulaqiya st.	3.00	25	D-2		R	L
3	Al Teraa Al Boulaqiya st.-Ismailia Canal	1.05	25	D-2		M	L
4	Ismailia Canal Rd Access-Shubra st.	1.55	30	D-2		R	L

Table 3.1.2 (cont...)

Seq. No.	Road Name/Section	Length (km)	Row Width(m)	Lane No.	One Way System	Inter-section Interval	Road Side Activity
27	AL TERAA AL BOULAQIYA						
1	Shubra st.-Rod Al Farag st.	1.63	19	S-3	O	F	L
2	Rod Al Farag st.-Ahmed Helmi st.	1.88	18	D-2		R	L
28	SHUBRA						
1	Galaa st.-Al Teraa Al Boulaqiya st.	0.80	63	D-2		F	L
2	Al Teraa Al Boulaqiya st.-Rod Al Farag st.	1.60	22	S-2	O	F	H
3	Rod Al Farag st.-Ahmed Helmi	3.60	40	D-2		M	M
30	ROD AL FARUG						
1	Al Teraa Al Boulaqiya st.-Shubra st.	0.50	18	S-2	O	F	M
2	Shubra st.-Abou Al Farag st.	0.95	18	D-1		F	M
31	AHMED SAID						
1	Salah Salm-Dr.Tawfiq sq.	1.00	25	S-2		M	L
2	Dr.Tawfiq sq.-210 m from Gueish st.	0.40	29	D-2		M	L
3	210 m from Gueish st.-Sekket Al Hadid st.	1.10	29	S-4		M	L
32	MISR & SUDAN						
	Sekket Al Hadid st.-Hadaek Al Kobba sq.	2.50	14	S-2		F	M
33	ABBASSEYA						
1	Abbasseya sq.-Sarayat st.	0.75	23	S-2	O	F	H
2	Sarayat st.-Moshir Ahmed Ismail sq.	1.40	25	D-2		M	H
34	GUEISH						
	Moshir Ahmed Ismail sq.-Attaba sq.	2.40	30	D-2		M	H
35	SARAYAT						
	Abbasseya st.-Fakhri Abou Al Nour st.	0.70	18	S-3	O	F	M
37	QALAA						
1	Salah Salem st.-Mosque Al Sultan Hassan	1.10	12	S-2		F	M
2	Mosque Al Sultan Hassan-Ahmed Maher sq.	1.10	12	S-2		F	M
3	Ahmed Maher sq.-Attaba sq.	0.70	14	S-2		F	M
38	AL KHALIFAH AL MAMOUN						
	Abbasseya sq.-Roxi sq.	3.85	50	D-3		M	L
47	ISMAILIA CANAL RD.						
1	Corniche Al Nile-Shubra st.	0.25	16	S-2		F	L
2	Shubra st.-Kobri Abboud sq.	0.90	35	D-2		R	M
3	Kobri Abboud sq.-Port Said st.	3.20	25	D-2		R	L
53	ORABI						
	Galaa st.-Orabi sq.	0.55	20	S-3	O	F	M
66	MARRIET						
	Tahrir sq.-Issaf sq.	0.60	28	D-2		F	L
72	QASR AL AINI						
1	Corniche Al Nile st.-Dr Handoussa st.	1.00	20	S-4	O	F	H
2	Dr Handoussa st.-Tahrir sq.	1.50	23	D-2		F	H
75	AUTOSTRADE						
1	Suez Desert rd.-Ahmed Said st.	7.35	36	D-2		M	L
2	Ahmed Said st.-Tebbin Access	31.60	36	D-2		R	L
81	SEKKET AL WAYLI						
1	Kobba sq.- Port Said st.	1.60	32	D-3		M	M
2	Port Said st.-Al Zawia Al Hamra Area	0.80	24	D-2		F	H

Note : 1) For Intersection Interval
R : Rare
M : Medium
F : Frequent
2) For Road Side Activity
L : Low
3) For One Way System
O : One Way
4) For Lane No.
S : Single
D : Dual

(2) Flyover/Underpass Location

Fig. 3.1.11 shows the existing flyover/underpass locations. The continuous flyovers are:

- 6th October br.,
- 26th July br.,
- Azhar st.,
- King Faisal br., and
- Flyovers on Autostrade.

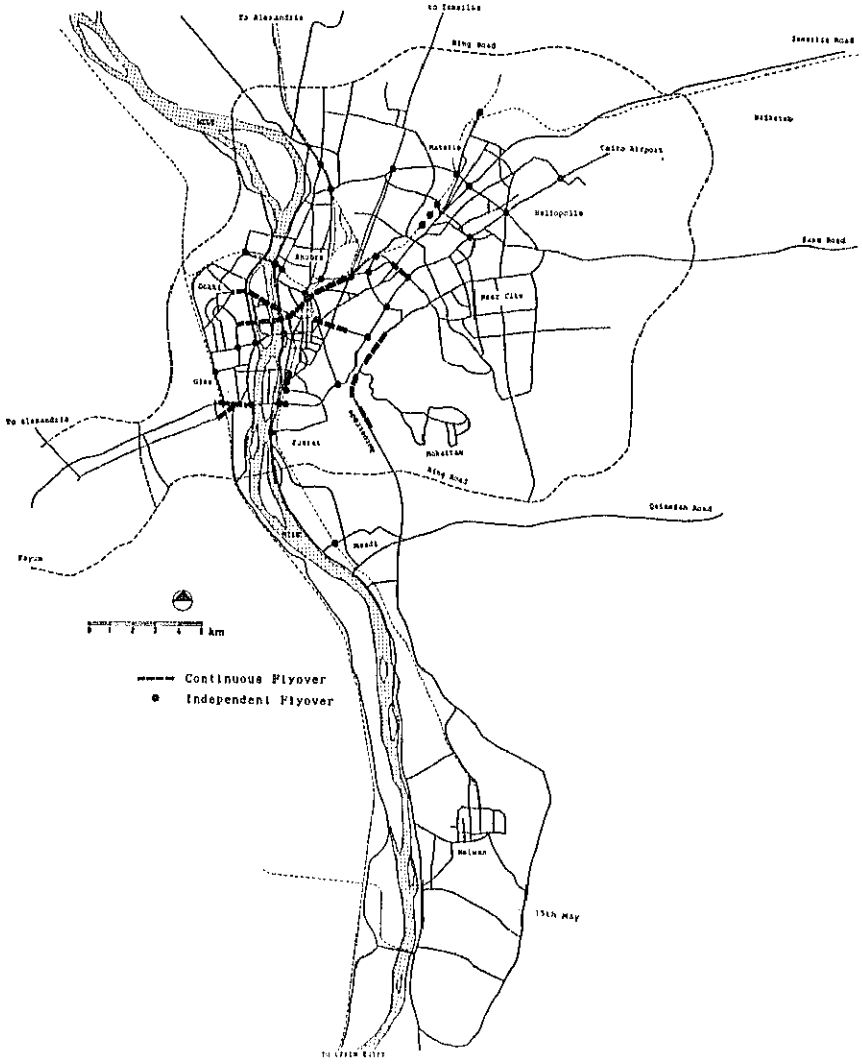


Fig. 3.1.11 Existing Flyovers/Under-passes Locations

There is a plan to extend 6th October flyover to connect the flyover on Abbasseya sq., and the section from Ramses sq. to Ghamra br. is under construction at present. For other flyovers, no extension is planned except for the construction of Abou Al Ella Junction on 26th July br. at the intersection with Corniche Al Nile st.

Most of the isolated flyovers are constructed either on railway or on canals. However, on the following axis, flyovers on the major junctions are provided successively.

- Ahram st. - Roda st. - Salah Salem st. - Orouba st.,
- Ramses st.
- Tahrir st. and
- Ismailia Canal road - Kablat st. - Hakim st. - Abou Bakr Al Seddiq st.

(3) ROW Width

In the new development areas such as new cities or new settlements, stepped ROW widths dependent on the road classification are secured under the Ministry of Housing and Reconstruction regulations. However, ROW in the built-up area is not secured despite of ROW ordinances. Therefore building to building width is considered to represent the present ROW.

Fig. 3.1.12 shows the distribution of road length by ROW width in the arterial road network. Most of the roads in the built-up CBD area have a ROW width of under 20 m. However, the roads in the newly developed Heliopolis, Nasr City, or Giza areas have ROW width of more than 30 m and up to 100 m, with wide planted central median.

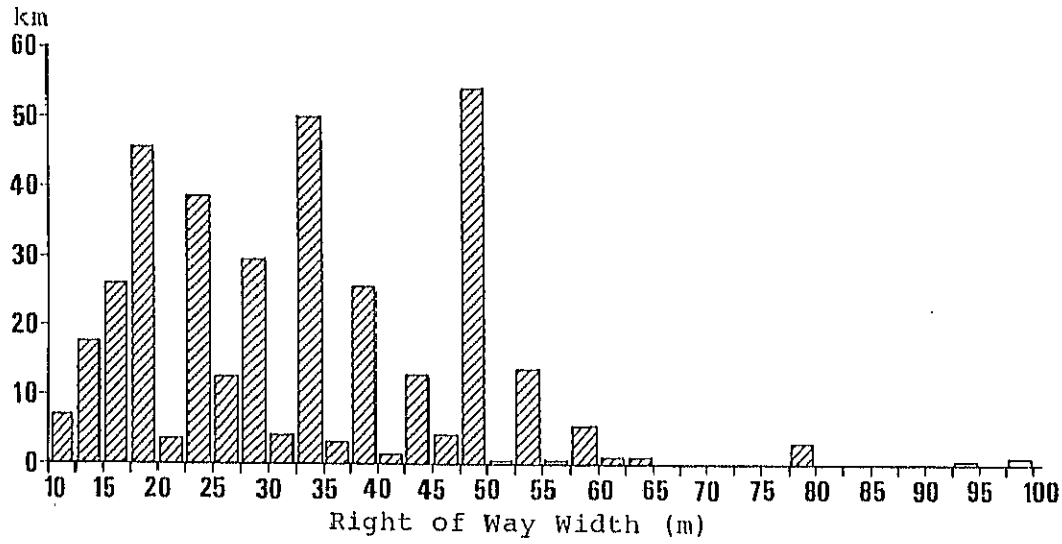


Fig. 3.1.12 Distribution of Present ROW Width

(4) Lane Number

On most of the roads in the Study Area, lane marks which identify the number of lanes are not painted. According to the road inventory in the current studies, the number of lanes on a road link were defined by their observations. Figures 3.1.13 to 3.1.15 show the relationship between;

- Lane nos. and carriageway width,
- Parking lane nos. and parking lane width, and
- Lane nos. and carriageway width by parking conditions

According to Fig. 3.1.15, two lane and three lane operations are clearly separated when there is no parking, however their carriageway width distributions are almost the same when there is curb parking.

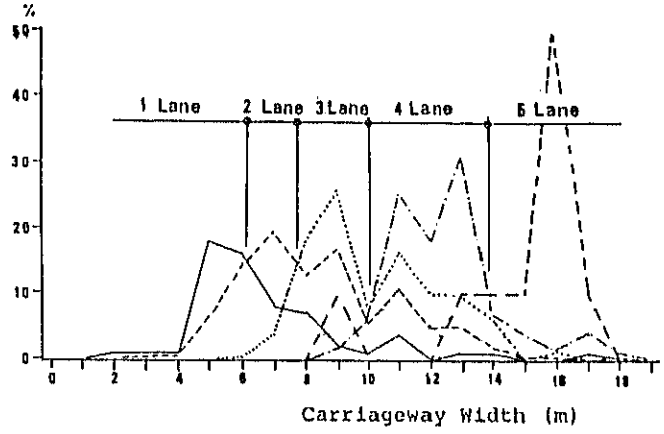


Fig. 3.1.13 Relationship Between Lane Nos. and Carriageway Width

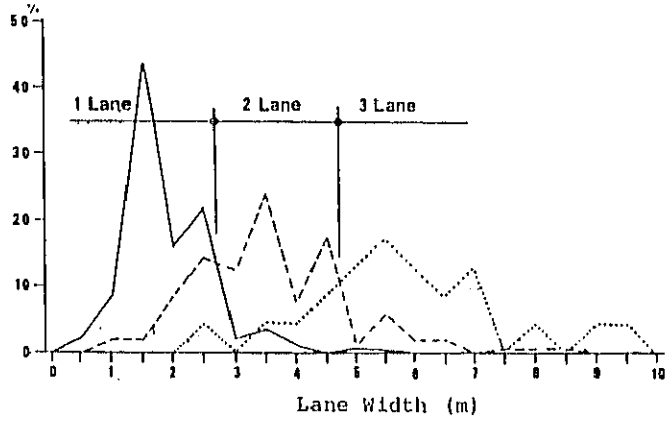


Fig. 3.1.14 Relationship between Parking Lane Nos. and Parking Lane Width

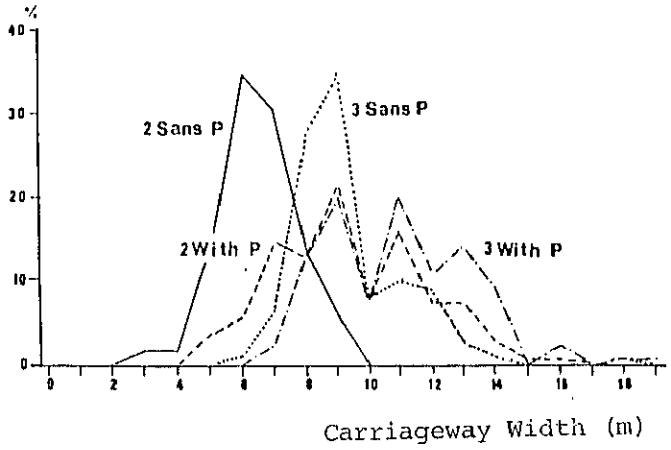


Fig. 3.1.15 Relationship between Lane Nos. and Carriageway Width by Parking Condition

Fig. 3.1.16 shows road length distributed by lane numbers. Of the total network length of 350 km, 160 km or 46% of road links are dual 2 lane operation, and 100 km or 29% are dual 3 lanes. The road link with the highest number of lanes is 6th October br. between Al Nile st. in Giza and Corniche Al Nile st. which has dual 5 lanes.

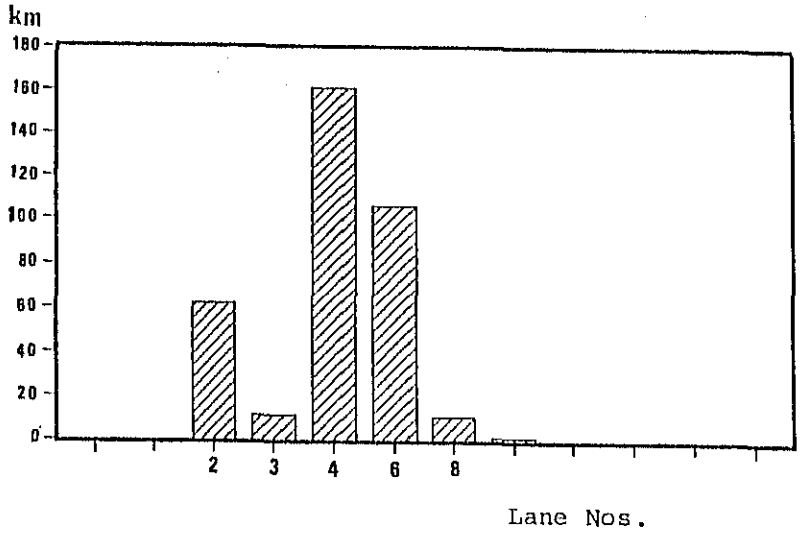


Fig. 3.1.16 Road Length Lane Nos.

(5) Intersection Frequency

Many arteries in the Study Area are divided by central medians, and smooth and constant speed flow of through traffic is sometimes interrupted by U-turn traffic at the openings of the central median. Therefore central median openings were counted in the road inventory as intersections which influence the free flow speed of the traffic.

Fig. 3.1.17 shows the location of links with an intersection frequency of more than 500 m. The only link appearing on the map in the expanded CBD, surrounded by Ramses st., Salah Salem st. and Corniche al Nile st., is Azhar st. flyover.

In Fig. 3.1.17 the percentage of the road length by the levels of intersection frequency is shown. Because of the longer link length of the roads in the suburban area, the length percentage of "more than 500 m" reaches 41.5% of the total road network.

(6) Road Side Friction

In the current studies, the existence of curb parking was recorded as one of the major factors to influence the free flow speed and traffic capacity of a link. In addition to the information on the curb parking, such road side activities as crossing

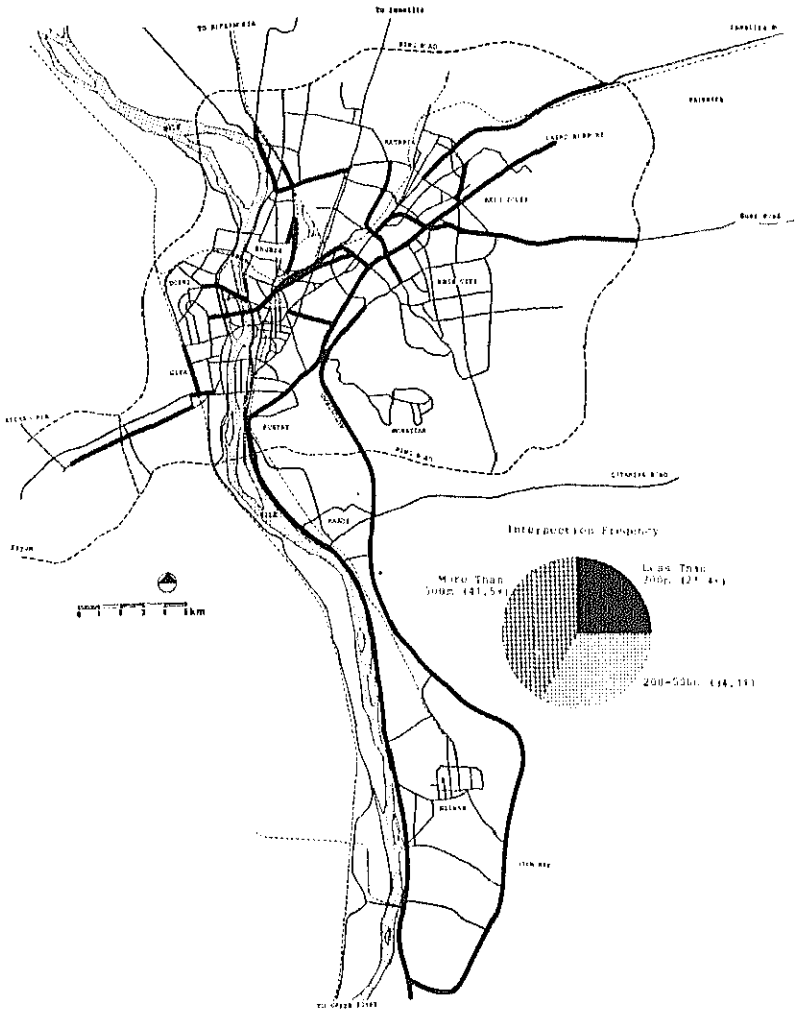


Fig. 3.1.17 Links with Intersection Frequency of more then 500 m

of pedestrian, passing of animal drawn vehicles, and loading and unloading of goods at the commercial area were considered as other factors, and were recorded as "Road Side Friction" in the inventory.

While curb parking will reduce traffic capacity by the occupation of available carriageway, road side friction will reduce both traffic capacity and running speed.

Fig. 3.1.18 shows the location of links with high road side friction. The radial routes from Attaba sq., namely Al Gueish st., Al Azhar st. under the flyover between Attaba sq. to Port Said st., Qalaa st., and Port Said st. have high road side friction.

In Fig. 3.1.18 the percentage of the road length by their levels of road side friction is shown. The percentage of "High Friction" is only 12.5% of the road network despite its serious influence on the traffic flow.

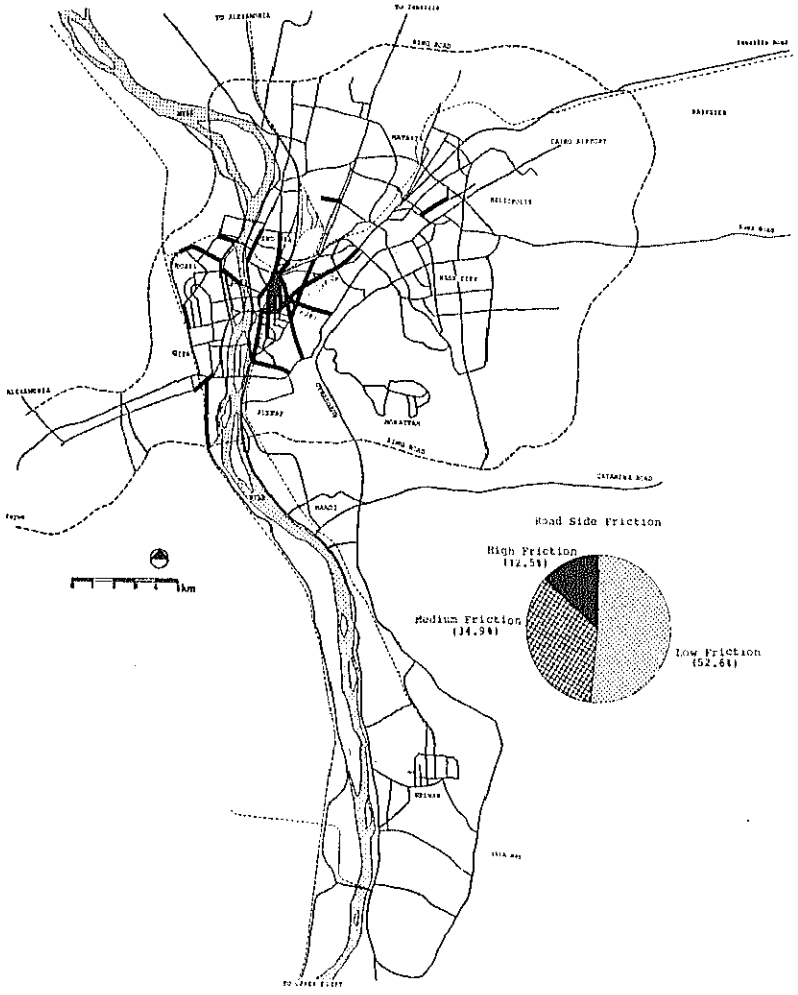


Fig. 3.1.18 Links with High Road Side Friction

(7) Traffic Signals

The locations of the presently signalized intersections are shown in Fig. 3.1.19. Most of the traffic signals are controlled manually by the policemen, thus no particular phasing or pattern are encountered. However, the introduction of the area traffic control system in CBD and the synchronized control system to the major arterials are being planned.

(8) Local Road Network

- CBD

Fig. 3.1.20 shows the local road network in CBD. The road density in the block is 206 m/Ha. which is the shortest among the three areas shown in the figure, however the average road width of 12.5 m and the road area percentage of 26.1% are intermediate values between Old City and New City.

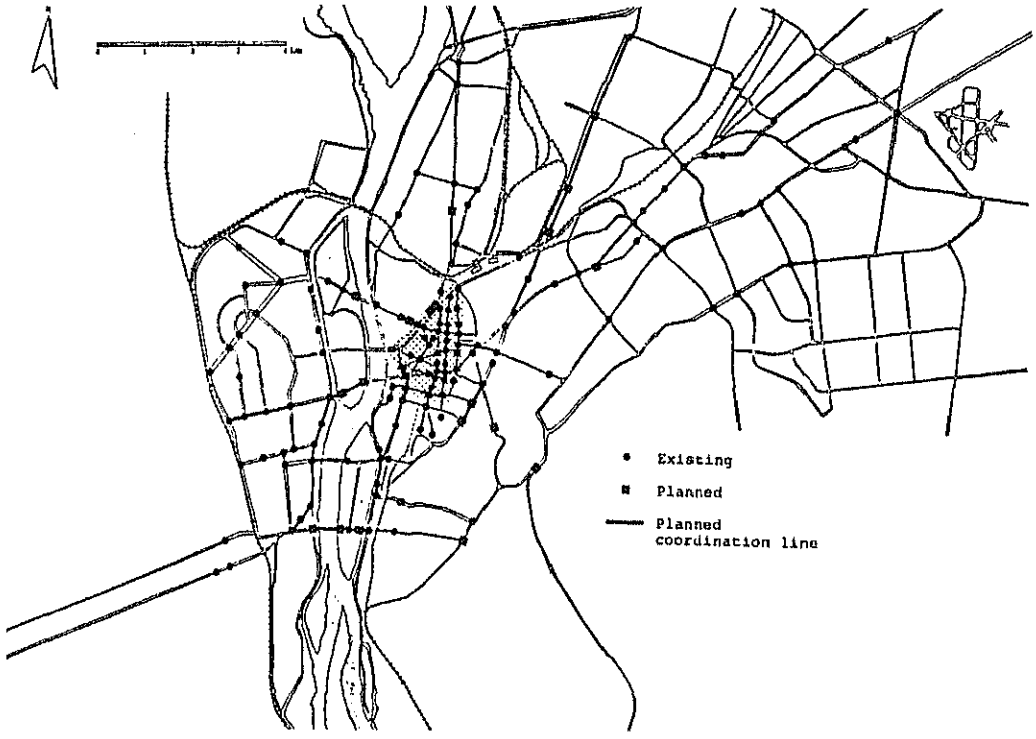
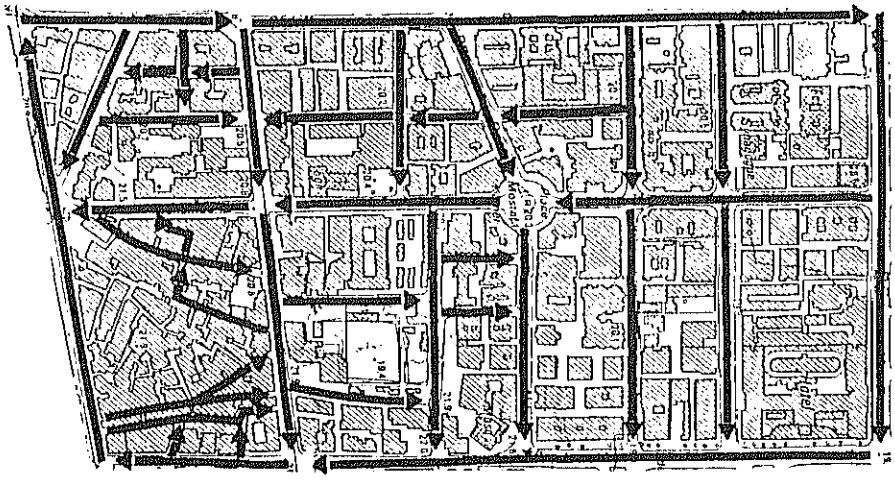


Fig. 3.1.19 Location of Signalized Intersections

The size of block surrounded by fringe roads of approx. 20 m width is 100 m x 150 - 250 m and contains narrow streets of approx. 5 m width.



(1) CBD

Fig. 3.1.20 Local Road Network in CBD

- **Old City**

Fig. 3.1.21 shows the Old City local road network in the Citadel area surrounded by Qalaa st. The road density is approx. 299 m/Ha which is the longest among the three areas, however the average road width of 6 m and the road area percentage of 15% are the lowest. The roads are winding and sometimes they are "Cru-de-sack" as shown in the figure. The spaces between buildings and roads are not clearly separated.

The area with an average distance of 500 m from the surroun-ding arteries, which are 2 way 2 lane and not wide enough, forms a poorly served traffic area.

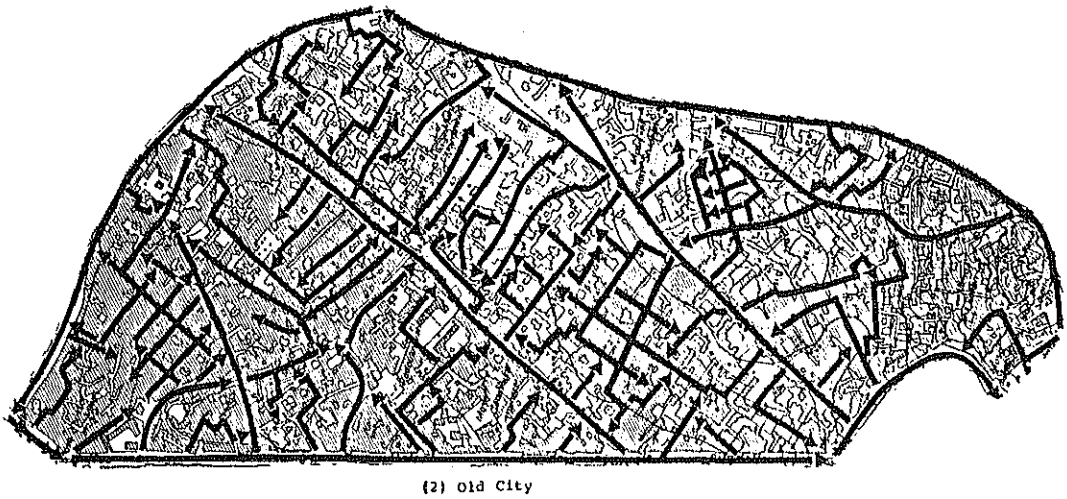
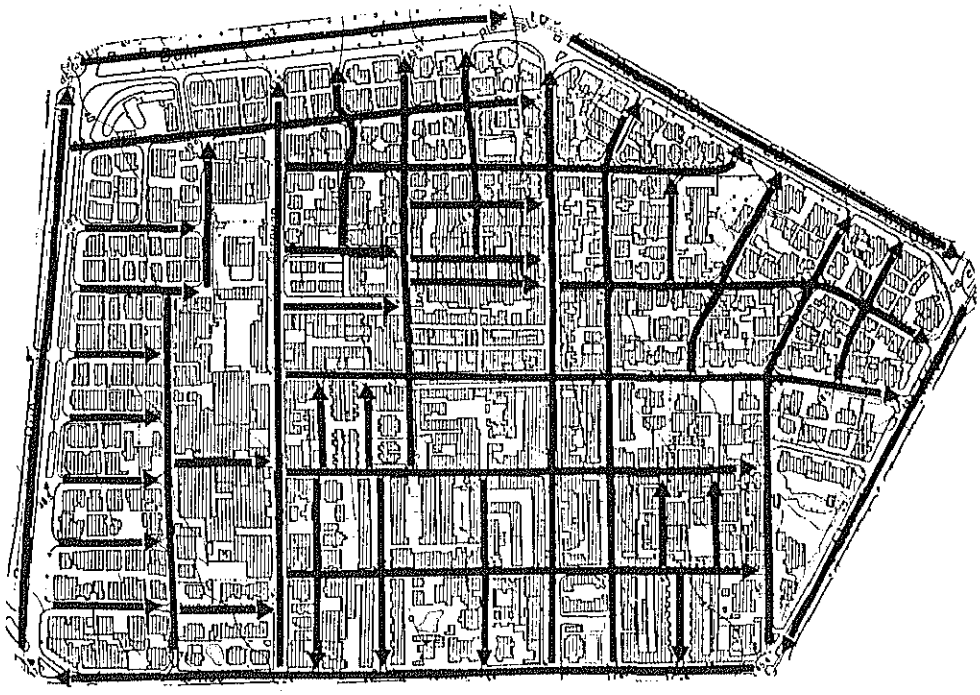


Fig. 3.1.21 Local Road Network in Old City

- **Newly Developed Area**

Fig. 3.1.22 shows the local road network in Heliopolis. The road density is 233 m/Ha, the average road width is 16 m and the road area percentage is 34.1% which is the highest among the three areas.

The blocks are surrounded by arteries with average interval of 500 m, and the width of these arteries are 50 - 60 m. The road area of these arteries reaches approx. 30% of the total road area, and the road area percentage decreases to 23% when the road area of these arteries is not included.



(3) New Developed Area

Fig. 3.1.22 Local Road Network in Newly Developed Area