Cairo University · Massachusetts Institute of Technology · Technology Planning Program

Cairo Urban Transport Project

Transport Planning Aids And Methods

Final Report — Volume III Part 1

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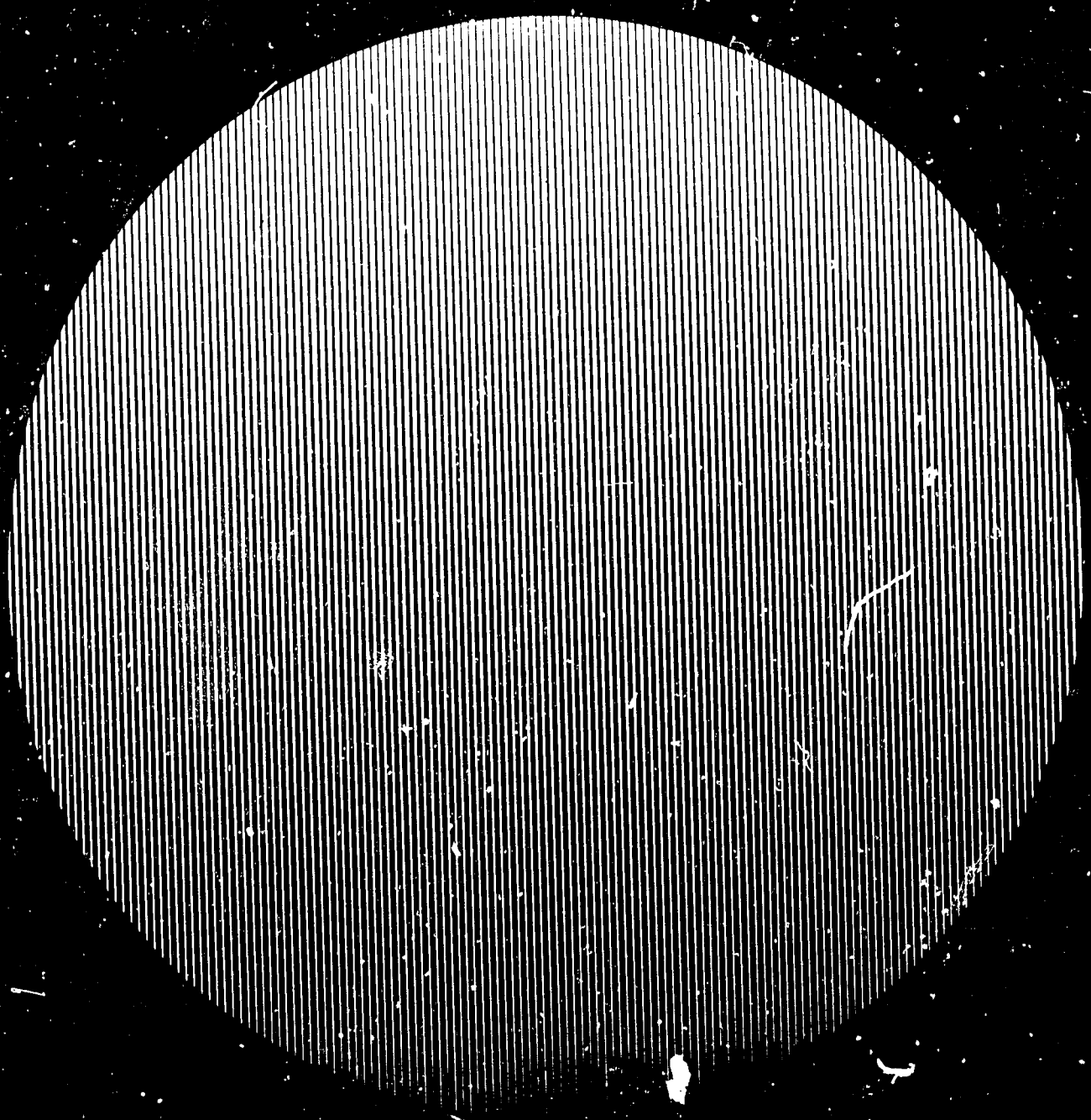

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VOLUME III
PART I

Basic Data Elaboration

VOLUME III

Transport Planning Aids and Methods for Cairo Urban Area

2

Introduction :

Since 1977, Cairo University (CU) and the Massachusetts Institute of Technology (MIT) have worked cooperatively in a multi-faceted technology adaptation program addressing research needs of Egypt. One component of this program has been the urban transportation system in Cairo; within this component, a wide range of research topics was examined. Before detailing methods and findings of these topics, it is useful to first review the goals of the Urban Transportation Research Project. This cooperative effort between MIT and transportation professionals in Cairo is designed to:

- Improve and broaden capabilities of academic and planning institutions concerned with transportation in Egypt.
- Establish a comprehensive and reliable data base that can be used in transportation studies and that can be periodically tested and updated by appropriate governmental agencies.
- Adapt and calibrate those transport planning models and methods most suitable for Cairo.
- Formulate and test the sensitivity of transportation behavior and performance to alternative transportation investment, traffic management, and government policies.

These broad goals lead to a rather varied research agenda, covering many aspects of transportation operations, decision making, planning, and programming. Volume III describes the achievements made in developing transport planning aids and methods as part of this research agenda.

There are five major sections to this volume, each of which is described briefly below :

Basic Data Elaboration, Volume III, Part (1)

Two traffic surveys - a 1977 survey of private transport in Cairo and a 1978 survey of public transport use - form the basis for much of the

research in this project. The survey results are stored on magnetic tapes, and a complete documentation of these two surveys and their results is available in the Department of Civil Engineering, Faculty of Engineering, Cairo University. Data elaboration for speed/volume/travel time relationships, socio-economic variables for the traffic zones and parking supply and use are among the subjects covered in Part one of this report.

Travel Demand Forecasting, Volume III, Part (2)

An important methodological foundation of urban transportation planning is the development of an analytical capability to model future transport supply and demand relationships. Toward this end, trip generation, distribution and assignment models were calibrated for the Cairo region; requisite investigations to obtain required input data for these models (such as car occupancy rates, peak hour factors, trip information) were also undertaken in order to facilitate model calibration. With these models, forecasts of travel demand in Greater Cairo by different transport modes and for different trip purposes are obtained. The forecast travel demand is then assigned to the future transport network in the city, and system performance is evaluated. These subjects are covered in Part two of this report.

Auto Ownership, Volume II, Part (2)

The dramatic increase in the number of private cars in Cairo (about a 40% increase between 1976 and 1978) significantly contributes to the problems of congestion, safety, and pollution (both air and noise) in Cairo. The purpose of this auto ownership study was to develop a suitable methodology for estimating future increases in car ownership for the

whole of Egypt, as well as for the different traffic zones in Greater Cairo in particular. The scope and findings of the auto ownership study are described in Part three of this report.

Parking, Volume III, Part (2)

Like most cities of its size, Cairo faces important questions about the future role of parking facilities and policies. This research element sought to develop a model which accurately portrays the interaction between parking supply (by type and location) and vehicular traffic operating on the urban street network in the CBD. Such a model is very useful in evaluating different parking policies in the city center and outlying areas of Cairo. Part four of this report reviews this phase of the research.

Case Studies, Volume III, Part (2)

Following these four methodological parts of the report, case studies are presented to illustrate the applications of the data base and the analytical tools developed in the course of the project to date. The first case study shows how the data and planning aids presented in parts one and two of this report can be used in project programming. The second case study investigates the impact of the regional underground line on surface public transport services in the city center.

As can be seen from this description of work effort, considerable energy has gone into making this research a success. Future research will benefit from the time and effort spent in establishing the solid foundation that the research activities described in this report represent.

TABLE OF CONTENTS

VOLUME III

PART (1)

BASIC DATA ELABORATION

	Page
Introduction	I-1
1. Field Surveys and Data Collection	I-2
1.1 Vehicular Transport Survey	I-2
1.1.1 The Study Area	I-2
1.1.2 Design of the Survey Forms	I-4
1.1.3 Locations of the Survey Stations	I-5
1.1.4 Field Work	I-5
1.1.5 Coding Systems	I-9
1.1.6 Master Files	I-11
1.2 Public Transport Survey	I-13
1.2.1 Zoning System	I-14
1.2.2 Selection of the Survey and Sampling Techniques	I-14
1.2.3 Conduct of the Survey	I-26
1.2.4 Coding of the Public Transport Survey Information	I-26
• Coding Sheet	I-28
• Coding System	I-27
1.2.5 Master File	I-31
1.3 Parking Surveys	I-33
1.3.1 Introduction	I-33
1.3.2 Description of the Parking Survey Area and Zoning System	I-33
1.3.3 Field Work	I-34
1.3.4 Survey Results and Analysis	I-44
1.3.5 Conclusions	I-48
1.4 Street Network Inventory	I-52
1.4.1 Elaboration of Nodal Street Network Map	I-52
1.4.2 Design of the Form	I-52
1.4.3 Execution of Field Work	I-54
1.4.4 Updating the Street Network Inventory	I-56
1.5 Travel Time Measurements	I-56
1.5.1 Isochronic Curves	I-56
1.5.2 Traffic Speed/Delay Characteristics	I-57

Page

1.6 Socio-Economic and Land Use Planning Parameters I-84

1.6.1 Maps I-87
1.6.2 Tables of the General Censuses of CAPMAS I-87
1.6.3 Methodology to Determine the Variables at the Traffic Sub-zone Level I-88
1.6.4 Tables of Socio-Economic and Land Use Variables of the Traffic Zones in Greater Cairo I-90

2. Data Processing I-92

2.1 Objectives I-92

2.2 Vehicular Transport Survey Data Processing I-94

2.2.1 Development of Minimum Travel Time Matrix I-94
2.2.2 Development of O/D Matrices I-95
2.2.3 Data Collection & Preparation I-107
2.2.4 Producing Trip Characteristics I-107
2.2.4.1 Subsystem I: Producing Master File with Mapped O/D Pairs I-108
2.2.4.2 Subsystem II: Producing Master File with Rough Enlargement Factor I-118
2.2.4.3 Subsystem III: Producing Master File with Refined Enlargement Factors I-131
2.2.4.4 Subsystem IV: Get Trip Characteristics . . I-137
2.2.5 List of the Computer Output Prints and the Data Recorded on Magnetic Tapes (Vehicular Survey) I-153

2.3 Public Transport Data Processing I-177

2.3.1 Phase I: Data Preparation & Validation I-177
2.3.2 Phase II: Producing Trip Characteristics I-179
2.3.3 List of the Computer Output Prints and the Data Recorded on Magnetic Tapes (Public Transport Survey) I-196

3. Base Year Assignment Check Computer Run I-213

4. List of Project Papers and Reports in Part I I-250

5. List of References I-254

LIST OF FIGURES

Figure Number	Title	Page
I-1	Zoning System for Vehicular Survey	I-3
I-2	Vehicular Survey Traffic Count Form	I-6
I-3	Vehicular Survey Road Interview Form	I-7
I-4	Zoning System for the Public Transport Survey	I-18
I-5	Railway Passengers Interview Form	I-24
I-6	Public Transport Passengers Interview Form	I-25
I-7	Coding Form for Public Transport Survey	I-28
I-8	Previous CBD Definitions of Cairo Metropolitan Area	I-35
I-9	CBD Definition in the Current Cairo Parking Study	I-36
I-10	Locations of Parking Supply	I-40
I-11	Illegal Parking Survey Area	I-42
I-12	Talaat Harb Zone Map for Overnight Parking Survey	I-43
I-13	Reduced-Scale Node and Link Map for the Enlarged Downtown area of Greater Cairo	I-53
I-14	Street Inventory Survey Form	I-55
I-15	Travel Time/Delay Survey Form	I-58
I-16	Isochronic Curve: 25 July 1977, 3:00 P.M.	I-59
I-17	Volume Count Form for Speed/Delay Relationships	I-62
I-18	Travel Time and Delay Measurements Form	I-68
I-19	Stop Time Delay for Different Test Routes by Time of Day	I-69
I-20	Free Flow Speed and Practical Capacity Concepts	I-72
I-21	Vehicular Survey Computer System Hierarchy Diagram	I-93
I-22	Public Survey Data Processing Computer System Hierarchy Diagram	I-178
I-23	Data Validation Cycle	I-180

LIST OF TABLES

Table Number	Title	Page
I-1	Zone Codes for O/D Movements	I-15
I-2	Passenger Car Equivalents	I-11
I-3	Parking Study Zoning System	I-34
I-4	Zonal Parking Supply by Type and Location	I-45
I-5	Illegal Parking Volume as a Percent of Legal Supply	I-46
I-6	Zonal Overnight Parking Volume	I-49
I-7	Relation of Overnight Parking Volume to Available Supply	I-50
I-8	Delay/Volume Relationships for Two Test Routes	I-65
I-9	Stop Time Delay by Cause Type for Different Test Links	I-66
I-10	Delay by Cause Type as a Percentage of Total Stop Time Delay for Different Test Links	I-67
I-11	Test Routes Categories for Stop Time Delay	I-70
I-12	Physical and Operating Characteristics of the Selected Test Links in Cairo	I-73
I-13	Practical Capacities in PCEs/hr/lane and Corresponding Free Flow Speeds for Cairo Metropolitan Area	I-79
I-14	Statistical Measures for the Calibration Parameters α and β for Different Test Routes in Cairo Street Network	I-80
I-15	Travel Time/Free Flow Time for Different Values of the Calibration Parameters α and β and Different Values of the Q/C ratio	I-81
I-16	Calibration Parameters α and β for the Traffic Capacity Restraint Formula for Different Area- and Facility-Types in Cairo Study Area	I-83
I-17	Available Socio-Economic and Land Use Variables	I-84
I-18	Arrangement of ODA_s Values in a Tabular Form	I-102

LIST OF TABLES (CONT.)

Table Number	Title	Page
I-19	Tabulation of Results of Traffic Assignment	I-103
I-20	Comparison Between Traffic Counts and the Results of the Traffic Assignment Run on Nile Screen Line	I-214
I-21	Comparison Between Zonal Production and Attraction and the Summation of Loads on Centroid Connectors	I-216
I-22	Comparison Between Traffic Counts and Assigned Volumes on Selected Important Links	I-221

Appendix (I-1) : Parking Survey Basic Data

Introduction

The primary objective of the basic data elaboration element of the urban transportation research project is to assemble an urban passenger transportation data base, and to collect and compile data needed for the estimation and subsequent use of travel demand forecasting methods. Traffic volumes and travel in the Greater Cairo area were monitored on a prototypical basis so that standard survey procedures, analytical methods, and documentation could be developed for Ministry use. Future replication of these methods and procedures will further enhance the existing data base, on which analysis and projections will be based.

There are two major chapters in this part of the report, dealing with the data collection activities and the data processing. The approach taken in this part of the report is to present the detailed procedures used so that the report can be a basic reference for future data collection and analysis activities in Cairo and in other major cities in developing countries.

CHAPTER ONE

FIELD SURVEYS AND DATA COLLECTION

1.1 Vehicular Transport Survey

The vehicular traffic survey for Greater Cairo provides planners and researchers with the data base necessary to identify and gauge traffic congestion on arterials and at intersections within the Greater Cairo downtown area and its surroundings. The data collected also form the basis for the analysis of traffic, proposals for traffic management, and the implementation procedures for new projects relating to short term as well as long term transport planning. Moreover, these data are to be used, in part, in the economic evaluation of proposed transport infrastructure investments in Greater Cairo.

1.1.1 The Study Area

The study area covered by the vehicular survey was carefully delineated so as to include essential traffic flow patterns and characteristics. The area covers the central business district and contiguous highly populated zones. The cordon line defining the study area intersects all main roads connecting the downtown with important adjacent suburbs and the capitals of the other governorates in Egypt.

Figure I-1 shows the study area bounded by the outer cordon line; it also shows the road network inside this cordon, the zoning system, and the intersections of the cordon line with main roads

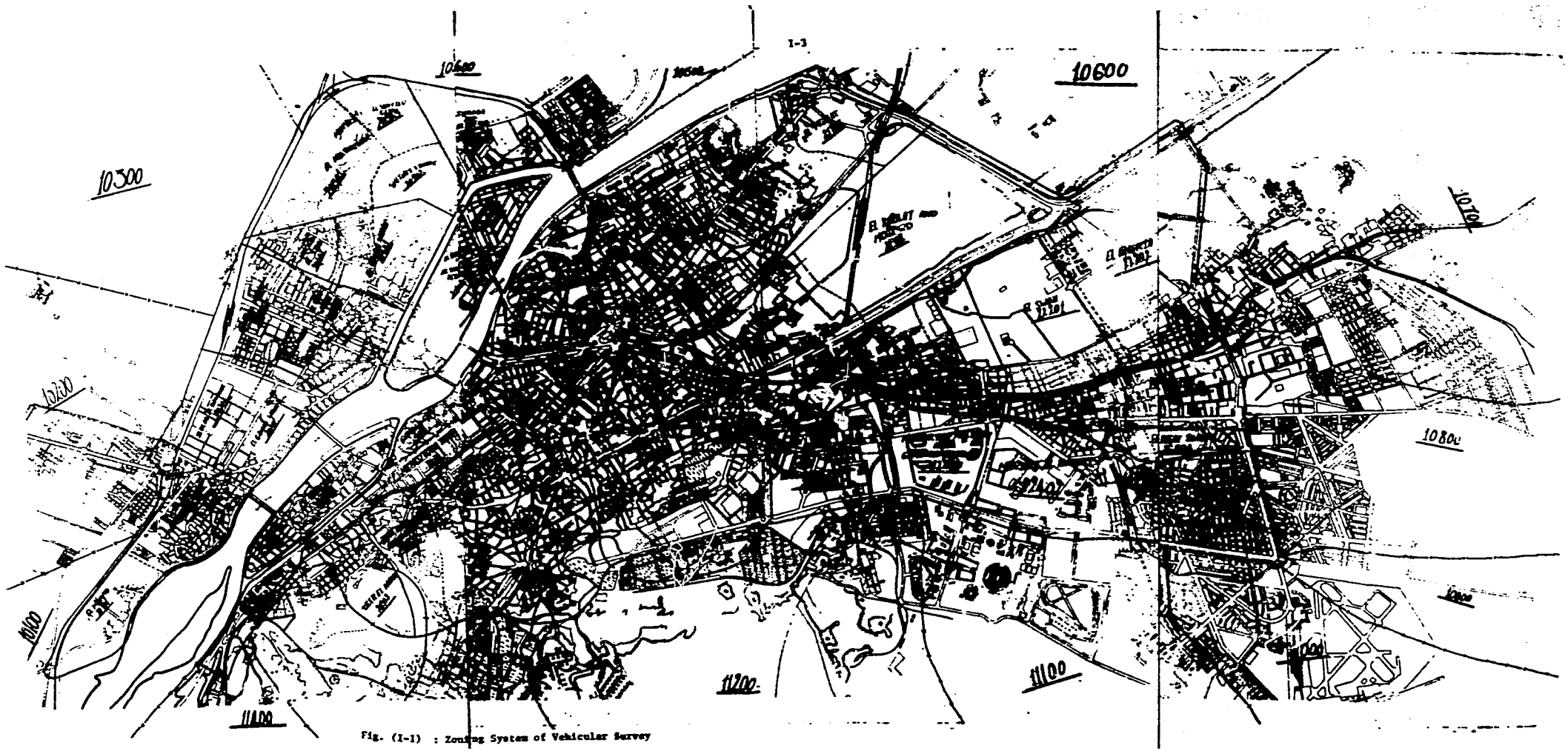


Fig. (I-1) : Zoning System of Vehicular Survey

From the east side, the study area is bounded by Salah Salem and Orouba Road, from Masr-El-Kadima in the south, to Tayaran Square in the north. From the southern side, the area is bounded by El-Malek El-Saleh Bridge, El-Giza Bridge, and El-Mounib District to the south of Giza City to the beginning of Upper Egypt agricultural road. From the west side that area is bounded by the west side of El-Mounib, Bulak El-Dakrour, and Embaba Districts as far as the northwestern entrance of Cairo from Manashi. The northern borders of the study are Imbaba Bridge, Rod El-Farage, Shubra El-Kehima, El-Waily at Kablat Street and Heliopolis at Abu Bakr El-Sedeak Street.

The study area was divided into 67 zones with their boundaries governed by the following criteria:

1. Homogeneous economic and social factors
2. Consistency in land use
3. Natural boundary location (such as physical boundaries or main arterials)
4. Level of accuracy required for the purpose of study.

According to the above criteria the zones were classified into three groups:

25 Central area zones, which were divided in turn into 66 subzones.

14 Urban area zones, lying between the outer cordon line of Greater Cairo and the cordon defining the central area.

28 Rural area zones outside Greater Cairo, generally corresponding with the administrative boundaries of the governorates.

Figure I-1 only shows the zoning system used in the Greater Cairo area.

1.1.2 Design of the Survey Forms

The traffic survey consisted of the following two activities:

1. Vehicle counts, according to type and time of day. The traffic count form shown in Figure I-2 was designed to provide the basic data

needed for the study with each traffic count sheet covering a 20-minute period.

2. Random sample interview of vehicle drivers and passengers. Figure I-3 shows the form designed to collect trip characteristics and origin/destination data.

1.1.3 Locations of the Survey Stations

External survey stations were located at all the intersections of the outer cordon line with the main traffic arteries so that it would be possible to intercept all the traffic entering and leaving the enlarged downtown area. Other internal survey stations were located at the intersections of the Nile screen line with the main arterials and at all important intersections used to enter or leave the enlarged downtown.

Appendices 2, 3, and 4 of the traffic survey report (1) contain: a map showing the locations of survey stations; sketches of the intersections and the main roads at which counting and interview stations were located; a list of names and code numbers of the 267 stations selected; and the manpower used for counting and interviewing at each station.

1.1.4 Field Work

Following the selection of the locations of the survey stations, manpower requirements were determined to secure: (a) a count of 100 percent of the traffic at all selected stations and (b) sufficient interviewers to allow a reasonable sample size to be taken. A total of 780 people were assigned to the 267 stations (an average of 2.6 for each station). In addition, a reserve or backup group of 50 persons was available to relieve and supplement surveyors when and where needed.

Figure I-2

VEHICULAR SURVEY TRAFFIC COUNT FORM

Station is on the external cordon ☐

Station is on the internal cordon ☐

Station is between the internal and external cordon ☐

Page No. ☐☐☐☐ Station No. ☐☐☐ Date ☐☐

1.	2	3	4	5	6	7	8	9	10	11	12	13	14
Timing HR. MIN.	Private Car	Taxi	Micro-Bus	Private Bus	P.T. Bus	Tram	Trolly Bus	Semi Lorry	Lorry	Lorry with Trailer	Bicy-cle	Cart	Tricy-cle

6

Figure I-3

VEHICULAR SURVEY ROAD INTERVIEW FORM

Page No. ☐☐☐☐ Station No. ☐☐☐ Date ☐☐ Starting time of interview ☐☐☐☐ Ending time of interview ☐☐☐☐

External cordon station ☐

Internal cordon station ☐

Station is between the internal and external cordons ☐

1	2	3	4	5	6	7	8	9	10
Was there a previous interview	Serial No.	Vehicle Type	No. of passen-gers	Trip Origin	Trip Destination	Purpose of Trip	Night Parking Place	Governorate of Registration	Remarks

Due to the large manpower requirement, it was decided to first train a group of supervisors, who would in turn be responsible for the training of a group under their control. Thirty-six (36) supervisors were given lectures and a demonstration of the survey and interview technique; they also participated in preliminary survey centered on the approaches to the 6th of October and Tahrir Bridges. Three hours of a test survey were conducted on 14 April, 1977, between 7 and 10 a.m. The results of the initial survey were used to make minor adjustments in the survey procedures, and to further refine the logistics for the larger surveys.

The main body of surveyors was divided into 10 groups, and surveyors were allocated to stations based on traffic volume estimates. Each surveyor was given a sketch of his station area, the survey forms, and an instruction sheet explaining proper methods for traffic counting and interviewing. A total of approximatley 16,000 traffic counting and 50,000 O-D survey forms were used.

On 16 April, 1977, all supervisors and surveyors were given a series of lectures explaining the process and administrative instructions. On 17 April, the day before the survey, all the supervisors were assembled. Each of the 10 groups was assigned a bus which would take each of the members of the group to his station, and each bus driver was given a map that detailed the route to be taken. Following the general meeting of 17 April, the surveyors were taken to the stations in the same fashion to be used the next morning, the day of the actual survey. In the field, each supervisor pointed out each surveyor's location, indicated which traffic flows to count or interview, and answered questions. On the day of the survey, ten radio-equipped cars were used to assist in field

emergencies and logistical control. A survey control room was also established to facilitate dispatching of additional surveyors (from the 50 held in reserve) to stations in the field.

On the day of the survey the ten groups assembled at 6 a.m., an hour before the starting time of the survey. The members were brought to their assigned stations in time to start the survey at 7 a.m. exactly, Monday, 18 April, 1977, and the survey was carried out in the following three periods:

Period one:	7 a.m. to 11 a.m.
Period two:	1 p.m. to 4 p.m.
Period three:	6 p.m. to 9 p.m.

Traffic policemen were assigned to control the traffic at each survey station, and each group leader spoke to the operation control room in Darassa every 15 minutes to inform the liaison officer about work progress.

At the end of the traffic survey (9 p.m.), busses picked up the surveyors at their stations and brought them to the starting points where they delivered their files to the group leaders. An operation room in the Central Traffic Agency in Nasr City was prepared for receiving files with the completed forms gathered by the group leaders at the end of the survey day. These files were brought in the next morning to the Faculty of Engineering, Cairo University for the data preparation phase.

1.1.5 Coding Systems

For coding of the vehicle type, the same serial number as used in the count form was adopted, with a code of 99 used in the case of missing data.

The zoning code for origins and destinations in the survey was based on a five field digit defined on the basis of the following three types

of zonal trip ends (see Table I-1):

Type One: Rural trip ends were given the symbol "0" in the first field. In the second and third fields, zone numbers adopted from the National Transport Study (carried out under the supervision of Transport Planning Authority) were used. Thr fourth and fifth columns were assigned zeros.

Type Two: Urban area trip ends between the cordon of Greater Cairo and cordon of the central area were given the symbol (1) in the first field. In the second and third fields was the zone number (a total of 14 zones). The fourth and fifth columns were assigned zeros.

Type Three: Central area trip ends were given the symbol "2" in the first field. The second and third fields had the zone numbers according to the zoning system explained in section 1.1.1. The fourth and fifth columns had the numbers of the subzones in each zone.

The trip purpose was coded as follows:

01 Home - Work
02 Work - Home
03 Home - Education
04 Education - Home
05 Home - Other Prupose
06 Other Purpose - Home
07 Work - Work
08 Other Purpose - Other Purpose
09 Work - Other Purpose
10 Other Purpose - Work
11 Other Purpose - Education
12 Education - Other Purpose
13 Education - Work
14 Work - Education
15 Home - Home

16 Education - Education

20 Work

30 Other Purpose

40 Education

50 Trucks

60 Home

99 No entry

1.1.6 Master Files

For the three survey periods, traffic volumes for each of the 267 stations were tabulated in a master file by vehicle type for each 10-minute period as well as hourly. This master file is available at Cairo University Project Library in four volumes as follows:

Vol. 1	Stations	1 - 67
Vol. 2	"	68 - 134
Vol. 3	"	135 - 201
Vol. 4	"	202 - 267

Applying Passenger Car Equivalent Factors (PCE's) commonly used in Egypt and shown in Table I-2, these traffic volumes were converted into PCE's and are also available in the master file.

Table I-2

Vehicle	Equivalent Passenger Car Unit
Micro-Bus	1 1/4
Private Bus	2
Public Transit Authority Bus	2 1/2
Tram	8
Trolly Bus	4
Ordianry Lorry	2 1/2
Lorry with Trailer	5
Pickup Truck	1 1/2
Bicycle / Motorcycle	1/2
Animal drawn Cart	6
Man Pushed Cart	1 1/2

21

Following the coding procedures of the interview forms, the records were punched at the Cairo University Computer Center. A print-out of the results was made available and was revised manually. The Survey Master File includes a total sample of 113,211 trips. A print-out of this master file was produced and is contained in 26 volumes (each volume contains the records of ten stations) in the Project Library.

1.2 Public Transport Survey

Even though, in terms of its social role and its significance to the growing economy, mass transit is the most important transport mode in Cairo, it suffers from severe problems of underinvestment and overcrowding. Over three million trips daily are carried with a fleet of 1,300 buses, while more than one million trips are made by tram, trolley bus, and urban railway combined. Some 13.6 million daily trips are forecast for the year 1990 (2), assuming there is sufficient capacity to absorb this growth in demand.

Several transport studies for Greater Cairo have been carried out since 1954 by local and foreign experts. However, most of these studies were brief, and some were focused mainly on the feasibility of constructing an underground rail network (2).

The CU/MIT research team, the Cairo Transport Authority, and the Transport Planning Authority jointly determined that a comprehensive public transport survey was warranted to augment and complement information from previous studies. This survey, together with the results of the vehicular traffic survey carried out in 1977, provides a valuable transportation data base which could be updated regularly.

1.2.1 Zoning System

To enable the integration of the results of the public transport survey with those of the 1977 vehicular survey, the same 66-zone configuration in the enlarged central area was to be used for the public transport survey, facilitating studies of both private and public transport in the future.

However, it was also noted that the area between the cordon of the enlarged central area and the cordon of Greater Cairo (which was divided inot 14 zones in the vehicular survey) was well-served by public transport, since these are generally newly developed areas with low car ownership. In order to have more refined data, these 14 zones were subdivided into 54 subzones, using methods as were used for the vehicular survey zoning system of the enlarged central area. (See Figure I-4)

1.2.2 Selection of the Survey and Sampling Techniques

The procedures used for buses, trams, trolleys, and ferries are described first, while ticketing and boarding procedures of the urban railway lines, which necessitated a special survey technique, are described subsequently.

There were two interview techniques considered:

a) Interviewing passengers at stops. This technique offers two primary advantages:

- it avoids problems associated with interviewing passengers on board overcorwded vehicles.
- all interviews could be grouped on an hourly basis for analysis.

However, the method has the following disadvantages:

- it tends to exclude alighting passengers and focuses on those waiting to board.
- in cases where more than one line serves a single stop, enlargement of the interview sample to population size would be impossible within reasonable levels of accuracy.

b) Interviewing passengers on board. This procedure would have one interviewer surveying selected passengers on board throughout each

Table I-1

Zone Codes for O/D Movements

Serial number	Subzone number	Subzone Name	Serial number	Subzone number	Subzone Name
1	20101	El-Moneeb	26	21202	Talaat Harb Sq.
2	20102	El-Giza	27	21203	Ataba Sq.
3	20201	Cairo University	28	21204	Falaky Sq.
4	20202	Cairo Univ. West	29	21205	Kloot Bey, El-Bihary
5	20301	El Mesana Dokki Sq.	30	21206	Tawfeekeia Sq. Halabi
6	20302	Dokki North	31	21207	Ramsis-Galaa
7	20303	Beinel Sarayat	32	21301	Boulac-Maspero
8	20401	Aggoza	33	21302	El-Sabteya,El-Kolaya
9	20402	Nadi El-Said	34	21401	Bab El Khalk
10	20501	El-Mohandesseen	35	21402	El-Kalaa Bab El Wazeer
11	20502	Sphinx Sq.	36	21501	El- Azhar St.
12	20503	Sahafeyeen	37	21502	El-Monsoureya
13	20600	Terzatel Swahel	38	21503	Bab El-Shaareya Sq.
14	20701	El-Roada	39	21504	El-Geish Sq.
15	20702	El-Manial	40	21601	Ghamra- El-Zaher Sq.
16	20301	Zamalek El-Bahareya	41	21602	El- Faggala
17	20302	Gezira	42	21701	Road El Farag
18	20901	Masr El Kadima	43	21702	Misarrah
19	20902	Ein El Seera	44	21703	El-Teraa El Boulakia
20	21001	El-Sayeda Zeinab	45	21801	Gesr el Bahr
21	21002	El- Sayeda Nafisa	46	21802	Hadayek Shubra
22	21003	Zeinhom, El Slakhana	47	21803	Shubra El- Mezallat
23	21101	Garden- City	48	21901	Mahamasha El Sharabeya
24	21102	Ministries's District	49	21902	Teraat El Ismailia
25	21201	Tahrir- Sq.	50	22001	Abassey a

Table I-1

Zone Codes for O/D Movements (cont.)

Serial number	Subzone number	Subzone Name	Serial number	Subzone number	Subzone Name
51	22002	Abdo Pasha	76	10402	Al-Warrak
52	22101	Sekketel Waili	77	10501	Shoubra El Khema
53	22102	Hadaek El Kobba	78	10502	Kanater El Khaireya
54	22103	Deerel Malak	79	10600	Bahtim-Mostorod
55	22104	Mansheyet El-Sadr	80	10701	Masaken El Helmeya
56	22105	Kasr El Kobba Sq.	81	10702	Ein Shams
57	22201	El Amerial, South	82	10703	Moassaset El-Zakaah
58	22202	El Amieriya, North	83	10704	El Matareya
59	22301	El Zeitoon	84	10705	Ezbet El Nakhl Misalla
60	22302	El Kobba	85	10706	El Masala
61	22401	Abdel Nasser Mosq.	86	10801	El Alf Maskan
62	22402	Manshit El Bakri	87	10802	El Nozha
63	22501	Roksi	88	10803	Masaken 23 July
64	22502	El- Ismailia	89	10804	El Hakestep
65	22503	El Gameh Sq.	90	10901	Cairo Int. Airport
66	22504	Merry land	91	10902	El Kolleya El Harbeya
67	10100	El Manawaat	92	11000	Almaza
68	10201	El Omraneya	93	11101	Asmaa Fahmi
69	10202	Awel El Haram	94	11102	Estad El Kahera
70	10203	Abu Katada	95	11103	El Azhar Girl's college
71	10204	El Taawon, El Talbeya	96	11104	El Azhar University
72	10205	El Ahram	97	11105	Ext. of El Azhar
73	10206	Mazeletel Saman	98	11106	Seventh &eighth Distr.
74	10300	Boulak El Dakror	99	11107	Fifth & sixth Distr.
75	10401	Mad'net Omal Embaba	100	11201	Kaeit Bey

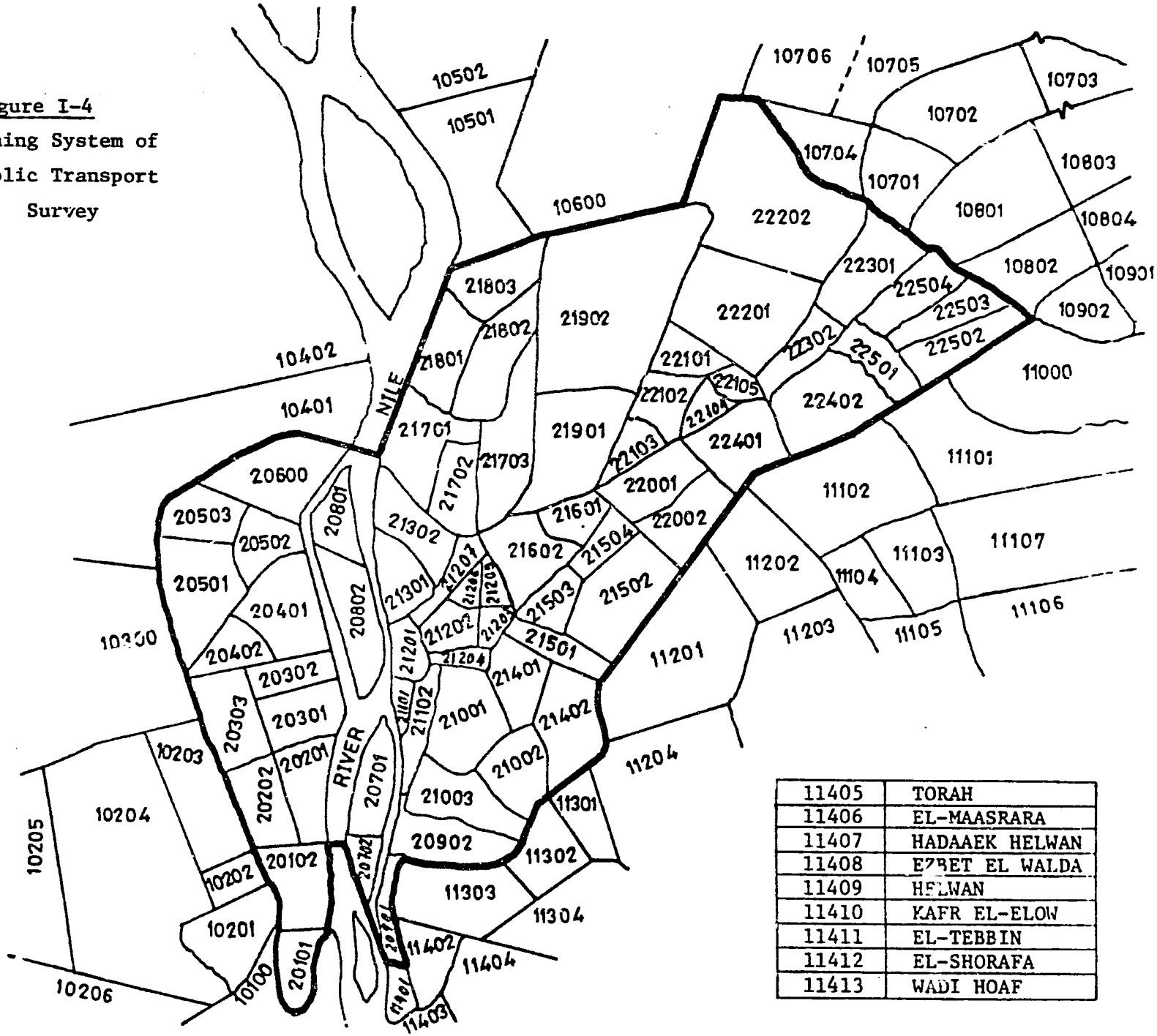
Table I-1

Zone Codes for O/D Movements (cont.)

Serial number	Subzone number	Subzone Name	Serial number	Subzone number	Subzone Name
101	11202	El-Hommeyat Hosp.	126	01900	Port Said
102	11203	Cairo Trans Garage	127	02200	Dakahleya
103	11204	El-Mokattam	128	03100	Gharbeya I
104	11301	El-Abageya	129	03400	Gharbeya II
105	11302	El-Emam El-Shafei	130	02500	Damyetta
106	11303	Gameh Amr	131	02800	Menoufeya
107	11304	El-Tonsi	132	03700	El Dakahleya,K.El.Sh.I
108	11401	Athar El Nabi-Dar El Salam	133	04000	Kafr El Shiekh II
109	11402	Khartet El Sheikh Mobarak	134	04300	K.El-Sh.III,El-Behera I
110	11403	El-Maadi	135	04600	El-Behera II
111	11404	El-Basateen	136	04900	El-Behera III Saloom
112	11405	Torah - Kotsika	137	05200	El-Berera IV
113	11406	El-Maasara	138	05500	El Behera V
114	11407	Hadaaek Helwan	139	05800	Tenth of Ramadan
115	11408	Ezbetel Walda	140	07000	Beni Suef
116	11409	Helwan	141	07300	El-Menya
117	11410	Kafr El Elw	142	07600	Asuit
118	11411	El Tabbin	143	07900	Souhag
119	11412	El Shorafa	144	08200	Quina
120	11413	Wadi Hoaf	145	08500	Aswan
121	00400	El-Kalioubeya	146	06700	El-Fayoum
122	00700	El-Sharkeya I	147	08800	New Valley
123	01000	El-Sharkeya II	148	09100	Red Sea
124	01300	Suez			
125	01600	Ismailia & Sina			

Figure I-4

Zoning System of Public Transport Survey



11405	TORAH
11406	EL-MAASRARA
11407	HADAAEK HELWAN
11408	EZBET EL WALDA
11409	HELWAN
11410	KAFR EL-ELOW
11411	EL-TEBBIN
11412	EL-SHORAFA
11413	WADI HOAF

run. To achieve a safe minimum sample size, one interviewer would be assigned to each vehicle on each route. The interviewers would be assigned a seat, varying in position, on successive vehicles in the following pattern: next to the front door in the first vehicle, at an intermediate position in the second vehicle, and near the back door in the third vehicle. This procedure reduces the chances of a sample bias toward those passengers who board at one end of the route.

To assess the difficulties associated with each survey and to measure the rate at which interviews could be completed, a test of both methods was conducted on 17 January, 1978, from 6:30 a.m. to 2:30 p.m. Two ten-man teams of trained interviewers from the Cairo Transport Authority were assembled. Ten interviewers were assigned to bus routes 44, 44', and 26 (one per bus), and ten interviewers were assigned to the bus stops of the three lines.

The results of these interviews indicated that passengers were very cooperative and responded to the questions asked by the interviewers. The on-board surveys averaged twelve interviews per hour per interviewer, while the rate for the interviewers at the bus stops was slightly higher. Aside from the crowded conditions on the buses, a key reason for the difference in the interview rates was that with the on-board survey the passengers were more inclined to ask questions about the survey and to use the opportunity to lodge service complaints. Passenger interviewers at bus stops did not, generally, experience this delay factor. As a result of this experiment and weighing the advantages and disadvantages of both methods, it was decided to adopt the on-board survey technique, especially to avoid the potential bias introduced when interviewing mainly boarding passengers at bus stops.

Refinements of the public transport survey form were made by the Cairo University and MIT teams near the end of March. Additionally, the degree of possible bias in the sampling technique, regarding long-distance passengers who would have a higher probability of being interviewed during the survey, was analyzed through an experiment.

Two routes were selected for this check: number 50' runs 17.95 km from Guesr El Suez to Tahrir Square and is representative of long routes; number 5 runs 5.1 km from Mit Okba to Ataba Aquare and is representative of short routes. These routes were selected to meet the following criteria:

- Each route should pass through several zones
- No route should be circular
- The overall trip lengths between terminals should be representative of both long and short distance routes.

Two alternative data collection procedures were tested:

Alternative A: Three vehciles on each route were surveyed, with one interviewer per bus. The position of the interviewer varied for each vehicle; next to the front door in the first vehicle, near the back door in the second vehicle, and at an intermediate position in the third vehicle. The intermediate position was included so as to avoid collecting data solely from the short distance passengers who usually stand by the doorways.

Alternative B: Three interviewers were allocated to a single vehicle along each bus route, one seated near the front entrance, one near the rear, and one at an intermediate position. The hypothesis here is that this procedure will, by increasing the sample size of passengers interviewed on a single bus, result in an unbiased sample of the total

population. The primary drawback of this procedure is that only one-third as many buses can be surveyed as in Alternative A, given equivalent manpower levels.

The interview procedures also had several characteristics in common:

- a common questionnaire form was used.
- two conductors were assigned to each vehicle surveyed to reduce the number of passengers traveling free, illegally.
- two inspectors were assigned to each vehicle. Each inspector was provided with a form on which to record passenger boarding and alighting at each bus stop.
- the interviewers made a mark on the ticket or pass held by each passenger interviewed in order to avoid duplication.
- the survey was conducted during the morning peak period and included three round trips on each vehicle.

For each bus route, the following calculations were made:

(a) Line profiles of on-board passengers were constructed from the counts at the bus stops along each route and from the matrices obtained from the survey sheet. These represented the sample.

(b) With inter-stop distances, an O-D matrix of distances between any pair of stops along the route was constructed.

(c) From (a) and (b) above, trip length frequency distributions for both the sample and total passenger populations of the two alternatives were derived for each route.

The statistical analysis of the results consisted of testing the goodness of fit of the two frequency distributions. The results of this analysis showed that the data collected by three interviewers on a single

bus more closely fit the frequency distribution of the total population than data collected by three interviewers riding separately on three consecutive buses. In the case of bus route 50, the degree of confidence associated with Alternative A (one interviewer per bus for three buses) was 1.95% while that associated with Alternative B (three interviewers per one bus only) was 4.66%. The conclusion was to assign as many interviewers as possible per vehicle (within the manpower limitations). Additionally, two inspectors per vehicle were used to collect the on-off counts that serve as the basis for enlarging the sample to represent the total population.

The on-board survey technique described above was not used on the urban railway lines for the following reasons:

- the severely overcrowded conditions on railway vehicles would seriously hinder an interviewer attempting to conduct the survey, and so, too, jeopardize the validity and completeness of collected data.
- urban railway tickets are valid for a one-hour period--the passenger may board any train that passes through during the hour after purchase. Therefore, data gathered based on tickets sold does not necessarily represent a true profile of passengers on any given train.

For these reasons, the on-platform survey technique was employed for the urban railway data collection. Two factors facilitated data processing: (1) every stop is served by only one line, and (2) the collected data can be classified at a predetermined time interval.

Urban railway tickets may be purchased at the platform or on-board the train. Seasonal passes (or ticket packets) are also available. Origins and destinations for the tickets purchased at ticket offices were recorded by observers at each ticketing position on each line.

To ascertain the total population characteristics using the urban railway lines, the following procedure was used:

(1) For each rail line, all the interviews carried out at each station in both directions represented the sample size for a particular time interval (6:30--7:30; 7:30--8:30,..., 14:30--15:30). The interviews were given serial numbers.

(2) For each time interval, the total tickets sold by the ticketing-selling positions in both directions was calculated.

(3) Trips were allocated by time interval, and the time centroid for each run was calculated, knowing the beginning and end times for each run.

(4) The number of tickets sold by on-board conductors for all trips falling within the same time interval in both directions was calcualted.

(5) Results of steps (2) and (4) were added for the same time interval to compute the total number of tickets issued by hour.

(6) From the information gathered from each passenger about the type of ticket he uses for his trip (full fare, season ticket, or free pass), it was possible to calculate an average percentage of passengers using season tickets and free passes for every hour of the survey.

(7) The total number of passengers using the route for each time interval = [total number of issued tickets] [1 + % of passengers using season tickets + % legal free riders].

Details of the design of the survey forms can be found in Reference (3). Figure I-5 and Figure I-6 illustrate the forms used in the mass transit survey for both railways and other public transport modes in Greater Cairo.

MINISTRY OF TRANSPORT - GENERAL ORGANIZATION OF THE EGYPTIAN RAILWAYS

CAIRO UNIVERSITY - MIT

Figure I-5

RAILWAY PASSENGERS INTERVIEW FORM

Helwan Line ☐ El Marg Line ☐

Station _____

Station Number ☐☐ Starting Time ☐☐☐☐ Number of interviewers on the platform ☐

Interviewer's Name _____

Sheet Number ☐☐☐ Ending Time ☐☐☐☐ Interviewer's Number ☐☐☐

Were you asked before?	Serial Number	Sex		Where are you coming from?								Which station are you getting off at?	Did you change modes during your trip?				Where are you going?								Will you change modes during your trip?				Fare			
									Address				No	Yes								Address			No	Yes						
		Male	Female	Home	Work	Education	Shopping	Other Purposes	Number	Street	District			Mode	Intermediate Station	Service Number	Home	Work	Education	Shopping	Other Purposes	Number	Street	District		Mode	Intermediate Station	Service Number	Ticket	Season Ticket	Free Pass	
	1																															
	2																															
	3																															
	4																															

Figure I-6

PUBLIC TRANSPORT PASSENGERS INTERVIEW FORM

MINISTRY OF TRANSPORT - CTA

CAIRO UNIVERSITY - MIT

INTERVIEWER NO. :
INTERVIEWER NAME :
DATE :

MODE : BUS ☐ TRAM ☐ TROLLEY ☐ METRO ☐ FERRY ☐

TRIP NO. ☐☐☐ STARTING TIME Hr. Min. ☐☐☐☐ LINE NO. ☐☐☐☐

SHEET NO. ☐☐☐ ENDING TIME ☐☐☐☐ UNIT SERIAL NO. ☐☐

NO. OF THE INTERVIEWERS IN THE UNIT ☐ NO. OF TICKETS SOLD IN ONE TRIP ☐

NAME OF THE STARTING TERMINAL : NAME OF TERMINAL INSPECTOR :

NAME OF THE ENDING TERMINAL : SIGNATURE OF TERMINAL INSPECTOR :

Were you asked before?	Serial Number	Sex		Where are you coming from?									Where are you going?									Did you change the mode during your trip?				Will you change the mode during your trip?			
										Address									Address			No	Yes			No	Yes		
		Male	Female	Home	Work	Education	Shopping	Other Purposes	At which stop did you board?	No.	Street	District	Home	Work	Education	Shopping	Other Purposes	At which stop are you getting off?	No.	Street	District		Mode	Intermediate Station	Service Number		Mode	Intermediate Station	Service Number
	1																												
	2																												
	3																												
	4																												
	5																												
	6																												

1.2.3 Conduct of the Survey

The large bus fleet and limited available manpower necessitated that the survey be carried out over four successive working days. Garages surveyed on a particular day were selected so as to maximize the area of the city covered by the survey on that day.

The number of buses surveyed on a particular route was kept roughly proportional to the total number of buses operating on that route:

Number of Peak Hour Buses Running on a Route	Number of Peak Hour Buses Included in the Survey
6	1
7-10	2
10 and more	3

The same ratios were applied to all other modes. The number of vehicles surveyed on every mode were as follows:

Buses:	345 vehicles	out of	1439	vehicles
Trolley:	30 vehicles	" "	74	vehicles
Tram:	30 units	" "	156	units
Ferries:	6 units	" "	18	units
Heliopolis Metro:	12 units	" "	45	units

The manpower used for the survey consisted of 660 students from the School of Engineering, Cairo University. In addition, the Cairo Transit Authority provided 200 men to record the on/off counts on buses, trams, trolley buses and the Heliopolis Metro.

Appropriate forms were distributed to interviewers, inspectors, and observers on the morning of the survey.

1.2.4 Coding of the Public Transport Survey Information

Two groups (consisting of 2 supervisors and 12 students in all) followed these steps for all data on each line:

(1) The forms for interview data and on/off counts for a specific vehicle were distributed, one to each student.

(2) The starting time, ending and serial number were cross-checked for each vehicle according to the available forms.

(3) The time centroid for each run was calculated for the appropriate time interval (i.e., any time between 0600 hr - 0700 hr was recorded in the 0630 hr class interval) and recorded on the forms for the particular run.

(4) Interviews conducted within the same time period were coded by serial numbers (e.g., 1-90 for the 0630 hr class interval, 1-105 for the 0730 hr class interval, and so on).

Groups of two students each were supervised by research graduates during the coding process.

In each group, one student called the information while the other recorded the relevant code on the data form (Figure I-7). Data on the cards were divided into 3 categories (see Figure I-7):

- Identification Section
- Information Section
- Magnification Section

- Coding System

Below are notations used in coding the above information.

1) Mode

Mode	Bus	Tram	Trolley	Metro	Ferry	Railways	Taxi	Others
Code	1	2	3	4	5	6	7	8

Figure I-7

MINISTRY OF TRANSPORT - PUBLIC TRANSPORT AUTHORITY - C.U./M.I.T

CODING SHEET FOR PUBLIC TRANSPORT SURVEY

Mode		Route		Date		Time			
1	2	3	4	5	6	7	8	9	10

Total No. of Passengers/hr				
67	68	69	70	71

Trip Serial No.	Sex	Where are you coming from?			Where are you going to?			Interchange				Trip Serial No.	Sex	Where are you coming from?			Where are you going to?			Interchange			
		Purpose	Station	Address	Purpose	Station	Address	Identification	Mode	Station	Route			Purpose	Station	Address	Purpose	Station	Address	Identification	Mode	Station	Route
11 12 13	14	15	16 17	18 19 20 21 22	23	24 25	26 27 28 29 30	31	32	33 34	35 36 37 38	39 40 41 42		43	44 45	46 47 48 49 50	51	52 53	54 55 56 57 58	59	60	61 62	63 64 65 66

28

2) Line

In a field of 4 digits, the 2nd, 3rd, and 4th digits were reserved for the line number. The first digit was either 2, 1 or 0, according to whether the line considered was identified with 2 marks ("), 1 mark (') or without maks respectively. In a case where the line was identified by means of letters, the first digit took the value of 3. As far as urban railway lines were concerned, a code of 7777 was given to the El-Marg line while 2 codes were given to the Helwan line*: 8888 for trips between Bab El Luk & Torah El Balad stations, and 9999 for trips between Kotsiks and Helwan Hammamat stations.

Examples:

Line 10	0	0	1	0
Line 10'	1	0	1	0
Line 125"	2	1	2	5
Line G 8	3	0	0	8

3) Date

Date	17/4/78	18/4/78	19/4/78	20/4/78	22/4/78
Code	1	2	3	4	5

*The number of passengers using that line (30 km long) were over 999/hr within some time intervals. With the field allocated to the trip serial number being 3 digits only, it was decided to split the trips along the line into two sections and hence two different "segments."

4) Time

The time is represented by 4 digits as follows:

07.30	0	7	3	0
15.30	1	5	3	0

5) Trip Characteristics:

--Trip Serial Number

Three (3) digits were used, starting from 1 for the first trip within a certain time period to the last trip within the same time period.

--Sex

Two digits were used: "1" signified a male passenger and "2" signified a female passenger.

--Trip Origin

8 coded digits were used as follows:

The first digit designated the purpose and took a value from the following:

Home	Work	Education	Shopping	Others
1	2	3	4	5

The second and third digits represented the station at which the passenger boarded the bus. The remaining 5 digits represented the zone number of the trip origin by locating the address on a zone map.

The maps available for Cairo were not completely up-to-date. Consequently, extra effort was required to identify the street names in the "newly" developed areas so as to facilitate the coding of trip origins/destinations.

--Trip Destination

The eight digits reserved for the trip destination were coded in a way similar to those for the trip origin.

--The Transfer (Interchange)

Eight (8) digits were coded as follows:

The first digit represented an identifier which read:

1: in the case where no transfer took place

2: in the case where the transfer took place before the interview

3: in the case where the transfer took place after the interview.

If more than one transfer occurred during one trip, only the one before the interview was considered (code 2). The second digit represented the interchange mode. The third and fourth digits represented the station where the transfer took place.

The remaining four digits were originally intended to designate the route used before/after the interchange. However, it was found that due to the dense network, passengers generally had a choice of lines at the transfer station, and so the line number quoted was not necessarily the one regularly used for the same trip. It was therefore decided to leave this field blank.

1.2.5 Master File

Following the coding procedure, the data were key-punched on magnetic tape in the CAPMAS computer center. Validation rules were adopted to correct errors in the coding procedures manually. The final master file contained 280,732 valid trips for the six modes of the public transport in Cairo (see section 1-5). A printout of this master file is reserved in the Project Library of Cairo University, Faculty of Engineering including:

Mode	Number of Volumes
Bus	36
Tram	4
Trolley	2
Metro	5
Ferry	1
Railway	3

1.3 Parking Surveys

1.3.1 Background

A survey of parking conditions in the Cairo CBD was critical to the Cairo Urban Transportation Research Project. Previous data on parking supply and demand characteristics were either missing, incomplete, or outdated. These data, together with data on overnight parking volumes, constitute the basis of the parking model developed in the course of this research (see Chapter IV).

This section describes the parking survey and its results, including estimates of available legal parking supply, illegal parking volumes, and overnight parking (number of vehicles parked before 7:00 a.m.).

1.3.2 Description of the Parking Survey Area and Zoning System

A review of previous transportation studies for Cairo indicated that definitions of CBD areas varied, depending on study purpose and time. Figure I-8 shows some of the previous and more common boundaries.

Most previous studies (1,2,4) considered the CBD area as divided into seven zones, as shown in Figure I-8. However, this segmentation was deemed insufficient, due primarily to the fact that demand for parking in these seven zones currently far exceeds the supply. Therefore, some drivers commonly park outside their destination zones and walk to their final destination sites. A second consideration leading to an expanded survey area has taken place in zones surrounding the well-defined seven CBD zones. Examples of these zones are Garden City and Al-Azhar.

Based on the above considerations, the study area for the parking survey encompassed the CBD plus a fringe of surrounding area in which

some CBD-bound travelers actually park. This fringe was divided into eleven zones, as shown in Figure I-9; the figure illustrates the external boundaries of the study area, as well as the boundaries of each zone. Table I-3 gives the zones and their code numbers as they appear in Figure I-9.

Table I-3

Parking Study Zoning System

Serial No.	Code No.	Zone Name
1	21101	Garden City
2	21102	Area of Ministries
3	21201	El-Tahrir
4	21202	Talaat Harb
5	21203	Attaba
6	21204	Adbin-
7	21205	Klot Beik
8	21206	Tawfikia
9	21207	Ramsis and Galaa
10	21501	Azhar and Ghoria
11	21503	Bab-El-Sheria

1.3.3 Field Work

Parking Supply Survey

The supply survey was subdivided into three stages:

1. Preliminary survey of all parking facilities (legal and illegal)
2. Field measurement of the area of parking lots and garages
3. Estimation of parking supply.

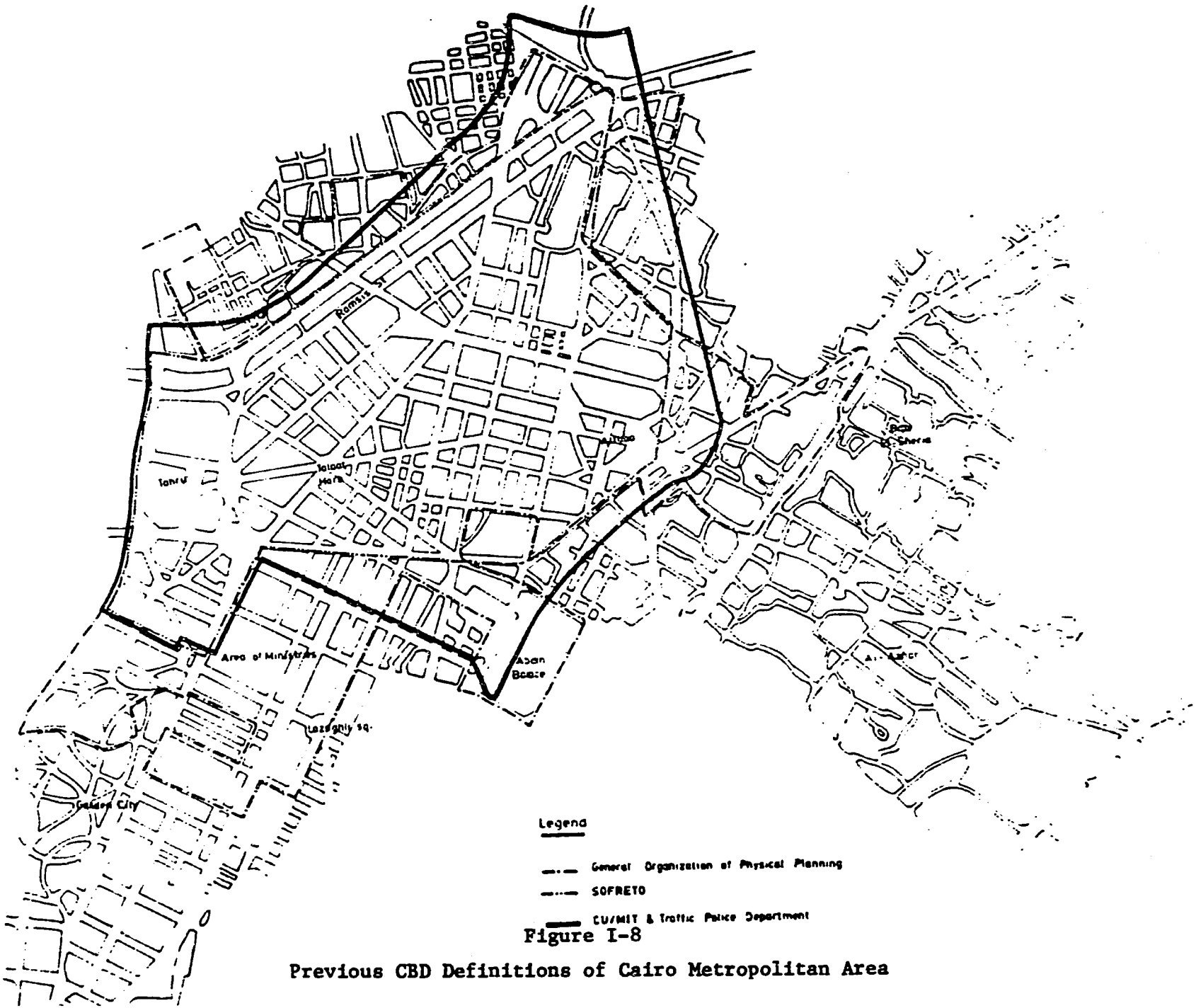


Figure I-8

Previous CBD Definitions of Cairo Metropolitan Area

45

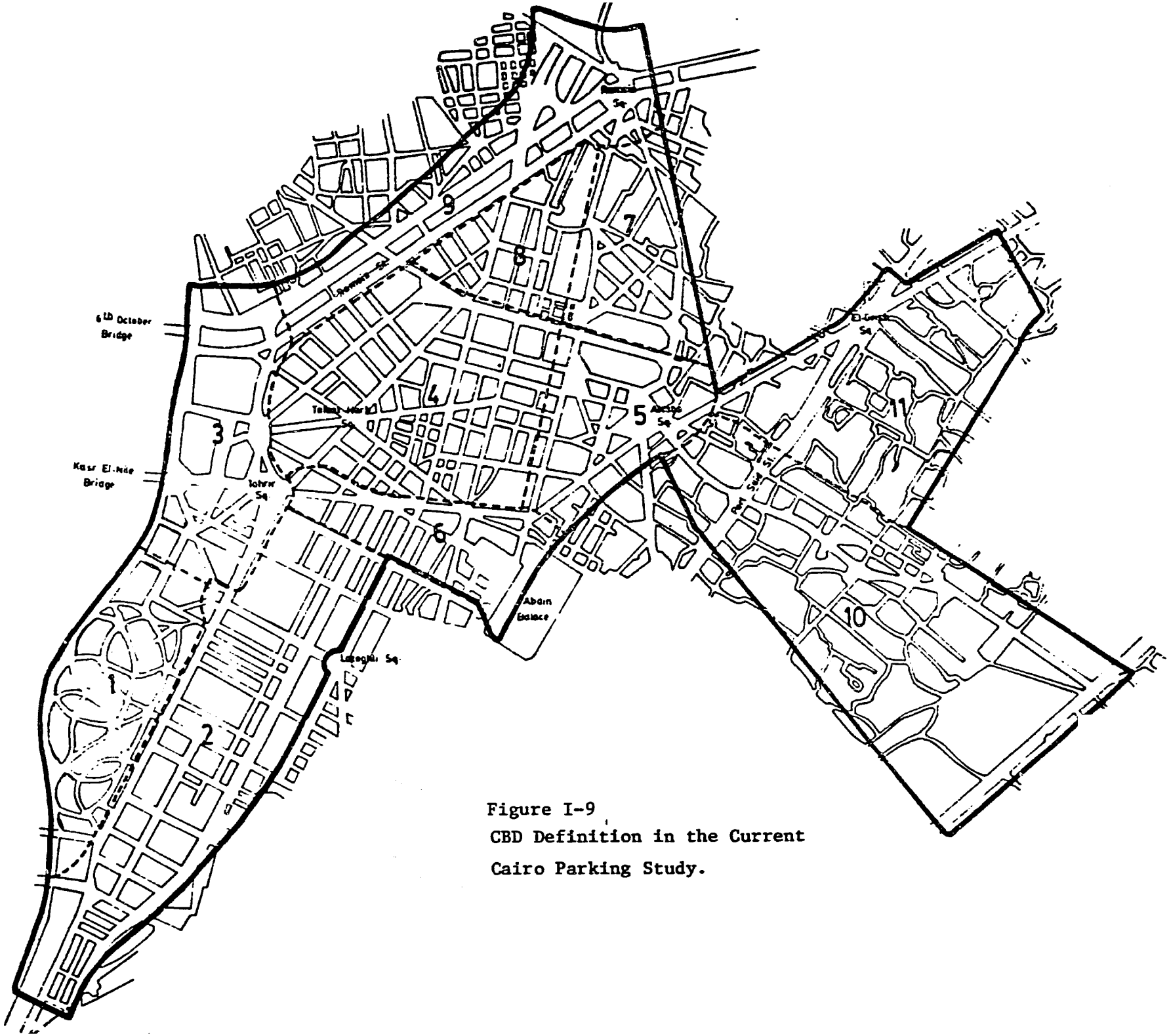


Figure I-9
CBD Definition in the Current
Cairo Parking Study.

46

1. Preliminary Survey of Parking Facilities

The purpose of this stage was to locate curb parking spaces (legal and illegal) and off-street parking garages and lots by name and location for further area measurement.

Two field survey forms were prepared. The form for surveying on-street parking facilities included the following data:

1. Street name.
2. Section limits (designated from a known intersection or square to the nearest known intersection or square).
3. Type and shape of parking (i.e. legal or illegal; parallel or angled).
4. General remarks, name of surveyor, zone or section number, and date.

A second form was prepared for surveying off-street parking facilities, and it contained the following data:

1. Lot or garage name (if any).
2. Type of facility (i.e., public garage, private garage, or open lot).
3. Address or location.
4. Estimated capacity.
5. General remarks, name of surveyor, zone or section number, and date.

The survey teams were given instruction sheets and a briefing about the purpose of the survey, an explanation of the field survey forms, problems that might be encountered, and methods of dealing with the public.

The work was conducted over a five-day period between the hours of 9:00 a.m. to 6:00 p.m., and survey forms were collected daily at 7:00 p.m. at survey headquarters at Cairo University.

2. Area Measurement of Off-Street Parking Facilities

The purpose of this phase was to determine the area of each parking facility, information later used in estimating the theoretical capacity of a particular facility.

The measurement survey was done by four groups, each group consisting of two surveyors equipped with a tape to measure the dimensions of the garage or lot. Each group also had a copy of the preliminary survey forms and blank sheets on which to draw an illustrative sketch of the facility. This inventory activity lasted for five days.

3. Estimation of Parking Supply

On-street parking supply was estimated by dividing the curb length where parking was permitted by an appropriate average car length and inter-car space, adjusted to the angle of parking (e.g., 4.455 m for parallel parking and 2.465 m for perpendicular parking). These values were determined by averaging the measures made for passenger cars parked in 15 sections chosen at random in 10 different streets located throughout the study area. The lengths of parked cars in these sections were measured (results are given in Appendix I-1, Table I-1-1). On-street metered parking supply was estimated by counting the number of meters in CBD zones.

Off-street parking supply was estimated in two steps. First, a theoretical capacity was calculated by dividing the area of the garage or

lot on the required unit area per car. (The average area required per car in an off-street parking facility was determined as shown in Appendix I-1, Table I-1-2. Five different lots were chosen for this purpose; the total area and number of parked cars in each were determined and the average value was calculated: 12 m^2/vehicle.)

Figure I-10 identifies the locations and types of parking facilities surveyed in each zone.

4. Survey of Illegal Parking

A comprehensive survey of illegal parking in the 11-zone study area was deemed beyond the scope of this study due to time and fund limitations. Therefore, samples of various parking types and locations were chosen to survey illegal parking. Thirty-five street sections representative of the same parking facilities in all the study area zones were selected; at least two street sections per zone were used.

The Talaat Harb zone is considered the core of Cairo CBD area, as it has the highest concentration of business, shopping, and recreational activities. Special attention was given to the study of illegal parking in this zone with ten street sections distributed over the zone being selected for this sampling purpose.

A detailed sketch for each street section was prepared with monitoring of each section lasting four hours, from 10:00 a.m. to 2:00 p.m. The number of illegally parked cars was recorded every half hour and the maximum number recorded during this period was considered to be the peak illegal parking volume. (Table I-1-3 in Appendix I-1 and Figure I-11 show the survey locations in each zone of the CBD area.)

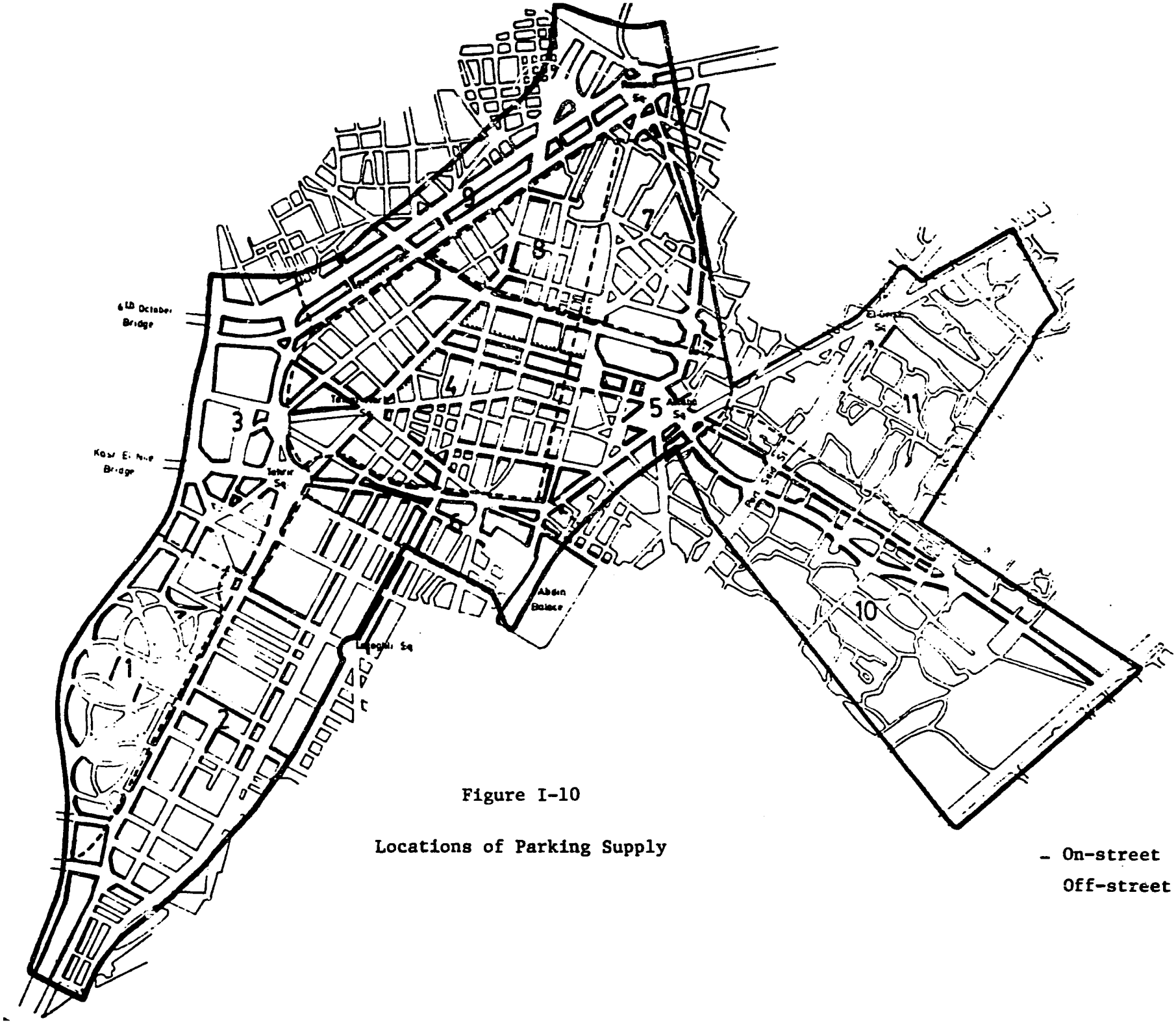


Figure I-10

Locations of Parking Supply

- On-street

Off-street

The supply data and estimated illegal parking volumes were used to compute the percent of illegal parking in the surveyed locations. These values were then used to estimate the percent of illegal parking in similar locations in the eleven different CBD zones.

5. Overnight Parking Survey

All street and parking lots in the 11 zones were surveyed, including private and public garages, which were assumed to be completely full during the survey. This assumption was based on previous preliminary field observations that clearly indicated that overnight parking facilities in the CBD area remained at 100% capacity until about 7:00 a.m.

Preparation of Maps

In preparation for the survey, a map for each survey zone was prepared and the survey path for each team delineated. Each path was chosen taking account of traffic directions in the street network; the points where the survey car should stop were indicated on the map. These stops enabled surveyors to count parked cars on narrow streets. Figure I-12 shows one of these maps for Talaat Harb zone.

Survey Instructions and Schedule

Survey cars and personnel were allocated based on the street length or parking lot area to be covered. Instruction sheets were prepared prior to the survey and explained in detail to each surveying team.

Survey days were weekdays during a period not including holidays. The starting time for the survey on each day was 4:30 a.m. so as to assure completion of the survey before 7:00 a.m. This implies that the number of cars leaving or arriving at any survey point between the actual time

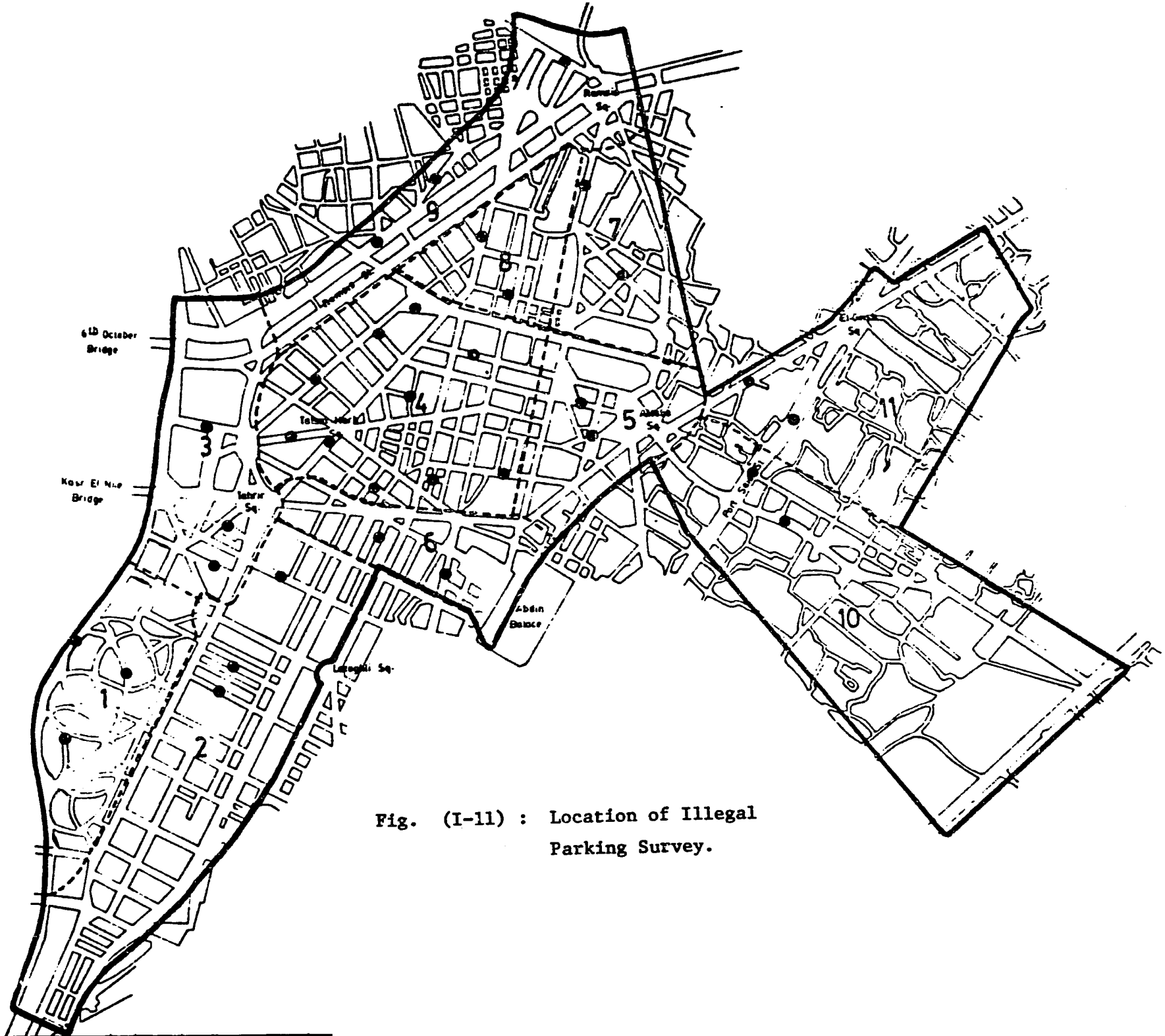


Fig. (I-11) : Location of Illegal Parking Survey.

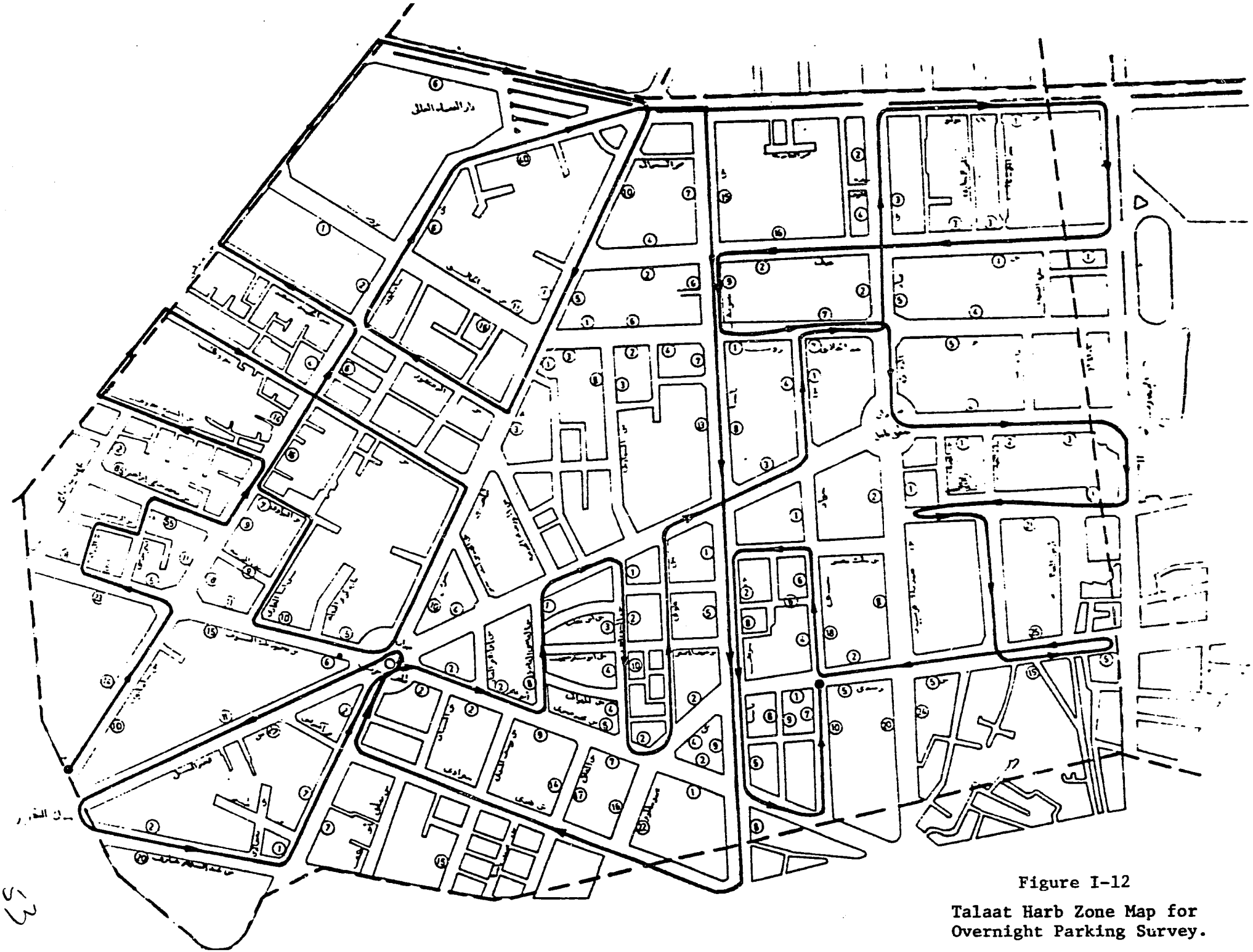


Figure I-12

Talaat Harb Zone Map for Overnight Parking Survey.

of the survey and 7:00 a.m. was not considered. However, this number is usually very small, and furthermore, the volume leaving can simply be assumed to be equal to the volume arriving in the same area during this period.

Field Work

Each two-person survey team was assigned a car driven by a third party. One surveyor carried a map and directed the car driver according to a predesignated path. The other two surveyors counted the number of parked cars, each surveyor counting the side of the street nearest him and recording the count on the zone map. On narrow streets, surveyors stopped to count the number of cars. For parking lots containing a relatively large number of cars, the surveyors walked the parking lot to obtain an accurate count of parked cars.

1.3.4 Survey Results and Analysis

Tables I-1-4 through I-1-10 in Appendix I-1 contain results of the survey on a zonal basis. Table I-4 presents the parking supply data for the eleven CBD zones. These data were grouped according to parking type and location. Table I-5 summarizes the estimates made for illegal parking in the CBD area. Values in Table I-5 are given for illegal volume and its percentage of on-street and total supply of parking.

Illegal parking volumes so recorded represent on-street illegal parking. Data on illegal parking in lots and garages were not available since no markings are used to designate spaces.

Data in Table I-5 clearly indicate a severe illegal parking problem that is widespread in all the Cairo CBD zones. As expected, the highest

Table I-4

Zonal Parking Supply by Type and Location

Parking Facility / Zone Name	On - Street		Off - Street				Total
	Free	Metered	Garages		Lots	Total Off-Street	
			Public	Private			
Garden City	1,661		1,030	[illegible]	87	1,346	3,007
Area of Ministries	2,087		426	153	1,246	1,825	3,912
El-Tahrir	368		77	75	1,362	1,514	1,882
Talaat Harb	2,542	149	1,376	689	709	2,774	5,465
Attaba	512	8	460	37	798	1,295	1,815
Abdin	536		348	119	-	467	1,003
Klot Beik	789		36	24	472	532	1,321
Tawfikia	1,122		118	223	164	505	1,627
Ramsis	552		474	240	603	1,317	1,869
Azhar and Ghoria	368		-	-	689	689	1,057
Bab-El-Sheria	793		198	-	796	994	1,787
Total	11,330	157	4,543	1,789	6,926	13,258	24,745

55

Table I-5

Illegal Parking Volume and its Percent to Legal Supply

Zone Name	Illegal Parking Volume	% of Illegal to On-street Parking Supply	% of Illegal to Total Parking Supply
Garden City	889	54	29.6
Area of Ministries	1,295	62	33.1
El-Tahrir	1,545	20	82.1
Talaat Harb	3,347	124.4	61.2
Attaba	1,152	221.5	63.5
Abdin	1,393	259.9	138.9
Klot Beik	492	62.4	37.2
Tawfikia	893	79.6	54.9
Ramsis	1,360	246.4	72.8
Azhar and Ghoria	1,461	397.0	138.2
Bab-El-Sheria	1,097	138.3	61.4
Total	14,924	131.72	60.3

percent of illegal on-street parking is in El-Tahrir, Abdin, Ramsis and Attaba zones, where a high volume of shopping, commercial and recreational activities are located. The Garden City zone has the lowest percent of illegal parking, followed by the area of Ministries. The effect of illegal and legal parking on street capacity is significant, especially in the core sections of the CBD as El-Tahrir, Ramsis, and Talaat Harb zones.

The survey results indicate a significant deficiency in parking supply. The high illegal parking volume, coupled with the fact that the supply estimates were derived using relatively low unit parking area conversion factors (approximately 11 and $12m^2$ per space for on- and off-street parking, respectively), clearly indicate that demand far exceeds the available supply.* However, the location, capacity, and possible local effects of any new parking facilities should be thoroughly studied to avoid congestion effects to an already overstressed street network.

The survey also indicates a need for better traffic control and enforcement of parking regulations in downtown Cairo. Logically, implementation of traffic control and enforcement measures implies that the Traffic Police Department of Cairo Governorate should expand its manpower, increase incentives to traffic policemen to compensate for the difficult working conditions, and revise the current system of issuing citations and collecting fines for traffic violations.

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*It is a separate but important policy issue whether and how that excess demand should be satisfied or discouraged (e.g., through pricing or other policies).

Table I-6 shows the total on- and off-street overnight parking. The overnight parking volumes as a percent of the legal supply are presented in Table I-7 for each type of parking facility in each zone.

The data indicate that overnight parking uses about 64% of the legal supply of parking. In some zones (such as area of Ministries, Attaba, Abdin, and others), the overnight volume actually exceeds the legal on-street supply and some cars are parking illegally in these zones until 7:00 a.m.

As may be expected, the proportion of illegal parking volume is lower for off-street than those for on-street parking. Also, in general, the proportion of illegal parking is higher in heavily residential zones rather than industrial or commercial zones.

1.3.5 Conclusions

The major conclusions arising from this survey are as follows:

1. Illegal parking is severe in the Cairo CBD area due to the large gap between the supply of on-and off-street parking and the parking demand.

2. Illegal parking is concentrated in the core zones of the CBD area where most of the shopping, commercial, and recreational activities occur.

3. The overnight parking volume consumes a large portion of the available legal supply. This portion is higher in residential zones than in those with industrial or commercial activities.

4. Due to relatively weak enforcement of parking regulations, on-street parking in downtown Cairo is characterized by very close spacing (12 m^2/car), which is approximately one-half the international standard. This indicates that the parking supply is actually about one-half of the estimated existing capacity, if parking conventional standards are applied.

5. While there is a need for new off-street parking facilities, their capacity and location must be carefully planned to avoid increasing street congestion.

Table (I-6) : Zonal Overnight Parking Volume

Zone Name \ Parking Facility	On - Street				Off - Street			Total
	Free	Metered	Illegal	Total	Garage	Lot	Total	
Garden City	1076		119	1195	1259		1259	2454
Area of Ministries	1731		490	2221	579	85	664	2885
El Tahrir	168		84	252	152	113	265	517
Talaat Harb	1072	35	344	1451	2065	141	2206	3657
Attaba	390		144	534	497	36	533	1067
Adbin	346		210	556	467		467	1023
Klot Beik	478		84	562	60	124	184	746
Tawfikia	675		28	703	341	28	369	1072
Ramsis	287		205	492	714	37	751	1243
Azhar and Ghoria	296		60	356	-	79	79	435
Bab-El-Sheria	573		21	594	198	26	224	818
Total	7,092	35	1,789	8,916	6332	669	7,001	15,917

Table (1-7) : Percentage of Overnight Parking Volume to Supply

Parking Facility / Zone Name	On-Street			Off-Street			Total		
	Supply	Overnight	%	Supply	Overnight	%	Supply	Overnight	%
Garden City	1,661	1,195	71.9	1,346	1,259	93.5	3,007	2.454	81.6
Area of Ministries	2,087	2,221	106.4	1,825	664	36.4	3,912	2,885	73.7
El Tahrir	368	252	68.5	1.514	265	17.5	1,882	517	27.5
Talaat Harb	2,691	1,451	53.9	2,774	2,206	97.5	5,465	3,657	66.9
Abdin	520	534	103.9	1,295	533	41.2	1,815	1,067	58.8
Attaba	536	556	103.7	467	467	100.0	1,003	1,023	102.0
Klot Beik	789	562	71.2	532	184	34.6	1,321	746	56.5
Tawfikia	1,122	703	62.7	505	369	73.1	1,627	1,072	65.9
Ramsis	552	492	89.1	1,317	751	57.0	1,869	1,243	66.5
Azhar	368	356	96.7	689	79	11.5	1,057	435	41.2
Bab El Sheria	793	594	74.9	994	224	22.5	1,787	818	45.8
Total	11,487	8,916	77.6	13,258	7,001	52.8	24,745	15,917	64.3

6. More traffic control and enforcement of parking regulations are required to reduce illegal parking and to facilitate traffic movement in the CBD street network.

   Further study is needed on:

   - parking use and duration for separate locations and parking types
   - pricing and policy strategies to control demand
   - methods to improve/ration use of existing space
   - mehtods to control impacts of parking on street operating capacity

1.4 Street Network Inventory

The traffic assignment program developed in the Cairo Urban Transportation Research Project divides the study area into five area types and the street network into six facility types. The physical and design characteristics of each network link in the study area must be defined for this program. To obtain this information, a street inventory was carried out.

1.4.1 Elaboration of a Nodal Street Network Map

From a road map (scale 1:1000) which shows the main arteries and feeder streets, a map for links and nodes was prepared. The link map is contained in Appendix 8 of Reference 1. Figure I-13 shows a reduced-scale copy of this map, which contains the main streets in the enlarged downtown Cairo. The maximum number of nodes in this area is 393; the centroids of trip generation and attraction in each zone are also plotted on this map. The direction of traffic is indicated by an arrow on one-way links; links without arrows have a two-way traffic flow. Big traffic squares (such as Tahrir Square) are considered to be one node, but for the traffic flow study such nodes were split into several dummy nodes with zero distances between every pair inside the square.

1.4.2 Design of the Form

The data and information needed to characterize each network link in Cairo enlarged downtown included:

- number of design lanes
- number of workable lanes
- number of parking lanes
- kind of parking (parallel, angle, perpendicular)
- total width of street (m).

Figure I-13

Reduced-Scale Node on Link Map for the Enlarged Downtown Area in Greater Cairo

63

Figure I-14 shows the form used to record and codify these physical and design characteristics for each link.

1.4.3 Execution of Field Work

The study area was divided into eleven parts; for each sub-area, a detailed map was prepared. A team of three engineering students and one policeman was responsible for carrying out the field work in each section. One day before the survey began, the members of the team explored the network to point out their numbers and check any difficulties. On Wednesday, 27 July, 1977, the inventory survey for all the streets in Cairo downtown was completed. Appendix 9 of Reference 1 contains tables of the collected data.

1.4.4 Updating the Street Network Inventory

Since the last street inventory in 1977, many roadway construction and improvement projects had been implemented in the surveyed area. For this reason, it was decided to update the 1977 Street Inventory. A new inventory was carried out in the period from 15 April to 15 May, 1981, by a team consisting of six engineers. The new information was prepared and is kept in the project library in Cairo University.

Figure I-14

Street Inventory Survey Form

From Node	To Node	Street Name	No. of work-able lanes	No. of park-ing lanes	Kind of parking	Total width of street (m)	Width of working carriage way
352	353	Gesr El Suez Str.	2	-	-	7.2	7.2
344	352	Kasr El Deyafa Str.	2	2	Parallel	11.2	6
352	344	See 344 352					
334	360	Oroba Str.	4	-	-	12.4	12.4
360	334	" "	4	-	-	12.4	12.4
334	325	Ismael El Fangary Str,	4	-	-	12	12
325	334	" " " "	4	-	-	11	11
310	311	Ramsis Str. Extension	3	2	Mixed	15	10
311	310	" " "	3	2	Parallel	15	10
309	310	" " "	4	1	Mixed	15	12
310	309	" " "	3	2	Parallel	15	9
301	306	Port Said Str.	2	1	-	8	6
306	301	Port Said Str.	2	1	-	8	6

65

1.5 Travel Time Measurements

1.5.1 Isochronic Curves

Travel time measurements on the existing main road network is an important element in a transportation study. Travel time and speed data assist in the identification of bottlenecks and in the evaluation of proposed system improvements. Existing speeds and travel times on the different links also serve as input for the different modeling phases of the transportation planning process. The construction of isochronic curves is one convenient method by which to portray the results of such measurements. In this section, the work done by the team in this area is briefly summarized.

Ataba (Post-Office) Square was established as the center point for drawing travel time isochrones for the study area, primarily because Ataba acts as the zero kilometrage starting point of the national road network. From Ataba Square nine routes were chosen to join all districts of Cairo as follows:

Route 1 : From Ataba to Heliopolis (Roxy) along Salah Salem Street

Route 2 : From Ataba to Kholapha El-Rashidien Mosque along Port-Said Street

Route 3 : From Ataba to Embaba Bridge

Route 4 : From Ataba to Bolak El-Dakrour Railway level crossing

Route 5 : From Ataba to Ahram Street in Giza

Route 6 : From Ataba to Maadi through El-Kornish Street

Route 7 : From Ataba to Shoubra El-Mazallat Square

Route 8 : From Ataba to Heliopolis Roxy through Ramsis Street

Route 9 : From Ataba to Shoubra through El-Kornish Street.

These routes are shown on the map in Appendix 10 of Ref. (1). The main intermediate stations to which the travel time from Ataba is measured are also indicated on this map.

Figure I-15 shows the form used for recording the travel time and other data at selected stations.

Monday, 18 July, 1977, was chosen as a working day on which to obtain representative traffic and travel time characteristics. Before the actual inventory began, the members of the working group traveled the routes for reconnaissance. Nine cars were rented to conduct the study between 7:00 a.m. and 4:00 p.m. Two engineering students traveled in each car on the nine routes selected, recording link travel times using stop watches with one second accuracy.

For each route, several tables were prepared to calculate the average travel time on the different links on an hourly basis. Also, the average travel time from Ataba to every node on the path was calculated. Isochronic maps were prepared for each hour starting from 7:00 a.m. until 4:00 p.m.

The pitch for the time interval was three minutes. The isochronic curves obtained from these measurements are attached in Appendix 10 of Ref. (1). Figure I-16 shows an example of these maps with a reduced scale.

1.5.2 Traffic Speed/Delay Characteristics

One way to assess the efficiency of use of the urban street network is to apply traffic assignment programs on proposed alternative network improvements. The assignment program used to test Cairo street network divided the study area into five types, and the street network into the six types mentioned earlier.

Figure I-15

TRAVEL TIME DELAY SURVEY FORM

Trip No. ☐☐

Page No. ☐☐

Date ☐☐☐

Name of Observer:

Route No. ☐

Starting point at going :

hr. min. sec.

Time of starting at going :

hr. min. sec.

Time of ending at return :

Trip		Going							Return						
No of station	Name of Station	Time at passing on Station			Time on the link			Notes	Time at passing on Station			Time on the link			Notes
		sec	min	hr.	sec	min	hr.		sec	min	hr.	sec	min	hr.	
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															

Place of end at station

Place of start for return

Time of end of trips sec. min. hr.

Time of starting for return sec. min. hr.

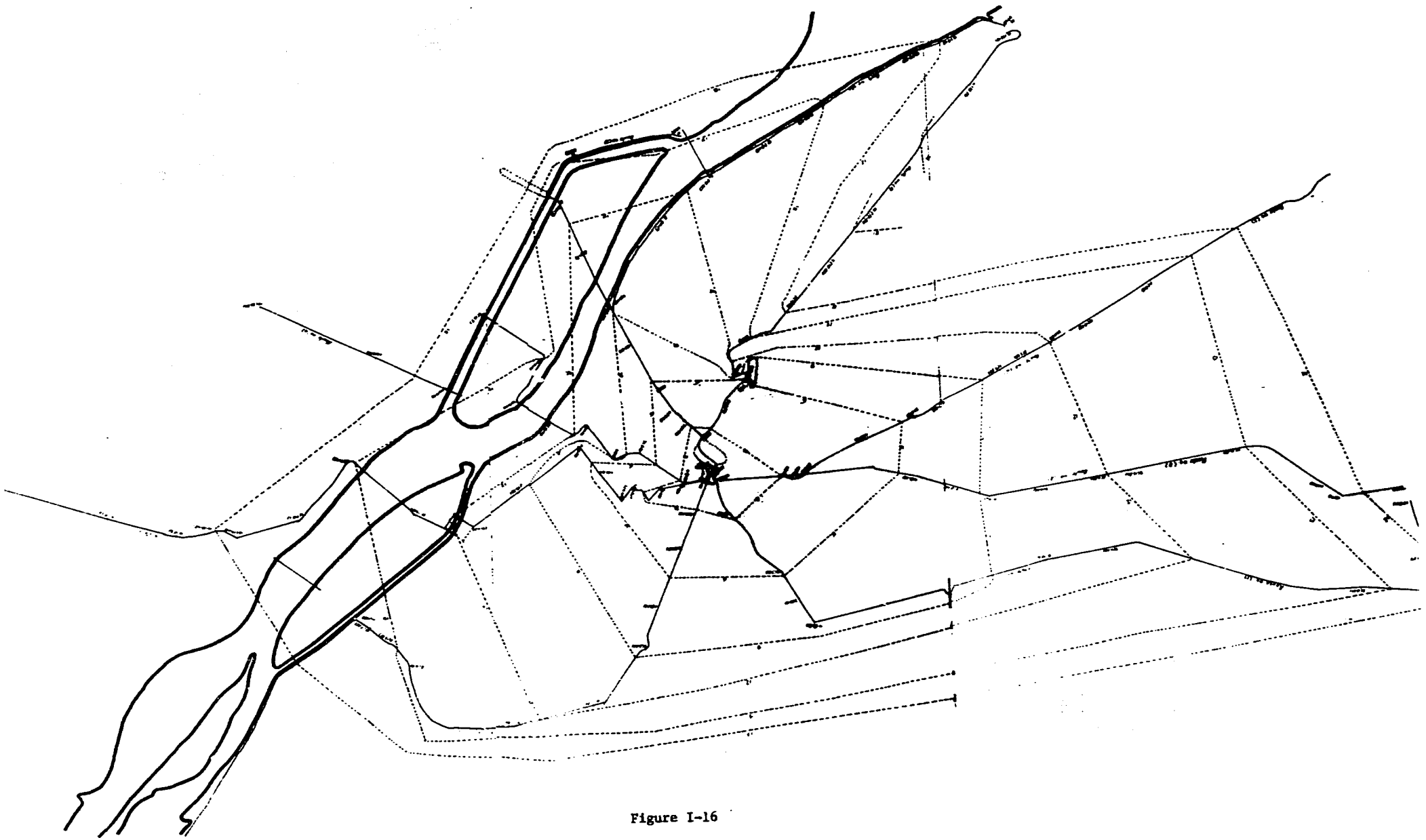


Figure I-16

Isochronic Curve (25 July 1977
3:00 p.m.)

The area types included:

- Central Business District (CBD)
- Fringe
- Residential
- Outer Business District (OBD)
- Rural.

The facility types included:

- One-way arterial (no parking)
- One-way arterial (parking one side)
- One-way arterial (parking both sides)
- Two-way arterial (no parking)
- Two way arterial (parking both sides)
- Other centroid connector.

The assignment program derives travel speeds corresponding to a given volume of traffic on the links from an empirical formula which was built into the program:

$$T = T_o \left[1 + \alpha \left(\frac{Q}{C}\right)^{\beta}\right]$$

where: T = travel time (sec/km) corresponding to a given traffic volume (Q).

T_o = travel time (sec/km), corresponding to free flow conditions.

C = practical capacity (PCE's/hr).

α, β = calibration parameters.

To calibrate this capacity restraint formula for Cairo conditions, it was necessary to determine the free flow speed and the practical capacity for each area type and facility type combination. These could only be obtained through actual field travel time measurements.

The main objectives of this study were two-fold: (1) to assess relationships between traffic volume, speed, and delay, through field measurements for different area types and street network facility types for the specific conditions of Cairo; and (2) to develop recommended

improvements of the network and system operation by investigating traffic delay characteristics such as delay duration, location, and cause of delay.

"The floating car" survey technique was used to obtain travel times over specified route lengths, the corresponding traffic volumes, delay times, and reasons for delay. To obtain representative travel times, the test car was used on selected routes in a series of runs. In this procedure the car's driver attempted to reach the median speed of traffic by passing as many vehicles as were passing him. Actual travel time on each link, as well as traffic volume counts for five-minute intervals, were recorded. A number of runs by car in each direction per hour was used for each link.

Two survey forms were designed for the study. The first was a traffic count form (Figure I-17), and the second was a travel time and delay measurement form (Figure I-18).

The routes were selected for different area- and facility-type combinations, and to be as uniform as possible with respect to physical conditions (width, number of lanes, and parking conditions) and traffic conditions (fluctuation of traffic volume, speed at a time point, and traffic composition).

A survey was conducted on thirty routes covering the various combinations with adequate sample size.

Prior to the survey, a street inventory on the selected test routes was conducted. This inventory was carried out before the speed/volume and delay measurements to guide the selection of the routes according to the criteria previously mentioned. A team consisting of four engineering students and a policeman for traffic control was sent to collect data on

Figure I-17

Volume Count Sheet for Speed/Delay Relationship

Area Type :

Page No. ☐☐☐ Station No. ☐☐☐ Date ☐ Facility Type :

1		2	3	4	5	6	7	8	9	10	11	12	13	14
Timing		Private Car	Taxi	Micro-Bus	Private Bus	P.T. Bus	Tram	Trolley Bus	Semi-Lorry	Lorry	Lorry with Trailer	Bicy-cle	Animal Cart	Tei-Cycle
Hr.	Min.													

the physical and traffic characteristics of selected test routes to ascertain that they satisfied all criteria concerning the following data:

- Length of link
- Number of designed lanes
- Number of usable lanes
- Paved width of the link
- Parking/No parking
- Number of access roads
- Number of signalized and unsignalized junctions per kilometer
- Flow direction in the link (one-way/two-way).

These data were documented in Ref. (5).

It is noteworthy that most of the selected routes were located within the study area, where a great deal of delay usually occurs, and were chosen on the basis of their representation of the road network and traffic conditions prevailing in Cairo.

The survey was conducted on 22 and 23 January, 1979--typical working days for the observed routes. The measurements covered the period from 7:00 a.m. until 4:00 p.m., with a break between 11:00 a.m. and 1:00 p.m.

With the "floating car" technique used for travel time and delay measurements, a series of runs was carried out to obtain representative travel times over links for various levels of traffic volumes. The travel time and delay and its causes were recorded by two observers, one reading the time from a stopwatch and the other recording data on the form. At least six runs per hour in each direction over each link were conducted.

To provide the corresponding traffic volumes, traffic counts were conducted simultaniously using a manual method. The traffic volumes were recorded by the counter for five-minute intervals on the traffic count sheets. Manual counting procedures using field personnel afforded the added advantage over automated counts of identifying the vehicle types shown earlier in Figure I-17. Traffic counts were carried out at selected

points on each route in order to determine the varying volumes due to the direct access of secondary roads to the test route, which accounts for increases or decreases in the volume along that route.

The manpower used for the survey was assigned as follows: 75 people for traffic counting; 52 observers in the test cars; and 13 people for reserve and administrative work.

After the collection of the field data, speed volume and delay relationships were derived. Factors used to convert the different vehicle types to passenger car equivalents (PCE's) are given in Table I-2.

Travel time on any specific test route was expressed in seconds; unit travel time (slowness) was then obtained by dividing travel time by the route length. Journey speed was computed as the inverse of slowness.

The facility types were grouped according to their physical characteristics as follows:

1. One-way streets were analyzed by determining the average slowness (seconds/km) and the corresponding traffic volume in passenger car equivalents (PCE's/hour) for a given traffic direction.

2. Two-way streets were analyzed by determining the mean travel-time for each return trip and the corresponding sum of the two flows in PCE's/hour. This was considered realistic since the flow in each direction cannot be considered separately with respect to its effect on speed and delays.

3. Two-way divided streets were analyzed considering each direction as a one-way street.

Delay was computed by the difference between the actual time required to cover a section of a street at a certain traffic volume and the time corresponding to free flow conditions. These travel time delays were calculated for each of the test routes and the relations between travel time-delay and the corresponding traffic volume were determined using a

regression analysis package. Table I-8 presents the mathematical relationships obtained for two test routes and the corresponding statistical measures.

Table I-8

Delay/Volume Relationships for Two Test Routes

Street Name	Equation	Correlation Coefficient R	Degrees of Freedom
El-Tahrir Bridge	$D = 4.724 + 0.014Q + 2.2 \frac{Q^2}{10^5}$	0.86	28
Abdel-Khalik Tharawat	$D = 34.021 + 0.333Q$	0.84	28

D = operational delay in (second/km),

Q = traffic volume in (P.C.E.'s/hr.)

The average delay (second/km) by cause type and by time of day for each rotue was obtained (see Tables I-9 and I-10). A graphical presentation of such measures is given in Figure I-19.

Analysis of results given in Tables I-9 and I-10 and Figure I-19 shows the following:

a) Test routes in the C.B.D. area suffered heavy delays, greater than in any other area type. Table I-11 shows that Ramsis Street, El-Gomhoria Street and Abdel-Khalik Sarwat Street suffered unacceptable delay (> 150 seconds/km).

Table I-9

Stop Time Delay (sec/km) by Cause Type for Different Test Links

(Morning and Afternoon Peaks).

Route No.	1		2		3		4		5		6		7		8		9		10	
Name of Route / Cause of Delay	Korniesh El-Nile		Giza St.		Tahrir St.		Ramsis St.		Emad El-Din St.		Gomhoria		Abel Khalik Tharwat St.		Shoubra St.		Misr & Sudan St.		Salah Salem St.	
	A.M.	P.M.	A.M.	P.M	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
Traffic signal	80	61	29	13	-	-	160	161	69	41	55	-	112	153	45	25	-	-	35	29
Congestion	7	-	-	-	25	25	24	17	2	15	103	131	12	19	7	3	11	2	2	2
Pedestrian Crossing	-	-	-	-	-	6	-	-	-	-	10	10	-	-	1	-	-	-	-	1
Parking	-	-	-	-	-	-	-	-	-	-	13	20	-	-	-	-	3	3	-	-
Turning Vehicles	20	-	-	-	-	-	-	-	-	-	4	6	-	-	1	3	-	-	-	-
Bus Stop	-	-	1	-	-	-	-	-	-	-	10	-	-	-	6	19	13	5	-	-
Miscellaneous	-	-	3	11	-	-	-	33	-	-	-	-	-	-	25	4	2	9	-	-
Total Stopped Delay	107	61	33	24	25	31	184	211	71	56	195	167	124	172	85	54	29	19	37	32

96

Table I-10

Delay by Cause Type as a Percentage of Total Stop Time Delay for Different Test Links (Morning and Afternoon Peaks).

Route No.	1		2		3		4		5		6		7		8		9		10	
Name of Route / Cause of Delay	Korniesh El-Nile		Giza St.		Tahrir St.		Ramsis St.		Emad El-Din St.		Gomhoria		Abel Khalik Tharwat St.		Shoubra St.		Misr & Sudan St.		Salah Salem St.	
	A.M.	P.M.	A.M.	P.M	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
Traffic signal	74	100	89	55	-	-	87	77	97	73	28	-	89	89	53	46	-	-	95	92
Congestion	6	-	-	-	100	81	13	7	3	27	53	78	11	11	8	6	38	13	5	5
Pedestrian Crossing	-	-	-	-	-	19	-	-	-	-	5	6	-	-	1	-	-	-	-	3
Parking	-	-	-	-	-	-	-	-	-	-	7	12	-	-	-	-	13	16	-	-
Turning Vehicles	20	-	-	-	-	-	-	-	-	-	2	4	-	-	2	6	-	-	-	-
Bus Stop	-	-	-	-	-	-	-	-	-	-	5	-	-	-	7	35	42	24	-	-
Miscellaneous	-	-	9	45	-	-	-	16	-	-	-	-	-	-	29	7	7	47	-	-
Total stopped Delay	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Area type :

Facility Type :

Name of Observer :

Entrance Node :

Exit Node :

No. of Workable Lanes :

Next Link :

Trip No. [ ][ ][ ]

Page No. [ ][ ][ ]

Date [ ][ ][ ]

Intersection : Street :

Intersection :

No. of Design Lanes :

Next Street:

	Hr.		Min.		Sec.	
Time at Entrance Node						
Time at Exit Node						

1	2		
Serial No. of stops	Stop Time		Reason for Stops
	Minutes	Seconds	
1st			
2nd			
3rd			
4th			
5th			
6th			
7th			
8th			
Total Delay Time			

Reasons Key : Traffic Signal:TS , Traffic Congestion : C , Stop Sign :SS,

Zebra Crossing : Z, Parking :PR , Turn Left :LT , Taxi : TP ,

Travel Time on Link No. : [ ][ ][ ][ ] Traffic Weaving: T

Total Time of Stops on Link : [ ][ ][ ][ ] Miscell. : M

Actual Travel Time : [ ][ ][ ][ ]

Length Between Entrance and Exit Nodes :

Operation Speed

Operation Condition Free Flow [ ]

Peak Flow [ ]

Figure I-18

Travel Time and Delay Measurements Form

78

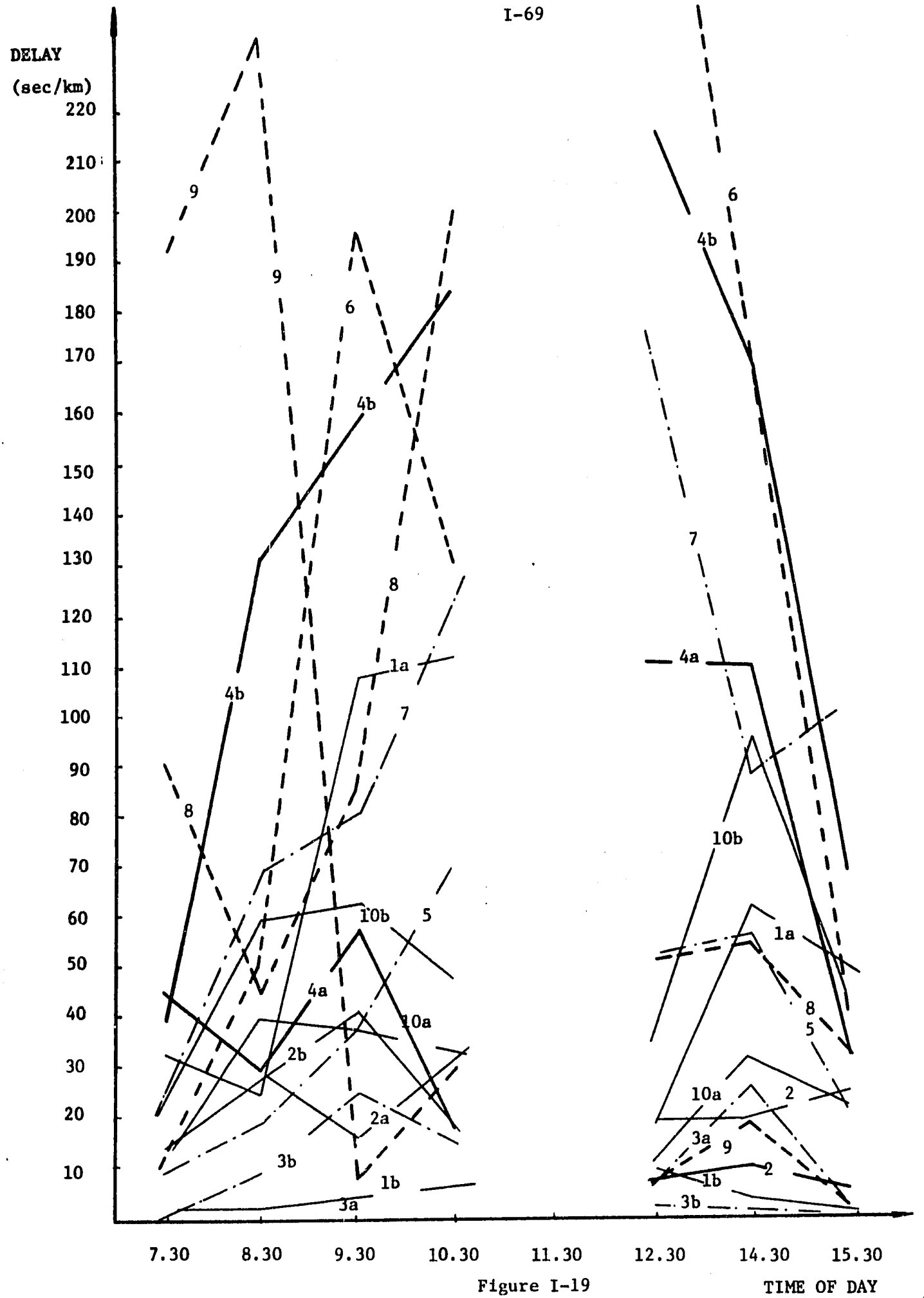


Figure I-19

Stop Time Delay for Different Test Routes by Time of Day

b) By comparing the values of operational delays and stop-time delays, it may be concluded that operational delay represents a small percentage of travel-time delay. The difference between travel-time delay and stop time delay decreases as the number of junctions per kilometer increases (e.g. stop-time delay amounts to roughly 25% of travel-time delay).

c) Stop-time delay due to traffic signals has the biggest effect on total stop-time delay, since it amounts to a value between 50% and 100% of the total.

Table I-11

Test Routes Categories for Stop Time Delay (sec/km)

Delay (sec/km)	Test Route Name
60	El-Tahrir Bridge, Misr & Sudan St., Salah Salem St., Giza St.
60 - 90	Emad El-Din St., Shoubra St.
90 - 120	Kornish El-Nile St.
120 - 150	---
> 150	Ramsis St., El-Gomhoria St., Abdel Khalik St.

Speed or travel-time/volume relationships with the best fit were tried for all the selected routes in the comprehensive survey of the 30 routes. In defining the practical capacity of the links of specific area type/facility type combinations, the following level of service factors were assumed:

1) A maximum delay of 90 seconds per kilometer (sec/km) on the main arterials inside the CBD area and the surrounding area (known as the fringe area).

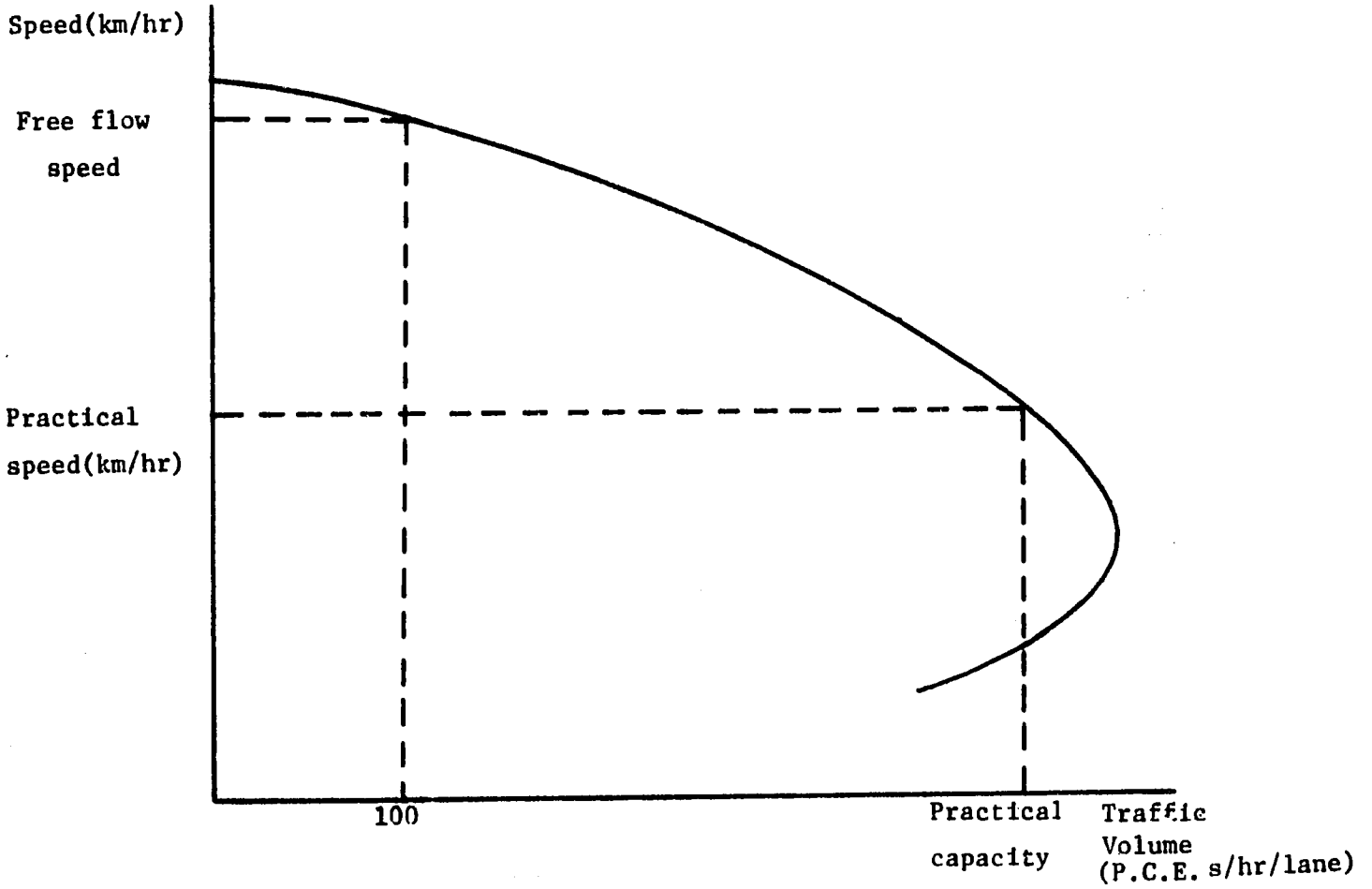
2) A delay of 75 sec/km was used in determining the practical capacities of links in the outer business districts.

3) A delay of 50 sec/km was used for links located within the residential area.

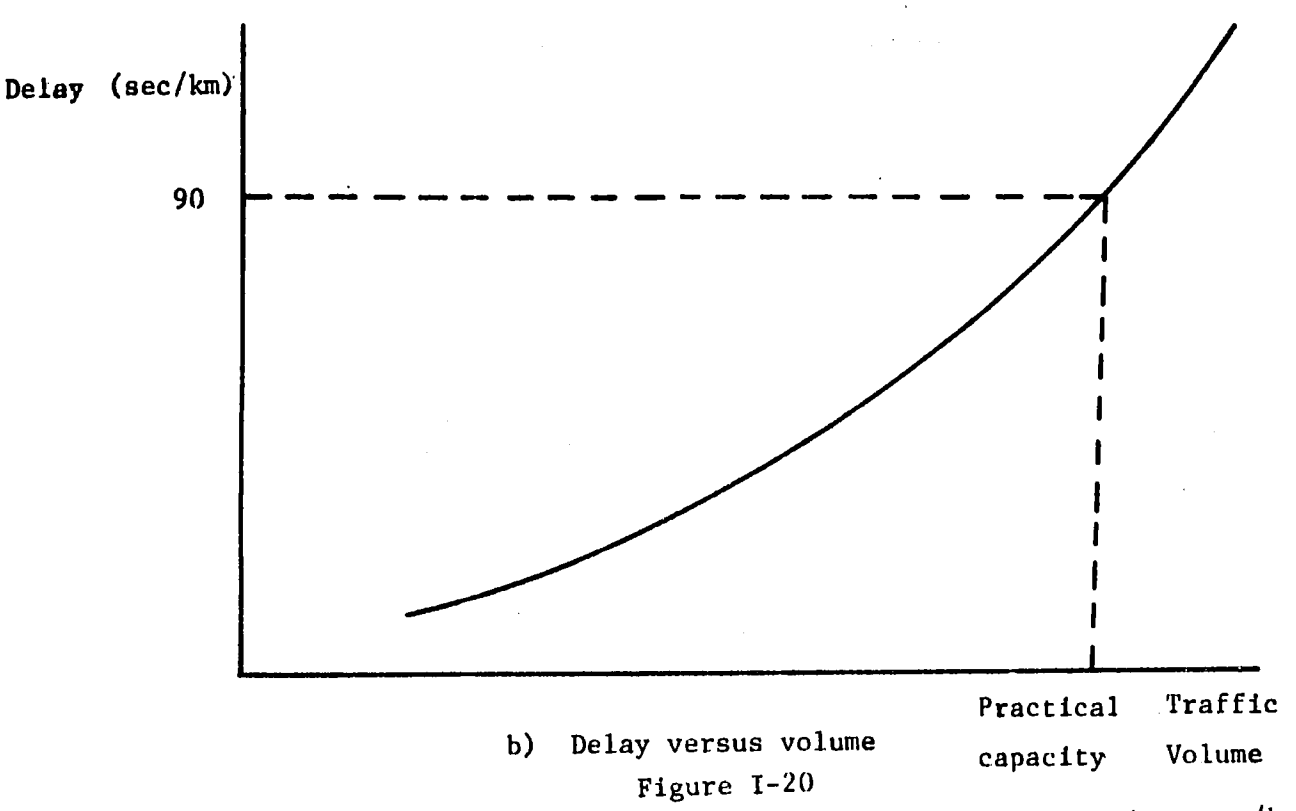
4) A delay of not more than 25 sec/km was used in the rural areas.

5) The free speeds were defined as the speed attempted when the traffic volume was less than or equal to 100 PCE's/hour/lane (standard lane width = 3.75 m).

Figure I-20 shows the previously mentioned base according to which the practical capacities and free flow speeds for all the selected routes could be determined. These values are documented in Table I-12. Some of the streets having both area type and facility type in common were pooled together in order to get the mean values of practical capacity and the average free flow speed for every area type/facility type combination. Final values of both practical capacities and free flow speeds for the different area type and facility type combinations are presented in Table I-13.



a) Speed versus volume



b) Delay versus volume

Figure I-20

Free Flow Speed and Practical Capacity Concepts

82

Table I-12

Physical and Operating Characteristics of the Test Selected Links in Cairo

Link No.	Name of Link	Length (m)	Area type	Facility type	Practical capacity P.C.E's hr/Lane	Free flow speed km/hr	Practical speed km/hr	Acceptable delay(sec/km)
1	Ramsis Street	1375	CBD	One-way Arterial (No parking)	700	32	18	90 sec/km
2	26 July Street	800	CBD	Two-way divided Arterial (No parking)	580 530	32	14	90 sec/km
3	El-Azhar Street	375	CBD	Two-way divided Arterial (No parking)	545 535	32	18	90 sec/km
4	Kasr El-Nile Street	425	CBD	One-way Arterial (one side parking)	530	34	18.5	90 sec/km
5	Port Said Street (the opposite direction)	1000	CBD	One-way Arterial (one side parking)	510	34	18.5	90 sec/km
6	Soliman Basha Street	358	CBD	One-way Arterial	225	28	16	90 sec/km

Table I-12 (cont.)

Physical and Operating Characteristics of the Test Selected Links in Cairo (cont.)

Link No.	Name of Link	Length (m)	Area type	Facility type	Practical capacity P.C.E's hr/Lane	Free flow speed km/hr	Practical speed km/hr	Acceptable delay(sec/km)
7	Abdel-Khalik Tharwat Street	346	CBD	One-way Arterial (one side parking)	255	28	16.5	90 sec/km
8	Sherif Street	400	CBD	One-way Arterial (both side parking)	310	18	12.5	90 sec/km
9	Mohamed Farid Street	300	CBD	One-way Arterial (both side Parking)	350	24	15	90 [illegible]
10	Adly Street	328	CBD	One-way Arterial (both side parking)	420	24	14.5	90 sec/km
11	Maglis El-Omma Street	350	CBD	Two-way Arterial (No parking)	640	28	15.5	90 sec/km
12	El-Gomhoria Street	450	CBD	Two-way Arterial (both side parking)	450	27	16	90 sec/km

Table I-12 (cont.)

Physical and Operating Characteristics of the Test Selected Links in Cairo (cont.)

Link No.	Name of Link	Length (m)	Area type	Facility type	Practical capacity P.C.E's hr/Lane	Free flow speed km/hr	Practical speed km/hr	Acceptable delay(sec/km)
13	El-Mobtadian Street	410	CBD	Two-way Arterial (both sides parking)	345	27	16	90 sec/km
14	Misr & Sudan Street	1100	Fringe	Two-way Arterial (both sides parking)	760	32	17.5	90 sec/km
15	El-Sariat Street	625	Fringe	Two-way Arterial (No parking)	780	30	17	90 sec/km
16	Ramsis Street (opposite direction)	1900	Fringe	Two-way Arerial (No parking)	790 880	38	19.5	90 sec/km
17	Kasr El-Ainy Street	755	Fringe	Two-way Arterial (No parking) divided	659 780	38	19.5	90 sec/km
18	El-Tahrir Street	785	Fringe	Two-way divided (One side parking)	735	45	21	90 sec/km

Table I-12 (cont.)

Physical and Operating Characteristics of the Test Selected Links in Cairo (cont.)

Link No.	Name of Link	Length (m)	Area type	Facility type	Practical capacity P.C.E's hr/Lane	Free flow speed km/hr	Practical speed km/hr	Acceptable delay(sec/km)
19	Ibrahim El-Likamy Street (opposite direction)	636	OCBD	Two-way divided Arterial (one side parking)	380 350	35	20	75 sec/km
20	Haron El-Rashid Street	700	OCBD	One-way Arctrial (one side parking)	330	36	20	75 sec/km
21	Hassan Sabry Street	435	OCBD	One-way Arterial (both side parking)	370	20	13	75 sec/km
22	Ismail Ramzy Street	350	OCBD	Two-way Arterial (both side parking)	330	35	20	75 sec/km
23	El-Eroba Street	960	Residl	Two-way divided (No parking)	520	50	30	50 sec/km
24	Ahmed Abdel Aziz Street (opposite direction)	710	Residl	Two-way divided (one side parking)	615 485	50	30	50 sec/km

Table I-12 (cont.)

Physical and Operating Characteristics of the Test Selected Links in Cairo (cont.)

Link No.	Name of Link	Length (m)	Area type	Facility type	Practical capacity P.C.E's hr/Lane	Free flow speed km/hr	Practical speed km/hr	Acceptable delay(sec/km)
25	Abu Bakr El-Sadik Street	1020	Residl	Two-way divided (one side parking)	500	50	30	50 sec/km
26	El-Nahda Street	594	Residl	Two-way Arterial (No parking)	675	30	20	50 sec/km
27	Shagret El-Dor Street	547	Residl	One-way Arterial (both side parking)	460	32	23	50 sec/km
28	Salah Salem St. (opposite direction)	1910	Rural	Two-way divided (No parking)	1120 1260	50	38	sec/km 25 sec/km
29	Korneish El-Nile Street (opposite direction)	1600	Rural	Two-way divided (No parking)	880 920	50	37	25 sec/km
30	6th October Bridge (opposite direction)	900	Rural	Two-way divided (No parking)	1400 1400	60	40	25 sec/km

As previously mentioned, the capacity restraint formula of the assignment model had to be calibrated specifically for greater Cairo conditions, since the traffic conditions, drivers' behavior, traffic composition, and environmental conditions in Cairo are so different from those in other cities. Therefore, an essential part in the study was to calibrate the model using the derived values of practical capacity and free flow speed shown in Table I-13.

Using the regression analysis, the parameters α and β, applicable to various routes chosen within the Cairo metropolitan area, were determined for each area type and facility type group with travel time data and the corresponding traffic volume, irrespective of time of day. The data used in the analyses were the same data processed previously using the PCE conversion factors given in Table I-2.

Several computer runs were carried out for the group of links which reflect the various physical and operating characteristics of the Cairo street network. Parameters for each group were obtained using average values of the free flow times (T_o) and the practical capacities for the links included in each group.

Table I-14 presents the calibration parameters for each group of links, the associated correlation coefficients and degrees of freedom.

Table I-15 presents values of T/T_o for specific values of Q/C and calibration parameters. This table is of great importance in comparing relationships obtained in Egypt and U.S.

The values of the calibration parameters (α and β) play an important role in determining the delay aysociated with different levels of traffic volumes. The final values chosen for α and β for the different area- and facility-type combinations are presented in Table I-16.

Table I-13

Practical Capacities (PCE's/hr/lane) and Corresponding Free Flow Speeds (km/hr) for Cairo Metropolitan Area

Area Type \ Facility Type	1	2	3		4		5	6
	Two-way Arterial (No Parking)	Two-way Arterial (Parking both sides)	One-way-Arterial (No Parking)		One-way Arterial (Parking one side)		Other/Controlled Connector	One-way Arterial (both side Parking)
1 C.B.D.	640	440	700	550*	525	240	10,000	400
	28	27	32	32	34	20	15	24
2 Fringe	800	750	1,200		750		10,000	700
	38	32	45		45		20	35
3 Residential	675	-	550		525		10,000	460
	30	-	50		50		20	32
4 O.B.D.	-	330	-		350		10,000	370
	-	35	-		35		20	20
5 Rural	-	-	1,200		700		10,000	-
	-	-	55		50		20	-

* Data for 2nd Class Street of the Same Area Type/Facility Type

89

Table I-14

Statistical Measures for the Calibration Parameters α and β for Different Test Routes in Cairo Street Network

Group No.	Street Name	α	β	Corr. Coef.	Degrees of Freedom
1	Ramsis (C.B.D.)	1.12	2.40	0.71	24
2	Kasr El-Nile, Port Said.	1.24	1.21	0.55	70
3	Soliman Basha, Abdel-Khalik	1.76	1.4	0.71	50
4	Sherif, Mohamed Farid, Adly.	1.06	1.04	0.67	60
5	Maglis El-Omma.	1.74	1.55	0.55	40
6	El-Gomhoria, El-Mobtadian	1.25	1.81	0.37	70
7	Misr & Sudan, Saraiat	0.52	0.97	0.59	70
8	Ramsis (fringe)& Kasr El-Ainy.	1.33	1.1	0.37	70
9	El-Eroba & Ahmed Abdel-Aziz	0.52	2.22	0.79	50
10	Shagret El-Dor	0.63	1.0	0.72	24
11	Hassan Sabry	1.46	2.0	0.81	30
12	Ibrahim El-Likamy, Haron El-Rashid, Ismail Ramzy	1.09	3.0	0.62	70
13	Salah Salem, Korneish El-Nile	0.25	1.69	0.53	70
14	6th October Bridge	0.28	1.65	0.40	24

Table I-15

Travel Time/Free Flow Time for Different Values of the Calibration Parameters (α & β) and Different Values of (Q/C)

α , β \ Q/C	0.25	0.50	0.75	1.0	1.25	1.50
0.15, 4*	1.0006	1.0094	1.0470	1.1500	1.3660	1.7600
0.26, 1.65	1.0264	1.0828	1.1617	1.2600	1.3757	1.5076
0.47, 1.32	1.0754	1.1883	1.3215	1.4700	1.6309	1.8026
0.52, 2.22	1.0239	1.1116	1.2746	1.5200	1.8534	2.2792
0.51, 0.97	1.1329	1.2604	1.3858	1.5100	1.6332	1.7558
0.625, 1.0	1.563	1.3125	1.4688	1.6250	1.7813	1.9375
1.06, 1.04	1.2507	1.5155	1.7859	2.0600	2.3369	2.6160
1.09, 3.0	1.0170	1.1363	1.4598	2.0900	3.1289	4.6787
1.12, 2.4	1.0402	1.2122	1.5615	2.1200	2.9134	3.9637
1.24, 1.21	1.2317	1.5360	1.8755	2.2400	2.6244	3.0253
1.25, 1.81	1.1017	1.3565	1.7426	2.2500	2.8720	3.6039
1.28, 0.6	1.5572	1.8445	2.0771	2.2800	2.4634	2.6325
1.33, 1.10	1.2895	1.6205	1.9692	2.3300	2.7000	3.0776
1.46, 2.0	1.0913	1.3650	1.8213	2.4600	3.2813	4.2850
1.74, 1.55	1.2029	1.5942	2.1140	2.7400	3.4590	4.2621
1.76, 1.4	1.2527	1.6669	2.1765	2.7600	3.4053	4.1048

* Derived from Urban Transportations Planning System (UTPS) of the U.S. Transportation Department.

a1

Due observation arising from this study is that the specific area type/facility type calibration parameters are dependent upon the road users' behavior. As the drivers' skill levels and driving behavior improve with time, it is recommended that the restraint formula be recalibrated to reflect these changes.

Table I-16

Calibration Parameters (α and β) of the Traffic Capacity Restraint Formula for the Different Area Type/ Facility Types in Cairo Study Area.

Area Type \ Facility Type		1	2	3	4	5	6
1 C.B.D.	β	1.55	1.81	2.4-1.21*	1.4	-	1.04
	α	1.74	1.25	1.12-1.24	1.76	-	1.06
2 Fringe	β	-	0.97	1.10	0.6	-	
	α	-	0.51	1.33	1.28		
3 Residential	β	1.32	-	2.22	2.22	-	1.0
	α	0.47	-	0.52	0.52	-	0.625
4 O.C.B.D.	β	-	3.0	3.0	3.0	-	2.0
	α	-	1.09	1.09	1.09	-	1.46
5 Rural	β	-	-	1.65	-	-	-
	α	-	-	0.26	-	-	-
		Two-way Arterial (No Parking)	Two-way Arterial (Parking both sides)	One-way-Arterial (No Parking)	One-way Arterial (Parking one side)	Other/Centriod Connector	One-way Arterial (parking both sides)

* Other Values of α and β for the Same Area Type/Facility Type Group with better Operating Conditions.

1.6 Socio-Economic and Land Use Planning Parameters

This section documents the available socio-economic and land use data for Greater Cairo. Zonal data are given for three zoning systems, including (1) the enlarged CBD area (these coincide in both private and public transprot surveys zoning systems); (2) the 14 traffic zones outside the enlarged CBD as defined by the 1977 vehicular transport survey; and (3) the corresponding 54 traffic subzones (usually referred to as zones) outside the enlarged CBD area and inside the outer cordon of Greater Cairo used in the 1978 public transport survey. The definition of the traffic zones of each of the above mentioned surveys is given in Refs. (1) and (3).

Before describing the data and the methodology used for converting data from the administrative zone level to traffic zone level, a list of the data derived at the traffic zone level is given in Table I-17.

Table I-17

Socio-Economic and Land Use Variables

Variable	Definition
1 Population	No. of inhabitants
2 Male labor force	No. of male labor force (age more than 6 years)
3 Female labor force	No. of female labor force (age more than 6 years)
4 Total labor force	No. of total labor force (age more than 6 years)
5 Area	Total area (km^2)

Table I-17 (cont.)

Variable	Definition
6 Residential area	Residential area (km^2) does not include multi-story area, only ground area of buildings)
7 Jobs offered	No. of jobs offered
8 Households	No. of households
9 Rooms	Total no. of rooms
10 Per capita income	Average per capita income/year (L.E.)
11 Money spent in transportation & communication per person	Average money spent in transportation & communication per inhabitant, per year (L.E.)
12 Residential Building	No. of residential buildings
13 No. of floors	No. of floors for total residential buildings
14 Buildings supplied with fresh water	No. of buildings with mains water public services
15 Buildings supplied with electricity	No. of buildings supplied with electricity
16 Buildings with sanitation	No. of buildings with sanitaiton sewerage
17 Total no. of buildings	No. of total buildings (residential and non-residential)
18 Garages	No. of garages
19 Shops	No. of shops
20 Multi-room D.U's	No. of multi-room dwelling units
21 Single-room D.U's	No. of single-room dwelling units
22 Trading establishments	No. of trading establishments
23 Trading establishment employees	No. of trade establishment's employees

95

Table I-17 (cont.)

Variable	Definition
24 Retail trade establishments	No. of retail trade establishments
25 Employees in RTE	No. of employees in retail trade establishments
26 Wholesale trade establishments	No. of wholesale trade establishments
27 Employees in WTS	No. of employees in whole trade establishments
28 Retail trade establishments	No. of retail trade establishments having 5 or more employees
29 Employments in RTES	No. of employees in retail trade establishments having 5 or more employees
30 Retail sales	Retail sales for retail trade establishments having 5 or more employees (L.E. x 1000)
31 Male graduates	No. of male graduates
32 Female graduates	No. of female graduates
33 Total graduates	No. of total graduates
34 Male students	No. of male students (age more than 10 years)
35 Female students	No. of female students (age more than 10 years)
36 Total Students	No. of total students (age more than 10 years)

1.6.1 Maps

1. A topographic map (scale 1:25,000) showing the boundaries of Greater Cairo as well as those of the administrative sectors (Aksam and Marakiz). The location of townships, villages, and cultivated areas are indicated on this map.

2. (a) Topographic map (scale 1:100,000) for Qalioubia Governorate.

(b) Topographic map (scale 1:100,000) for Helwan suburb.

(c) Topographic map (scale 1:25,000) for Giza Governorate.

3. A map showing the boundaries of Greater Cairo taken from CAPMAS.

4. A group of maps, one for each administrative sector (kism) showing boundaries of administrative subzones (Shiakhat) for Cairo Governorate as given by CAPMAS.

5. A map (scale 1:10,000) showing boundaries of traffic zones and subzones.

6. A group of maps, one for each subzone, from which the O/D survey coding was carried out. These maps show names of streets and major features of each subzone.

1.6.2 Tables of the General Censuses of CAPMAS

The following tables of socio-economic data are derived from the General Censuses of the CAPMAS, Nov. and Dec., 1976.

Group A: For each of the administrative subzones (Shiakhat) and for townships and villages:

Table A-1 Population
Table A-2 No. of jobs offered
Table A-3 No. of residents per room (only for Cairo Governorate)

97

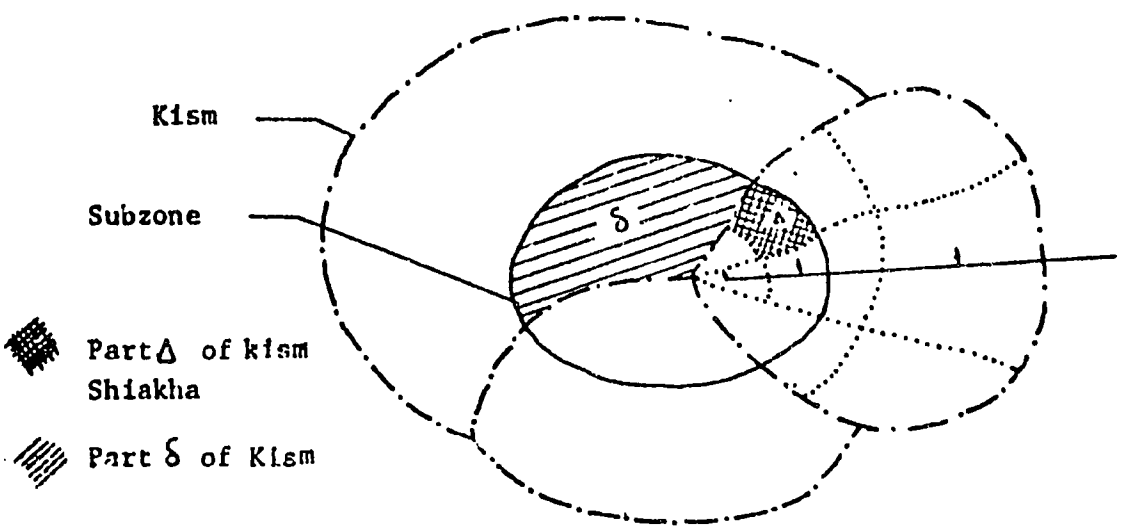
Group B: Tables for each administrative sector (kism or markaz)

Table B-1 No. of male, female and total labor force
Table B-2 No. of one-room D.Us. and multi-room D.Us.
Table B-3 No. of households
Table B-4 No. of graduates and students
Table B-5 Income and money spent on transportation per person
Table B-6 No. of residential buildings and no. of residential floors
Table B-7 No. of trading establishments and their employment
Table B-8 No. of buildings with fresh watermains, electricity, or sanitation
Table B-9 No. of buildings and no. of workers engaged in retail trade and whole trade activities
Table B-10 No. of buildings and no. of workers and retail sales value (L.E.) for retail trade having 5 or more workers
Table B-11 No. of non-residential and residential buildings, no. of garages and no. of shops
Table B-12 No. of people per room (for Giza and Oalioubia Governorates

(Note: All tables are available for Greater Cairo except Tables A-3 and B-12.)

1.6.3 Methodology to Determine the Variables at the Traffic Subzone Level

Although population was given by shiakha, some other variables (such as number of households and labor force, among others) were only given by aksam. The aim was to determine the variable under consideration at the traffic subzone level. The notation used in this task is given and illustrated below:



98

RA_{s_i} = Residential area of shiakha i

$RA^j_{\Delta s_i}$ = Part of residential area of shiakha i which lies within subzone j

$(Ratio)^j_{\Delta s_i} = \frac{RA^j_{\Delta s_i}}{RA_{s_i}}$ (Note: if the whole shiakha is located within the boundaries of a zubzone, the ratio equals 1.0)

POP_{s_i} = population of shiakha i

$POP_{\Delta s_i}$ = part of population of shiakha i which lies within subzone j

$= (Ratio)^j_{\Delta s_i} * POP_{s_i}$

POP_{K_i} = Population of kism i = $\sum_{\Delta i} POP^j_{\Delta s_i}$

$POP^j_{\Delta k_i}$ = Part of population of kism i which lies within subzone j

$= \sum_i POP_{s_i}$

$(Ratio)^j_{\Delta k_i} = POP^j_{\Delta k_i} / POP_{k_i}$

In order to determine any socio-economic variable X for a subzone j where the available data is given at shiakha level:

$$X^j = \sum_{\Delta i} * X_s \, (Ratio)^j_{\Delta s_i}$$

where:

X^j = yhr socio-economic variable under consideration for subzone j

X_{s_i} = the socio-economic variable under consideration as given at shikha level

$(Ratio)^j_{\Delta s_i}$ = as defined earlier.

In order to determine any socio-economic variable Y for a subzone j where the available data is given at kism level:

$$Y^j = \sum_{\Delta i} Y_{k_i} * (Ratio)^j_{\Delta k_i}$$

where:

Y^j = the socio-economic variable under consideration for subzone j

Y_{k_i} = the socio-economic variable under consideration as given at kism level

$(Ratio)^j_{\Delta k_i}$ = as defined earlier.

1.6.4 Tables of Socio-economic and Land Use Variables of the Traffic Zones in Greater Cairo

All the variables were determined for the 66 traffic zones of the enlarged CBD as well as for the 54 subzones outside the enlarged CBD which were used in the 1978 public transport survey. Having obtained data for each of the 54 subzones of the public transport survey, it was a relatively easy task to aggregate the variables at the 14 zone level of the private transport survey.

Tables containing the calculated zonal socio-economic and land use variables of the traffic zone are listed below:

Table 1

Socio-economic and land use variables of the 66 traffic zones of the enlarged CBD.

Table II

Socio-economic and land use variables of the vehicular transport survey 14 traffic zones located outside the enlarged CBD.

100

Table III

Socio-economic and land use variables of the public transport survey 54 traffic zones located outside the enlarged CBD.

These tables can be found in report TDF 17/TC4 (Ref. code 21-177-1-1 in the Project Library; Cairo University.

However, it was not possible to obtain some zonal values of variables at the traffic zone level due to the unavailability of these variables for the corresponding administrative zones. These variables are also listed in the same reference.

CHAPTER TWO

DATA PROCESSING

The data of the Urban Transportation Project described in Chapter 1 is the main data input to the Urban Transportation Project Analysis. The data processing phases of the project are discussed in this chapter. The functional design of the each system is presented using the HIPO (Hierarchy plus Input - Process - Output) technique, which emphasizes the graphical presentation of the system functions.

The output of the processing phases represents the data base of the Cairo Urban Transport Project; it consists of master files containing the trip characteristics derived from vehicular, public transport, and other surveys. The master files and computer printoutputs are filed in the Project Library. File specifications, record layouts, and computer printouts are shown at the end of the corresponding items of this section.

2.1 Objectives

The main objectives of the data processing activity were to obtain reasonably complete and reliable analysis data base and to estimate future trip characteristics for use in transportation planning and evaluation.

The data processing system design is intended to provide:

- Accuracy and reliability, by applying strict programming validation rules as well as the manual checking and correction of different kinds of logical errors.
- Simplicity, by stratifying the system into levels.
- Flexibility by allowing the modification of the procedures at any stage.
- Economy, in terms of the cost associated with the computer time and the data preparation.

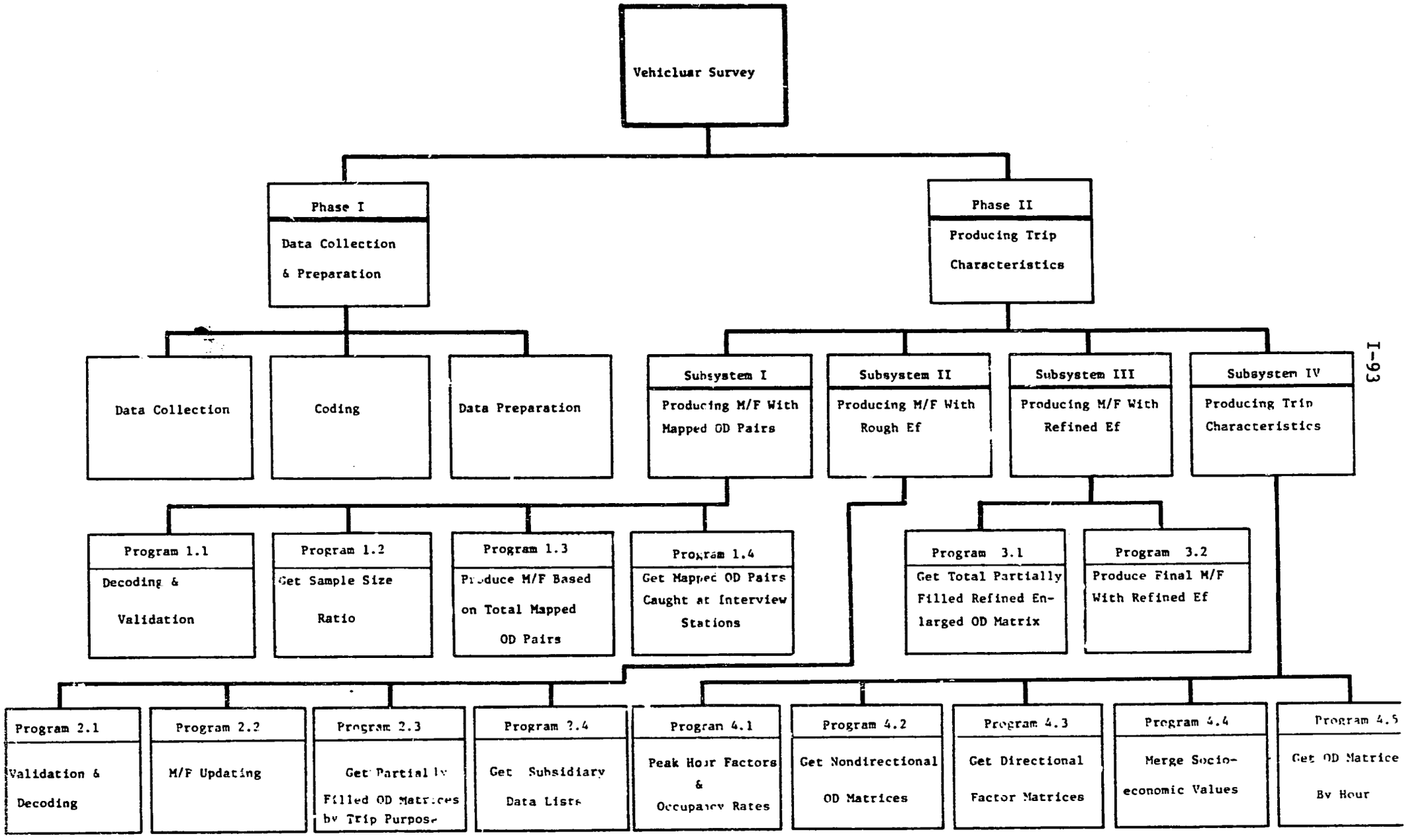


Figure I-21 : Vehicular Survey Computer System Hierarchy Diagram

2.2 Vehicular Transport Survey Data Processing

The purpose of the vehicular transport data processing activity was to:

1. Provide a valid master file with refined enlarged movements between O/D pairs crossing cordon or screen lines (mapped O/D pairs).

2. Produce trip information required for travel demand forecasting and assignment purposes.

The design of the vehicular transport survey data processing is presented here. The system levels are shown in the Vehicular Survey Computer System Hierarchy Diagram, Figure I-21.

2.2.1 Development of Minimum Travel Time Matrix

Besides being one of the key performance measures for testing alternative network configurations, the minimum travel time matrices were essential for the processing phases. The use of the minimum travel time matrix to fill the empty cells of the enlarged partially filled O/D matrices for the different vehicle types is described subsequently. The same minimum travel time matrix was also used for the gravity model in the trip distribution stage of travel demand forecasting as described in Part II.

One output of the traffic assignment model is a minimum travel time matrix. To get this matrix, the Cairo road network was represented in a node/link form (see section 1.4). The travel time along each link under free flow conditions was calculated knowing the link length and the free flow speed of the respective area type/facility type combination where the link was located using the appropriate routine of the assignment

model. The minimum travel times between all O/D pairs were then calculated by totaling the travel times along all links forming the minimum time path between each O/D pair.

2.2.2 Development of O/D Matrices

The procedure used for developing O/D matirces was to enlarge sampled O/D interview data intercepted between the different O/D pairs. The procedure began by producing enlarged, rough, partially filled O/D matrices using information from interviews conducted at cordon lines and at intermediate interview stations. An iterative balancing procedure was then used to refine these matirces to match with traffic counts at cordon/screen line stations. Complete O/D matrices were then obtained by filling the empty cells using standard methodologies. The main steps of this procedure are explained below.

- Identification of Stations Visited by Interviewed Vehicles Traveling Between Each of the Mapped O/D Pairs

The mapped O/D pairs are those which have movements crossing a cordon or screen line. Selected information was obtained from the master file for these mapped O/D pairs:

- All mapped O/D pairs for each mode sampled during the survey period
- The total number of trips sampled for each O/D pair
- The total number of stations at which each O/D pair movement was intercepted (i.e., all stations at which any interviewee stated that he was traveling between the said O/D pair) and
- Station number and the sample interviewed at each station corresponding to each O/D pair.

- Determination of the Possible Paths Between Mapped O/D Pairs

From station list, it was possible to identify all paths between each O/D pair that crossed one or more cordon lines. All stations on the cordon/screen line that intercepted any O/D movement were included on the path, even if no trips this O/D pair were sampled at this station. These stations were used later in the iterative refinement procedure. Note that any illogical path (based on careful intuitive judgment) was eliminated.

- Determination of Enlargement Factors

Two approaches were suggested for deriving the factor by which the sampled interviews between a certain O/D pair had to be enlarged: the averaging approach, (Ref.6), and the probabilistic approach, (Ref. 7). Only one method was suggested for averaging, while three methods were suggested for the probabilistic apprach.

a) The Averaging Approach:

The mathematical formulation for the averaging method can be expressed as follows:

$$T_{ij} = \sum_{k=1}^{K} t_{ijk} \cdot \frac{1}{w_{ijk}} \cdot \frac{1}{q_k}$$

where:

t_{ijk} = the number of vehicles interviewed at station k traveling from zone i to zone j

w_{ijk} = station weight for the O/D pair i-j to take into consideration the effect of double counting*

q_k = sample size ratio at station k

K = total number of stations found on the different paths between i and j (k = 1, ..., K).

---

*Weight determination is described in Ref. (6).

An average enlargement factor for the O/D pair i-j could be obtained as follows:

$$Q_{ij} = \frac{\sum_{k=1}^{K} t_{ijk}/w_{ijk}}{T_{ij}}$$

where:

Q_{ij} = enlargement factor for the pair i-j

An advantage of this approach is the relative ease of calculation, especially for large networks; while a weakness of this approach is that if one of the stations has a very small sample size ratio (q_k), it would lead to an over estimate of the value T_{ij}, and hence a biased estimate for the enlarged O/D movements.

b) <u>The Probabilistic Approach</u>:

The probabilistic approach uses the following fomulation:

$$Q_{ij} = \sum_{r_m \varepsilon R} P(r_m) \left[1 - \prod_{n=1}^{k_m \varepsilon K} (1 - q_{nm})\right]$$

where:

Q_{ij} = the probability to be interviewed for the O/D pair i-j; its inverse is the enlargement factor for the O/D pair

r_m = route m (there are r possible routes for the O/D pair)

$P(r_m)$ = the probability of a vehicle taking route r_m

q_{nm} = sample size ratio at station n on route m

k_m = number of stations on route m

K = total number of stations.

The three methods considered for the probabilistic approach differ in the estimation of the probability of a vehicle taking route m:

1. The Probabilistic Method

In this method, the probability of a vehicle taking a route, $P(r_m)$, is assigned using engineering judgment from the experience of the person assigning these probabilities. These probabilities should reflect the relative degree of use of the different routes by cars going from zone i to zone j. The advantage of this method is that it entails fewer calculations than the other two probabilistic methods. The weakness of the approach is that probabilities are assigned by subjective judgment, creating possible inaccuracies, the degree of which cannot be precisely known.

2. The Modified Probabilistic Method

In this method, the probabilities $P(r_m)$ are estimated from the sample of people interviewed and found to be going from zone i to zone j on route r_m relative to the total number of people sampled and found to be going from i to j. This approach overcomes the weakness of the coding probabilistic method, although it increases the required number of calculations. Also, in the first probabilistic approach it is assumed that separate, parallel routes could always be identified for the O/D pairs. This is not actually the case if the configuration of the network is such that there is a mixture of parallel and sequential routes. In this case, weights (w_k) are intorduced to resolve double counting. The modified probabilistic mehtod was applied for each set of parallel routes, taking into consideration that the total number of people interviewed going from i to j was the total of the set and not the total of the O/D pair. Then,

the probability of being interviewed was estimated for this set (q). The modified probabilistic method was then applied to the sets as if they were stations in sequence.

The modified probabilistic method for a parallel network uses the following relationship to estimate inter-zonal travel:

$$Q_{ij} = \sum_{r_m \varepsilon} \sum_{n=1}^{k_m \varepsilon K} \frac{t_{nm}}{w_{nm}} \Big/ \sum_{k=1}^{K} \frac{t_{nm}}{w_k} \quad 1 - \prod_{n=1}^{k_m \varepsilon K} (1 - q_{nm}) \quad .$$

The mathematical expression for a compound network depends on the configuration of the network.

The advantage of this method is that it eliminates subjective judgment for the determination of the probabilities $P(r_m)$. Also, it is not unstable when the sample size ratios (q_k) are very small. A disadvantage of the method is the large number of calculations involved, especially for a large compound network.

3. <u>The Modified Weighted Probabilistic Method</u>

This method is similar to the modified probabilistic method, except that when $P(r_m)$ is evaluated from the number of people interviewed and found to be going from i to j (t_{ijk}), as in the case of the modified probabilistic method, it is weighted by the sample size ratio for the stations involved. This method did not lead to a significant improvement in estimation, even though it increased the number of calculations dramatically. Therefore, it was decided not to include it in the comparison between methods.

Sensitivity analysis of the sample sizes showed that the averaging method can lead to unstable results as the sample size for one or more of the stations decreases. The probabilistic method was thus favored; but the modified probabilistic method also overcomes the major weakness of the probabilistic method, the use of subjective judgment in assigning the probabilities (P_{rm}). It was decided to develop rough, enlarged, partially-filled matirces from the records master file by multiplying each O/D sample record by the inverse of its probability to be interviewed as calculated by the modified probabilistic approach.

- Assignment Factors and the Refinement of Enlarged Rough O/D Movements

To refine the enlarged movements between the O/D pairs, traffic between each pair was assigned to the different cordon/screen line stations; adjustment of the assigned traffic to the counted one was then done iteratively. This was achieved by using O/D Assignment Factors (ODA). The notation for ODA is given as factors followed by bracketed cordon/screen line station numbers to which a certain flow has to be assigned. The ODA value ranges from zero to one and is equal to the ratio $T/\Sigma T$, where:

T = enlarged trips assigned to a cordon/screen line station.

ΣT = total enlarged trips for a certain O/D pair.

The assignment factors could also be defined as the probability of a vehicle taking route r_m out of a group of r possible routes joining the O/C pair and crossing the cordon/screen line.

The probability of taking a route r_m out of a group of possible routes is computed in the process of calculating the probability to be interviewed; the ODAs were determined simultaneously.

Again, the basic idea of refining the rough enlarged partially filled O/D matrices is to balance the volume assigned from the rough enlarged partially filled matrices to the cordon/screen line stations with the traffic counts at these stations. The balancing procedure was carried out following the steps outlined below:

1. The ODA values for each of the mapped O/D pairs of the matrix were arranged in tabular form as shown in Table I-18. The summation of ODA values for an O/D pair which crosses only one cordon/screen line must equal 1.0. In case of more than one cordon/screen being crossed, the summation of ODA values for each cordon/screen line group of stations should equal 1.0. In other words, average O/D volumes for an O/D pair crossing more than one cordon/screen line station should be computed to avoid double counting (see step 6-b below). The values of ODAs determined at this step were kept constant throughout the remaining steps of the iterative balancing procedure.

2. Retrieve the traffic count V for the whole survey period for all cordon/screen line stations (1 to Q) from the master file of the traffic counts (see section 1.1).

3. For each O/D pair, ODA values were multiplied by the corresponding rough O/D volume. These products were stored in an assignment table similar to that shown in Table I-19.

4. To get the "Σ row(s)" in Table I-19, a horizontal summation for each cordon screen line station was performed.

5. The ratio $r_s^o = \frac{\Sigma^{row_s}}{V}$ was then calculated. The value of r_s^o indicates error in sampling (i.e. the value of the probability of being interviewed) and the probability of taking a certain path (i.e. ODA values).

6. First iteration

   a. The value of the cells in the corresponding rows of Table I-19 were multiplied by $1/r_s^o$.

   b. Vertical summation in Table I-19 was carried out, and the outcome was aggregated depending on the number of corresponding cordon/screen lines crossed by each O/D pair movement, to obtain the refined O/D volumes of the first iteration ($T_{AB}^{(1)}$).

   c. The volumes obtained in the preceding step ($T_{AB}^{(1)}$) were multiplied by values of ODAs of Table I-18 for each O/D pair.

Table I-18

Arrangement of ODA Values in a Tabular Form

Cordon/ screen/line station			Mapped O/D pairs (3269 columns)	
1 2 3 • • • S • • • Q			These cells contain the ODA values	

Table I-19

Tabulation of Results of Assignment

Cordon screen/line station	O/D Pairs				$\sum$row	V	r
1 2 3 • • • S • • • Q			These cells contain the traffic assignment from each O/D pair to the relevant cordon/screen line station.				
Rough O/D volume							

d. Horizontal summation for each cordon/screen line station of Table I-19 was carried out, and the ratios were calculated from,

$$r_s^{(1)} = \frac{\Sigma \text{ row's at iteration (1)}}{V} .$$

e. $R^{(1)} = \sum_{s=1}^{Q} (1-r_s^{(1)})^2$, was then computed.

7. Iteration was repeated and the corresponding R value in each iteration was determined.

8. Iteration was continued until R reached minimum value and then iteration was stopped.* O/D volumes obtained from step 6(b) were considered to be the refined O/D movements.

9. The refined volume was divided by the rough volume for each mapped O/D pair to get a correction factor for the probability to be interviewed. The corrected probabilities were then added to the master file of the records to get a refined enlarged master file for the mapped O/D pairs.

10. Refined enlarged master file was processed to get refined partially filled matrices by trip purpose for passenger trips for different vehicle types.

- Filling the Empty Cells

At this stage, refined partially filled matrices had been derived; the next step was to fill the empty cells. The empty cells are of two kinds: those corresponding to a mapped O/D pair (i.e. inter cordon-area movements, crossing the cordon line but not observed during the survey period), and cells corresponding to O/D movement within the cordon areas (i.e., intra cordon-area movements). The cell-filling process was carried out using a standard methodology (8,9). This section is a short and straightforward description of the input and procedure used for this task:

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*In order to establish the system, it was suggested to perform the procedure for 20 iterations for one matrix (as an example). For each iteration list the values of r_s (s ranging from 1 to Q) as well as the corresponding value of R.

INPUTS:

- Partial trip matrix T_{ij} including <u>all mapped</u> O/D pairs <u>only</u>, even those having zero flows

  - Partial trips generated:

$$G_i = \sum_j T_{ij}$$

  - Partial trips attracted:

$$A_j = \sum_i T_{ij}$$

- Travel time matrix U_{ij}; see section (2.2.1)
- Friction factors F_k, consisting of an array of c elements corresponding to equal travel time class intervals of 2 minutes eack relevant to the time matrix U_{ij}.

Procedure:

1. Begin by giving two arrays q_i, x_j the value 1:

$$q_i^o = 1, x_j^o = 1$$

2. For the c class intervals calculate F_k^1:

$$F_k^1 = \frac{\sum_L T_{ij}}{\sum_L q_i \cdot x_j}$$

where L = number of elements T_{ij} belonging to class k.

From matrix U_{ij}, use elements belonging to class k, and T_{ij} from the refined partially filled matrix, to calculate F_k^1.

3. Calculate q_i^1 from:

$$q_i^1 = \frac{G_i}{\sum_j x_j^o \cdot F_k^1}$$

4. As in step (3) calculate X_j^1 from

$$X_j^1 = \frac{}{\sum_i q_i^1 \cdot F_k^1}$$

5. Check for convergence by calculating the error:

$$R = \sum_i \sum_j \sqrt{(T_{ij} - q_i^p \cdot x_j^p \cdot F_k^p)^2}$$

where p denotes iteration p, i and j vary for 1 to 80 (the number of zones within the Greater Cairo Area, where the Gravity Model was applied).

6. If the error corresponding to iteration p is greater than 0.01 of that of the immediately preceding iteration p-1, then repeat step 2; otherwise continue with step 7.

7. Derive the estimated trip matrix $\hat{T}_{ij}$ from:

$$\hat{T}_{ij} = q_i^p \cdot x_j^p \cdot F_k^p ,$$

where k is the class interval corresponding to the element U_{ij}.

8. Compute the statistic G^2 from:

$$G^2 = 2 \sum_i \sum_j T_{ij} \log_e (T_{ij}/\hat{T}_{ij})$$

(Note: If $T_{ij} = 0$, an error will occur since $\log_e 0 = -\infty$; in this case $[T_{ij} \log_e (T_{ij})/(\hat{T}_{ij})] = 0$.)

9. Fill the remaining <u>unmapped empty cells</u> as in step 7 and obtain the totally filled matrix.

The above 9-step procedure was applied for the following passenger trip classes:

a) Home/Work + Work/Home
b) Home/Other + Other/Work
c) Non-Home Based
d) All purposes.

116

Vehicle types included:

a) Private cars
b) Taxis
c) Micro Buses
d) Private Buses

2.2.3 Data Collection & Preparation

Data collection and preparation, the first phase of the vehicular survey effort, was discussed in section 1.1 of this report. A summary of this stage follows (see Fig. I-21):

Data were collected using two forms:

a. Volume count sheet, for counting vehicles at the counting stations.

b. Road interview form, for collecting data on trip characteristics.

Using these two forms, data were punched on cards, inspected to detect and correct errors, and stored on two magnetic tape master files. Those files included:

a) Traffic Count Master File

Contains a record for each station of each hour. Each record consists of the station number, the hour, and the count of each mode at the station at the hour.

b) Vehicular Survey Master File

Two types of master files were prepared. The first file contains a record for each three interview trips. The other file contains one record for each interview trip. A total of 113,211 trips interviewed were conducted.

2.2.4 Producing Trip Characteristics

The output of phase II of the functional design was:

a. The final valid survey data base
b. Trip information required for travel demand forecasting and assignment purposes (see Fig. I-21).

Output data are produced in different types and formats. The system was divided into four main subsystems, each consisting of a set of programs, including short functional models (see Fig. I-21). The system design was carried out at four main levels:

1. System level
2. Subsystem level
3. Program level
4. Module level.

The design was based on the theory presented in section (2.2.2) applied to four travel modes:

1. Private Cars
2. Taxis
3. Micro-Buses
4. Private Buses.

2.2.2.1 Subsystem I: Producing Master File With Mapped O/D Pairs

Subsystem I contained all the modules used in the predetermination stage. The purpose of this subsystem was to produce two main outputs:

1. Mapped O/D pairs caught at interview stations, as shown in Computer Output Number o-c*, which is used in the determination of paths used between a certain O/D pair during the survey.

2. New M/F based on total mapped O/D pairs, which was used in subsystem II.

In addition, the following lists, to be used in data analysis, were produced:

1. List of cordon zones mapping; see Computer Output Number--"C.O.N." (O-a 1)

2. List of through O/D pairs crossing the enlarged downtown--C.O.N. (O-a 2).

3. List of total mapped O/D pairs--C.O.N. (O-a 3).

4. List of sample size ratios by mode/station--C.O.N. (O-d)

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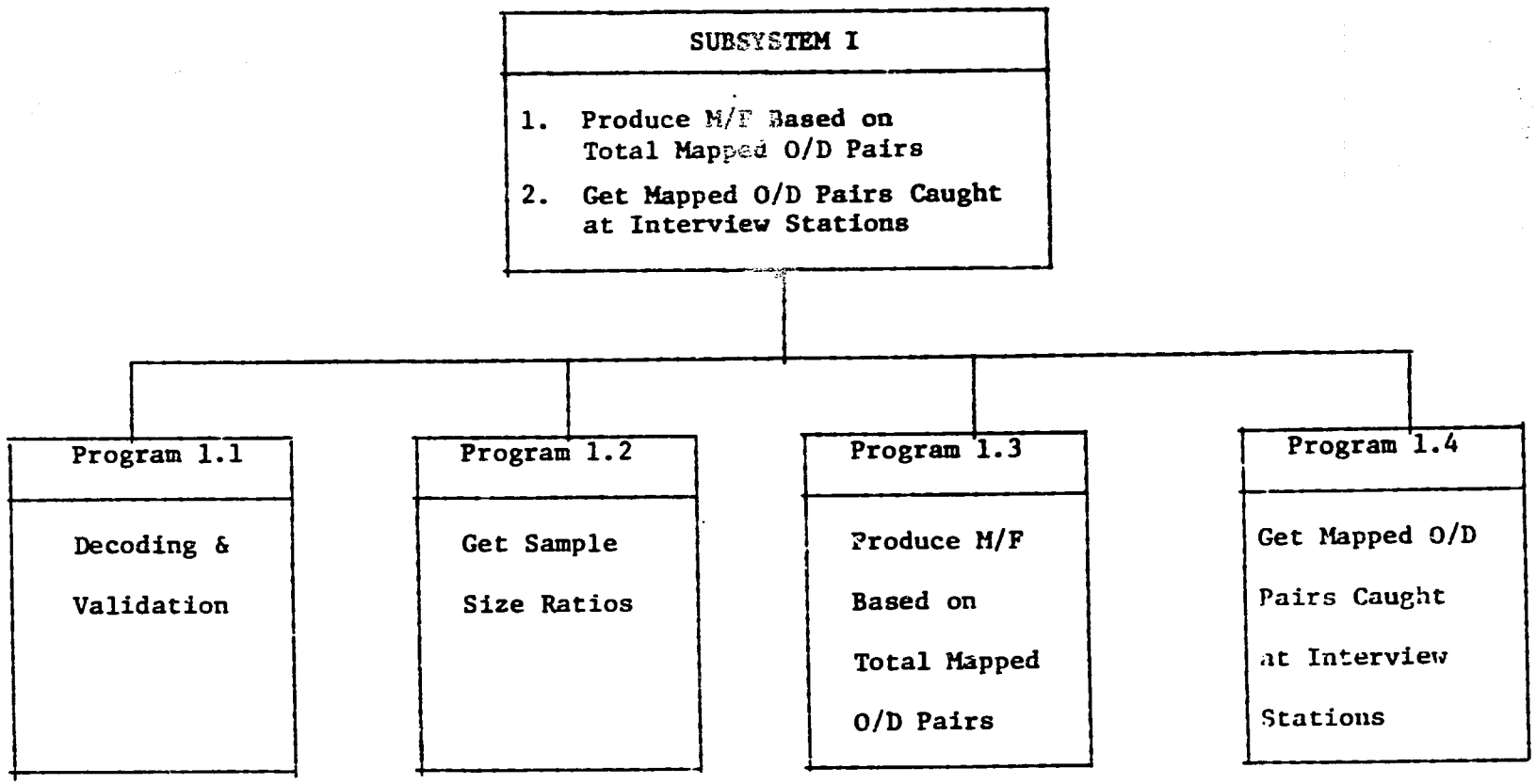
*See list of Computer Output Prints at the end of section (2.3).

5. List of O/D pair movements caught by different number of stations--C.O.N. (O-b)

6. List of mapped O/D pairs caught by interview stations--C.O.N. (O-c).



Subsystem I

120

Program 1.1

Decoding & Validation

1.1.1 Decoding

This activity consisted of translating the coded origin and destination into the original zoning serial numbers. The serial form facilitated the validation as well as sorting data.

1.1.2 Sorting

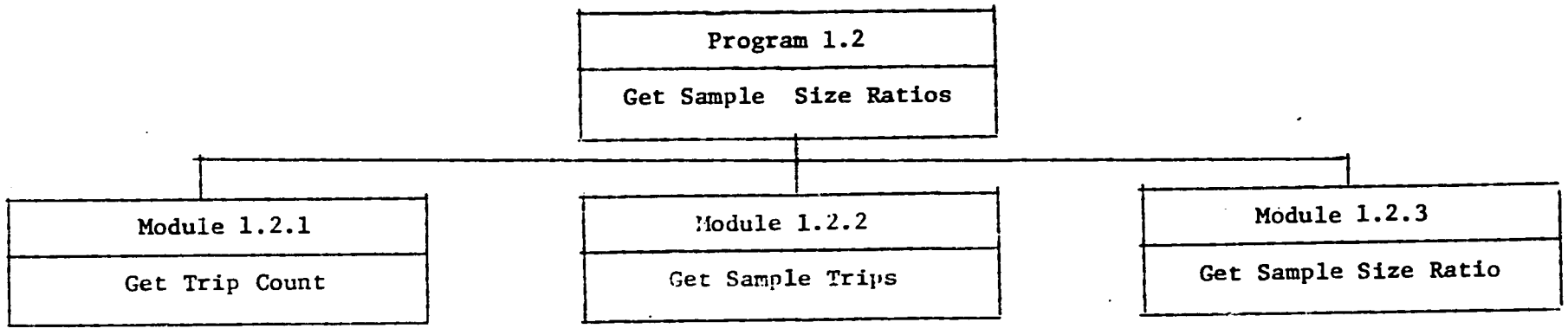
This activity consisted of classifying the master file data by mode/origin/destination/station/hour.

1.1.3 Validation

This activity consisted of validating the Vehicular Survey Data according to the following range checks:

a. Mode No. (2-14)
b. Origin No. (1-108)
c. Destination No. (1-108)
d. Station No. (1-267)
e. Purpose No. (1-160)

The total number of valid trips, after applying the validation rules, was found to be 90,824 trips.



INPUT

1. Decoded sorted valid M/F (VS1)
2. Count M/F (VS2)

PROCESS

1. Get sample trips (S), by (mode/hour/station)
2. Get trip count (C), by (mode/hour/station)
3. Get sample size ratio, by (mode/hour/station)

OUTPUT

1. Sample size ratio by (mode/station), for:
   a - each hour,
   b - each period, and
   c - total hours
   C.O.N. (o-o)

Program 1.2

122

Program 1.2

Get Sample Size Ratio

This program consisted of the following three activities:

1.2.1 Obtain Trip Count

Preparing the count for each station in a tabular form sorted by mode/hour.

1.2.2 Obtain Sample Trips

Preparing the sample of each station in a tabular form sorted by mode/hour.

1.2.3 Obtain Sample Size Ratio

To get the sample size ratio of trips caught at each station by mode for:

a. each hour
b. each period
c. total hours

Program 1.3

Produce New M/F Based on Total Mapped O/D Pairs

- **Module 1.3.1** — Get Cordon Zones Mapping
- **Module 1.3.2** — Get Through O/D Pairs Crossing the Enlarged Downtown
- **Module 1.3.3** — Get Total Mapped O/D Pairs
- **Module 1.3.4** — Produce New M/F for Mapped O/D Pairs

INPUT

1. Decoded Sorted Valid M/F (VS3)

PROCESS

1. Get zero/one matrix for :
   - a- Cordon zones O/D pairs (map 1),
   - b- Through movements O/D pairs (map 2),
   - c- Total movements O/D pairs (map 3)
2. Use total movements zero/one matrix to produce new M/F for mapped O/D pairs
3. Use the zero/one matrices to get the required lists

OUTPUT

1. List of cordon zones mapping (C.O.N. o-a-1)
2. List of through O/D pairs crossing the enlarged down town (C.O.N. o-a-2)
3. List of total mapped O/D pairs (C.O.N. o-a-3)
4. New M/F based on total mapped O/D pairs (VS4)

Program 1.3

Program 1.3

Produce New M/F Based on Total Mapped O/D Pairs

1.3.1 Obtain Cordon Zones Mapping

To get the O/D pairs passing through cordon areas inside the enlarged downtown.

1.3.2 Obtain Through O/D Pairs Crossing the Enlarged Downtown

To get the through O/D pairs crossing the enlarged downtown.

1.3.3 Obtain Total Mapped O/D Pairs

To get the total mapped O/D pairs, i.e., the summation of (Map 1) and (Map 2).

1.34 Produce New M/F Based on Total Mapped O/D Pairs

Using the total mapped O/D pairs zero/one matrix to create a new master file for the trips of the mapped O/D pairs only, and skipping of other trips. Total number of trips based on mapped O/D pairs was 51,851.

Program 1.4

1. Get Mapped O/D Pairs Caught at Interview Stations
2. Get O/D Pairs Movements Caught by Different Number of Stations

Module 1.4.1

Get Mapped O/D Pairs Caught at Interview Stations

Module 1.4.2

Get O/D Pairs Movements Caught by Different Number of Stations

INPUT	PROCESS	OUTPUT
1. Decoded sorted valid M/F based on total mapped O/D pairs (VS4).	1. For each mode, for each O/D pair, get the stations visited and number of trips at each station 2. Select the mode and get number of stations visited for each O/D pair 3. Scan the matrix to produce the O/D pairs caught by different number of stations	1. List of mapped O/D pairs caught at interview stations. (C.O.N. o-c) 2. List of O/D pair movements caught by different number of stations (C.O.N. o-b)

Program 1.4

126

Program 1.4

Get Mapped O/D Pairs Caught at Interview Stations & O/D Pairs Movements Caught by Different Number of Stations

1.4.1 Obtain Mapped O/D Pairs Caught at Interview Stations

To get O/D pair, total number of trips, total number of stations, the stations and their sample interviewed.

1.4.2 Obtain O/D Pair Movement Caught by Different Number of Stations for Each Mode

To get a list of the number of stations and the corresponding O/D pairs movements caught by these stations starting from zero stations (i.e. mapped O/D pairs which should have been caught by station during the Survey, due to the sample size, however, no station caught any of these O/D pair trips).

2.2.4.2 Subsystem II: Producing Master File With Rough Enlargement Factor

Subsystem II was concerned with the data preparation in the implementation stage (see section 2.3.2). The purpose of this subsystem was two-fold:

1. To produce an updated master file with a rough enlargement factor for each trip for mapped O/D pairs. Number of trips for each node were as follows:

1.	Private Car	25,582 trips
2.	Taxi	13,135 trips
3.	Micro-Bus	884 trips
4.	Private Bus	939 trips.

2. To obtain partially filled sample and enlarged O/D matrices by trip purpose, C.O.N. (V-a), (V-b), (VI-a), and (VI-b).

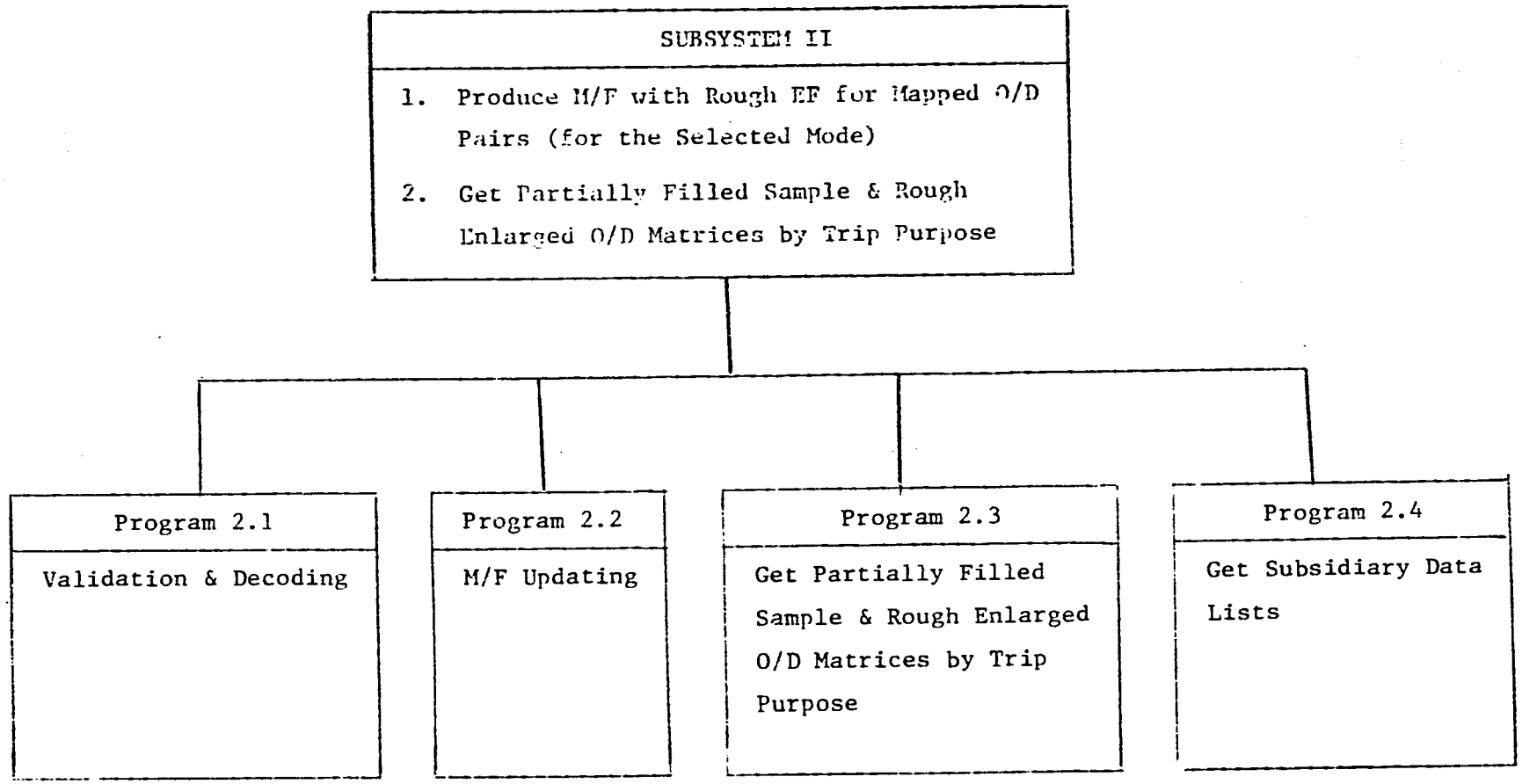
In addition, some subsidiary lists of data were produced at this stage. These included:

1. Validated data as input to the program with O/D pairs having irrelevant stations, C.O.N. (I).

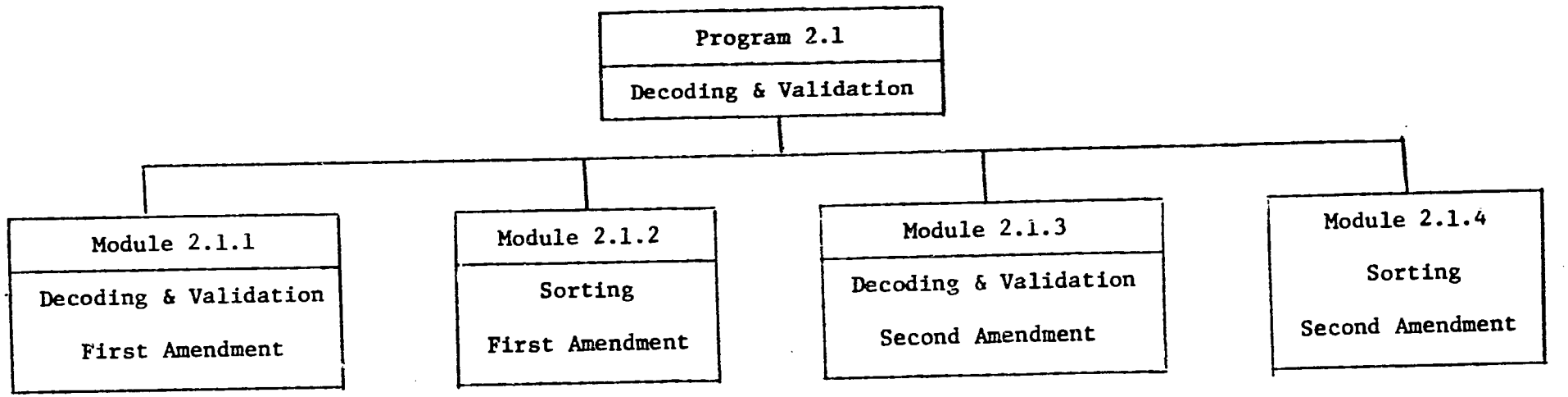
2. Sorted validated input data by origin/destination with O/D pairs having irrelevant stations, C.O.N. (II).

3. Validated O/D pairs, excluding O/D pairs having no probability of being interviewed, C.O.N. (III).

4. Cordon/screen line stations and the O/D pairs visiting them, C.O.N. (IV).



Subsystem II



INPUT

1. First Amendment (P1)
2. Second Amendment (P2)

PROCESS

1. Decoding of origin and destination
2. Validation using the range checks
3. Sorting by orig./dest.

OUTPUT

1. Validated O/D pairs excluding O/D pairs having no probability to be interviewed (P3) (C.O.N.III)
2. Validated O/D pairs having irrelevent stations (P4) (C.O.N. I)

Program 2.1

Program 2.1

Decoding & Validation

2.1.1 Validation & Decoding for the First Stage of Master File Amending

a. The first amendment consisted of data needed to update the master file (see section 2.2.2). Amendments consisted of one record for each mapped O/D pair in the master file for the selected mode. Data items and validation rules included the following:

1. The origin and destination should be one of 108 zones.
2. The probability to be interviewed in the paths between the O/D pair should be ≤ 1 and >0.
3. The assignment flow fraction related to cordon/screen line station, should be ≤ 1 and > 0.
4. The stations should be one of the cordon/screen line station (61 stations).

b. Decoding of origin and destination to their original serial number.

c. Validation of the first amendment, C.O.N. (I) (list of validated data).

The number of O/D pairs for each mode were as follows:

a) Private car 3269 O/D pairs
b) Taxi 2782 O/D pairs
c) Micro-Bus 656 O/D pairs
d) Private Bus 678 O/D pairs.

2.1.2 Sorting First Amendment

This consisted of sorting valid first amendment on the same key as the master file (origin/destination) after eliminating all the errors discovered.

2.1.3 Validation & Decoding of the Second Stage of Master File Amending

a. Second amendment consisted of data needed to update (skipping) trips related to irrelevant stations, i.e., stations which were not in the logical paths for any O/D pair. This data set consisted of one record for each O/D pair having irrelevant station station or more. Data items and validation rules included the following:

1. The origin and destination should be one of the first amendments O/D pairs
2. The stations should be > 0 and ≤ 267.

b. Decoding of origin and destination to their original serial numbers.

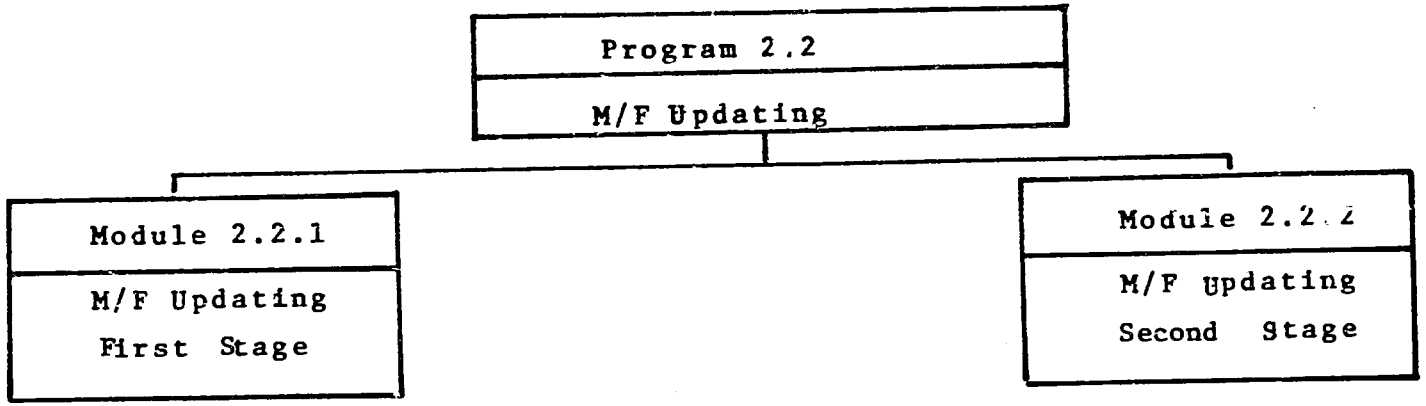
c. Validation of second amendments.

The number of O/D pairs having irrelevant stations for each model were as follows:

a)	Private Cars	848 O/D pairs
b)	Taxi	865 O/D pairs
c)	Micro-Buses	56 O/D pairs
d)	Private Buses	86 O/D pairs.

2.1.4 Sorting of Valid Second Amendments

This consisted of sorting valid amendments on the same key of the master file (origin/destination) after rectifying all identified errors.



INPUT

1. Valid sorted first amendments (P2)
2. Valid sorted second amendments (P4)
3. M/F based on total mapped O/D pairs (VS4)

PROCESS

1. Using first amend., produce M/F without trips of O/D pairs having no prob. to be interviewed and with the EF of each related O/D pair
2. Using second amend., produce M/F without irrelevant trips

OUTPUT

1. M/F with rough EF for mapped O/D pairs (VS5), for the selected mode

Program 2.2

133

Program 2.2

M/F Updating

2.2.1 M/F Updating First Stage

Using the first amendments, select the trips from the M/F (other than trips with O/D pairs having no probability to be interviewed) and add the EF to each trip record, where

$$EF = \frac{1}{prob.}$$

2.2.2 M/F Updating Second Stage

Purpose

Using the second amendments, produce M/F without the irrelevant trips.

Program 2.3

Get Partially Filled Sample & Rough Enlarged O/D Matrices by Trip Purpose

Module 2.3.1

Get Non-Sorted O/D Matrices

Module 2.3.2

Sorting of O/D Matrices

Module 2.3.3

Splitting Matrices by Code

INPUT	PROCESS	OUTPUT
1. M/F with rough EF for mapped O/D pairs (VS5), for the selected mode.	1. Produce unsorted O/D matrices 2. Sorting by code/purpose 3. Splitting of matrices by code.	1. Partially filled sample & rough enlarged O/D matrices by trip purpose. C.O.N.(V) and (VI)

Program 2.3

Program 2.3

Get Partially Filled Sample & Rough Enlarged O/D Matrices by Trip Purpose

The following procedure was followed within this program:

2.3.1 Get Non-Sorted O/D Matrices

Get non-sorted partially filled O/D matrices by trip purpose (HW, WH, HO, OH, NHB) for the following codes:

1. Sample vehicle trips
2. Sample passenger trips
3. Enlarged vehicle trips
4. Enlarged passenger trips.

2.3.2 Sorting O/D Matrices

Sorting O/D matrices by code/purpose.

2.2.3 Splitting of O/D Matrices

Split matrices by code into four groups, one for each code. Each group contained five O/D matrices, one for each purpose, C.O.N. (VII-a).

Total volumes for the code and purpose for each mode are shown in the following charts:

1. Private Car Trips :

Code / Purpose	Sample		Enlarged	
	Vehicle	Passenger	Vehicle	Passenger
HW	8,049	15,805	51,042	102,006
WH	5,003	9,853	31,313	62,624
HO	3,509	7,870	21,498	50,660
OH	1,491	3,137	9,690	21,363
NHB	7,530	15,750	49,526	107,155
Total	25,582	52,415	163,069	343,808

2. Taxi Trips

Code / Purpose	Sample		Enlarged	
	Vehicle	Passenger	Vehicle	Passenger
HW	3,054	9,500	32,644	100,646
WH	1,495	4,706	15,870	51,527
HO	1,876	6,108	20,155	65,047
OH	666	2,249	6,951	23,521
NHB	6,044	20,414	67,029	230,756
Total	13,135	42,977	142,649	471,497

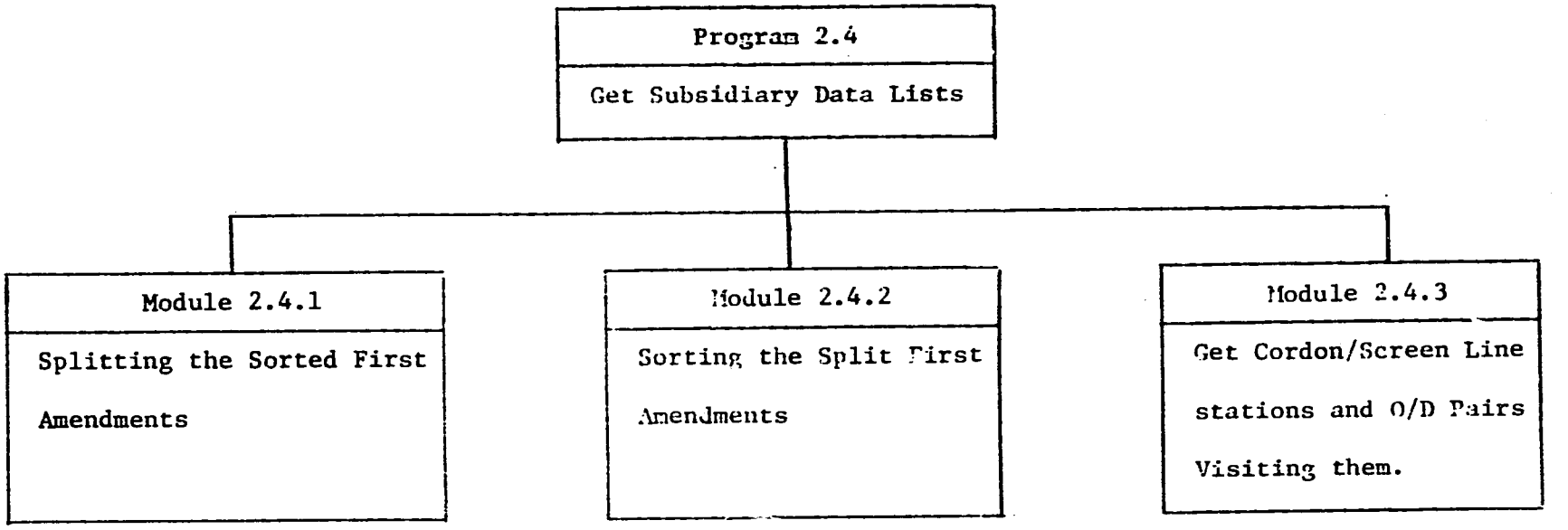
HW = Home to work
WH = Work to home
HO = Home to other
OH = Other to home
NHB = Non-home based

3. Micro Bus Trips

Code / Purpose	Sample		Enlarged	
	Vehicle	Passenger	Vehicle	Passenger
HW	191	1365	5432	32,611
WH	106	651	1862	11,250
HO	23	120	502	2,844
OH	8	69	140	1,297
NHB	556	3121	12292	64,656
Total	884	5326	20228	112,658

4. Private-Bus Trips

Code / Purpose	Sample		Enlarged	
	Vehicle	Passenger	Vehicle	Passenger
HW	204	5064	3799	91051
WH	143	4098	2360	57919
HO	6	101	100	1511
OH	1	1	3	3
NBH	585	13870	9297	203191
Total	939	23134	15559	353675



INPUT	PROCESS	OUTPUT
1. Valid sorted first amendments	1. Split the valid sorted first amendment into records, one record for each cordon/screen line station related to mapped O/D pairs 2. Sort by orig./dest./station 3. Produce the required data lists	1. Classified data lists; see C.O.N. IV

Program 2.4

Program 2.4

Get Subsidiary Data Lists

This program consisted of the following sequence of steps:

2.4.1 Splitting the Sorted First Amendments

Each O/D record was split into different records; one record for each cordon/screen line station related to the O/D pair.

2.4.2 Sort the Split First Amendments

Entailed the sorting of split records by origin/destination/station.

2.4.3 Obtain the O/D pairs at each cordon/screen line station

These data were listed as follows:

1. O/D pairs with flow fraction equal to one.
2. O/D pairs with flow fraction less than one.

Lists 1 and 2 are shown in C.O.N (IV).

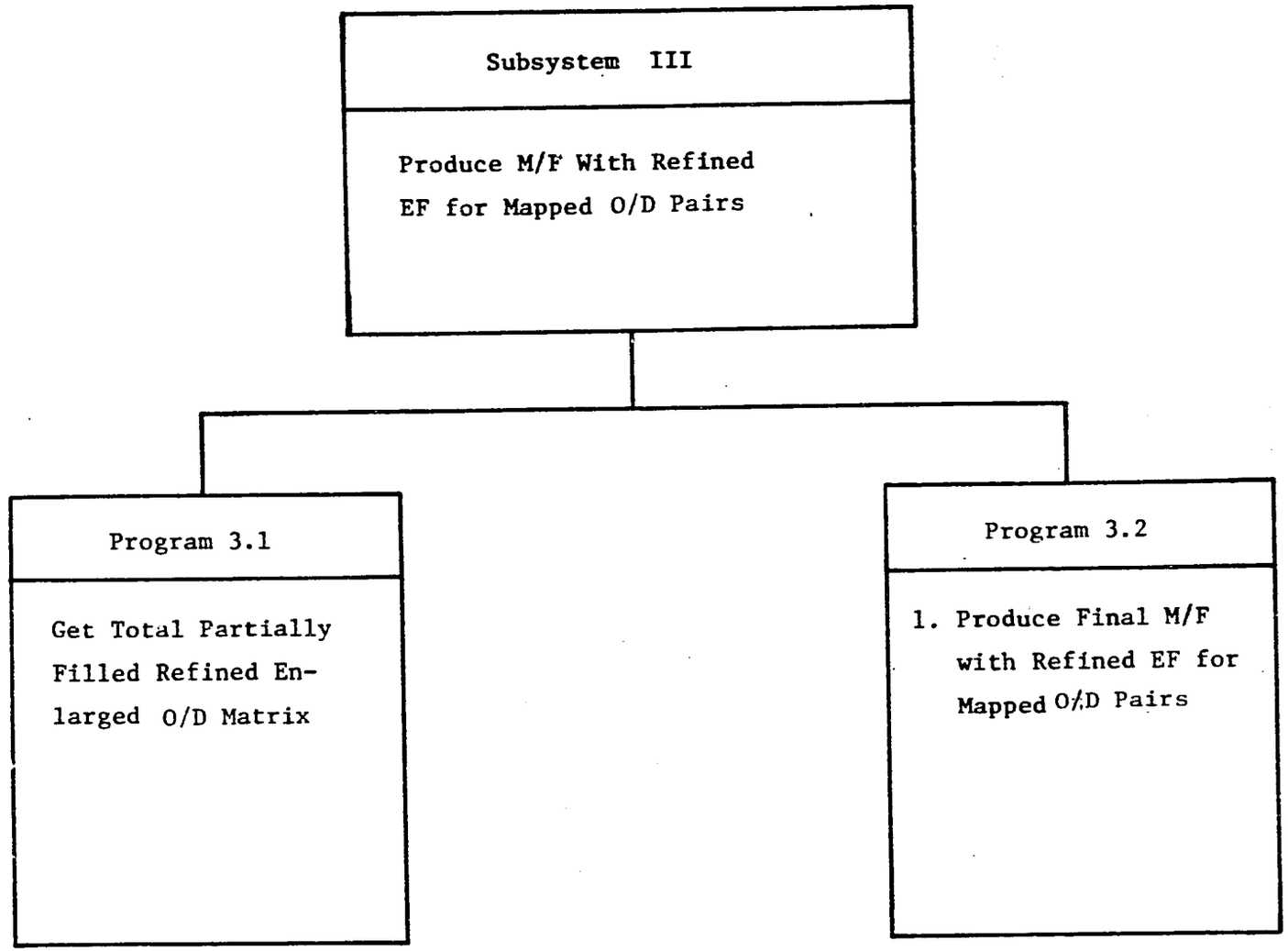
2.2.4.3 Subsystem III: Produce Master File with Refined Enlargement Factor

A new M/F for the selected mode with refined EF for mapped O/D pairs was derived. The refined EF is obtained by multiplying the rough EF by the ratio a/b, where:

a = Total partially filled refined enlarged O/D matrix, produced from applying the iterative balancing procedure (see section 2.2.2), and

b = Total partially filled rough enlarged O/D matrix, C.O.N. (VII-a).

The list of the correction factors for probabilities of being interviewed are shown in C.O.N. (VII-d).



Subsystem III

142

Program 3.1

Get Total Partially Filled Refined Enlarged Matrix.

Module 3.1.1

Get Total Partially Filled Rough Enlarged O/D Matrix

Module 3.1.2

Get Assignment Flow Fraction Average Matrix.

Module 3.1.3

Get Total Count Table for Cordon/Screen Line Stations

Module 3.1.4

Get Total Partially Filled Refined Enlarged O/D Matrix

INPUT

1. Partially filled,rough enlarged O/D matrices by trip purpose
2. Valid sorted first amendments (P2)
3. Trip counts by mode/hour/station (c)
4. Sorted split first amendments (P5)

PROCESS

1. Sum the matrices to produce total matrix
2. Use P2 to produce an average matrix
3. Sum up the trip count
4. Apply the iterative balancing procedures to get total partially filled refined enlarged matrix

OUTPUT

1. Total partially filled refined enlarged O/D matrix; C.O.N. (VII - c)
2. Statistics from the iterative balancing procedures.C.O.N. (VII-b)

43

Program 3.1

Program 3.1

Get Total Partially Filled Refined Enlarged O/D Matrix

3.1.1 Obtain Total Partially Filled Rough Enlarged O/D Matrix

This required summing the O/D matrices by trip purpose to get the total partially filled rough enlarged O/D matrix.

3.1.2 Derive the Assignment Flow Fraction Average Matrix

For each mapped O/D pair, the assignment flow fractions were summed to obtain the average flow assignment fractions, which should be equal to or greater than one.

This "average value" matrix was used to compensate for the effect of multiple counting during the iterative balancing procedure.

3.1.3 Derive the Total Count Table

Consists of summing the trip count of the total hours for the cordon/screen line stations to obtain total count Table suitable for the iterative balancing procedures module.

3.1.4 Derive the Total Partially Filled Refined Enlarged O/D Matrix

Using the iterative balancing procedure technique (explained in section 2.2.2), the total partially filled refined enlarged matrix for vehicle trips was produced.

Total number of refined enlarged vehicle trips for all hours and purposes, after applying the iterative balancing procedures, were as follows:

a.	Private Car	159,867 trips
b.	Taxi	103,059 trips
c.	Micro-bus	11,686 trips
d.	Private-bus	9,939 trips.

Program 3.2

Produce Final M/F With Refined EF For Mapped O/D Pairs

Module 3.2.1	Module 3.2.2	Module 3.2.3
Get Sum of Differences	Get Refined/Rough Ratio Matrix	Produce Final M/F With Refined EF for Mapped O/D Pairs

INPUT	PROCESS	OUTPUT
1. Total partially filled rough enlarged O/D matrix	1. Get the sum of differences between the refined/rough partially filled total O/D matrices 2. Get the ratio of the refined/rough partially filled O/D matrices 3. Use this ratio to correct the EF of the corresponding trip O/D pair in the M/F	1. Final M/F with refined EF for mapped O/D pairs (VS6)

Program 3.2

Program 3.2

Produce Final M/F with Refined EF for Mapped O/D Pairs & Get Partially Filled Refined Enlarged O/D Matrices

3.2.1 Derive the Sum of Differences

To get the sum of differences between the refined/rough partially filled total O/D matrices. To check the validity of the results, the values of the sum of differences for each mode were as follows:

1.	Private Car	41,623
2.	Taxi	89,840
3.	Micro-Bus	11,740
4.	Private-Bus	15,162.

3.2.2 Get Refined/Rough Ratio Matrix

This matrix was used to obtain the ratio between the values in each cell of the refined matrix and those in the rough partially filled total matrices.

These ratios were used to correct the EF of the corresponding O/D trip in the M/F, C.O.N. (VII-d).

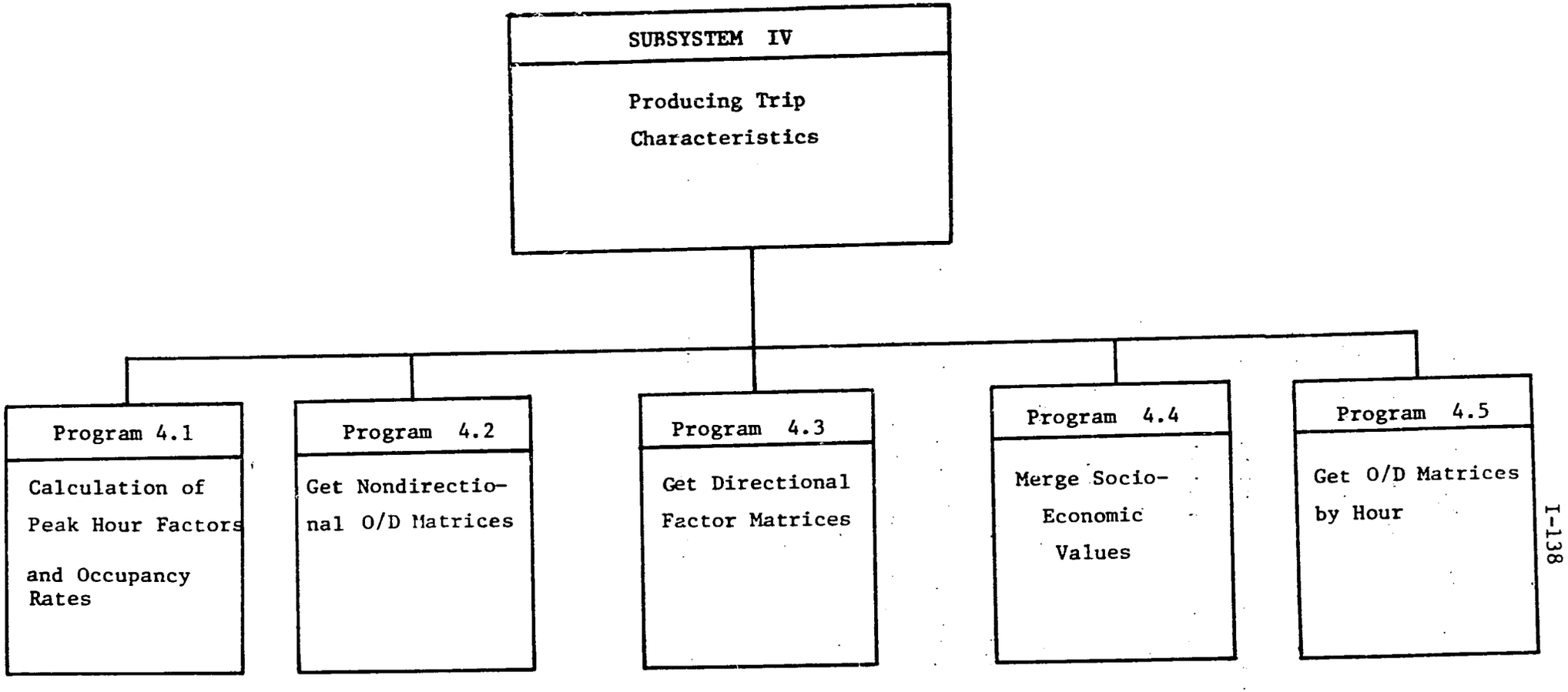
3.2.3 Produce Final M/F with Refined EF for Mapped O/D Pairs

Correct the EF of each trip in the M/F by the ratio of the corresponding O/D pair, as mentioned before.

2.2.4.4 Subsystem IV: Derive Trip Characteristics

Techniques for filling the empty cells (see sec. 2.2.2) were applied to get full O/D matrices by the following procedure:

1. Produce a minimum travel time matrix by building minimum travel time trees under free flow conditions. A trip distribution curve using a 2 minute class interval was then obtained.
2. Produce five full O/D matrices by trip purpose and one total matrix for passenger trips by each mode.
3. Derive the fluctuation factor by hour, by purpose, and the occupancy rate for each mode.
4. Derive zone characteristics by merging the passenger trip attraction and production of each zone with the socio-economic characteristics of this zone. Data in this form were thus suitable for the second stage of regression analysis and cross-classification for trip generation.
5. Derive O/D matrices by hour for the morining period for parking study pruposes.



Subsystem IV

148

Program 4.1

Calculation of Peak Hour Factors & Ocupancy Rates

Module 4.1.1

Calculation of Peak Hour Factors

Module 4.1.2

Calculation of Occupancy Rates

INPUT	PROCESS	OUTPUT
Refined enlarged M/F for Mapped OD pairs	For each trip purpose (HW, WH, HO, OH, NHB) Get : 1. The fluctuation factor by hour 2. The occupancy rate	1. Fluctuation factors by purpose/hour (10 hours) C.O.N. XVII) 2. Occupancy rates by purpose C.O.N. XVIII)

Program 4.1

149

Program 4.1

Calculation of Peak Hour Factors & Occupancy Rates

This program consists of two activities:

4.1.1 Calculation of the Hourly Fluctuation Factors

For each mode a run was executed to ascertain the fluctuation factor by hour/purpose for enlarged vehicle trips.

The output was produced in a tabular form, C.O.N. (XVII).

4.1.2 Calculation of the Vehicle Occupancy Rates

The occupancy rates of each mode, for each trip purpose, were derived, C.O.N. (XVIII).

The fluctuation factors and occupancy rates were used to derive the full O/D matrices by hour for vehicle trips to be used for assignment purposes.

Program 4.2

Get Non-directional O/D Matrices

Module 4.2.1	Module 4.2.2	Module 4.2.3	Module 4.2.4
Get Minimum Travel Time Matrix	Get Partial Filled O/D Matrices For Passenger Trips	Get Full O/D Matrices For Passenger Trips	Get Non directional O/D Matrices

INPUT

1. Cairo network in node & link system
2. Master file with refined enlargement factor
3. Total movements O/D pairs (Map3)

PROCESS

1. Find the minimum travel time by building minimum trees under free flow conditions
2. Get partially filled O/D matrices by trip purpose for passenger trips and one total matrix
3. Apply the gravity models to fill the empty cells and produce full O/D matrices

OUTPUT

1. Minimum travel time matrix; (C.O.N. IX-b)
2. Network description (C.O.N. XX)
3. Full O/D matrices for passenger trips by purpose and all purpose matrix C.O.N. XXXI)
4. Full non-directional O/D matrices for passenger trips
5. Statistics (C.O.N. X-b)

Program 4.2

Program 4.2

Produce Full O/D Matrices

4.2.1 Deriving the Minimum Travel Time Matrix

The minimum travel time between each O/D pair was estimated by building minimum (travel time) trees under free flow conditions, using the Cairo network configuration, network description, and the minimum travel matrix, shown in C.O.N. (IX-a) & (IX-b), respectively.

4.2.2 Derive Partially Filled O/D Matrices For Passenger Trips

For each mode, five O/D matrices were produced, one for each purpose (HW, WH, HO, OH, and NHB).

For each mode (private car, taxi, micro-bus, and private-bus) one matrix (all day, all purpose) was also produced. Partially filled O-D matrices are shown in C.O.N. (IXX).

4.2.3 Derive Full O/D Matrices For Passenger Trips

A full O/D matrix was produced for each one of the matrices produced in 4.2.2. This was achieved by using the techniques suggested in section 2.2.2 for filling the empty cells. The distribution of trips was based on the minimum time between each O/D pair produced by module 4.2.1, taking two minutes as the most suitable class interval for the private car and taxi modes. This class interval was selected after sensitivity analysis on different classes, i.e., one, two, three, four, five, and nine-minute class intervals, C.O.N. (XI), (XII), (XIII), (XV), (XVI) and (XVII). For micro-bus and private-bus, five-minute class intervals gave the best results. Full O/D matrices are shown in C.O.N. (XX).

152

4.2.4 Derive Non-Directional O/D Matrices

Three O/D matrices were produced separately for the private car and taxi trips. These were:

a. HBW (HW + WH)

b. HBO (HO + OH)

c. NHB

They are shown in C.O.N. (XXI).

Total volumes of each of the partially filled full directional and non-directional matrices were as follows:

1. Partially Filled O/D Matrices. All purpose, all hours, for passenger Trips:

   a. Private Car 314,444 trips
   b. Taxi 259,442 trips
   c. Micro-Bus 61,081 trips
   d. Private-Bus 232,315 trips.

2. Full O/D Matrices. All purposes, all hours, for passenger trips.

   a. Private Car 595,668 trips
   b. Taxi 413,957 trips
   c. Micro-Bus 90,550 trips
   d. Private-Bus 411,582 trips.

3. Partially O/D Matrices by Purpose for Passenger Trips

Partially Filled O/D Matrices by Purpose for Passenger Trips

	HW	WH	HO	OH	NHB
Car	100,898	58,412	48,900	19,554	86,725
Taxi	72,477	26,601	36,305	13,852	110,195

4. Full O/D Matrices by Purpose For Passenger Trips

	HW	WH	HO	OH	NHB
Car	189,096	117,989	76,548	40,639	175,222
Taxi	104,469	47,276	54,842	27,680	188,594

5. Full Nondirectional O/D Matrices For Passenger Trips

	HBW	HBO	NHB
Car	307,085	117,187	175,222
Taxi	151,745	82,522	188,594

Program 4.3
Get Directional Factor Matrices

INPUT	PROCESS	OUTPUT
1. Full O/D matrices by trip purpose, for passenger trips (HW, WH, HO, OH) 2. Full nondirectional O/D matrices for passenger trips, (HBW, HBO)	For each mode, get 2 directional factor matrices. a. HW/HBO b. HO/HBO	Two directional factor matrices for HW, and HO. C.O.N. (XXII)

Program 4.3

Program 4.3

Derive Directional Factor Matrices

This process consists of two steps:

1. Divide the synthesized matrix representing all-day person trips for the purpose HW by its corresponding nondirectional matrix for the same purpose (HBW), thus obtaining the directional factor matrix for this purpose.
2. Similarly obtain a directional factor matrix for the purpose HO.

Program 4.4
Merge Socio-economic Values

INPUT	PROCESS	OUTPUT
1. The non-directional attraction and production values 2. Socio-economic data	For each mode, for each purpose (HBW, HBO, NHB) merge the trip attraction and production values with the corresponding socio-economic values	Zone trip information (C.O.N. XXIII)

Program 4.4

157

Program 4.4

Merge Socio-Economic Values

This program entailed merging the zone socio-economic variable value with the attractions and productions in a form suitable for regression analysis and cross classification.

Program 4.5

Get O/D Matrices By Hour (morning Period)

Module 4.5.1	Module 4.5.2	Module 4.5.3	Module 4.5.4
Get Partially Filled O/D Matrices	Get Full Matrices (First Method)	Get Fluctuation Factors By Hour	Get Full O/D Matrices (Second Method)

INPUT

1. Master file with refined enlargement factors
2. Minimum travel time matrix
3. Total movements O/D pairs

PROCESS

1. Get partially filled O/D matrices
2. Produce full O/D matrices by hour for each mode (first method)
3. Get the fluctuation factor by hour
4. For private car, get one total matrix for the four hours
5. Produce full O/D matrix for private car
6. Use the fluctuation factors to produce hourly O/D matrices (second method)

OUTPUT

1. Hourly modal partially filled enlarged O/D matrices for passenger trips
2. Hourly modal full O/D matrices for passenger trips (first method) C.O.N. (XXIV)
3. Fluctuation factors by hour C.O.N. (XXV)
4. Full hourly O/D matrices for mode car for passenger trips (second method) C.O.N. (XXXVI)

159

Program 4.5

Program 4.5

Get O/D Matrices by Hour, Morning Period

4.5.1 Get Partially Filled O/D Matrices

Get modal (modes: car, taxi, micro-bus, and private bus) hourly (hours 7, 8, 9, and 10) partially filled refined enlarged O/D matrices for passenger trips.

4.5.2 Get Full O/D Matrices (First Method)

Using the technique suggested in section 2.3.2 for filleng empty cells, produce full O-D matrices for the partially filled matrices produced in 4.5.1.

4.5.3 Get Fluctuations Factors by Hour

For each mode get the hourly fluctuation factors for the morning period by dividing the enlarged refined vehicle trips by the total refined enlarged vehicle trips of the period recorded in the refined enlarged master file, thus obtaining four fluctuation factors for each mode.

4.5.4 Get Full O/D Matrices (Second Method)

1. For mode private car only, get one partially filled refined enlarged O-D matrix for passenger trips for the morning period, i.e., the summation of the four morning hours (7,8,9, and 10).

2. Apply the filling of empty cells technique to produce one full O/D matrix for passenger trips for the first period for private car.

3. Multiply the matrix produced in step 2 by the hourly fluctuation factors for private car to produce hourly full O/D matrices for passenger trips for private car (second method).

Total volumes of matrices produced under 4.5 are shown in the following charts.

Zonal Productions and Attractions Calculated by the two

Methods for the Different Hours of the Morning Period

Zone No.	Zone Name	7:00 - 8:00				8:00 - 9:00			
		Attraction		Production		Attraction		Production	
		M_2*	M_1 **	M_2	M_1	M_2	M_1	M_2	M_1
21101	Garden City	1451	2347	723	408	2098	1271	1051	1133
21102	Area of Ministries	1393	1455	782	794	2022	2314	1135	1014
21201	El-Tahrir	2105	2317	465	314	2055	3357	675	450
21202	Talaat Harb	2025	1887	930	462	2930	3443	1341	1005
21203	Attaba	1555	893	325	382	2252	2618	471	389
21204	Abdin	963	471	437	405	1392	709	635	668
21205	Klot Beik	75	0	151	40	110	91	223	627
21206	Tawfikia	1512	977	217	156	2188	2107	318	252
21207	Ramsis	2580	2774	922	927	3738	2994	1339	1284
21501	Azhar	788	503	131	206	1154	1053	195	176
21503	Bab El-Sheria	127	0	1087	227	136	179	1570	4123

M_1^{**} = Method 1

M_2^{*} = Method 2

Zonal Productions and Attractions Calculated by the Two Methods for the Different Hours of the Morning Period (cont.)

Zone No.	9:00 10:00				10:00 11:00			
	Attraction		Production		Attraction		Production	
	M_2	M_1	M_2	M_1	M_2	M_1	M_2	M_1
21101	1884	1742	944	791	1811	1925	901	1488
21102	1813	1750	1010	1041	1744	1481	979	1097
21201	2736	2397	603	530	2631	2527	573	1233
21202	2633	2145	1205	1117	2537	2839	1158	2496
21203	2021	2329	422	238	1944	1965	405	729
21204	1251	692	569	429	1024	3201	548	774
21205	96	227	200	4	92	43	192	125
21206	1962	802	289	164	1889	4044	279	625
21207	3355	2692	1204	610	3230	4634	1156	2118
21501	1029	989	172	148	984	1476	165	116
21503	167	444	1406	457	160	0	1352	624

2.2.5 List of the Computer Output Prints and the Data Recorded on Magnetic Tapes

(Vehicular Survey)

Computer Output Prints of Vehicular Survey

C.O.N.	Description	Modes				
		Private Cars	Taxi	Mic. Bus	Private Bus	All Modes
0-0	Sample, count, and sample size ratio at each station by hour, period, and all day, for each mode.	✓	✓	✓	✓	✓
0-a.1	Cordon zones O/D pairs	—	—	—	—	✓
0-a.2	Through movements O/D pairs.	—	—	—	—	✓
0-a.3	Total mapped O/D pairs	—	—	—	—	✓
0-b	O/Dpairs movements caught by different number of stations.	✓	✓	✓	✓	—
0-c	Mapped O/D pairs caught at interview stations.	✓	✓	✓	✓	✓
I	List of validated data as input to the program with O/D pairs having irrelevant stations	✓	✓	✓	✓	—
II	List of sorted validated input data by origin/destimation with O/D pairs having irrelevant stations.	✓	✓	✓	✓	—

164

C.O.N.	Description	Modes				
		Private Cars	Taxi	Mic. Bus	Private Bus	All Modes
III	List of validated O/D pairs excluding O/D pairs having no probability to be interviewed.	✓	✓	✓	✓	—
IV	List of cordon/screen Line stations and O/D pairs visiting them.	✓	✓	✓	✓	—
V-a	Partially filled sample O/D matrices by trip purpose for vehicle trips.	✓	✓	✓	✓	—
V-b	Partially filled sample O/D matrices by trip purpose for passenger trips	✓	✓	✓	✓	—
VI-a	Partially filled enlarged rough O/D matrices by trip purpose for vehicle trips.	✓	✓	✓	✓	—
VI-b	Partially filled enlarged rough O/D matrices by trip purpose for passenger trips.	✓	✓	✓	✓	—
VII-a	List of sample O/D volumes assigned to 61 stations, station count, and ratio between them.	✓	—	—	—	—

165

C.O.N.	Description	Modes				
		Private Cars	Taxi	Mic. Bus	Private Bus	All Modes
VII-b	Values of r & R obtained during balancing the assigned enlarged cells divided by the stations traffic counts at cordon and screen line stations.	✓	✓	✓	✓	—
VII-c	Total partially filled Refined enlarged O/D matrix for vehicle trips(output of iter-active balacncing pro-cedures).	✓	✓	✓	✓	—
VII-d	List of correction factors for probability to be interviewed	✓	✓	✓	✓	—
VII-e	Sum of differences between refined and rough enlarged total O/D matrices	✓	✓	✓	✓	—
VIII-a	Values of r & R for different cycles of the iterative balancing procedured when considering Nile Screen line stations only.	✓	—	—	—	—

166

C.O.N.	Description	Modes				
		Private Cars	Taxi	Mic. Bus	Private Bus	All Modes
VIII-b	Refined matrix based on iterating on screen line stations only	✓	—	—	—	—
VIII-c	List of correction factors for probability to be interviewed (screen line stations).	✓	—	—	—	—
VIII-d	Sum of differences between rough & enlarged O/D volumes (screen stations).	✓	—	—	—	—
IX-a	Cairo network description.	—	—	—	—	✓
IX-b	Minimum travel time matrix.	—	—	—	—	✓
X-a.1	Partially filled enlarged total O/D matrix for passenger trips [80 zones (before gravity)]	✓	✓	✓	✓	—
X-a.2	Partially filled enlarged total O/D matrix for passenger trips [108 zones (before gravity)]	✓	✓	✓	✓	—
X-b	Results of Coefficients q, x, F by the different cycles.	✓	✓	✓	✓	—

167

C.O.N.	Description	Modes				
		Private Cars	Taxi	Mic. Bus	Private Bus	All Models
X-c	Partially filled Refined enlarged total O/D Matrix for passenger trips (after gravity)	✓	—	—	—	—
X-d	Full O/D Matrix, all purposes, all hours for passenger trips.	✓	✓	✓	✓	—
XI	Full O/D Matrix for passenger trips (one minute class interval)	✓	—	—	—	—
XII	Full O/D Matrix for passenger trips (two minute class interval)	✓	✓	—	—	—
XIII	Full O/D Matrix for passenger trips (three minute class interval)	✓	—	—	—	—
XIV	Full O/D Matrix for passenger trips(four minute class interval)	✓	—	—	—	—
XV	Full O/D Matrix for passenger trips(five minute class intervals)	✓	—	—	—	—

C.O.N.	Description	Modes				
		Private Cars	Taxi	Mic. Bus	Private Bus	All Models
XVI	Full O/D Matrix for passenger trips(nine minute class interval)	✓	—	—	—	—
XVII	Hourly fluctuation factors by trip purpose	✓	✓	✓	✓	—
XVIII	Occupancy rates by trip purpose	✓	✓	—	—	—
IXX	Partially filled O/D matrices by purpose for passenger trips	✓	✓	—	—	—
XX	Full O/D matrices by purpose for passenger trips.	✓	✓	—	—	—
XXI	Non -directional O/D matrices.	✓	✓	—	—	—
XXII	Directional factor matrices	✓	✓	—	—	—
XXIII	Zones trip information	✓	✓	—	—	—

C.O.N.	Description	Modes				
		Private Cars	Taxi	Mic. Bus	Private Bus	All Models
XXIV	Partially filled rough enlarged O/D matrices by hour (morning period for passenger trips.	✓	✓	✓	✓	—
XXV	Full O/D matrices by hour for passenger trips (morning period).	✓	✓	✓	✓	—
XXVI	Check Assignment Run	-	-	-	-	✓

170

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	:	Out 1 O/D Survey
2.	File Description	:	- Vehicular Survey 1977 - Count M/T - Record for each Hour of each Station
3.	Keys	:	Station/Hour
4.	Number of Records	:	
5.	Record Type	:	☐ Variable Length ☑ Fixed Length
6.	Record Length	:	82 ch.
7.	Medium	:	M/T
8.	Location	:	NCC (ICL - 1906)
9.	Serial Numbers# / Number of Tracks	:	1. 222012/7 2. 31/9 3. 4. 5.

At The Project Computer Library

171

FORM No. : 2

RECORD LAYOUT

File Name : OUT 1 O/D SURVEY

Description	Format	Field #
Station #	I3	1
Hour	I2	2
	2X	3
Volume of Mode 2 (Private Car)	I6	4
3 (Taxi)	I6	5
4 (Micro - Bus)	I5	6
5 (Private - Bus)	I5	7
6 (Public Transit Bus)	I5	8
7 (Tram)	I5	9
8 (Trolly Bus)	I5	10
9 (Pick up Truck)	I5	11
10 (Truck)	I5	12
11 (Tractor - Trailer)	I5	13
12 (Bicycle / Motorcycle)	I5	14
13 (Animal - Cart)	I5	15
14 (Human - Cart)	I5	16
		17
		18
		19
		20

FORM NO. : 1

FILE SPECIFICATION

1. File Name	:	Station 1
2. File Description	:	- Vehicular Survey 1977 - Decoded M/F - Working File 1
3. Keys	:	Mode / Hour
4. Number of Records	:	94, 023 Rec
5. Record Type	:	☐ Variable Length ☑ Fixed Length
6. Record Length	:	43 ch.
7. Medium	:	M/T
8. Location	:	NCC (ICL - 1906)
9. Serial Numbers#/ Number of Tracks	:	1. 102/7 2. 3. 4. 5.

At The Project Computer Library

173

FORM NO. ¥ 2

RECORD LAYOUT

File Name : STATION 1

Description	Format	Field #
Mode	A_4	1
Origin #	A_4	2
Destination #	A_4	3
Station #	A_4	4
Hour	A_4	5
Minute	A_4	6
Serial	A_4	7
Number of Passengers	A_4	8
Purpose	A_4	9
Parking Zone	I5	10
Governorate	I2	11
		12
		13
		14
		15
		16
		17
		18
		19
		20

174

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	:	Station 2
2.	File Description	:	- Vehicular Survey 1977 - Decoded M/F - Working File 2
3.	Keys	:	Mode/Orgig./Dest./Stat./Hour
4.	Number of Records	:	94,023 Rec.
5.	Record Type	:	☐ Variable Length ☑ Fixed Length
6.	Record Length	:	43 ch.
7.	Medium	:	M/T
8.	Location	:	NCC (ICL _ 1906)
9.	Serial Numbers#/ Number of Tracks	:	1. 103/7 2. 3. 4. 5.

At The Project Computer Library

FORM NO. : 2

RECORD LAYOUT

File Name : STATION 2

Description	Format	Field #
Mode	A_4	1
Origin #	A_4	2
Destination #	A_4	3
Station #	A_4	4
Hour	A_4	5
Minute	A_4	6
Serial	A_4	7
Number of Passengers	A_4	8
Purpose	A_4	9
Parking Zone	I5	10
Governorate	I2	11
		12
		13
		14
		15
		16
		17
		18
		19
		20

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	:	Private
2.	File Description	:	- Decoded, Sorted, Valid, M/F - Secod, Generation
3.	Keys	:	Mode/Origin/Destination/Station/Hour
4.	Number of Records	:	90,824 Rec.
5.	Record Type	:	☐ Variable Length ☑ Fixed Length
6.	Record Length	:	43 chr.
7.	Medium	:	M/T
8.	Location	:	NCC (ICL - 1906)
9.	Serial Numbers # / Number of Tracks	:	1. 104/7 2. 3. 4. 5.

At The Project Computer Library

177

FORM NO. : 2

RECORD LAYOUT

File Name : PRIVATE

Description	Format	Field #
Mode	A_4	1
Origin #	A_4	2
Destination #	A_4	3
Station #	A_4	4
Hour	A_4	5
Minute	A_4	6
Serial	A_4	7
Number of Passengers	A_4	8
Purpose	A_4	9
Parking Zone	I5	10
Governorate	I2	11
		12
		13
		14
		15
		16
		17
		18
		19
		20

178

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	:	Private 2
2.	File Description	:	Vehicular Survey 1977 M/F Based on Total Mapped OD Pairs
3.	Keys	:	Mode/Origin/Destination/Station/Hour
4.	Number of Records	:	51,851 Rec. (for all modes)
5.	Record Type	:	☐ Variable Length ☑ Fixed Length
6.	Record Length	:	43 ch.
7.	Medium	:	M/T
8.	Location	:	NCC (ICL - 1906)
9.	Serial Numbers#/ Number of Tracks	:	1. 106/7 2. 3. 4. 5.

At The Project Computer Library

RECORD LAYOUT

FORM NO. : 2

File Name : PRIVATE 2

Description	Format	Field #
Mode	A_4	1
Origin #	A_4	2
Destination #	A_4	3
Station #	A_4	4
Hour	A_4	5
Minute	A_4	6
Serial	A_4	7
Number of Passengers	A_4	8
Purpose	A_4	9
Parking Zone	I5	10
Governorate	I2	11
		12
		13
		14
		15
		16
		17
		18
		19
		20

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	:	New Master
2.	File Description	:	- Vehicular Survey 1977 - Private Car M/F - Last Generation - Final M/F with Refined EF
3.	Keys	:	Mode/Origin/Destination/Station/Hour
4.	Number of Records	:	25,582 Records (mode car only)
5.	Record Type	:	☐ Variable Length ☑ Fixed Length
6.	Record Length	:	32 ch.
7.	Medium	:	M/T
8.	Location	:	NCC (ICL - 1906)
9.	Serial Numbers # / Number of Tracks	:	1. 300073/7 2. 110/7 3. 762/9 4. 766/9 5.

At The Project Computer Library

FORM NO. : 2

RECORD LAYOUT

File Name : NEW MASTER

Description	Format	Field #
Mode		1
Origin #		2
Destination #		3
Station #		4
Hour		5
Serial		6
Number of Passengers		7
Purpose		8
Parking Zone		9
Governorate		10
Enlargement Factor		11
		12
		13
		14
		15
		16
		17
		18
		19
		20

182

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	:	Sort O/D Tape 7
2.	File Description	:	- Vehicular Survey 1977 - Master File - First Generation - Record for each Trip
3.	Keys	:	Mode/Hour
4.	Number of Records	:	113, 211 Rec.
5.	Record Type	:	☐ Variable Length ☑ Fixed Length
6.	Record Length	:	32 ch.
7.	Medium	:	M/T
8.	Location	:	NCC (ICL - 1906)
9.	Serial Numbers #/ Number of Tracks	:	1. 222662/7 2. 11/9 3. 4. 5.

At The Project Computer Library

FORM NO. : 2

RECORD LAYOUT

File Name : SORT OD TAPE 7

Description	Format	Field #
Station #	I3	1
Hour	I2	2
Minute	I2	3
Serial	I2	4
Mode	I2	5
Number of Passenger	I2	6
Origin Code	I5	7
Destination Code	I5	8
Purpose	I2	9
Parking Zone	I5	10
Governorate	I2	11
		12
		13
		14
		15
		16
		17
		18
		19
		20

FORM NO. : 2

184

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	:	Final Taxi
2.	File Description	:	- Vehicular Survey 1977 - Taxi M/F - Last Generation - Final M/F with Refined EF
3.	Keys	:	Mode/Origin/Testination/Station/Hour
4.	Number of Records	:	13,135 Records (Mode Taxi Only)
5.	Record Type	:	☐ Variable Length ☑ Fixed Length
6.	Record Length	:	32 ch.
7.	Medium	:	M/T
8.	Location	:	NCC (ICL - 1906)
9.	Serial Numbers#/ Number of Tracks	:	1. 707/9 2. 744/9 3. File Store 4. 5.

At The Project Computer Library

FORM NO. : 2

RECORD LAYOUT

File Name : FINAL TAXI

Description	Format	Field #
Mode	I1	1
Origin #	I3	2
Destination #	I3	3
Station #	I3	4
Hour	I2	5
Serial	I2	6
Number of Passengers	I2	7
Purpose	I1	8
Parking Zone	I5	9
Governorate	I2	10
Enlargement Factor	F8.3	11
		12
		13
		14
		15
		16
		17
		18
		19
		20

186

2.3 Public Transport Survey Data Processing

The functional design of the public transport survey data processing is presented in this section. The system levels are shown in the system hierarchy diagram Fig. (I-22). The system design consisted of two main phases:

a. Phase I - data preparation and validation

b. Phase II - producing trip characteristics.

The design and the implementation of Phase I and most of Phase II were completely finished and documented in a final report (3). For more details the reader can refer to this report.

Objectives of the system design were to:

1. provide a valid data base for the public transport survey 1978,
2. produce trip information required for travel demand forecasting and network improvements for public transport.

2.3.1 Phase I: Data Preparation & Validation

This phase was divided into three stages as follows:

1. Data Collection

Data was collected using four main forms; and three secondary forms (see reference (3)). Each form has a unique purpose as discussed in detail in the same reference. Data collected amounted to 282,000 interviews collected over 10 hours per day for 5 days.

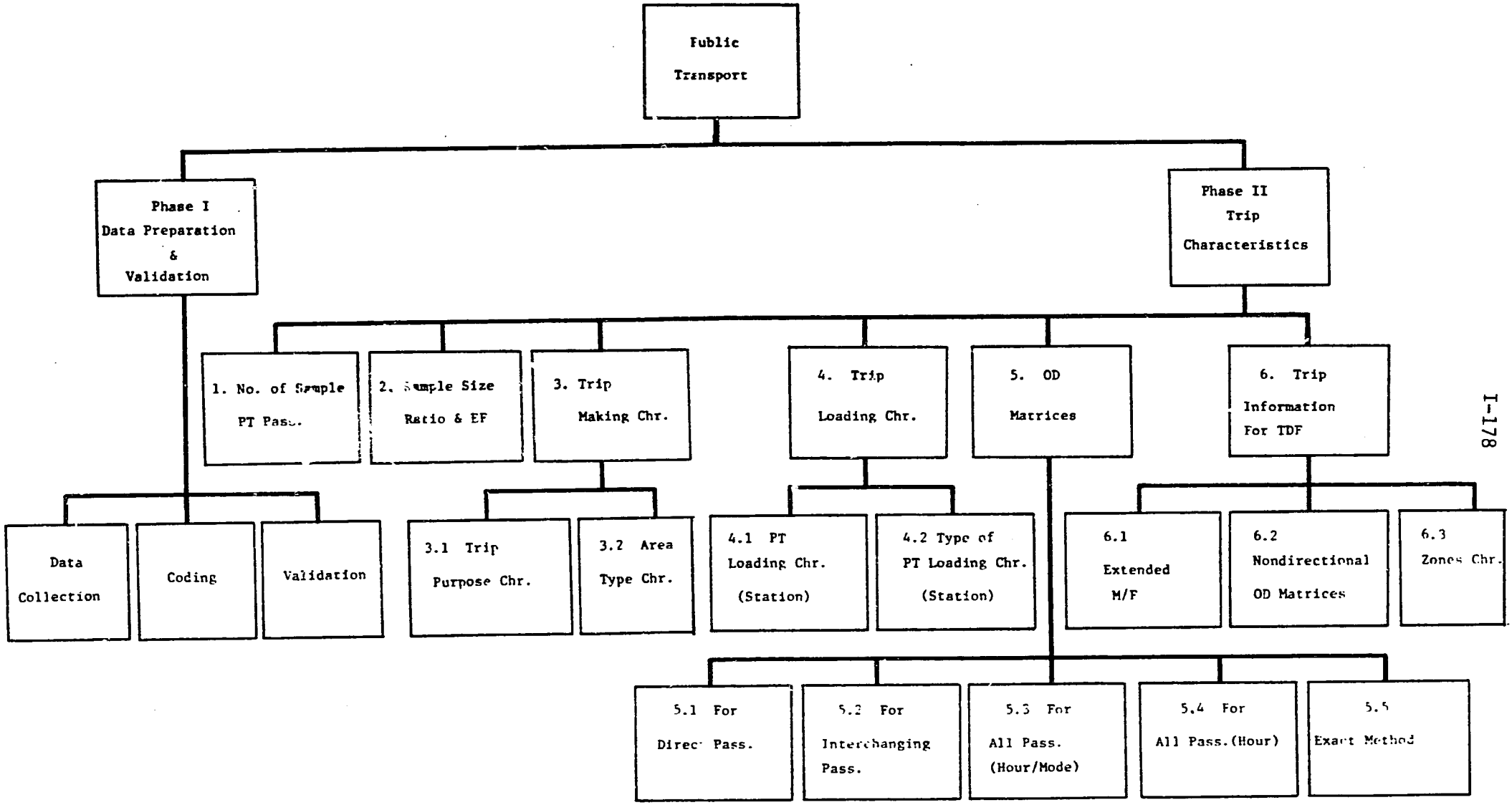


Figure 1-22 : Public Transport Survey Data Processing Computer System Hierarchy Diagram

2. Coding

Different codes were used for mode, line, sex, trip purpose, zones station number, and trip transfers. (Details in reference (3).)

3. Data Preparation and Validation

Data were recorded two trips per line and stored on magnetic tape subfiles which were subject to a well-designed validation cycle, shown in Fig. (I-23). Possible errors were classified into four types,

a. Address error,
b. Cap error,
c. Primary error, concerning zones, purpose, serial, and
d. Secondary error, concerning other trip items.

After applying different validation rules, a final valid master file was produced. (Details in reference (3).)

2.3.2 Phase II: Producing Trip Characteristics

The purpose of this phase was to produce:

1. Origin/destination matrices representing the trip movement between zones by mode and hours of day for direct and transferring passengers.

2. A data set representing the trip characteristics of each zone in a pattern suitable for transport planning and research purposes.

The steps for producing origin/destination matrices described in this section are modifications to the procedures described in the 1978 report (Ref. (3)). These steps were determined in the light of the analysis of the first results of the 1978 report and are considered as the final correct O/D matrices of the public transport survey.

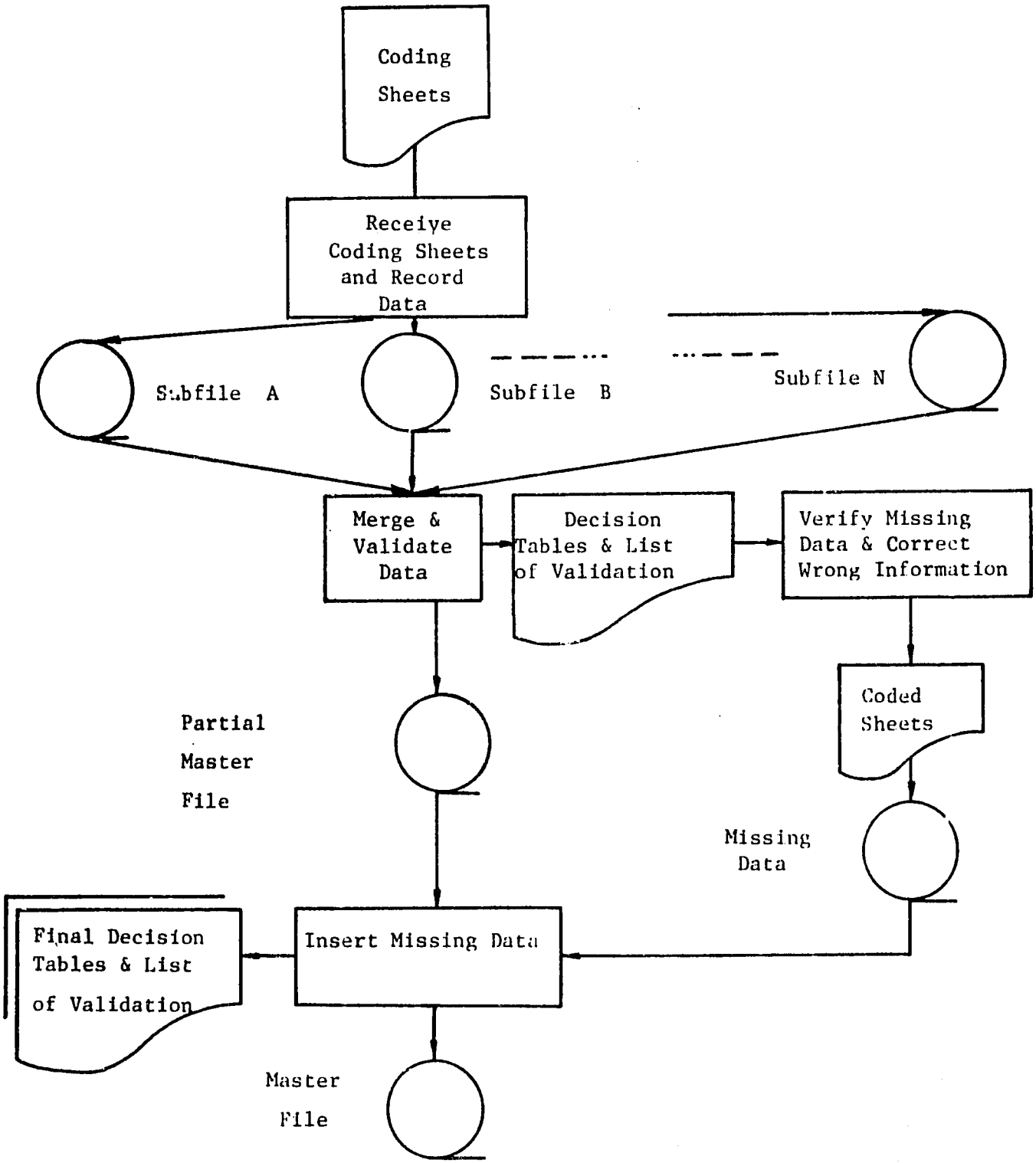


Fig. (I-23):Data Validation Cycle

Also, to get zone characteristics, trip volume, and socio-economic values in a pattern suitable for trip generation forecasting models, a new extended master file, sorted by origin/destination/mode/hour, was produced; this is shown in subsystem (6) of Fig. (I-22). A new purpose code was produced by grouping the original codes in Ref. (3) into new groups, as follows:

The Transit Purpose/Code Combinations

Purpose	Code	Consist of	Original Transit Master File Code
HBW	1	H/W & W/H & H/E & E/H	1/2 & 2/1 & 1/3 & 3/1
HBS	2	H/S & S/H	1/4 & 4/1
HBO	3	H/O & O/H	1/5 & 5/1
HBSO	4	H/S & S/H & H/O & O/H	1/4 & 4/1 & 1/5 & 5/1
NHB	5	W/W & O/O & W/O & O/W & O/E & E/O & E/W & W/E	2/2 & 5/5 & 2/5 & 5/2 & 5/3 & 3/5 & 2/3 & 3/2
ALL	6	ALL	All of the above codes

where : H Home
W Work
E Education
S Shopping
O Other

Each block in the hierarchial diagram of phase II of Fig. (I-22) is described in the following pages in an overview diagram. A list of the computer output prints as well as the data recorded on magnetic tapes of the public transport survey is given at the end of this section.

No. of Sample PT Pass.

- No. of Pass by Line/Hour
- No. & Percentage of Pass by Mode/hour
- Percentage of Direct Pass by Mode/Line/Hour.
- Percentage of Direct Pass by Mode/Hour

INPUT

1. Mode
   Line
   Time
   Total No of Passengers per line/time
2. The No. of direct & interchanging Passengers.

PROCESS

1. Get the total No. of passengers for a mode and their %
2. Get the total No. of passengers for a certain time & their %.
3. Calculate the No. of direct and interchanging passengers.
4. Find percentage of direct passengers
   a. by mode/line/hour
   b. by mode/hour

OUTPUT

1. No. of Passenger by line/hour (C.O.N. 2)
2. No. of passenger and percentages by mode/hour (C.O.N. 3)
3. Also for each
   - Mode, line hour (C.O.N.4),or
   - Mode, hour (C.O.N. 5)
     a. No. of passengers
     b. No. of interchanging passengers only
     c. No. of direct passengers
     d. Percentage of direct passengers to the total

192

2. Sample Size Ratio & EF

INPUT	PROCESS	OUTPUT
1. Total No. of Passengers 2. No. of Interviewed Passengers	1. Get Sample Size Ratio (SSR) 2. Get Enlargement Factor (EF)	SSR & EF by Line by Mode for each Hour. (C.O.N. 6, 6A)

193

3.1 Trip Purpose Characteristics

3.1.1 Trip Making Chr's by Trip Purpose and Time

INPUT

For each trip purpose

1. (O & D)
2. Sex
3. Time

PROCESS

1. Calculate the No. of trips by time of the day and by mode for each trip Purpose.
2. Percentage of trips by time of the day and by mode for each trip purpose.
3. Percentage of trips by trip purpose for each hour and for each mode

OUTPUT

1. Trip making characteristics by trip purpose and time (C.O.N. 9)
2. Trip making characteristics by trip purpose by mode (C.O.N. 10)

3.1.2 Trip Making Chr's by Purpose and Mode.

3.2 Area Type Characteristcs

3.2.1 Trip Making/Area Type Chr's by Mode & Hour

INPUT

For each trip :

1. Purpose
2. Sex
3. Mode

PROCESS

1. Calculate the No. of trips by mode and O/D area type for each hour and for the whole survey period
2. Percentage of trips by mode for each O/D area type for each hour (and for the whole survey period)
3. Percentage of trips by O/D area type for each mode for each hour (and for the whole survey period)

3.2.2 Trip Making/Area Type Chr's by Mode

OUTPUT

Tables indicating the kind of P T trips according to O/D area types. (C.O.N. 11, 12)

4.1 Public Transport Loading Characteristcs by Stations

4.1.1 Trip Interchanging by Mode and Station

INPUT

For each trip :

1. Mode
2. Station (O & D & I)

PROCESS

Calculate the no. of trips at each station according to :

a) The interchanged trips, and

b) The mode interchange

OUTPUT

1. No. of interchanging trips between modes by stations & percentages (C.O.N. 13)
2. PT station loading trips (originating, destinating or interchanging) by mode (C.O.N. 14)

4.1.2 Public Transport Stations Loading by Mode

4.2 Type of Public Transport Loading Characteristcs

4.2.1 Pt Station Loading for All Modes

INPUT

For each trip :

1. Station (O & D & I)
2. Area type

PROCESS

Calculate the no. of trips at each station for :

1. Each area type
2. For all modes

OUTPUT

1. PT station loading trips (originating, destinating, or interchanging) for all modes (C.O.N. 15)
2. PT station loading by area types (C.O.N. 16)

4.2.2 Trip Making/Area Types at each Station

5.1 O/D Matrices for Direct Passengers

INPUT

1. No. of direct interviewed passengers (decoded M/F by mode/hour/line).
2. Enlargement factor (mode/hour/line).

PROCESS

1. Check the direct trips.
2. Get O/D Matrix for each hour of each mode.
3. Sort O/D matrices by hour/mode

OUTPUT

1. matrices by mode/hour for direct passengers.
2. matrices by hour for direct passengers (C.O.N. 20)

5.2 O/D Matrices for Interchanging Passengers

5.2.1 O/D Matrices by Hour/Mode

INPUT

1. The number of interviewed passengers who interchange (decoded M/F by hour/mode/line.)
2. Enlargement factor by hour/mode/line

PROCESS

1. Check the interchange
2. Get the O/D Matrix of interchange for each hour of each mode.

5.2.2 O/D Matrices by Hour

OUTPUT

1. O/D matrices of interchanging passengers by hour/mode (C.O.N. 17).
2. O/D matrices of interchanging passengers by hour.

5.3 O/D Matrices for All Passenger (Hour/Mode)

INPUT	PROCESS	OUTPUT
1. O/D matrices of direct passengers by hour/mode. (C.O.N. 20) 2. O/D matrices of interchanging passengers by hour/mode (C.O.N. 17)	Sum up the two matrices to produce O/D matrices for all passengers by hour/mode.	O/D Matrices for all passengers by hour/mode. (C.O.N. 7 Modified)

292

5.4 O/D Matrices All Passengers

(Hour)

INPUT	PROCESS	OUTPUT
O/Dmatrices for all passengers by hour/mode (C.O.N. 7m)	Sum O/D matrices for each hour.	O/D matrices for each hour of the survey for all passengers (C.O.N. 8 modified).

5.5 O/D Matrices (Exact Method)

5.5.1 O/D Matrices by Mode by Hour (Second Method)

INPUT

O/D pairs of all passengers (M/F)

PROCESS

1. Get exact O/D matrices
2. Get O/D error & relative error matrices

OUTPUT

1. Exact O/D matrices by mode by hour. (C.O.N. 18)
2. O/D error & relative error matrices (C.O.N. 19)

5.5.2 O/D Error & Relative Error Matrices

6.1 Extended M/F

INPUT

1. Decoded M/F sorted by mode/hour/line.
2. EF file sorted by mode/hour line.

PROCESS

1. Cancel itra-zonal trips and trips of hour 15.
2. Convert home based trips to be non-directional.
3. Group purposes of trips into new codes.
4. Merge the EF with the trip records.
5. Sort by orig./dest./mode/hour.

OUTPUT

Extended M/F for non-directional and new purpose coded trips, sorted by origin/dest./mode/hour. Number of records in this master file was 257,415

6.2 Nondirectional O/D Matrices

6.3 Nondirectional Sample O/D Matrices

Extended M/F

1. Get sample O/D matrices for GC 6 matrices 120, zones.
2. Get attraction and production for the following :
   a. Sample trips of CBD
   b. Sample trips of GC
   c. Enlarged of GC
   d. Enlarged trips of external area.

6.4 Attraction & Production

1. Non-directional sample O/D matrices.
2. Attraction and Production for sample, enlarged, CBD, GC, and external area.

6.3 Zones Characteristics

INPUT

1. Attraction and production values of enlarged trips of GC.
2. Socio-economic values of GC zones.

PROCESS

For each zone, merge socio-economic values with the trip volumes, attraction and production.

OUTPUT

A set of observations representing the zones characteristics ; C.O.N.

2.3.3 List of the Computer Printouts and the Data Recorded on Magnetic Tapes (Public Transport Survey)

List of Computer Printouts of the

Public Transport Survey of 1978

Volume*	C.O.N.	Description
Vol.(1)	1	Table of Contents of Public Transportation Survey.
	2	No. of Passengers by Line by Time
	3	No. of Public Transport Passengers by Mode by Hour and Percentage Carried by Each Mode During Every Hour of the Survey Period.
Vol. (2)	4	No. of Passengers Interviewed by Interchange by Line by Mode.
	5	No. of Passengers Interviewed by Interchange by Mode and the Same (For Valid Adress Records Only)
Vol. (3)	6	Sample Size Ratio and Enlargement Factos by Mode by Line for Each Hour.
Vol. (4) to Vol. (69)	7	O/D Matrices by Mode by Hour; Modes are: Bus, Tram Trolly, Metro, Ferry, Railways Hours : 6,7,8,9,10,11,12,13,14,15, All
Vol. (70) to Vol. (80)	8	O/D Matrices by Hour on all Modes Hours : 6,7,8,9,10,11,12,13,14,15,All

* The computer Printouts are bound in volumes serially numbered as given in this column. These volumes are kept in the Project library.

Volume*	C.O.N.	Description
Vol. (81)	9	a) Number of Trips by Time of the Day for each Trip Purpose. b) Percentage of Trips by Time of Day for each Trip Purpose. c) Percentage of Trips by Trip Purpose for each Hour.
	10	a) Number of Trips by Mode and Trip Purpose. b) Percentage of Trips by Mode for each Trip Purpose. c) Percentage of Trips by Trip Purpose for each Mode.
Vol. (82)	11	a) Number of Trips by Mode and O/D Area Type by Sex b) Percentage of Trips by Mode for each O/D Area Type by Sex. c) Percentage of Trips by O/D Area Type for each by Sex
	12	a) Number of Trips by Mode and O/D Area Type b) Percentage of Trips by Mode for each O/D Area Type c) Percentage of Trips by O/D Area Type for each Mode

Volume	C.O.N.	Description
Vol. (83)	13	a-1) Number of Interchange Trips Between Modes by Stations. b-1) Percentage of Interchange Trips Between Modes for all Stations. c-1) Percentage of Interchange Trips in the Stations for each Interchanging Mode. a-2) Number of Interchange Trips Between Modes by Stations. b-2) Percentage of Interchange Trips Between Modes for each Station. c-2) Percentage of Interchange Trips in the Stations for each Interchanging Mode.
Vol. (84)	14	Trips originated or Destinating or Interchanging at P T Stations by Mode.
	15	Trips Originated or Destinating or Interchanging at P T Stations for all Modes.
	16	a) Number of Trips for O/D Area Type of each Station. b) Percentage of Trips for O/D Area Type of each Station. c) Percentages.
Vol.(85) to Vol.(161)	17	Matrix of Interchanging Passengers for the Modes : Bus, Tram, Trolly, Metro, Ferry, Railways all Modes. Time : 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, All.

Volume	C.O.N.	Description
Vol.(162) to Vol.(238)	18	a) O/D Matrix by Hour Mode for all Passengers (Second Method) Mode: Bus, Tram, Trolly, Metro, Ferry, Railways, all Modes. Time: 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, All.
Vol.(239) to Vol.(315)	18	b) O/D Error Matrix by Hour by Mode. Mode: Bus, Tram, Trolly, Metro, Ferry, Railways, all Modes. Time: 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, All .

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	:	Master File
2.	File Description	:	- Public Transport Survey 1978 - Decoded, Valid M/F
3.	Keys	:	Mode, Hour, Line #
4.	Number of Records	:	280,732 Rec.
5.	Record Type	:	☐ Variable Length ☑ Fixed Length
6.	Record Length	:	39 ch.
7.	Medium	:	M/T
8.	Location	:	NCC (ICL - 1906)
9.	Serial Numbers # / Number of Tracks	:	1. 105/9 2. 3. 4. 5.

At The Project Computer Library

FORM NO. : 2

RECORD LAYOUT

File Name : MASTER FILE

Description	FORMAT	FIELD #
Mode #	I1	1
Line #	I4	2
Day	I1	3
Hour	I2	4
Minute	I2	5
Volume per Hour	I5	6
Serial	I3	7
Sex	I1	8
Origin Purpose	I1	9
Origin Station #	I2	10
Origin #	I5	11
Destination Purpose	I1	12
Destination Station #	I2	13
Destination #	I5	14
Identifier	I1	15
Interchanging Mode #	I1	16
Interchanging Station #	I2	17
		18
		19
		20

212

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	: Master File 1
2.	File Description	: -Public Transport Survey 1978 -Decoded Valid M/F
3.	Keys	: Hour/Mode/Line/Origin/Dest.
4.	Number of Records	: 280,732 Rec.
5.	Record Type	: ☐ Variable Length ☑ Fixed Length
6.	Record Length	: 39 ch.
7.	Medium	: M/T
8.	Location	: NCC (ICL - 1906)
9.	Serial Numbers #/ Number of Tracks	: 1. 404/9 2. 3. 4. 5.

At The Project Computer Library

FORM NO. : 2

RECORD LAYOUT

File Name : MASTER FILE 1

Description	Format	Field #
Mode #	I1	1
Line #	I4	2
Day	I1	3
Hour	I2	4
Minute	I2	5
Volume per Hour	I5	6
Serial	I3	7
Sex	I1	8
Origin Purpose	I1	9
Origin Station #	I2	10
Origin #	I5	11
Destination Purpose	I1	12
Destination Station #	I2	13
Destination #	I5	14
Identifier	I1	15
Interchanging Mode #	I1	16
Interchanging Station #	I2	17
		18
		19
		20

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	:	Master File 2
2.	File Description	:	- Public Transport Survey 1978 - Decoded, Valid M/F - Corrected Data with EF for each Record.
3.	Keys	:	Mode/Hour/Line
4.	Number of Records	:	280,732 Rec.
5.	Record Type	:	☐ Variable Length ☑ Fixed Length
6.	Record Length	:	39 ch.
7.	Medium	:	M/T
8.	Location	:	NCC (ICL - 1906)
9.	Serial Numbers # / Number of Tracks	:	1. 331 / 9 2. 3. 4. 5.

At The Project Computer Library

FORM NO. : 2

RECORD LAYOUT

File Name : MASTER FILE 2

Description	Format	Field #
Mode #	I1	1
Line #	I4	2
Day	I1	3
Hour	I2	4
Volume for Hour	I5	5
Serial	I3	6
Sex	I1	7
Origin Purpose	I1	8
Origin Station #	I2	9
Origin #	I3	10
Destination Purpose	I1	11
Destination Station #	I2	12
Destination #	I3	13
Identifier	I1	14
Interchanging Mode #	I1	15
Interchanging Station #	I2	16
Enlargement Factor	F6.2	17
		18
		19
		20

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	:	NEWEF2
2.	File Description	:	- Public Transport Survey 1978 - Enlargement Factor M/F
3.	Keys	:	Mode / Hour / Line .
4.	Number of Records	:	
5.	Record Type	:	▫ Variable Length ▫ Fixed Length
6.	Record Length	:	35 chr.
7.	Medium	:	M/F
8.	Location	:	NCC (ICL - 1906)
9.	Serial Numbers # / Number of Tracks	:	1. File Store 2. 3. 4. 5.

At The Project Computer Library

FORM NO. : 2

RECORD LAYOUT

File Name : NEWEF 2

Description	Format	Field #
Mode #	I1	1
Line #	I4	2
Hour	I4	3
Sample Volume	I5	4
Total No. of Passengers	I5	5
Sample Size Ratio	F8.3	6
Enlargement Factor	F8.3	7
		8
		9
		10
		11
		12
		13
		14
		15
		16
		17
		18
		19
		20

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	:	NEWEF3
2.	File Description	:	- Public Transport Survey 1978 - Enlargemnet Factor M/F - Final Valid Copy
3.	Keys	:	Mode / Hour / Line
4.	Number of Records	:	
5.	Record Type	:	☐ Variable Length ☐ Fixed Length
6.	Record Length	:	
7.	Medium	:	M/T
8.	Location	:	NCC (ICL - 1906)
9.	Serial Numbers# / Number of Tracks	:	1. File Store 2. 3. 4. 5.

At The Project Computer Library

FORM NO. : 2

RECORD LAYOUT

File Name : NEWEF 3

Description	FORMAT	FIELD #
Mode #	I1	1
Line #	I4	2
Hour	I4	3
Sample Volume	I5	4
Total No. of Passengers	I5	5
Sample Size Ratio	F8.3	6
	F8.3	7
Enlargement Factor		8
		9
		10
		11
		12
		13
		14
		15
		16
		17
		18
		19
		20

FORM NO. : 1

FILE SPECIFICATION

1.	File Name	: NEWEF4
2.	File Description	: - Public Transport Survey 1978 - Enlargement Factor M/F - Final Valid Copy
3.	Keys	: Hour / Mode / Line
4.	Number of Records	:
5.	Record Type	: ☐ Variable Length ☐ Fixed Length
6.	Record Length	:
7.	Medium	: M/T
8.	Location	: NCC (ICL - 1906)
9.	Serial Numbers# / Number of Tracks	: 1. File Store 2. 3. 4. 5.

At The Project Computer Library

FORM NO. : 2

RECORD LAYOUT

File Name : NEWEF 4

Description	Format	Field #
Mode #	I1	1
Line #	I4	2
Hour	I4	3
Sample Volume	I5	4
Total No. of Passengers	I5	5
Sample Size Ratio	F8.3	6
Enlargement Factor	F8.3	7
		8
		9
		10
		11
		12
		13
		14
		15
		16
		17
		18
		19
		20

3. Base Year Assignment Check Computer Run

A computer assignment run was carried out using the 1977 peak hour matrix in passenger car equivalents (PCEs) together with the 1977 coded street network to test the assignment model and to make sure that the network was properly coded.

This matrix was produced by the following procedure:

i) Produce full hourly modal O/D matrices for urban passenger trips as was discussed in section (2.3.4.4) of this report.*

ii) Produce enlarged hourly modal O/D matrices for rural/urban passenger trips.

iii) Merge the matrices obtained in steps (i), (ii) to produce modal hourly O/D matrices for passenger trips for the whole study area.

iv) Get two occupancy rates for each mode, one for the intra urban area and the other for the rural/urban movements.

v) For each one of the matrices produced in step (iii), do the following:

   a. Divide each cell by the occupancy rate of the area and mode.

   b. Multiply each cell by the PCEs of the respective mode. Thus, produce modal hourly O/D matrices in PCEs.

vi) Sum the matrices produced in step (v) to produce hourly O/D matrices in PCEs for all modes.

vii) Print the grand total for each hour. They are as follows:

   a. Hour 7-8: 56,029 PCEs
   b. Hour 8-9: 56,548 "
   c. Hour 9-10: 43,777 "
   d. Hour 10-11: 45,652 "

   Select the peak hour which was found to be hour 8-9.

---

*"Hours" considered are 7-8, 8-9, 9-10, and 10-11; "modes" are car, taxi, microbus, and private bus; and "urban area" consists of zone 1-80, "rural area" of zones 81-108.

Output of the assignment was then compared with traffic counts on the Nile Screen Lines. The results are given in Table (I-20):

Table (I-20)

Comparison Between Traffic Counts and the Results of the Assignment Run on Nile Screen Line

Bridge	East - West				West - East			
	Station No.	Traffic Count P.C.E's	Assigned Volume P.C.E's	Relative Error %	Station No.	Traffic Count P.C.E's	Assigned Volume p.C.E's	Relative Error %
Giza	267	1711	2143	+ 253*	266	2000	2576	+28,8
Gamaa	264	1869	2738	+ 46.7	265	2026	2068	+2.2
Tahrir	247	3470	3000	-13.5	248	700	711	+1.6
6th October					261	2158	2776	+28.6
26th July	258	2203	2750	+24,5	257	105[illegible]	1482	+40
Imbaba	117	1312	1156	-11,8	116	1637	1554	-5.1
Total	10565		11787	+11.6	9579		11167	+16.6

* Relative error (%) = $\frac{\text{(Assigned Vol.)} - \text{(Traffic Count)}}{\text{(Traffic Count)}} \times 100$

The assigned values are higher than the traffic counts due to the errors in both the directional and fluctuation factors. For more clarification, the assigned values are those obtained from the the 10-hour matrices multiplied by the directional and by the fluctuation factors for the four vehicle types. The 10-hour matrices are obtained as explained in section 2.3.2.2 in two steps. Firstly, balancing the traffic counts with the O/D movements crossing the cordon and screen lines; and secondly, smoothing the O/D traffic pattern according to a gravity model. As the result in table (I-20) shows, the assigned volumes crossing the screen line are higher than the traffic counts. Further checks of the base year assignment run consisted of the following:

- Total zonal productions and attractions should be equal to the total volume assigned to the centroid connectors of the corresponding zone in the appropriate direction (see Table (I-21). From that table, it could be seen that there are no mistakes, neither in the assignment model nor in the coding of the centroid connectors, i.e. that each zone is connected to the street network.

- Comparison between minimum travel time matrix under free flow conditions and that at the end of the assignment run under congested condition has shown consistently an increase in the travel time between any O/D pair after the assignment stage, see C.O.N. (XXVI).

- Minimum paths between selected O/D pairs were checked and were found to be logical, see C.O.N. (XXVI).

- Comparison between traffic counts and assigned volumes on important links shows close agreement, see table (I-22).

Table (I-21): Comparison Between Zonal Production and Attraction and the Summation of Loads on Centroid Connectors

Zone No.	Nodes Connected to Zone Centroid	Production		Attraction	
		From O/D matrix	From the Design. Plan	From O/D Matrix	From the Design. Plan
1	264	92	92	59	59
2	262, 263	1082	1082	1449	1449
3	272, 271, 259	317	317	1463	1463
4	267, 272, 257	12	12	30	30
5	277, 287, 270, 269	717	717	740	740
6	278, 286, 287	657	657	601	601
7	270, 274	639	639	162	162
8	315, 293, 297	1855	1855	528	528
9	281, 283	116	116	76	76
10	301, 303	806	806	263	263
11	311, 316	173	173	11	11
12	317	132	132	1	1
13	337, 312, 311	714	714	538	538
14	253, 252	1069	1069	314	314
15	242, 248, 239	277	277	34	34
16	314, 318	737	737	833	833
17	323, 292	143	143	381	381
18	251, 265	336	336	282	282
19	245, 250	240	240	61	61
20	220, 221, 373	655	655	540	540
21	374, 379, 380, 381	485	485	86	86
22	230, 245, 381	57	57	134	134
23	228, 229, 236	590	590	897	897
24	217, 218, 227	638	638	1719	1719

Table (I-21) (Cont.)

Zone No.	Nodes Connected to Zone Centroid	Production		Attraction	
		From O/D Matrix	From the Assign. Run	From O/D Matrix	From the Assign. Run
25	210, 214	1297	1297	2443	2443
26	133, 132, 151, 205	613	613	2200	2200
27	109, 129, 122, 127	378	378	1426	1426
28	166, 168	371	371	56	56
29	115, 118, 119	318	318	11	11
30	136, 145, 137, 146	199	199	1064	1064
31	158, 162	958	958	2351	2351
32	327, 333, 329	638	638	449	449
33	332, 334	463	463	499	499
34	383, 384, 386	246	246	604	604
35	387, 385, 376, 377	450	450	117	117
36	392, 391, 389, 387	9	99	527	527
37	421, 394, 396	110	110	210	210
38	398, 389, 396	2149	2149	45	45
39	412	313	313	101	101
40	422, 423, 410	670	670	161	161
41	405, 398, 115, 116	575	575	46	46
42	360, 358, 339	565	565	262	262
43	342, 335, 347	2663	2663	945	945
44	355, 354	955	955	247	247
45	371, 372, 359, 360	534	534	64	64
46	372, 364, 361	488	488	76	76
47	366, 369	659	659	150	150

Table (I-21) (Cont.)

Zone No.	Nodes Connected to Zone Centroid	Production		Attraction	
		From O/D Matrix	From the Assign. Run	From O/D Matrix	From the Assign. Run
48	428, 456, 350	192	192	2146	2146
49	459, 458, 364	7	7	5	5
50	429, 430, 414	510	510	689	689
51	435, 434, 417	582	582	1204	1204
52	439, 458	149	149	46	46
53	458, 438, 427, 428	17	17	36	36
54	428, 426	693	693	13	13
55	440, 445, 437	44	44	0	0
56	442, 443	1468	1468	1065	1065
57	428, 441, 461, 463	5	5	26	26
58	462, 461, 463, 495	250	250	1202	1202
59	489, 490, 492, 493	931	931	1836	1836
60	467, 469, 471	257	257	131	131
61	433, 436, 447, 456	111	111	702	702
62	455, 488, 475, 456	729	729	227	227
63	482, 488	1446	1446	881	881
64	510, 501, 512	856	856	214	214
65	509, 514, 515	297	297	655	655
66	496, 508	753	753	334	334
67	264	172	172	115	115
68	261, 266	2318	2318	1853	1853
69	261, 273, 304	131	131	24	24
70	305, 310, 336	641	641	337	337

Table (I-21) (Cont.)

Zone No.	Nodes Connected to Zone Centroid	Production		Attraction	
		From O/D Matrix	From the Design. Run	From O/D Matrix	From the Design. Run
71	370, 519	1582	1582	844	844
72	462, 519	613	613	918	918
73	495, 492, 462	1149	1149	738	738
74	494, 513, 514, 516	5303	5303	3178	3178
75	517	605	605	3452	3452
76	503, 517, 504	1639	1639	1097	1097
77	486, 456	1084	1084	1671	1671
78	433, 393, 377	22	22	525	525
79	378, 250, 265, 379	158	158	92	92
80	265	1816	1816	1615	1615
81	519	459	459	928	928
82	519	124	124	127	127
83	519	6	6	24	24
84	517	96	96	541	541
85	519, 494	106	106	169	169
86	519	68	68	548	548
87	519	60	60	23	23
88	519	593	593	52	52
89	519	3	3	2	2
90	519	4	4	0	0
91	336, 370, 519	144	104	232	232
92	519	0	0	0	0
93	519	67	67	18	18
94	519	0	0	0	0

Table (I-21) (Cont.)

Zone No.	Nodes Connected to Zone Centroid	Production		Attraction	
		From O/D matrix	From the Assign. Run	From O/D Matrix	From the Assign. Run
95	519	0	0	0	0
96	261, 519	62	62	56	56
97	261, 519	0	0	0	0
98	261	0	0	9	9
99	494	0	0	0	0
100	264	22	22	38	38
101	264	0	0	7	7
102	264	0	0	46	46
103	264	1	1	25	25
104	264	0	0	0	0
105	264	0	0	0	0
106	261	38	38	270	270
107	264	0	0	0	0
108	265, 517	5	5	15	15

Table (I-22) : Comparison Between Traffic Counts and Assigned Volumes on Selected Important Links

Station No.	Link Code No.	Square or Street Name	Traffic Count PCE's	Assignment Volume PCE's	Relative Error%
1	328-201	Kornish and Galaa St.	1940	2031	+ 4.7
5	160-203	Ramsis St.	2137	1569	-26.6
150	158-159	Ramsis St.	1671	1505	- 9.9
6	203-160	Ramsis and Abdel Khalik St.	1157	1183	+ 2.3
29	294-287	Nile and Galaa Sq.	2690	2256	-16.1
98	255-256	Giza Square	1015	969	- 4.5
100	272-256	Gamaa Bridge Square	949	939	- 1.1
101	257-256	" "	2301	1937	- 16
103	272-271	" "	1701	1688	- 0.8
85	456-486	Salah Salem St.	2169	2556	+17.9
86	486-456	" "	2136	2460	+15.2
151	162-161	Galaa and 26th July St.	1183	993	-16.1
152	147-121	Gomhoria and 26th July	750	837	-11.6
146	379- 38	Magra El-Eyoun and Salah Salem	1665	1691	+ 1.6
182	111-398	Geish and Bab El-Sheria	1764	1634	- 7.4
147	329-328	26th July and Kornish	2137	2213	+ 3.6
148	201-328	" "	1408	1478	+ 5.0
149	328-327	" "	1296	1039	-19.8
170	169-383	Port Said St. and Rihan St.	1177	1362	+15.7
191	414-415	Abdo-Basha Square	1155	1053	- 8.8
207	470-480	Roxi Square	1314	1204	- 8.4
106	278-277	Dokki Square	2224	2363	+ 6.3

Appendix A

PARKING SURVEY BASIC DATA

Table A-1-1 : Average Passenger Car Length for On-Street Parking Facilities

A. Parallel

Street Name	Direction or Location	Capa-city	Length (m)	$x = \frac{\text{Length}}{\text{Capacity}}$	$x-\bar{x}$ (10)	$(x-\bar{x})^2(10)^{-2}$
1. Talat Harb	From 26 July, to Adly	23	100	4.348	-1.07	1.1450
2. Adly	From Talat Harb, to Sherif	24	105	4.375	-0.80	0.6400
3. Adly	From Sherif, to Emad EL Din	34	155	4.559	+1.04	1.8160
4. Emad El Din	From Adly, To Sarwat	14	60	4.286	-1.69	3.8560
5. Emad El Din	From Sarwat, to Mostafa Kamel Sq.	13	60	4.615	+1.60	2.5600
6. Kasr El Nil	From Most. Kamel Sq. to Gumhuriya	44	205	4.660	+2.05	4.2030
7. Kasr El Nil	From Talat Harb Sq. to Tahrir Sq.	66	310	4.697	+2.42	5.8564
8. Talat Harb	From El Bustan to Tahrir Sq.	18	80	4.444	-0.11	0.0121
9. El Tahrir	From Most. Abu Heef, to Tahrir Sq.	20	85	4.250	-2.05	4.2035
10. El Tahrir	From Youssef El Gendi, to Tahrir Sq.	35	160	4.571	+1.16	1.3456
11. 26 July	In front of Dar El Kadaa El Aaly	35	150	4.286	-1.69	2.8561

Table A-1-1 : Average Passenger Car Length for On-Street Parking Facilities(Cont.)

A. Parallel

Street Name	Direction or Location	Capa-City	Length (m)	$x = \frac{\text{Length}}{\text{Capacity}}$	$x-\bar{x}$ (10)	$(x-\bar{x})^2$ $(10)^{-2}$
12. Sherif	From 26 July to Adly	29	125	4.310	-1.45	2.1025
13. Sheikh Rihan	From El Tahrir Sq. to Tahrir St.	38	170	4.474	+0.19	0.036
14. Saad Zagloul	From El Kasr El Aini to Falaky	57	260	4.561	+1.06	1.236
15. Maarouf	From Talat Harb to Champillion	41	180	4.390	-0.65	0.4225
				66.826		31.2897

$$\bar{x} = \frac{\sum x}{n} = \frac{66.826}{15} = 4.455 \text{ ms}$$

$$s = \text{Standard diviation} = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} = \sqrt{\frac{31.2897}{15}} = 0.14443$$

Table A-1-1 : Average Passenger Car Length for On-Stree: Parking Facilities (Cont.)

B. Perpendicular

Street Name	Location	Capacity	Length
Champillion	In front of Dar El Kadaa El Aaly Lot	71	175

Average Passenger Car Length for Perpendicular Parking = $\frac{175}{71}$ = 2.465 m

Table A-1-2 : Average Area Per Car In An Off-Street Parking Facility

Lot Name	Location	Capacity	Area (m^2)	$x = \frac{\text{Area}}{\text{Capacity}}$	$x-\bar{x}$	$(x-\bar{x})^2$
1. Opera	Opera Sq.	614	7956	12.9576	+1.0411	1.0839
2. Dar El Kadaa El Aaly	26 July St.	172	1988	11.5582	-0.3583	0.1284
3. El Tahrir	Behind Omar Makram	266	3000	11.2782	-0.6383	0.4074
4. Mogamma El Tahrir	In front of Tahrir lot	60	736	12.2667	+0.3503	0.1227
5. Kasr El Nil	Champillion and Kasr El Nil	92	1060	11.5217	-0.3948	0.1559
				59.5823		1.8983

$$\bar{x} = \frac{\sum x}{n} = \frac{59.5823}{5} = 11.9165 \ m^2/car$$

$$s = \sqrt{\frac{\sum (x-\bar{x})^2}{n}} = 0.3872 \ m^2$$

236

Table A-1-3 : Survey of Illegal Parking

Zone No.	Site No.	No. of Cars Parked On-Street at								Maximum No. of Cars Parked			Length (m)	Facility* Type	No. of Lanes	Lenth/ Illegal (m/car)
		10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	Total	Legal	Illegal				
21101	1	92	94	83	80	73	64	73	68	94	56	38	500	5		13.16
	2	44	63	49	52	58	62	64	61	64	–	64	400	3	4	6.25
	3	157	158	153	150	115	148	154	146	158	78	80	600	5		7.50
21102	4	148	144	140	136	134	126	104	94	148	135	13	600	5		46.15
	5	127	141	138	131	152	142	112	128	152	135	17	600	5		35.29
	6	110	129	141	148	140	142	139	130	148	64	84	540	4	5	6.43
21201	7	124	135	142	131	141	125	119	128	142	89	53	400	2	2	7.55
	8	156	161	170	157	174	186	182	171	86	110	76	490	5		6.45
	9	35	37	42	40	38	34	32	26	42	–	42	220	3	3	5.24
21202	10	170	181	186	190	183	177	170	164	190	67	123	600	4	4	4.88
	11	134	139	138	132	148	117	121	86	148	110	38	410	6	4	10.79
	12	108	119	114	111	119	120	113	113	120	85	35	380	5		10.86
	13	173	176	184	171	180	186	189	183	189	89	100	400	5		4.00
	14	230	238	237	262	280	273	269	258	280	139	141	530	6	4,5	3.76
	15	104	118	117	116	120	126	124	111	126	–	126	580	1,3	4,5	4.60
	16	113	111	120	120	123	124	129	133	133	54	79	480	4	4	6.08
	17	150	148	151	157	159	158	139	142	159	90	69	400	6	4	5.85
	18	254	261	272	283	288	242	257	227	288	70	218	620	4	4	2.80
	19	211	224	218	238	223	231	216	212	238	56	182	500	4	4	2.75

* See Section (1.5)

Table A-1-3 : Survey of Illegal Parking (Cont.)

Zone No.	Site No.	No. of Cars Parked On-Street at								Maximum No. of Cars Parked			Length (m)	Facility* Type	No. of Lanes	Length Illegal (m/car)
		10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	Total	Legal	Illegal				
21203	20	65	67	65	62	63	68	71	77	77	55	22	500	6	3	22.73
	21	68	67	69	68	82	82	88	75	88	-	88	450	3	4	5.11
21204	22	58	68	69	71	78	80	76	70	80	74	6	330	2	2	55.00
	23	61	62	62	62	70	72	68	72	72	34	38	360	4	2	9.47
21205	24	140	151	166	126	166	139	150	155	166	122	44	550	2	2	12.50
	25	122	126	141	133	120	121	112	115	141	100	41	450	2	2	10.98
21206	26	201	211	223	223	121	123	133	126	223	108	115	600	2	2	5.22
	27	186	163	160	178	145	140	149	145	186	107	79	520	6	4	6.58
21207	28	37	39	41	37	30	37	28	38	41	-	41	400	1	2	9.76
	29	39	53	50	55	56	41	48	44	56	-	56	540	3	4	9.64
	30	131	159	166	161	147	141	118	122	166	-	166	1080	3	3	6.51
	31	149	154	122	124	92	37	89	85	154	77	77	430	5		5.58
21501	32	130	145	159	167	167	170	171	167	171	45 -	60 66	200 350	4 3	4 4	6.67 5.30
	33	207	194	202	226	238	260	260	247	260	125	135	550	4	3	4.10
21503	34	372	373	286	397	495	447	386	388	495	135	360	600	4	3	1.67
	35	147	152	149	126	189	224	224	224	224	110	114	500	2	4	4.39

* See Section (1.5)

Table A-1-4 : On-Street Free Parking

Zone No.	Serial No.	Street Name	Length (m)	Capacity
1	2	3	4	5
21101	1	Lazogli	260	58
	2	Latin America	135	30
	3	Ahmed Raghib	365	82
	4	Ibrahim Nagib	480	108
	5	El Shikh Youssef	170	38
	6	El Sarray	200	45
	7	Ahmed Basha	450	101
	8	El Ibrahimy	160	36
	9	Sif El Din	290	65
	10	El Nabatat	240	54
	11	Gamal El Din	700	157
	12	El Perga	400	90
	13	Ittehad El Mohamyèn El Arab	230	52
	14	Dar El Shifa	250	56
	15	Aisha El Tmuria	440	99
	16	El Sallut	350	78
	17	El Salamlec	380	85
	18	Gemys	500	112
	19	El Tlombat	430	97
	20	El Dywan	280	63
	21	Moderiat El Tahrir	160	36
	22	Other	400	90
	23	Hasan Morad	130	29

Table A-1-4 : On-Street Free Parking (Cont.)

Zone No.	Serial No.	Street Name	Length (m)	Capacity
1	2	3	4	5
21101	24	Moh. Mahmoud	550	123
	25	Sheikh Rihan	285	64
	26	El Falaky	800	180
	27	Mansour	1600	359
	28	Maglis El Shaab	80	18
	29	Moh. Basha Said	600	135
	30	Saad Zagloul	600	135
	31	Darih Saad	600	135
	32	Ismail Basha Abaza	600	135
	33	Safia Zagloul	300	67
	34	Moh. Ez El Arab	270	61
	35	Amin Basha Sami	550	124
	36	Ismail Basha Serry	650	146
	37	El Mawardy	650	146
	38	Ali Ibrahim	200	45
	39	Shikh Ali Youssef	800	180
	40	Youssef El Gendi	150	34
21201	41	Shikh Barakat	320	72
	42	Abd El Kader	420	110
	43	Omar Makram	60	13
	44	In front of Tahrir Bus Station	420	94
	45	Dr. Selim Hasan	350	79

240

Table A-1-4: On-Street Free Parking (Cont.)

Zone No.	Serial No.	Street Name	Length (m)	[illegible]
1	2	3	4	5
21202	46	Abd El Salam Aaref	160	36
	47	Nasr El Din & Qoshtmr	170	38
	48	Talat Harb	260	58
	49	Kser El Nil	880	196
	50	Champillion	800	180
	51	Hessin Basha El Maamary	400	90
	52	Karim El Dawla	130	29
	53	Ahmed Sokary, El Khadrawi & Sayed Taha	400	90
	54	Moh. El Hag	280	63
	55	El Shikh Maarouf	320	72
	56	Maarouf	600	135
	57	Dr. Adb El Hameed Said	520	117
	58	Between Maarouf & Abd El Hameed Said	150	34
	59	Abd El Khalik Sarwat	500	112
	60	El Darmaly	180	40
	61	Bustan	130	29
	62	Huda Sharawi	440	99
	63	Moh. Sabri Abu Alam	155	35
	64	Moh. Mazlum	280	63
	65	El Falaky	200	45
	66	Sherif	700	157
	67	Gawad Hosny	800	180

Table A-1-4 : On-Street Free Parking (Cont.)

Zone No.	Serial No.	Street Name	Length (m)	Capacity
1	2	3	4	5
21202 (cont.)	68	Moh. Farid	520	116
	69	Emad El Din	310	70
	70	Hasan Ibrahim	90	20
	71	El Kadi El Fadel	150	34
	72	El Shrifeen	220	49
	73	Alwy	220	49
	74	Aly Labib	100	22
	75	El Porsa El Gedida	200	45
	76	El Fadel	80	18
	77	Sekket El Fadel	180	40
	78	El Shawarbi	380	85
	79	El Said Moh. Taher	250	56
	80	Mostafa Abu Hif	180	40
21203	81	El Gumhuria	650	146
	82	Pidak	480	108
	83	26 July	390	88
	84	El Geish	260	58
	85	Between El Geish & El Posta	250	56
	86	Between Abd El Aziz & El Gumhuria	250	56
21204	87	Youssef El Gendi	120	27
	88	El Falaky	130	29
	89	Mostafa Abu Hif	130	29
	90	Mansour	150	34

Table A-1-4 : On-Street Free Parking (Cont.)

Zone No.	Serial No.	Street Name	Length (m)	Capacity
1	2	3	4	5
21204 (cont.)	91	Fahmy	150	34
	92	Abd El Aziz	140	31
	93	Moh. Farid	330	74
	94	Abd El Moneim	200	45
	95	Gumhuria Sq.	220	49
	96	Ali Basha Zo	65	15
	97	Between Youssef El Gendi & Tahrir Sq.	350	79
	98	Between Abd El Aziz and Cordon Line	400	90
21205	99	Gumhuria	1120	251
	100	Nagib El Rihani	540	121
	101	El Mahdi	390	88
	102	El Knisa El Morksia	520	117
	103	Halim Basha	80	18
	104	Other	100	22
	105	El Argania	180	40
	106	El Genina	450	101
	107	El Alfy	140	31
21206	108	Emad El Din	1000	224
	109	Khalig El Khory	510	114
	110	Nagib El Rihani	220	49
	111	Zakaria Ahmed	320	72
	112	Galal	60	13

243

Table A-1-4 : On-Street Free Parking (Cont.)

Zone No.	Serial No.	Street Name	Length (m)	Capacity
1	2	3	4	5
21206 (cont.)	113	Ali El Kassar	70	16
	114	Soliman El Halabi	700	157
	115	El Porsa	390	88
	116	Zaki	380	85
	117	Orabi	240	54
	118	Caray El Azbakia	400	90
	119	El Alfy	480	108
	120	Abd El Kader	110	25
	121	Bustan El Dekka	120	27
21207	122	El Sabtia	420	94
	123	El Falaky	350	97
	124	El Teraa El Bolakia	680	153
	125	El Zahhar	180	40
	126	Shenen	160	36
	127	El Sahafa	160	36
	128	Seket El Miah	100	22
	129	El Madrasa El Taliania	120	27
	130	El Fahhama	110	25
	131	Zahr El Gmmal	180	40
21501	132	Om Gholam	160	36
	133	El Tablita	180	40
	134	Port Said	800	180
	135	El Muiz Lidin Illah	500	112

244

Table A-1-4 : On-Street Free Parking (Cont.)

Zone No.	Serial No.	Street Name	Length (m)	Capacity
1	2	3	4	5
21503	136	El Muiz Lidin Illah	1100	247
	137	Port Said	1250	281
	138	El Geish	960	265

Table I-1-5 : On-Street Metered Parking

Zone	Street Name	Number	Capacity
21202	Adly	108	108
	Talat Harb	41	41
21203	Adly	8	8

245

Table A-I-6 : Off-Street Parking Lots

Zone No.	Serial No.	Name And/Or Location	Area (m^2)	Practical Capacity	Overnight Parking
21101	1	10 Ibrahim Nagib St	663.3	55	
	2	10 Abd ElRhman Fahmi St.	390.0	32	
21102	3	Faculty Of Medicine and Pharmacy	3,504.0	292	18
	4	16 Mohamed Ez El Arab St. (Dar El Helal)	567.0	47	8
	5	1 Maglis El Shaab St	2,300.0	192	
	6	3 Maglis El Shaab St. (Ministry of Health)	3,000.0	250	10
	7	Maglis El Shaab St (Local Government)	965.7	81	
	8	Ministry of Justice	874.7	73	8
	9	Ministry of Interior	2,200.0	183	14
	10	Communication Authority	64.0	5	3
	11	Ministry Of Social Affairs	875.0	73	5
	12	Ministry Of Transportation	603.0	50	9
21201	13	Tahrir Square	3,000.0	250	31
	14	In front of Mogammaa El Tahrir	736.0	61	5
	15	In front Of Egyptian Museum	1,224.0	102	15
	16	Misr Company of vehicles commerce	1,012.5	84	
	17	In front of the Center Control building	4,650.0	388	24
	18	Nile Hilton Hotel	1,388.0	116	38
	19	In front of the Socialist Union	2,372.0	198	
	20	In front of Telivision building	1,957.5	163	
22202	21	Between 27 and 29 Marouf St.	3,525.0	294	126
	22	Dar El Qadaa El Aali	1,988.0	166	15
	23	150 Mohammed Farid St.	1,680.0	140	
	24	Sobih	530.0	44	
	25	Inside Dar El Qadaa El Aali	780.0	65	

Table A-I-6 : Off-Street Parking Lots (Cont.)

Zone No.	Serial No.	Name And/Or Location	Area (m^2)	Practical Capacity	Overnight Parking
20203	26	Opera Square	7,956.0	663	9
	27	Vehicle Inspection Center	1,000.0	83	27
	28	Kesm Abdin	470.0	39	
	29	Nile Company of Agricultural Productions	150.0	13	
20205	30	In front of Cinema El Nasr	694.0	58	
	31	103 Gomhouria St.	280.0	23	
	32	Commercial General Company	1,440.0	120	
	33	In front of Lunabark Hotel	816.0	68	44
	34	Sidnawi Hospital	1,686.0	141	45
	35	Cinema Diana	744.0	62	35
20206	36	9 Kalig El Khuri St.	1,832.0	152	22
	37	22 Zakaria Ahmed St.	138.0	12	6
20207	38	In front of Cairo Railway Station	1,190.0	99	16
	39	Beside El Qulali Bus Station	1,200.0	100	4
	40	Ramsis and Gomhouria Intersection	1,810.0	151	6
	41	Beside Kesm El Azbakia	1,066.0	89	
	42	In front of Cinema Romans	1,973.0	164	11
21501	43	Behind Hossein Hospital	544.7	45	
	44	Inside Hossein Hospital	859.7	72	
	45	Inside Azhar University	1,206.0	101	
	46	In front of Gamaa El Hussein	1,827.1	152	45
	47	In front of Al Azhar Department	1,059.7	88	
	48	El Tablita Stop	168.0	14	
	49	In front of Industrial Selling Company	482.0	40	
	50	El Kenisa El Gedida	256.0	21	
	51	Gowher El Kaed	274.0	23	17

Table A-1-6 : Off-Street Parking Lots (Cont.)

Zone No.	Serial No.	Name And/Or Location	Area (m^2)	Practical Capacity	Overnight Parking
21510 (cont.)	52	In front of Singer Company	98.0	8	
	53	El Moski & Port Said Intersection	90.8	8	8
	54	Al Azhar & Port Said Intersection	476	40	9
	55	In front of Khedr El Attar	146.9	12	
	56	El Khodar Market	79.2	7	
	57	Inside El Kenisa El Gedida	700.0	58	
21503	58	Bab El Sharia Square	1,278.0	106	3
	59	In front of 73 El Geish St.	153.0	13	
	60	Port Said & El Geish Intersection	1,023.0	85	4
	61	121 El Moez Ledin Ellah St.	234.0	20	
	62	El Moez Ledin Ellah & Beit El Kady Intersection	279.5	24	
	63	Beit El Kady Square	1,890.0	157	9
	64	Kalawon Hospital	280.0	23	10
	65	El Kasabi Land	1,876.0	156	
	66	El Moez Ledin Ellah & Amir Geiush Intersection	202.5	17	
	67	El Selhedar School	1,400.0	116	
	68	El Ahwani Alley & El Bayomi Intersection	387.6	32	
	69	Bawaba El-Fetouh	562.0	47	

Table A-I-7 : Off-Street Parking Garages "Private"

Zone No.	Serial No.	Name And/Or Location	Area (m^2)	Practical Capacity
21101	1	8 Gemis St.	181.5	15
	2	9 Gemis St./Mohmoud Orabi	107.0	9
	3	7 Muderiat El Tahrir/Helwan Univ.	148.0	12
	4	8A Muderiat El Tahrir	162.8	14
	5	8B Muderiat El Tahrir	289.6	24
	6	3 El Salsoul St./Mere De Dieu School	209.0	18
	7	1 El Hadiqa St.	461.7	39
	8	7 Mahmoud Ahmed Hefni St	354.4	30
	9	6B Diwan St.	197.1	17
	10	6A Diwan St.	84.0	7
	11	Tolombat St.	158.2	13
	12	Tolombat St./Imeko	360.8	30
21102	13	3 Falaki St.	42.3	4
	14	25 Mobtadian St./ El Mobtadian	345.6	29
	15	7 Dareh Saad St./El Wadi	201.2	17
	16	22 Hessein Hegazi	300.0	25
	17	5 Youssef El Gendi St.	946.0	78
21201	18	4A Latin America St.	600.0	50
	19	118 Kornish El Nile St.	300.0	25
21202	20	7A Kasr El Nile St.	334.0	28
	21	28 Abdel Hamid Said St	750.0	63
	22	17 Abdel Khaliq Sarwat St./Akroboul	478.0	40
	23	12 Adbel Khaliq Sarwart St.	600.0	50
	24	Ramsis and Maarouf Intersection	2,250.0	188
	25	3 Sayed Taha St.	463.0	39
	26	El Fawala St.	160.0	13
	27	Nile Company of Roads abd Bridges	148.0	12
	28	28 Adly St.	388.5	32
	29	11 Mashadi St./ Aqari Bank	65.0	5
	30	24 Sherif St./National Bank	395.3	33

Table A-1-7 : Off-Street Parking [illegible]

Zone No.	Serial No.		Name And/Or Location	Area (m^2)	Practical Capacity
21202 (cont.)	31		Elwi St./Central Bank	145.0	12
	32		Huda Shaarawi St.	1,004.0	84
	33	19	Huda Shaarawi St.	1,083.0	90
21203	34	4	Abdel Aziz St./Zahret Abdin	445.0	37
21204	35	14	Fahmi St.	550.0	46
	36	32	Falaky St.	883.3	74
21205	37	3	Gomhouria St./Hanna Shenouda	140.0	12
	38	5	Elbab Elbahari St.	143.0	12
21206	39	22	Zakaria Ahmed St./El-Nasr	290.0	24
	40	17	Zakaria Ahmed St./Lox	487.0	41
	41	6	Orabi Square/Misr-Petrol Company	140.0	12
	42	3	Alfi St.	914.0	76
	43	15	Ali El-Kassar St.	162.0	14
	44	6	Zakaria Ahmed St./Alfi	559.0	47
	45	2	Nagib El-Rehani	245.5	20
21207	46	31	Galaa St.	84.0	7
	47	29	Galaa St.	1,200.0	100
	48		Ahram Building	1,600.0	133

250

Table A-I-8 : Off-Street Parking Garages "Public"

Zone No.	Serial No.	Name And/Or Location	Area (m^2)	Practical Capacity
21101	1	8 Rostom St./Rostom	149.2	13
	2	3 Haras St./Ahmed Ali Sharaf Eldin	266.5	22
	3	10 Hessein Morad St./Tarek	1,423.0	119
	4	2 Hessein Morad St./Rifouli	1,271.0	106
	5	85 Kasr Aini St./Magdi	462.5	39
	6	16 Mohamed Ahmed Hanafi St./Mishu	266.6	22
	7	8 Salamlek St./Salamlek	688.5	58
	8	Eisha El-Tomouria St./Fateh	670.4	56
	9	14 Mohamed Ahmed Hanafi St./Zahraa	540.1	45
	10	10 Eisha El-Tomouria St./Onsi Marzouq	403.2	34
	11	5 Dar Elshifa St./Osman Marzouq	658.8	55
	12	2 Moderiat Tahrir St./El Saada	648.2	54
	13	1 El Hadika St./El Shark	400.0	33
	14	10 Diwan St./Abu Elzahab	206.6	17
	15	5 Moderiat El-Tahrir/El Delta	169.5	14
	16	12 Dar El Shifa St./Abd Elsalam Tork	458.8	38
	17	12 Dar El Shifa St./Ahram	276.0	23
	18	1 Nabatat St./Fatehi El Fadali	272.5	23
	19	5 Nabatat St./Zaki	446.2	37
	20	7 Nabatat St./Adel Abu Seif	666.9	56
	21	4A Sarray El Kobra/El Sarray	335.0	28
	22	3 Ibrahim Nagib St./El Nasr	334.0	28
	23	13 Ibrahim Nagib St./Kamal Fahmy	373.4	31
	24	3 Tolombat St./El Ebrahimia	146.2	12
	25	2 Salsoul St./Hassan Taha Ezzat	194.0	16
	26	3 Diwan St./El-Diwan	606.7	51
21102	27	22 Sabaa Sakayat St./Ettehad El Arab	761.5	63
	28	23 Rashidy St./Baris	181.0	15
	29	43 Mawardi St./Mimy	219.5	18
	30	28 Mobtadian St.	260.0	22
	31	19 Ismail Abaza St./Ismail Abaza	226.0	19
	32	9 Saad Basha St./Kasem	308.8	26

251

Table A-I-5 : Off-Street Parking [illegible] (Cont.)

Zone No.	Serial No.	Name And/Or Location	Area (m^2)	Practical Capacity
21102	33	7 Saad Basha St./Saad	447.7	37
	34	18 Hessein Hegazi St./Sharkia	378.8	32
	35	19 Abd Elhamid El-Ramali St./Amir	450.0	38
	36	17 Abd Elhamid El-Ramali St./Azhar	784.8	65
	37	35A Mansour St./Bab Ellouk	421.8	35
	38	53 Falaki St./Tarek	451.0	38
	39	12 Youssef El Gendi St./Omar	223.8	19
21201	40	2 Kasr El-Doubara St./El Shams	626.6	52
	41	7 Lazogli St./Isis	300.0	25
21202	42	12 Talaat Harb St./El-Badrawi	1,042.0	87
	43	3 Karim Eldawla Ally/El-Antekhana	155.0	13
	44	5 Hessein Basha Elmeimary St./El-Ryad	759.0	63
	45	7 Hessein Basha Elmeimary St./El-Syaha	591.0	49
	46	3 Maarouf St./Odion	1,102.0	92
	47	28 Maarouf St./Aburegila	1,886.5	157
	48	10 Maarouf St./Maarouf	885.5	74
	49	5 Mohammed Helmi Ibrahim St./ Mohammed Ali	576.0	48
	50	135 Mohammed Farid St./Omar Gouda	1,001.0	83
	51	43 Mashadi St./Deluxe	571.8	48
	52	13 Sekka Elraghrabi St./Iman	454.5	38
	53	14 Kasr El Nile St./Elgandoul	235.0	20
	54	14 Kasr El Nile St./El-Eimoubilia	3,869.0	322
	55	18 Huda Shaarawi St./Sheikh Hamza	366.5	30
	56	1 Bustan El-Seidy St./Rish	369.6	31
	57	19 Abd Elkhalek Sarwat St./Shawarbi	1,058.0	88
	58	33 Misr Bank St./Kasr El Nile	758.5	63
	59	4 Mazloum St./Ayda	836.1	70
21203	60	17 Gomhouria St.	2,016.0	168
	61	1 Adly St./Continental	3,500.0	292

252

Table [illegible]-8 : Off-Street [illegible]

Zone No.	Serial No.	Name And/Or Location	Area (m^2)	Practical Capacity
21204	62	2 Abd ElAziz Gawish St./Anwar	973.0	80
	63	17 Fahmi St./Azhar	501.3	42
	64	19 Fahmi St./Eizoubna	763.0	64
	65	35 Mansour St./Bab Ellouk	625.0	52
	66	52 Falaki St./Tarek	560.0	47
	67	14 Youssef Elgendi St./Giwani	398.0	33
	68	19 Bustan St./Reviera	356.8	30
21205	69	8 El-Genina St./Azmi	203.0	17
	70	54 Nagib El-Rihani St./Wafaa & Eiman	230.0	19
21206	71	18 Zakaria Ahmed St./Galal	815.0	68
	72	13 Bustan Eldekka St./Rinou	605.0	50
21207	73	6 Ramsis St./Ramsis	2,672.0	223
	74	33 Galaa St./Galaa	1,600.0	133
	75	El-Nagda	476.4	40
	76	34 Ramsis St.	360.0	30
	77	Diana Ally/Tegran	576.0	48
21503	78	457 Port Said St./Port Said	822.0	69
	79	Sengl Srour From El Geish St./ Shark	1,550.0	129

253

Table A-1-9 : [illegible]

Zone No.	Street Name	Volume	Zone No.	Street Name	Volume
21101	Lazogli	25	21102	Mohammed Mahmmoud	33
	Rostem	3		Fahmy	8
	Ahmed Raghib	26		El Falaki	37
	Elshikh Youssef	13		Youssef El Gindi	-
	Latin America To Kornish	35		Sheikh Rihan	2
	Ibrahim Nagib	-		Mansour	70
	El Sarray Elkobra	15		Moh. Basha Said	132
	Hassan Murad	93		Saad Zaglol	160
	Moh. Abdel Azzim	25		Darih Saad	132
	Ahmed Basha	3		Ismail Abaza	104
	El Nabatat	30		Safia Zaglol	68
	Ibrahim Basha	36		Moh. Ezz El Arab	22
	Gamal Eldin	39		Branch From Ezz El Arab	50
	El Tolombat	87		Br. From Mansour	12
	El Bergas	24		Amin Sami	96
	El Kornish	-		Br. From Amin Sami	48
	Moderiat El Tahrir	27		Ismail Serry	71
	Dar El Shifa	74		Aly Youssef	147
	Mahmmoud Hifni	165		ElMawardy	57
	Madrab ElNashab	43		Br. From ElMawardy	124
	El Salamlek	35		Br. From Rashidy	96
	El Salol	35		El Rashidy	38
	ElDiwan and Handosa	88		Br. From Ali Ibrahim	41
	Abdel Rahman Fahmy	93		Ali Ibrahim	8
	Eisha El Timoria	43		Kasr El Aini	-
	Kamel El Shenawi	19		Kasr El Aini to Kornish	12
	Total	1076			

254

Table [illegible] (Cont.)

Zone No.	Street Name	Volume
21102 (Cont.)	Saba Sakkyat	79
	Bostan El Dikka	73
	Mawfak ElDin	22
	Br. From ElKornish	13
	Shikh Youssef Sq.	-
	Total	1731
21201	In front of Mogama El Tahrir	-
	Kornish ElNile	-
	Br. from Latin America	49
	Abdel Kader	22
	Shikh Rihan	-
	Shikh Barakat	36
	Selim Hassan	14
	Tahrir Station	5
	From Ramsis To Selim Hassan	42
	Hilton Kornish	-
	Total	168
21202	26th July	-
	Beside Dar El Kadaa	10
	Champillion and 26th July Intersection	-
	Talaat Harb	29
	Sherif	92
	Emad ElDin	82
	Gawad Hosny	45
21202 (cont.)	El Shriffen	36
	El Kady ElFadel	11
	Mohamed Mazlom	54
	El Falaky	47
	Youssef El Gindy	25
	El Bustan ElSaady	15
	Br. Bet. El Gindy and El Falaky	34
	El Mahdy and Ibrahim	10
	El-Shawarbi	11
	Seket ElFadl	5
	ElAwayed Alley	10
	Mohammed Taher	5
	Ard ElFawala	5
	Seket El Maghrabi	3
	El Batal Abdel Azziz	17
	Karim ElDawla	29
	Goshtomor	6
	Hussein ElMemary	10
	Nasim Morsy	18
	ElNabarawi and Mohammed ElHag	14
	Adbel Salam Aref	19
	Huda Sharawi	41
	Mohammed Sedki and Mostafa Abu Heif	13
	Mamer Express	6
	Kasr El Nile	37
	Sabri Abu Alam	-
	Roshdy	-

255

Zone No.	Street Name	Volume
21202 (cont.)	El Mahrani and Abu Bakr Khayrat	27
	From Sherif to Seket El Fadl	14
	From Sherif to Gawad Hosny	6
	Bank Misr	16
	From El Gomhoria to Mohammed Farid	25
	Mahmoud Basioni	-
	From Nasim El Morsy to Moh. El Hag	23
	Mohammed Helmy Ibrahim	85
	El Shikh Marrouf	16
	Marrouf	52
	El Madrasa	9
	Abdel Hamid Said	40
	Abdel Khalek Sarwat	32
	Adly	41
	From Sherif to ElShawarbi	2
	Champillion	108
	Total	1237
21203	26th July	12
	El Bosta	-
	El Geish	53
	El Mosky	6
	El Azhar	-
	El Gomhoria	41
	Abdel Aziz	-
	Sherif El Kebeer	-

Zone No.	Street Name	Volume
21203 (cont.)	Bet. Sherif and Abdel Aziz	19
	Bet. Abdel Aziz and El Gomhoria	94
	El Bidak	66
	Bet. El Bidak and El Gomhoria	59
	El Dabtia	40
	Abdel Khalek Sarwat	-
	Total	390
21204	Abdel Salam Aref	-
	Bab Elluk Alley	9
	Sabri Abu Alam	-
	Sherif	7
	Nobar	-
	Huda Sharawi	7
	El Gomhoria	-
	Ali ZuElFakar	21
	Br. From ElGomhoria	2
	From Nobar to Moh. Farid	10
	El Balagsa	2
	Moh. Farid	51
	Oshlak Abdin	19
	Abdel Moneim	34
	Gomhoria Sq.	16
	El Tahrir	-
	Abdel Aziz Gawish	9
	Fahmy	11
	Mansour	31
	El Falaki	20
	Youssef ElGendy	32

256

Table A-I-9 : Legal On-Street Overnight Parking (Cont.)

Zone No.	Street Name	Volume
21204 (cont.)	Bet. ElGendy and Talaat Harb	43
	Mostafa Abu Heif	22
	Total	346
21205	Klot Beik	-
	Nagib ElRihany	113
	El Bosta	-
	Br. From El Bosta	4
	Br. From ElRihany	3
	El Genina	25
	El Mahdy	75
	El Gomhoria	72
	Bet. El Mahdy to El Genina	53
	Bet. El Rihany and El Mahdy	23
	ElKenisa El Morkosia	72
	Br. from El Gomhoria	38
	Total	478
21206	El Tawfikia	31
	Bet. ElAlfy and 26th July	47
	El Borsa	43
	Zaki	66
	Orabi	46
	Soliman ElHalaby	86
	Zakria Ahmed	89
	Nagib ElRihany	17
21206 (cont.)	Emad ElDin	57
	El Khory	59
	Br. from El Khory	9
	From Zakria Ahmed to Emad ElDin	10
	Br. From ElRihany	4
	Ali ElKasar	69
	Dobreih	9
	Bostan ElDekkah	33
	Total	675
21207	Ramsis	10
	Bet. Ramsis and Gomhoria	15
	El Galaa	-
	El Teraa El Bolakia	81
	El Fahama	53
	El Mostashfa	4
	Shanin	26
	Khalig ElNassr	15
	El Sabtia	43
	In front of Kism El Kahraba	27
	From Klot Beik to El Gomhoria	4
	El Gomhoria	-
	Bab El Bahr	-
	Klot Beik	-
	Ramsis Sq.	9
	Total	287

257

Table A-I-9 : Legal On-Street Overnight Parking (Cont.)

Zone No.	Street Name	Volume
21501	Al Azhar	43
	Gawhar ElKaed	5
	Bet. AlAzhar and Ahmed Maher	25
	ElKhalig ElMasry	57
	Br. From Azhar	24
	El Moski	4
	Br. From ElHussein	28
	El Darrasa	54
	From Gawhar El Kaed to AlAzhar	15
21501 (cont.)	Branshes	41
	Total	296
21503	ElMoez Ledin Ellah	2
	ElKhalig ElMasry	136
	Bab ElSheria Sq.	4
	ElGeish	431
	Total	573

258

Table A-I-10 : On-Street Illegal Overnight Parking Volume

Zone	Street Name	Overnight Parking
21101	Lazogli	5
	Ahmed Rageb	5
	Ibrahim Nagib	52
	El Kornish	34
	Handussa	19
	Hassan Mourad	4
	Total	119
21102	Mohammed Mahmoud	17
	Fahmy	18
	Falaki	37
	El Gendy	34
	Rihan	19
	Ismail Abaza	63
	Safia Zaglol	24
	Ezz El-Arab	106
	Ali Youssef	45
	Ali Ibrahim	14
	Youssef Square	20
	Kasr El Aini	93
	Total	490
21201	Beside Mogamaa El-Tahrir	28
	Kornish	24
	Rihan	12
	Kornish Besid Hilton	20
	Total	84
21202	26th July	11
	Champillion and 26th July	40
	Champillion	20
	Talaat Harb	8
	Abd El-Salam Aref	8
	Kasr El-Nile	22
	Mohammed Sabry Abu Alam	39
	Roshdy	69
	Mahmoud Basyouny	76
	Sarwat	36
	Sherif	15
	Total	344
21203	26th July	4
	Bosta	11
	Azhar	3
	Gomhouria	23
	Abd El Aziz	73
	Sarwat	3
	Dahtia	6
	Sherif El Kabir	21
	Total	144
21204	Abd El Salam Aref	63
	Sabry Abu Alam	8
	Nobar	9
	Gomhouria Street	16

Table A-I-10 : On-Street Illegal Overnight Parking Volume (Cont.)

Zone	Street Name	Overnight Parking
21204 (cont.)	Gomhouria Square	16
	Tahrir	44
	Ali Zu-El-Fakkar	13
	Falaky	16
	Fahmy	15
	Youssef El Gendi	6
	Abd El-Aziz Gawish	4
	Total	210
21205	Klot Beik	63
	Bosta	12
	Genina	9
	Total	84
21206	Nagib El Rihany	16
	Orabi	12
	Total	28
21207	Ramsis	68
	Galaa	62
	Gomhouria	22
	Klot Beik	28
	Bab El-Bahr	25
	Total	205
21501	Azhar	60
21503	Bab ElSheria Square	21

4. List of Papers and Reports in Part (I):

Serial No.	Title	Author(s)	Date	Area Code	Library Code
1	Traffic Volume/Travel Behaviour Survey Documentation	Thomas Brigham	1977	-	21/30
2	Cairo Urban Transportation Project (Traffic Survey) (Traffic Survey)	Ministry of Transport Cairo University, Ministry of Interior Affairs (Traffic Sector)	Nov. 1977	-	21/45
3	Cairo Urban Transportation Project (Traffic Surveys) Appendices : 3, 4 and 5, 7, 9, 11 and 12	Ministry of Transport, Cairo University, Ministry of Interior Affairs (Traffic Sector)	Nov. 1977	-	21/46
4	Proposal for a zoning System as a base for Cairo Public Transport Network Design.	M. El-Hawary F. Abdel Bary M. T. Ismail	March 1979	-	21/76
5	Cairo Urban Transportation Project Public Transport Survey (1978) Vol. (1): The P.T. Survey Report Vol. (2): Appendix 1, 2, 3 and 5 Vol. (3): Appendix A	M. El-Hawary A.H.El-Salmawy F. Abdel Bary T. El-Reedy M. Owais M.H.El-Sherif	June 1979	-	21/109
6	Discussion note on the MIT/CU 1977 Road side Interview Surveys.	Mackay Group	July 1979	-	21/136

Serial No.	Title	Author(s)	Date	Area Code	Library Code
7	Comments on discussion note on the MIT/CU Survey of July 1977.	M. El-Hawary	Aug. 1979	-	21/137
8	The Public Transport Survey (An execution Summary)	T. El-Reedy	Aug. 1979	-	21/140
9	Data Processing System Design of Cairo Transit System	M.H.El-Sherif	Dec. 1979	-	21/201
10	A Procedure for Calculation of transfer trip passengers and external trip passengers for a study area (Deck of Punched Cards + List of Program)	M.H. El-Sherif	Dec. 1979	-	21/202
11	Data Processing System Design for getting the trip information required for TDF	M.H. El-Sherif	Dec. 1979	-	21/203
12	Comment on the discussion notes by Jamieson Mackay and Partners (July, 1979) and Cairo University (Aug. 1979) Concerning the Validity of the 1977 Traffic Surveys.	J. Montgomery	Dec. 1979	-	21/322
13	Data Processing Documentation	T. Hashem M.H. El-Sherif	1979	-	21/309
14	A Proposal for Estimating the Private Transport O/D Matrices	A. Han M. Hassan	Jan. 1980	-	21/195

262

Serial No.	Tiltle	Author(s)	Date	Area Code	Library Code
15	A procedure for developing O/D matrices based on 1977 Cairo survey	M. El-Hawary	March, 1980	-	21/229
16	Comments on the New Procedure Suggested for Enlargement of the 1977 Cairo Traffic Survey Results.	F. Abdel-Bary A.S. Huzayyin T. El-Reedy T. Hashim T. El-Hakim	April 1980	-	
17	Data Processing Requirements	T. Hashem	April 1980	-	21/254
18	Review of Methods to Develop O/D Matrices from 1977 Cairo Survey	N. Wilson M. Meyer J. Montgomery	April 1980	-	21/236
19	Probability Versus Averaging Methods (Calculation Notes)	M. El-Hawary N. Wilson J. Montgomery	April 1980	-	21/235
20	Survey of Overnight Parking	M.S.Nourel-Din H.K. Ismail	April 1980	-	21/251
21	Splitting trips by purpose, converting non-directional matrices into directional ones, occupancy rates and peak hour factor in view of the new procedure for reprocessing 1977 Cairo Vehicular Survey Data	A.S. Huzayyin T. El-Reedy	April 1980	-	21/314

Serial No.	Tiltle	Author(s)	Date	Area Code	Library Code
22	O/D Private transport matrices and the matrix infilling procedure	J. Montgomery	July 1980	-	21/275
23	A parking Survey for Cairo C.B.D. Area	M. El-Hawary M.S.Nourel-Din H.K. Ismail	July 1980	-	21/281
24	Brief review of suggested Method for developing O/D matrices based on the 1977 Cairo Traffic Survey	M. El-Hawary K.G.Abdel Nasser	July 1890	-	21/289
25	Development of OD matrices based on 1977 Cairo Survey	M. El-Hawary	Nov. 1980	-	21/300
	Data Processing Procedures to get Refined OD matrices	T. Hashem	Nov. 1980	-	21/316
26	Preleminary Report concerning the Statistical Validity of the Cairo Vehicular Survey (1977)	K.G.Abdel Nasser	1980	-	21/311
27	Street Inventory for Cairo Network (Year 1981)	F. Abdel-Bary T. El-Reedy	May 1981	-	21/362

5. List of References

1. Cairo University/MIT/TPA, "Cairo Traffic Survey", Cairo, Nov., 1977.

2. Cairo Transportation Study, "Greater Cairo Underground", Ministry of Transport/Sofretu, Cairo, Oct., 1971.

3. Cairo University/MIT/Ministry of Transport, "Manual of Public Transport Survey", Cairo, 1979.

4. Shawaly, El-Sayed, "Speed and Volume Characteristics on Urban Street Network of Cairo Metropolitan Area", M. Sc. Thesis, Cairo University, 1979.

5. El-Hawary, M. "A Procedure for Developing O/D Matrices based on 1977 Cairo Survey", Cairo University, Nov. 1980.

6. Abdel-Nasser, K. "Preliminary Report Concerning the Statistical Validity of the Cairo Vehicular Survey 1977" Cairo, 1980.

7. Neffendorf, E. (Alan M. Voorhees and Associates) and Wooton, H.J. (Wooton, Jeffreys and Partners), A Travel Estimation Model Based on Screenline Interviews, Presented to: P.T.R.C. Summer Annual Meeting, 1974.

8. Netherlands Engineering Consultants, Egypt National Transport Study, Working Paper No. 18, Summary of Methods for Synthesizing O/D Matrices as Applied in the Egypt National Transport Study.