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COMPREHENSIVE
TRANSPORTATION PLAN
IN THE MUNICIPALITY OF
MANAGUA
IN THE REPUBLIC OF
NICARAGUA

Final Report
Appendices

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March 1999

ALMEC CORPORATION
YACHIYO ENGINEERING CO. LTD.

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APPENDICES

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 - 3. Data Processing Methodology**
 - 4. OD Matrices (Planning Zone)**
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APPENDIX 1

TRANSPORTATION SURVEYS CONDUCTED

1. Survey Framework

Surveys conducted in the study are listed in Table 1.1. All these surveys have been carried out during the period January to March 1998. Their objectives, methods, coverage and schedule are explained in the following sections:

Table 1.1 Outline of Surveys Conducted

SURVEY	OBJECTIVES	COVERAGE	METHOD
1) Person-Trip Survey	<ul style="list-style-type: none"> Social-economical profile and travel characteristics of Managua residents. 	<ul style="list-style-type: none"> About 9,000 households or 48,000 residents (4% sampling) 	<ul style="list-style-type: none"> Direct interview with household members.
2) Screenline Survey	<ul style="list-style-type: none"> Current traffic volume 	<ul style="list-style-type: none"> 7 stations along the screenline 	<ul style="list-style-type: none"> Traffic count (vehicle and passengers) 12 or 24 hours.
3) Cordonline Survey	<ul style="list-style-type: none"> Travel characteristics of residents outside Managua 	<ul style="list-style-type: none"> 6 stations on the Managua municipal boundary 	<ul style="list-style-type: none"> Roadside interview Traffic count (vehicle and passengers) 12 or 24 hours.
4) Truck Survey	<ul style="list-style-type: none"> Truck movement 	<ul style="list-style-type: none"> 50 major companies 	<ul style="list-style-type: none"> Questionnaire
5) Traffic Count	<ul style="list-style-type: none"> Vehicular traffic volume 	<ul style="list-style-type: none"> 12 stations. 	<ul style="list-style-type: none"> Traffic count (vehicle) 12 or 24 hours.
6) Intersection Traffic Count	<ul style="list-style-type: none"> Vehicular traffic volume by direction 	<ul style="list-style-type: none"> 38 stations 	<ul style="list-style-type: none"> Traffic count (vehicle) 12 hours.
7) Travel Speed Survey	<ul style="list-style-type: none"> Travel Speed on major roads 	<ul style="list-style-type: none"> 8 routes 	<ul style="list-style-type: none"> Floating car method
8) Airport Survey	<ul style="list-style-type: none"> Travel characteristic to-from the airport. 	<ul style="list-style-type: none"> On roads to/from the airport 	<ul style="list-style-type: none"> Traffic count (vehicle and passenger) Roadside interview
9) Road Inventory Survey	<ul style="list-style-type: none"> Dimension and characteristics of major roads 	<ul style="list-style-type: none"> All arterial roads in Managua 	<ul style="list-style-type: none"> Observation and Measurements
10) Signal and Traffic Sign Survey	<ul style="list-style-type: none"> Current traffic management practice 	<ul style="list-style-type: none"> 40 intersections 	<ul style="list-style-type: none"> Observation and Measurement
11) Parking Survey	<ul style="list-style-type: none"> Parking characteristics 	<ul style="list-style-type: none"> Selected business/commercial area for off-road parking Selected 5 off-road parkings for detailed survey 	<ul style="list-style-type: none"> Observation, count and interview Recording time of entrance/exit
12) Bus Units Survey	<ul style="list-style-type: none"> Number of bus units used in Managua 	<ul style="list-style-type: none"> All bus companies 	<ul style="list-style-type: none"> Interview and questionnaire
13) Bus Occupancy Survey	<ul style="list-style-type: none"> Average occupancy of bus 	<ul style="list-style-type: none"> 13 stations (almost same as Traffic Count) 	<ul style="list-style-type: none"> Observation 12 hours.
14) Bus Passenger Survey	<ul style="list-style-type: none"> Number of boarding and alighting passengers by route Bus passenger's perception 	<ul style="list-style-type: none"> At major 5 bus terminals 	<ul style="list-style-type: none"> Count and interview
15) Taxi survey	<ul style="list-style-type: none"> Operating characteristics of taxi 	<ul style="list-style-type: none"> 50 units 	<ul style="list-style-type: none"> Direct interview with drivers
16) Air Pollution Survey	<ul style="list-style-type: none"> Air quality of Managua 	<ul style="list-style-type: none"> 30 locations for NO₂, NO_x and SO₂ 4 locations for SPM 	<ul style="list-style-type: none"> Measurement by equipment 3 days
17) Noise Survey	<ul style="list-style-type: none"> Noise level of Managua 	<ul style="list-style-type: none"> 4 locations 	<ul style="list-style-type: none"> Measurement by equipment 3 days

2. **Person-Trip Survey**

1) **Objectives**

The primary objective of the person-trip survey is to acquire information on the travel characteristics of the residents of Managua. The socio-economic profile of the residents is also outlined.

2) **Methodology**

A. **Sampling**

The targeted number of samples was 47,000 persons which are equivalent to about 4% of Managua's population of six (6) years old or above. The total population of Managua was estimated at 1.34 million as of 1997.

A two-stage random sampling was adopted as follows:

i. **Sampling of "Segmento"**

"Segmento" is the smallest unit defined by INEC (Instituto Nacional de Estadísticas y Censos) for the implementation of the Census. Each "Segmento" includes about 60 "viviendas", and the total number of "Segmentos" is 3,021 for the entire Municipality of Managua. As the first stage sampling, 1,023 "Segmentos" were extracted at random in proportion to the population of each District.

ii. **Sampling of "Vivienda"**

"Vivienda" is a housing unit which may include two or more households. In Nicaragua, there is no concept of household in its statistical systems. INEC maintains maps of all "Segmentos" which show the location of all "Viviendas" and their numbers. As the second stage sampling, 10 "Viviendas" were extracted at random (with the same interval) from each of the sampled "Segmentos". As a result, 10,230 "Viviendas" were selected for the person-trip survey.

B. **Sampling List**

In the absence of complete listings of "Viviendas" (in Nicaragua, it is legally prohibited to maintain a list containing personal information such as name, age, sex and address), the interviewers had to visit sampled "Viviendas" using the map of each "Segmento" with colored marks on the selected "Viviendas". However, after the interviews, the interviewers made the list of samples.

C. **Method of Interview**

Interviewees were interviewed directly by the interviewers. The visit for interview was reiterated up to four (4) times in the case of absence.

D. **Interview Items**

Items of interview are classified into "Control Information", "Vivienda Information", "Vivienda Member Information" and "Trip Information".

Control Information

- Zone No.
- Sheet No.
- Census No.
- Trip Maker/Non Maker
- No. of Trips
- Direct/Indirect (interview)

Vivienda Information

- No. of vivienda members
- No. of vivienda members of 6 years old and above
- No. of owned cars
- No. of owned cargo vehicles

Vivienda Member Information

- Time necessary to walk to the nearest bus stop
- Name of the nearest bus stop
- No. of years of residing in the place
- Location of previous residence
- Sex
- Age
- Status of employment or school attending
- Location of workplace
- Occupation
- Type of industry
- Monthly income level
- Location of school

Trip Information

- Date
- Trip No.
- Starting place of trip (Origin)
- Starting time of trip
- Destination of trip
- Time of arrival at destination
- Trip purpose
- Mode of transportation
- Location of transfer (name of bus stop)
- Car use
- No. of passengers on board
- Location of parking

The actual survey form used is presented in Figure 2.4

E. Zoning

In general, zoning should be determined in consideration of the availability of socio-economic indicators, administrative boundaries, land use, transportation network, planning level and so on. In Managua, however, the most critical factor to determine the zoning for the Study was the availability of data on population and number of household by zone. INEC had a fine zoning system, however, there was no population and household (or vivienda) data consistent to the zoning. The Municipality of Managua had both, but they were not consistent with each other. Moreover, between the population data of INEC and the Municipality of Managua, there was a large discrepancy (0.9 million vs. 1.3 million). Under these circumstances, the Study Team took the following procedure:

- i. Through a series of discussions with INEC and various directorates of the Municipality of Managua, the Study Team assumed that the population data of the Municipality of Managua would be more precise than that of INEC due to its rigid reporting system based on direct and periodic investigation of each barrio.
- ii. The Municipality of Managua (Division General de Urbanismo) has a zoning system for city planning called UTB (Uso Territorial Básico). The number of zones is 208 for entire Managua out of which 180 are for the urban area. Although this zoning system had no corresponding socio-economic indicators, it was found possible to recompile the population data by barrio according to the UTB zoning, and the Study Team requested the Municipality to tackle with this task. In response to this request, the Municipality compiled the population and number of "Viviendas" according to the UTB zoning.
- iii. Thus, the UTB zoning system with corresponding data of population and number of "Viviendas" was prepared.

For this person-trip survey, the UTB zoning system was adopted for Managua. For the area outside Managua, 24 zones were established by the Study Team. In summary, the number of zones are:

Managua	Urban (Urbano)	180 zones
	Periphery (Comarca)	28 "
Outside Managua		<u>24 "</u>
Total		232 zones

The zoning is shown in Figure 2.1, 2.2 and 2.3 for Central Area of Managua, Entire Managua and outside Managua, respectively. Note that this zoning is only for the purpose of compiling survey data. For traffic analysis, the zones should be aggregated depending on the purpose.

3) Survey Organization

The person-trip survey was contracted out to INEC. INEC is a semi-governmental organization in charge of surveys including the Census. Their performance was quite satisfactory and sufficient discussions were made between INEC and JICA Study Team. Prior to the conduct of the survey, INEC established an organization explained below.

Figure 2.1 Person Trip Survey Zone

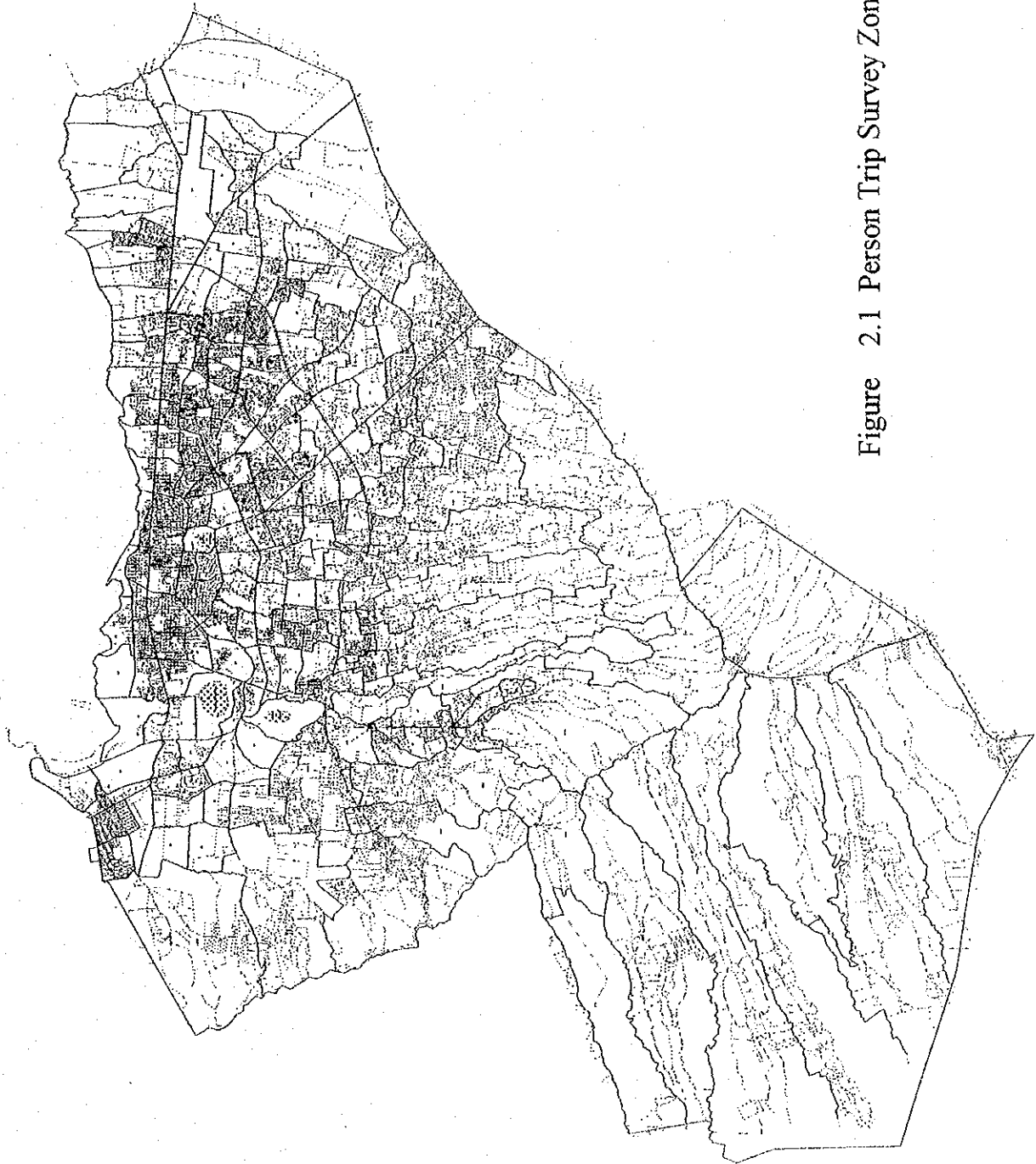


Figure 2.2 PT Survey Zone in Central Area

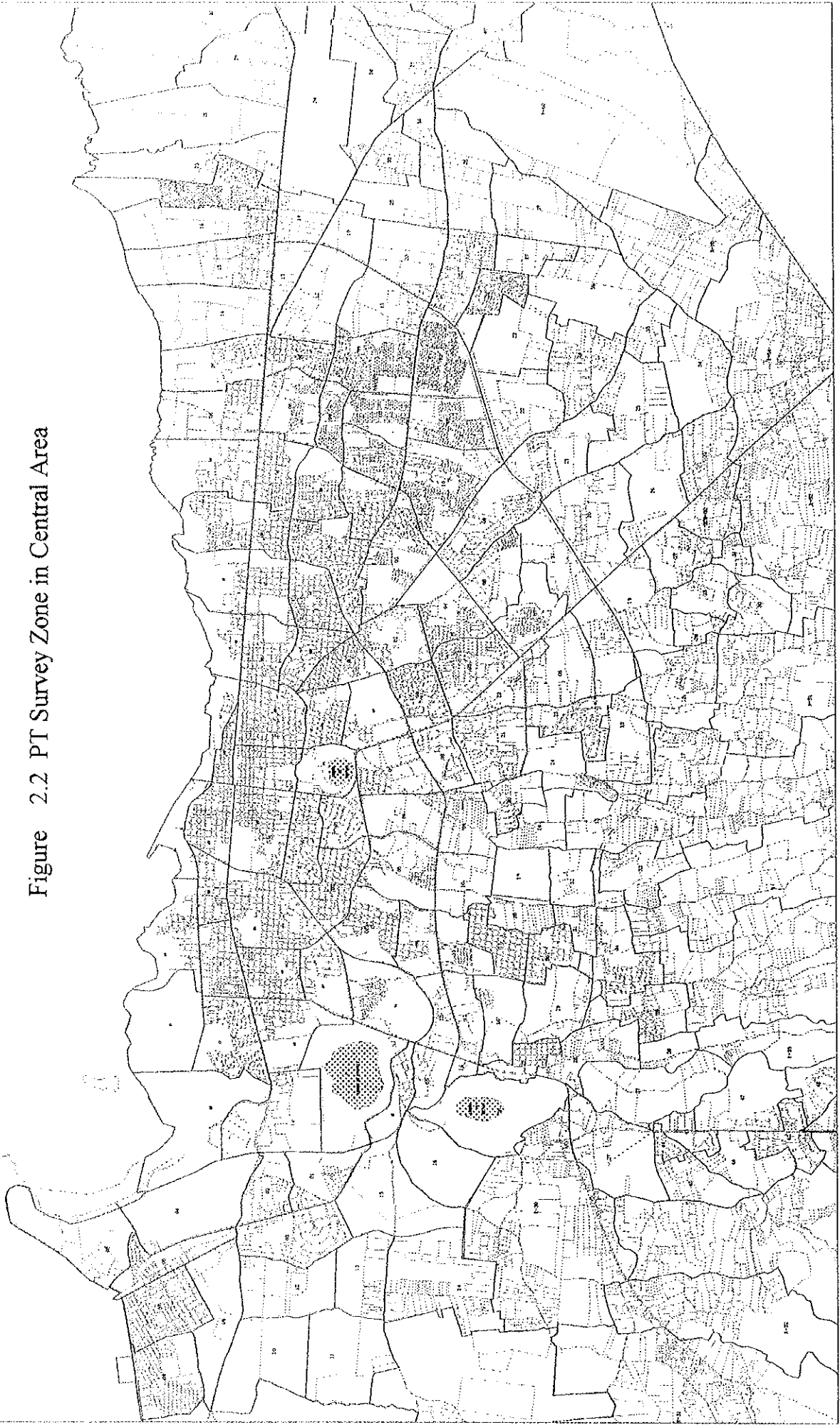
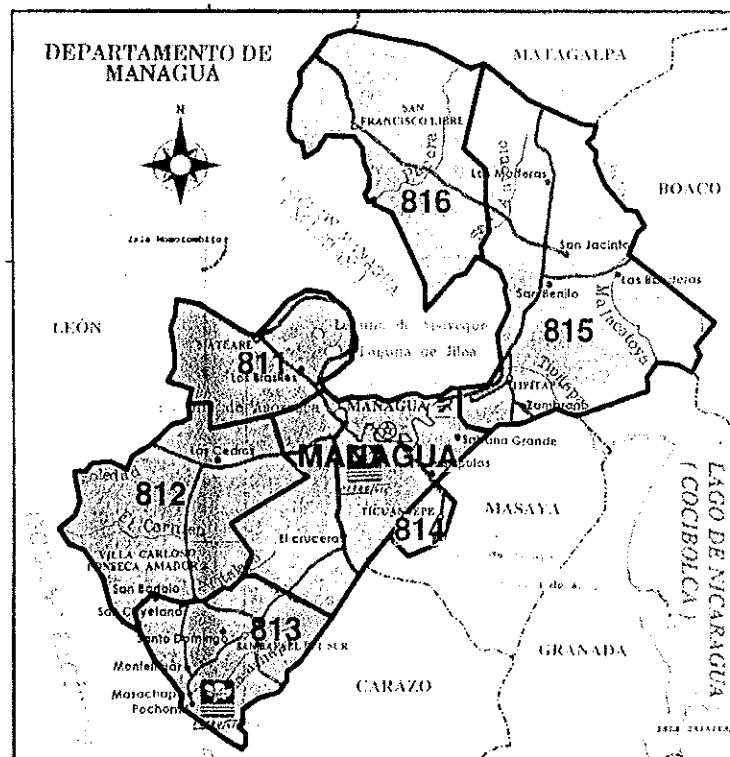
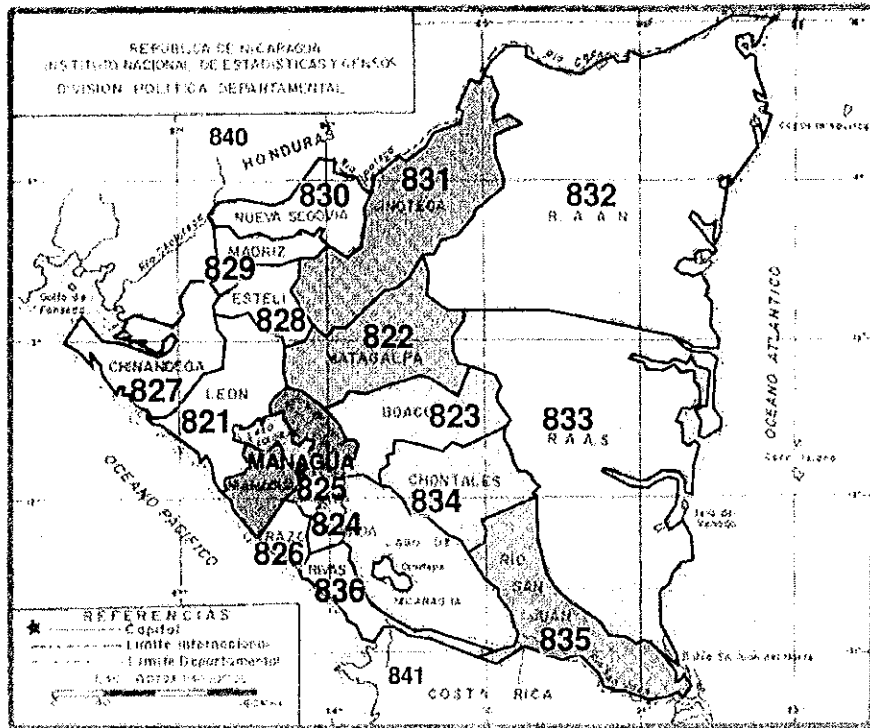


Figure 2.3 Person Trip Survey zones outside the Study Area



A. Sampling

The tasks of the samplers were:

- Sampling of "Segmentos"
- Extract maps of "Segmentos" and prepare photocopies
- Sampling of "Viviendas" and marking of sampled "Viviendas" on the maps of "Segmentos"

B. Training

The tasks of the trainers were:

- Determine coding categories
- Design of survey form
- Prepare survey manuals
- Training of supervisors
- Training of interviewers
- Conduct of "dry run"

C. Interview

After the training, 10 supervisors were selected to organize 10 survey teams. Each survey team was composed of a supervisor and five (5) trained interviewers. For a period of three (3) weeks including Saturdays and Sundays, each team was dispatched to the field at 9:00 a.m. and they conducted interviews until 9:00 p.m. The supervisors collected the filled survey forms every night and submitted them to the coders.

D. Coding

The coders checked the returned survey forms through the coding process. If error was found, the form was returned to the responsible supervisor of the interview. The task of the coders was essential in coding:

- Zone of residence, origin and destination
- Occupation and industry (consistent to the Census)
- Bus stop (there are 441 bus stops in Managua)

E. Data Entry

The coded data were inputted to computer by key punchers. In parallel to this data entry, some simple checks were conducted in relation to categories and interrelations of several items. Logical checks were subsequently done for the created database.

F. Survey Schedule

The survey was carried out according to the schedule shown in Table 2.1.

Table 2.1
Schedule of Person-Trip Survey

WORK ITEM	PERIOD
1. Survey Design	
• Design of samples	Jan. 15 – 20
• Design of Survey Form	Jan. 20 – 28
• Sampling	Jan. 20 – 28
• Zoning	Jan. 19 – 31
• Design of Data Processing	Jan. 20 – 31
• Manual Preparation	Jan. 23 – 31
2. Survey Implementation	
• Training of supervisors / interviewers	Feb. 1 – 3
• Interview	Feb. 4 – Mar. 5
3. Coding	
• Checking of returned forms	Feb. 9 – Mar. 5
• Coding of occupation / industry	Feb. 9 – Mar. 7
• Coding of zone / bus stop	Feb. 9 – Mar. 7
4. Data Entry	
• Programming	Feb. 9 – Mar. 7
• Data Entry	Feb. 16 – Mar. 10
• Data Check	Mar. 2 – 13
• Data Correction	Mar. 2 – 13
5. Data Compilation	
• Preparatory Compilation	Mar. 16 – 20

Figure 2.4
Person - Trip Survey Form

INEC JICA STUDY TEAM ALMA
ESTUDIO DEL PLAN INTEGRAL DE TRANSPORTE Y VIABILIDAD DEL MUNICIPIO DE MANAGUA
ENCUESTA ORIGEN - DESTINO DE VIAJES DE PERSONAS

INFORMACION DE LA VIVIENDA		INFORMACION PERSONAL		SEXO (9) CONDICION DE ACTIVIDAD		LUGAR DE TRABAJO (10)		OCUPACION PRINCIPAL (11)		TIPO DE ACTIVIDAD (12)		INGRESO MENSUAL (13)		LUGAR DE ESTUDIO (14)		HORA DE SALIDA (15)		DESTINO (17)		HORA DE LLEGADA (18)		MEDIOS DE TRANSPORTE (19)		LUGAR DONDE CAMBIA EL TRANSPORTE COLECTIVO (20)		MANEJO AUTOMOTOR (21)		CANTOS QUE INCLUYE USTED? (22)		DONDE SE ESTACIONA? (23)			
(1) TOTAL DE MIEMBROS DE LA VIVIENDA: <input type="text"/> (2) TOTAL DE MIEMBROS MAYORES DE 5 AÑOS: <input type="text"/>		(3) NUMERO DE AUTOMOVILES EN LA VIVIENDA: <input type="text"/> (4) VALOR DE PASAJOS: <input type="text"/>		(5) CANTIDAD DE AÑOS QUE TIENE DE VIVIR EN EL MISMO BARRIO: <input type="text"/> (6) DONDE HA VIVIDO ANTERIORMENTE: <input type="text"/>		(7) SEXO: <input type="text"/> (8) CONDICION DE ACTIVIDAD: <input type="text"/>		(10) LUGAR DE TRABAJO: <input type="text"/>		(11) OCUPACION PRINCIPAL: <input type="text"/>		(12) TIPO DE ACTIVIDAD: <input type="text"/>		(13) INGRESO MENSUAL: <input type="text"/>		(14) LUGAR DE ESTUDIO: <input type="text"/>		(15) HORA DE SALIDA: <input type="text"/>		(17) DESTINO: <input type="text"/>		(18) HORA DE LLEGADA: <input type="text"/>		(19) MEDIOS DE TRANSPORTE: <input type="text"/>		(20) LUGAR DONDE CAMBIA EL TRANSPORTE COLECTIVO: <input type="text"/>		(21) MANEJO AUTOMOTOR: <input type="text"/>		(22) CANTOS QUE INCLUYE USTED?: <input type="text"/>		(23) DONDE SE ESTACIONA?: <input type="text"/>	
(1) TOTAL DE MIEMBROS DE LA VIVIENDA: <input type="text"/> (2) TOTAL DE MIEMBROS MAYORES DE 5 AÑOS: <input type="text"/>		(3) NUMERO DE AUTOMOVILES EN LA VIVIENDA: <input type="text"/> (4) VALOR DE PASAJOS: <input type="text"/>		(5) CANTIDAD DE AÑOS QUE TIENE DE VIVIR EN EL MISMO BARRIO: <input type="text"/> (6) DONDE HA VIVIDO ANTERIORMENTE: <input type="text"/>		(7) SEXO: <input type="text"/> (8) CONDICION DE ACTIVIDAD: <input type="text"/>		(10) LUGAR DE TRABAJO: <input type="text"/>		(11) OCUPACION PRINCIPAL: <input type="text"/>		(12) TIPO DE ACTIVIDAD: <input type="text"/>		(13) INGRESO MENSUAL: <input type="text"/>		(14) LUGAR DE ESTUDIO: <input type="text"/>		(15) HORA DE SALIDA: <input type="text"/>		(17) DESTINO: <input type="text"/>		(18) HORA DE LLEGADA: <input type="text"/>		(19) MEDIOS DE TRANSPORTE: <input type="text"/>		(20) LUGAR DONDE CAMBIA EL TRANSPORTE COLECTIVO: <input type="text"/>		(21) MANEJO AUTOMOTOR: <input type="text"/>		(22) CANTOS QUE INCLUYE USTED?: <input type="text"/>		(23) DONDE SE ESTACIONA?: <input type="text"/>	
(1) TOTAL DE MIEMBROS DE LA VIVIENDA: <input type="text"/> (2) TOTAL DE MIEMBROS MAYORES DE 5 AÑOS: <input type="text"/>		(3) NUMERO DE AUTOMOVILES EN LA VIVIENDA: <input type="text"/> (4) VALOR DE PASAJOS: <input type="text"/>		(5) CANTIDAD DE AÑOS QUE TIENE DE VIVIR EN EL MISMO BARRIO: <input type="text"/> (6) DONDE HA VIVIDO ANTERIORMENTE: <input type="text"/>		(7) SEXO: <input type="text"/> (8) CONDICION DE ACTIVIDAD: <input type="text"/>		(10) LUGAR DE TRABAJO: <input type="text"/>		(11) OCUPACION PRINCIPAL: <input type="text"/>		(12) TIPO DE ACTIVIDAD: <input type="text"/>		(13) INGRESO MENSUAL: <input type="text"/>		(14) LUGAR DE ESTUDIO: <input type="text"/>		(15) HORA DE SALIDA: <input type="text"/>		(17) DESTINO: <input type="text"/>		(18) HORA DE LLEGADA: <input type="text"/>		(19) MEDIOS DE TRANSPORTE: <input type="text"/>		(20) LUGAR DONDE CAMBIA EL TRANSPORTE COLECTIVO: <input type="text"/>		(21) MANEJO AUTOMOTOR: <input type="text"/>		(22) CANTOS QUE INCLUYE USTED?: <input type="text"/>		(23) DONDE SE ESTACIONA?: <input type="text"/>	

INFORMACION DEL DESPLAZAMIENTO

No. De Viaje	(15) ORIGEN				(16) HORA DE SALIDA	(17) DESTINO	(18) HORA DE LLEGADA	(19) PROPOSITO DEL VIAJE	(20) MEDIO DE TRANSPORTE	(21) LUGAR DONDE CAMBIA EL TRANSPORTE COLECTIVO		(22) MANEJO DEL AUTO EN QUE VIAJE	(23) CUANTOS PASAJEROS MAS ALICIONA EN ESTE VIAJE?	(24) DONDE SE ESTACIONA?
	De su Residencia	De su lugar de Trabajo	De su lugar de Estudio	Si es otra Direccion						Ruta	Barrio			
1er. Viaje	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	A.M. P.M.	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	1er. Medio 2do. Medio 3er. Medio 4to. Medio 5to. Medio 6to. Medio 7mo. Medio	1. Si 2. No 3. No	Personal(s)	1. En la via en pagar Estacionamiento 2. Area o Edificio de Estacionamiento 3. Area o Edificio de Estacionamiento pagado 4. No se estaciono	
2do. Viaje	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	A.M. P.M.	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	1er. Medio 2do. Medio 3er. Medio 4to. Medio 5to. Medio 6to. Medio 7mo. Medio	1. Si 2. No 3. No	Personal(s)	1. En la via en pagar Estacionamiento 2. Area o Edificio de Estacionamiento 3. Area o Edificio de Estacionamiento pagado 4. No se estaciono	
3er. Viaje	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	A.M. P.M.	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	1er. Medio 2do. Medio 3er. Medio 4to. Medio 5to. Medio 6to. Medio 7mo. Medio	1. Si 2. No 3. No	Personal(s)	1. En la via en pagar Estacionamiento 2. Area o Edificio de Estacionamiento 3. Area o Edificio de Estacionamiento pagado 4. No se estaciono	
4to. Viaje	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	A.M. P.M.	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	1er. Medio 2do. Medio 3er. Medio 4to. Medio 5to. Medio 6to. Medio 7mo. Medio	1. Si 2. No 3. No	Personal(s)	1. En la via en pagar Estacionamiento 2. Area o Edificio de Estacionamiento 3. Area o Edificio de Estacionamiento pagado 4. No se estaciono	
5to. Viaje	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	A.M. P.M.	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	1er. Medio 2do. Medio 3er. Medio 4to. Medio 5to. Medio 6to. Medio 7mo. Medio	1. Si 2. No 3. No	Personal(s)	1. En la via en pagar Estacionamiento 2. Area o Edificio de Estacionamiento 3. Area o Edificio de Estacionamiento pagado 4. No se estaciono	
6to. Viaje	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	A.M. P.M.	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	1er. Medio 2do. Medio 3er. Medio 4to. Medio 5to. Medio 6to. Medio 7mo. Medio	1. Si 2. No 3. No	Personal(s)	1. En la via en pagar Estacionamiento 2. Area o Edificio de Estacionamiento 3. Area o Edificio de Estacionamiento pagado 4. No se estaciono	
7mo. Viaje	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	A.M. P.M.	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	1er. Medio 2do. Medio 3er. Medio 4to. Medio 5to. Medio 6to. Medio 7mo. Medio	1. Si 2. No 3. No	Personal(s)	1. En la via en pagar Estacionamiento 2. Area o Edificio de Estacionamiento 3. Area o Edificio de Estacionamiento pagado 4. No se estaciono	
8vo. Viaje	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	A.M. P.M.	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	1er. Medio 2do. Medio 3er. Medio 4to. Medio 5to. Medio 6to. Medio 7mo. Medio	1. Si 2. No 3. No	Personal(s)	1. En la via en pagar Estacionamiento 2. Area o Edificio de Estacionamiento 3. Area o Edificio de Estacionamiento pagado 4. No se estaciono	
9no. Viaje	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	A.M. P.M.	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	1er. Medio 2do. Medio 3er. Medio 4to. Medio 5to. Medio 6to. Medio 7mo. Medio	1. Si 2. No 3. No	Personal(s)	1. En la via en pagar Estacionamiento 2. Area o Edificio de Estacionamiento 3. Area o Edificio de Estacionamiento pagado 4. No se estaciono	
10mo. Viaje	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	A.M. P.M.	1. Residencia	2. Lugar de Trabajo (Lo mismo que en (10))	3. Lugar de Estudio (Lo mismo que en (14))	4. Barrio y Direccion	1er. Medio 2do. Medio 3er. Medio 4to. Medio 5to. Medio 6to. Medio 7mo. Medio	1. Si 2. No 3. No	Personal(s)	1. En la via en pagar Estacionamiento 2. Area o Edificio de Estacionamiento 3. Area o Edificio de Estacionamiento pagado 4. No se estaciono	

Observaciones:

3. Screenline Survey

1) Objectives

This survey intends to count traffic volume at several stations allocated along a predetermined screenline. The result is used not only to analyze traffic characteristics but to calibrate the results of the person-trip survey.

2) Methodology

The survey is divided into two (2) types:

- A. Traffic count
- B. Vehicle occupancy survey

The former counts the traffic volume by vehicle type, by direction and by time of the day for either 12 hours or 24 hours starting from 7:00 a.m. The vehicle types are classified into 10 categories as follows:

- | | |
|----------------------|----------------|
| 1. Passenger Vehicle | 2. Mini Bus |
| 3. Large Bus | 4. Taxi |
| 5. Light Truck | 6. Large Truck |
| 7. Truck Trailer | 8. Motorcycle |
| 9. Bicycle | 10. Others |

The latter is a sample survey to record the seating capacity and the number of passengers on board by vehicle type, by direction and by time of the day. The result is to be expanded against the counted traffic volume to obtain information on passenger traffic volume.

The survey forms used are presented in Figure 3.2 and 3.2.

3) Survey Stations

Seven (7) stations were identified along the North-South screenline crossing the city center. The location is shown in Table 3.1 and Figure 3.1.

4) Survey Schedule

The survey was conducted on a weekday either on February 9 or February 11, 1998, as shown in Table 3.1. For four (4) major stations, the survey was carried out for 24 hours, while for the remaining three (3) stations, for 12 hours. The survey was started at 7:00 a.m.

Table 3.1
Screenline Survey Stations

Station No.	Station Name	Location	Execution Date	Direction	Time
1	Palacio Nacional	At front of Ruben Dario Park	9/2/98	East - West	7:00-19:00 (12 hours)
				West - East	
2	Dupla Norte	Corp. Roberto Terán Building, at front of San Antonio Park	9/2/98	East - West	7:00 – 7:00 (24 hours)
				West - East	
3	Dupla Sur	At front of José Artigas Park. At front of Pedro J. Ch. Plaza	9/2/98	East - West	7:00 – 7:00 (24 hours)
				West - East	
4	Calle Colón	From Simón Bolivar Monument, ½ block West	9/2/98	East - West	7:00-19:00 (12 hours)
				West - East	
5	Paseo Tiscapa	From University Avenue Intersection, ½ block West	11/2/98	East - West	7:00 – 9:00 (12 hours)
				West - East	
6	Avenida Bolivar	From ENEL Traffic Light, ½ block North	11/2/98	North-South	7:00 – 7:00 (24 hours)
				South-North	
7	Pista Juan Pablo II	At front of Centro Recreativo La Piñata	11/2/98	East - West	7:00 – 7:00 (24 hours)
				West – East	

Figure 3.1 Location of Screenline Survey Point

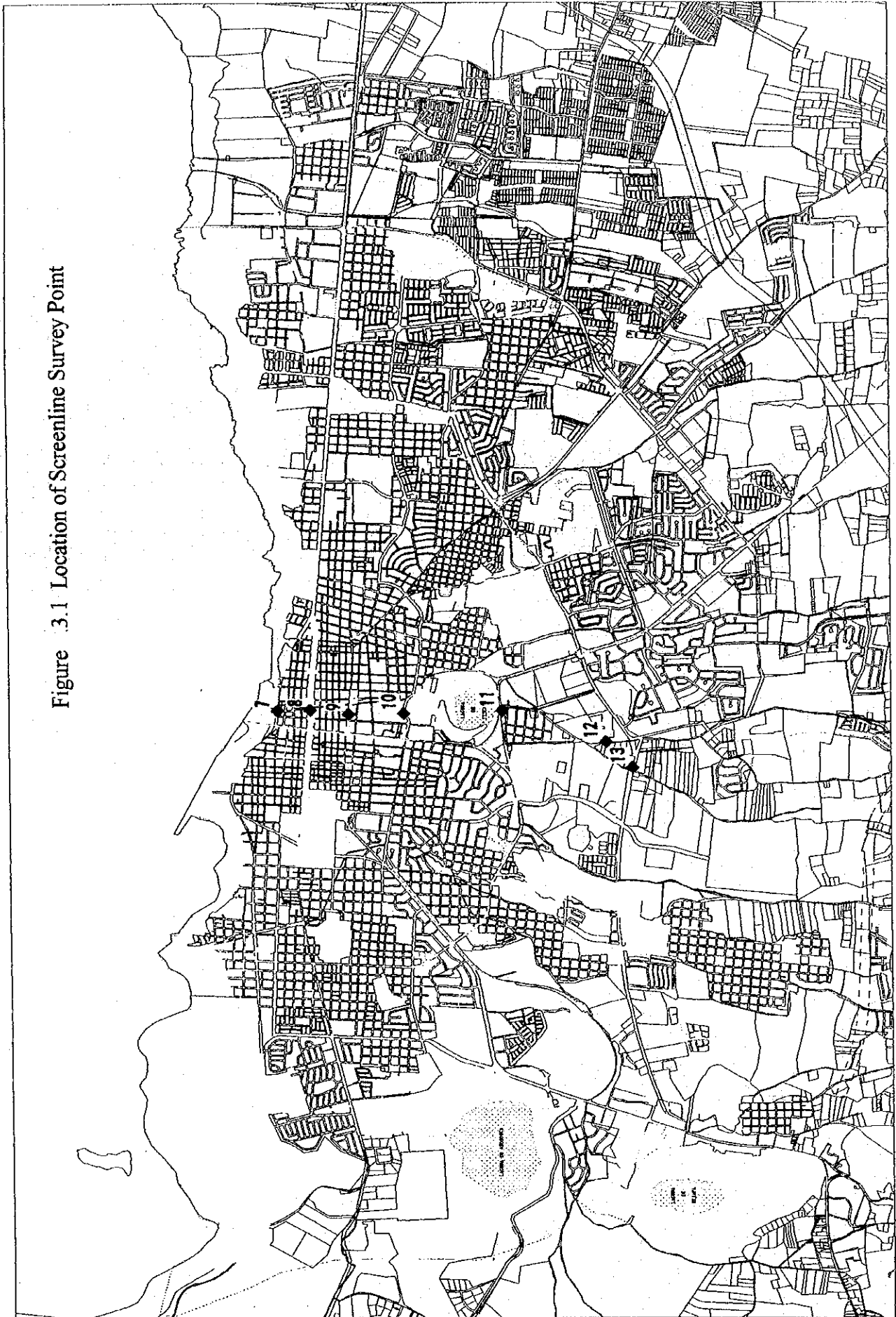


Figure 3.2
Traffic Count Survey Form

PLAN MAESTRO DE TRANSPORTE DE MANAGUA

CONTEO Y CLASIFICACION VEHICULAR

CONTADOR: _____ SENTIDO 1 DE: _____ A _____ FECHA: ____/____/____
 2 DE: _____ A _____ ESTACION N° _____

PAGI

HORAS	VEHICULO DE PASAJEROS	MINI BUS	AUTO BUS	TAXI	CAMION PEQUEÑO	CAMION GRANDE	CAMION ARTICULADO	MOTO CICLETA	BICI CLETA	OTROS	TOTALES	
											SUB-TOTAL	TOTAL
07-00												
08-00												
08-00												
09-00												
09-00												
10-00												
10-00												
11-00												
11-00												
12-00												
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15-00												
15-00												
16-00												
16-00												
17-00												
17-00												
18-00												
18-00												
19-00												
SEN1												
SEN2												
SUB-TOTAL												

PLAN MAESTRO DE TRANSPORTE DE MANAGUA

CONTEO Y CLASIFICACION VEHICULAR

CONTADOR: _____

SENTIDO 1 DE: _____ A _____
2 DE: _____ A _____

FECHA: ____/____/____
ESTACION N° _____

PAG2

HORAS	VEHICULO DE PASAJEROS	MINI BUS	AUTO BUS	TAXI	CAMION PEQUEÑO	CAMION GRANDE	CAMION ARTICULADO	MOTO CICLETA	BICI CLETA	OTROS	TOTALES	
											SUB-TOTAL	TOTAL
19-00												
20-00												
20-00												
21-00												
21-00												
22-00												
22-00												
23-00												
23-00												
24-00												
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04-00												
05-00												
05-00												
06-00												
06-00												
07-00												
SEN1												
SEN2												
SUB-TOTAL												
TOTAL												

Figure 3.3
Vehicle Occupancy Survey Form

PLAN MAESTRO DE TRANSPORTE DE MANAGUA

INDICE DE OCUPACION VEHICULAR

ESTACION: _____ N° _____

FECHA: _____ / _____ / _____

SENTIDO: 1 DE: _____ A _____

2 DE: _____ A _____

HORA: _____

TIPO DE VEHICULO:		
No.	NUMERO DE PASAJEROS	CAPACIDAD SENTADOS
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Total		

TIPO DE VEHICULO:		
No.	NUMERO DE PASAJEROS	CAPACIDAD SENTADOS
1		
2		
3		
4		
5		
6		
7		
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14		
15		
16		
17		
18		
19		
20		
Total		

TIPO DE VEHICULO:		
No.	NUMERO DE PASAJEROS	CAPACIDAD SENTADOS
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2		
3		
4		
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19		
20		
Total		

TIPO DE VEHICULO:		
No.	NUMERO DE PASAJEROS	CAPACIDAD SENTADOS
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4		
5		
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12		
13		
14		
15		
16		
17		
18		
19		
20		
Total		

TIPO DE VEHICULO:		
No.	NUMERO DE PASAJEROS	CAPACIDAD SENTADOS
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19		
20		
Total		

TIPO DE VEHICULO:		
No.	NUMERO DE PASAJEROS	CAPACIDAD SENTADOS
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16		
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18		
19		
20		
Total		

TIPO DE VEHICULO:		
No.	NUMERO DE PASAJEROS	CAPACIDAD SENTADOS
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19		
20		
Total		

TIPO DE VEHICULO:		
No.	NUMERO DE PASAJEROS	CAPACIDAD SENTADOS
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18		
19		
20		
Total		

TIPO DE VEHICULO:		
No.	NUMERO DE PASAJEROS	CAPACIDAD SENTADOS
1		
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19		
20		
Total		

TIPO DE VEHICULO:		
No.	NUMERO DE PASAJEROS	CAPACIDAD SENTADOS
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19		
20		
Total		

4. Cordonline Survey

1) Objectives

This survey aims to obtain traffic information on the boundary of the Municipality of Managua. Based on the results of this survey, the characteristics of trips made by the residents outside the Study Area (Managua) become clear. The result is used to supplement the person-trip survey regarding non-residents' trips made in the Study Area as well as to analyze the traffic characteristics in the peripheral areas.

2) Methodology

The survey is three-fold, i.e:

- A. Traffic count
- B. Vehicle occupancy survey
- C. Roadside OD interview

Traffic count was conducted for 24 hours starting from 7:00 a.m. (except for one station for 14 hours) by vehicle type, by direction and by time of the day. The same vehicle classification as the screenline survey was used (10 categories).

Vehicle occupancy survey was conducted on a sample basis similarly to the screenline survey. Seating capacity and number of passengers were observed and recorded by vehicle type, by direction, and by time of the day for the same duration as the traffic count.

Roadside OD interview was carried out by stopping vehicles at the stations. The interviewed items include origin, destination, trip purpose, address, number of passengers on board and seating capacity. Three (3) different survey forms were used depending on the type of vehicle: a) Drivers of private mode such as car and truck; b) Drivers of public mode such as bus and taxi; and c) Passengers of public mode. Although this survey was conducted in parallel to the traffic count and vehicle occupancy survey, interview by stopping vehicles was not carried out during night time (7:00 p.m. or 9:00 p.m. to 7:00 a.m. of the next day) due to the unfavorable peace and order situation in the peripheral area.

The survey forms used for the roadside OD interview are presented in Figure 4.2 to 4.4.

3) Survey Station

The location of the cordon line survey stations is shown in Figure 4.1 and Table 4.1.

4) Survey Schedule

The survey was conducted on a weekday either on February 4 or 6, 1998, as indicated in Table 4.1.

Table 4.1
Cordonline Survey Stations

Station No.	Station Name	Location	Execution Date	Address	Counting Time
1	Ciudad Sandino	Km. 13.5 New Road to Leon	4/2/98	Leon-Managua Managua-Leon	7:00 – 7:00 (24 hours)
2	Santa Ana	Km. 17.5 Old Road to Leon	4/2/98	Leon-Managua Managua-Leon	7:00 – 7:00 (24 hours)
3	Monte Fresco	Km. 13 North Road	4/2/98	Tipitapa-Managua Managua-Tipitapa	7:00 – 7:00 (24 hours)
4	El Arroyo	Km. 14 Road to Masaya	6/2/98	Masaya-Managua Managua-Masaya	7:00 – 7:00 (24 hours)
5	Las Conchitas-San Rafael del Sur	Km. 34 Road to Pochomil	6/2/98	Pochomil - Managua Managua-Pochomil	7:00-21:00 (14 hours)
6	Las Conchitas-4 Esquinas	Km. 28 South Road	6/2/98	Diriamba-Managua Managua-Diriamba	7:00 – 7:00 (24 hours)

Note: Roadside OD interview was conducted for 12 hours for Stations 1, 2 and 3, and for 14 hours for Stations 4, 5 and 6.

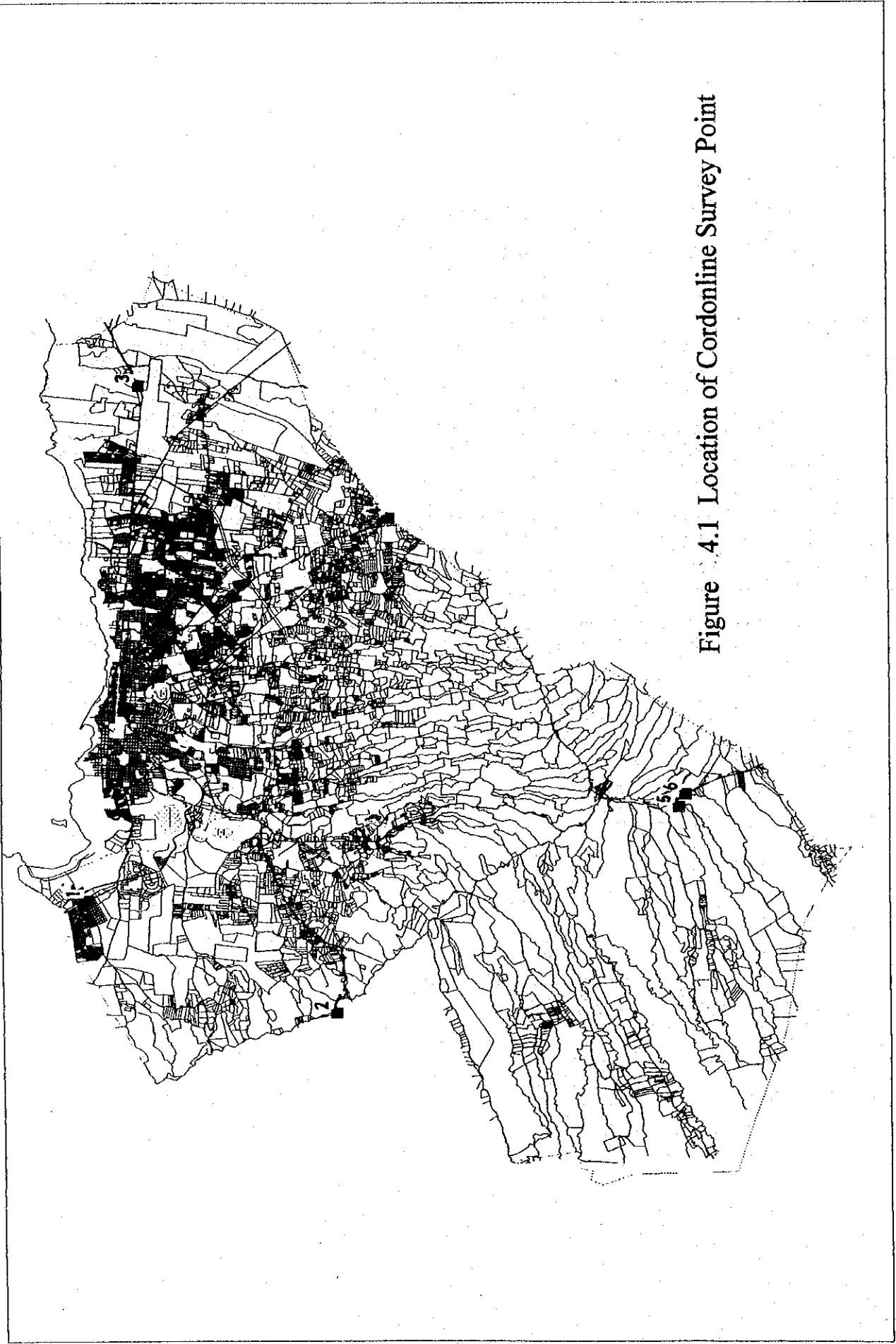


Figure 4.1 Location of Cordonline Survey Point

Figure 4.2

Roadside OD Interview Form (Driver, Private)

Forma A Encuesta de la Línea de Cordón Forma Encuesta de Conductor Forma-Privada	JICA - ALMA PLAN MAESTRO DE TRANSPORTE DE LA MUNICIPALIDAD DE MANAGUA
--	--

Control de Dato:	
Numero de Estación: _____ Dirección: _____ Encuestador: _____ Jornada: <input type="checkbox"/> 1ra <input type="checkbox"/> 2da <input type="checkbox"/> 3ra	Nombre de la Estación: _____ Fecha: _____ Hora: _____ Clima (condiciones) _____

Datos de Encuesta:	1	2	3
1. MODO DE VIAJE 1. Vehículo de Pasajeros 6. Camión Grande 2. Minibus 7. Camión Articulado 3. Autobus 8. Motocicleta 4. Taxi 9. Bicicleta 5. Camión Pequeño 10. Otros	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. ORIGEN Dónde empezó este Viaje? (De la dirección, o edificio conocido o localidad cercana)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. DESTINO Dónde termina este viaje? (De la dirección, o edificio conocido o localidad cercana)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. PROPOSITO DEL VIAJE 1. A la Casa 4. Privado 2. Al Trabajo 5. De Negocios 3. Al Colegio/Universidad 6. Otros	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. NUMERO DE PASAJEROS (incluyendo al Conductor)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. CAPACIDAD O NUMERO DE ASIENTO	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. BARRIO DE RESIDENCIA Y MUNICIPIO	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Figure 4.3
Roadside OD Interview Form (Driver, Public)

Forma B Encuesta de la Línea de Cordón Forma encuesta de conductor forma-pública	JICA - ALMA PLAN MAESTRO DE TRANSPORTE DE LA MUNICIPALIDAD DE MANAGUA
--	--

Control de Datos:	
Numero de Estación: _____	Nombre de la Estación: _____
Dirección: _____	Fecha: _____
Encuestador: _____	Hora: _____
Jornada: <input type="checkbox"/> 1ra <input type="checkbox"/> 2da <input type="checkbox"/> 3ra	Clima (Condiciones) _____

Datos de Encuesta:		1	2	3
1. NUMERO DE PLACA				
2. TIPO DE VEHICULO				
1. Microbus		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Bus Grande		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Taxi		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. RUTA	1) ORIGEN			
	Nombre de Terminal/parada	_____	_____	_____
	Dirección/Edificios conocido cercano	_____	_____	_____
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) DESTINO	Nombre de Terminal/parada	_____	_____	_____
	Dirección/Edificio conocido cercano	_____	_____	_____
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. NUMERO DE PASAJEROS (incluyendo al Conductor)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. N°. DE ASIENTOS (CAPACIDAD)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Figure 4.4

Roadside OD Interview Form (Passenger, Public)

Form C Encuesta de la Línea de Cordón Forma encuesta de conductor forma-pública	JICA - ALMA PLAN MAESTRO DE TRANSPORTE DE LA MUNICIPALIDAD DE MANAGUA
---	--

Control de Datos:	
Numero de Estación: _____ Dirección: _____ Encuestador: _____ Jornada: <input type="checkbox"/> 1ra <input type="checkbox"/> 2da <input type="checkbox"/> 3ra	Nombre de la Estación: _____ Fecha: _____ Hora: _____ Clima (Condiciones) _____

Datos de Encuesta:	1	2	3	4	5	6
1. NUMERO DE PLACA						
2. TIPO DE VEHICULO						
1. Microbus 2. Bus Grande 3. Taxi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. ORIGEN						
Terminal/Parada Dirección/Edificio conocido cercano	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. DESTINO						
Terminal/Parada Dirección/Edificio conocido cercano	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. PROPOSITO DEL VIAJE						
1. A la Casa 2. Al Trabajo 3. Al colegio/Universidad 4. Privado/Personal 5. De Negocios 6. Otros	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. BARRIO DE RESIDENCIA Y MUNICIPIO	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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5. **Truck Survey**

1) **Objective**

Although the person-trip survey aims to capture the movement of people and vehicles in a comprehensive manner, business trips, particularly in relation to goods vehicles, have been difficult to capture in the past person-trip surveys in different countries. This survey has been designed to supplement the person-trip survey in relation to the movement of goods vehicles by interviewing directly the truck owner companies.

2) **Methodology**

Prior to the survey, 50 major companies were selected for interview after consultation with the counterpart staff of ALMA and MCT. Although the initial intention was to select 25 companies (50%) from the transport industry, most of them refused to answer, and the allocated samples had to be transferred to other industries. Table 5.1 is the list of companies interviewed. The interviewed items are:

A. Company Profile

- Type of industry
- No. of employees
- No. of vehicles owned
- Operation of vehicles
- Others

B. Movement of vehicle Owned (up to about 10 vehicles per company)

- Major ODs
- Purpose of vehicle use
- Kilometrage run per vehicle
- Major cargo items transported
- Others

The survey forms used are presented in Figures 5.1 and 5.2.

During the survey, supervisors visited the sampled company at first to explain the objectives and the contents of the survey showing an official letter requesting cooperation. Then after their agreement, interviewers visited the company again, and interviewed the person in charge of vehicle operation or checked the vehicle utilization records.

3) **Survey Schedule**

The survey was conducted during the period March 2 to 6, 1998.

Table 5.1
List of Interviewed Companies

No.	Surveyed Companies	Transport Company	Other Companies	No. of Vehicles
1	SIMSA CONSTRUCCIONES	X		4
2	NICALIT, S.A.		X	2
3	COCARENA	X		2
4	INDIANS TRANSPORT	X		4
5	TROPIGAS, S.A.		X	4
6	TRANSPORTE JUSTINO (MURILLO MEMBRENO)	X		6
7	EL CARACOL		X	11
8	ALCALDIAN DE MANAGUA		X	8
9	TABACALERA DE NIC.		X	21
10	LABORATORIOS RAMOS		X	6
11	COPA		X	3
12	LLAMSA INGENIEROS CONSULTORES	X		6
13	BAYER		X	4
14	COTRAFAL	X		6
15	ARMOL TRADING COMPANY	X		6
16	ALKE DE NICARAGUA		X	2
17	OCAL		X	11
18	COOPERATIVA DE TRANSPORTE ARENEROS DE NICARAGUA	X		11
19	INETER		X	12
20	ENEL CENTRAL		X	12
21	CARLAFISA		X	4
22	MUDANZAS MUNCIALES	X		4
23	LACAYO FIALLOS	X		16
24	AGROSA	X		3
25	TRANSPORTES GUEVARA	X		6
26	INAA CARRETERA NORTE		X	11
27	MINISTERIO DE CONSTRUCCION Y TRANSPORTE.		X	10
28	DISTRIBUIDORA CESAR GUERRERO		X	6
29	JABONERIA ZAMORA		X	3
30	EMPRESA BROOKS HAMILTON, CIA. LTDA.	X		2
31	TRANSPORTE HERNANDEZ	X		11
32	CAFÉ SOLUBLE PRESTO		X	15
33	INDUSTRIA TIP-TOP		X	7
34	NABISCO CRISTAL		X	11
35	INDUSTRIA KATIVO DE NICARAGUA, S.A.		X	4
36	PAME		X	7
37	LA SELECETA		X	11
38	ENITEL		X	12
39	LA PERFECTA		X	17
40	EMBOTELLADORA PEPSI		X	10
41	NAP INGENIBROS, S.A.	X		6
42	PROINCO	X		6
43	VENTALUM, S.A.		X	4
44	SERVITRANSA	X		11
45	TISA	X		11
46	INDUSTRIAS DELMOR		X	8
47	INISER		X	6
48	BAVINIC		X	11
49	TORTIMASA		X	8
50	CONIASA	X		11
	TOTAL	19	31	393

Figure 5.1
Survey Form for Cargo Vehicles Movement (Company Profile)

**ESTUDIO DEL PLAN INTEGRAL DE TRANSPORTE Y VIALIDAD DEL
 MUNICIPIO DE MANAGUA
 ALMA - JICA**

INVESTIGACION DE MOVIMIENTO DE VEHICULOS DE MERCANCIAS

NUMERO DE VEHICULOS PERTENECIENTES A LA OFICINA LOCAL DE LA EMPRESA
 (Se incluyen vehículos que por derecho de uso pertenecen a la misma
 - ejemplos / vehículos alquilados exclusivamente para la misma, etc.)

RESUMEN DE LA EMPRESA

NOMBRE DE LA EMPRESA :

LUGAR DE LA OFICINA LOCAL DE LA EMPRESA :

TIPO DE NEGOCIO :

NÚMERO DE EMPLEADOS :

Número de empleados permanentes :

Número de empleados temporales :

TOTAL :

SUPERFICIE DE LA PROPIEDAD DE LA OFICINA LOCAL :

NOMBRE DE LA PERSONA ENTREVISTADA :

NÚMERO DE TELÉFONO :

	TOTAL	Número de Vehículos en la clasificación por frecuencia medio de servicio por semana		
		5 veces por semana	2, 3 ó 4 veces por semana	Una o ninguna
No. de Vehículos de pasajeros :				
No. de Buses o Microbuses :				
No. de Vehículos Pequeños de Carga :				
No. de Vehículos Grandes de Carga :				
No. de Camiones - Tractores :				
No. de Vehículos de Otros Tipos (Tanque · Mezcladora de cemento · Volquete, etc.) :				
Total :				

Figure 5.2

Survey Form for Cargo Vehicles Movement (Vehicle)

Boleta de Encuesta del Estado Actual del Servicio de Vehículos

Por favor anote abajo el servicio de vehículo por un día (___ día de ___ mes) cuando se realizó

Vehículo en objeto de Encuesta

① Número de placa	⑤ Longitud de Recorrido el día de la encuesta	
② Tipo de vehículo (por semana) L. Séas 2.2-Mías 2.1.Ídas 2.0.Ías	a. Lectura de kilometraje al inicio del recorrido	_____
③ No. de límite de personas a bordo	b. Lectura de kilometraje al término del recorrido	_____
④ La capacidad máxima de carga	c. Longitud del recorrido por un día (= b - a)	_____

Lista de Clasificación

- | | | | |
|---------------------------|------------------------------|------------------------|---------------------|
| ① Propósito | ② Tipo de Vehículo | ③ Artículo de Carga | ④ No. de Personas |
| 1. Distribución | 1. Vehículo en tránsito | 1. Productos Agrícolas | 1. Vehículos Camión |
| 2. Envío | 2. Vehículo parado en carga | 2. Productos Químicos | 2. Vehículos |
| 3. Regreso - Parado | 3. Vehículo girando en carga | 3. Productos Minerales | 3. Vehículos |
| 4. Transporte de carga | 4. Carro-tractor | 4. Madera | 4. Vehículos |
| 5. Tránsito a la estación | 5. Vehículo de tránsito | 5. Maquinaria - Equipo | 5. Vehículos |
| 6. Parado en la estación | 6. Vehículo | 6. Vehículos | 6. Vehículos |
| 7. Vehículo a la estación | 7. Vehículo en tránsito | 7. Vehículos | 7. Vehículos |
| 8. Tránsito a la estación | 8. Vehículo | 8. Vehículos | 8. Vehículos |
| 9. Parado en la estación | 9. Vehículo | 9. Vehículos | 9. Vehículos |
| 10. Vehículo en tránsito | 10. Vehículo | 10. Vehículos | 10. Vehículos |
| 11. Vehículo | 11. Vehículo | 11. Vehículos | 11. Vehículos |
| 12. Vehículo | 12. Vehículo | 12. Vehículos | 12. Vehículos |
| 13. Vehículo | 13. Vehículo | 13. Vehículos | 13. Vehículos |
| 14. Vehículo | 14. Vehículo | 14. Vehículos | 14. Vehículos |
| 15. Vehículo | 15. Vehículo | 15. Vehículos | 15. Vehículos |
| 16. Vehículo | 16. Vehículo | 16. Vehículos | 16. Vehículos |
| 17. Vehículo | 17. Vehículo | 17. Vehículos | 17. Vehículos |
| 18. Vehículo | 18. Vehículo | 18. Vehículos | 18. Vehículos |
| 19. Vehículo | 19. Vehículo | 19. Vehículos | 19. Vehículos |
| 20. Vehículo | 20. Vehículo | 20. Vehículos | 20. Vehículos |

Registro de Servicio

No.	⑦ Lugar Origen	⑧ Destino	⑨ Zona No. Llegada	⑩ Zona No. Salida	⑪ Tiempo Salida	⑫ Longitud de Intervalo	⑬ Propósito del Servicio	⑭ Artículo de Carga	⑮ Peso de Carga	⑯ No. de Personas
No. 1										
No. 2	(mismo con No. 1 destino)									
No. 3	(mismo con No. 2 destino)									
No. 4	(mismo con No. 3 destino)									
No. 5	(mismo con No. 4 destino)									
No. 6	(mismo con No. 5 destino)									
No. 7	(mismo con No. 6 destino)									
No. 8	(mismo con No. 7 destino)									
No. 9	(mismo con No. 8 destino)									
No. 10	(mismo con No. 9 destino)									

6. Traffic Count Survey

1) Objectives

This survey aims to outline the current traffic situation in Managua together with the screen-line survey (section 3), the cordon-line survey (section 4) and the intersection traffic count survey (section 7).

2) Methodology

The survey is a traffic count by vehicle type (10 categories same as the screen-line survey), by direction and by time of the day. Out of the 12 stations, nine (9) were surveyed for 12 hours (7:00 – 19:00) and the remaining three (3) for 24 hours (0:00 – 24:00).

The survey form used is presented in Figure 6.2.

3) Survey Location

Table 6.1 and Figure 6.1 show the location of 12 survey stations. These stations have been selected so as to form an inner cordon-line.

Table 6.1
Traffic Count Surveys Stations

No	Survey Station	12h/24h	Date
1	Section between Refinery and Villa Dorado	12	27-Feb
2	Section Satellite Asosoca and Las Piedrecitas	12	27-Feb
4	Section between exit San Judas and El Ceibo (San Judas)	12	27-Feb
5	Section between Radio University and UNICIT	12	27-Feb
7	Section between Radial Sto. Domingo and Lozelsa	12	27-Feb
8	Section between Rubenia and Barrio Venezuela	12	27-Feb
9	Section between Oriental Cemetery and Puente El Eden	12	27-Feb
10	Section between RUCFA and Villa Progreso	12	27-Feb
11	Section between Tacos Charros, Bello Horizonte and Suburban Highway	12	27-Feb
3	Section between 7 Sur and Nejapa	24	27-Feb
6	Section between San Francisco Mall and the Embassy of Mexico	24	27-Feb
12	Section between Pasteurizadora La Perfecta and Portezuelo	24	27-Feb

4) Survey Schedule

This survey was conducted on February 27, 1998 at all 12 stations.

Figure 6.1 Location of Traffic Count Survey Point

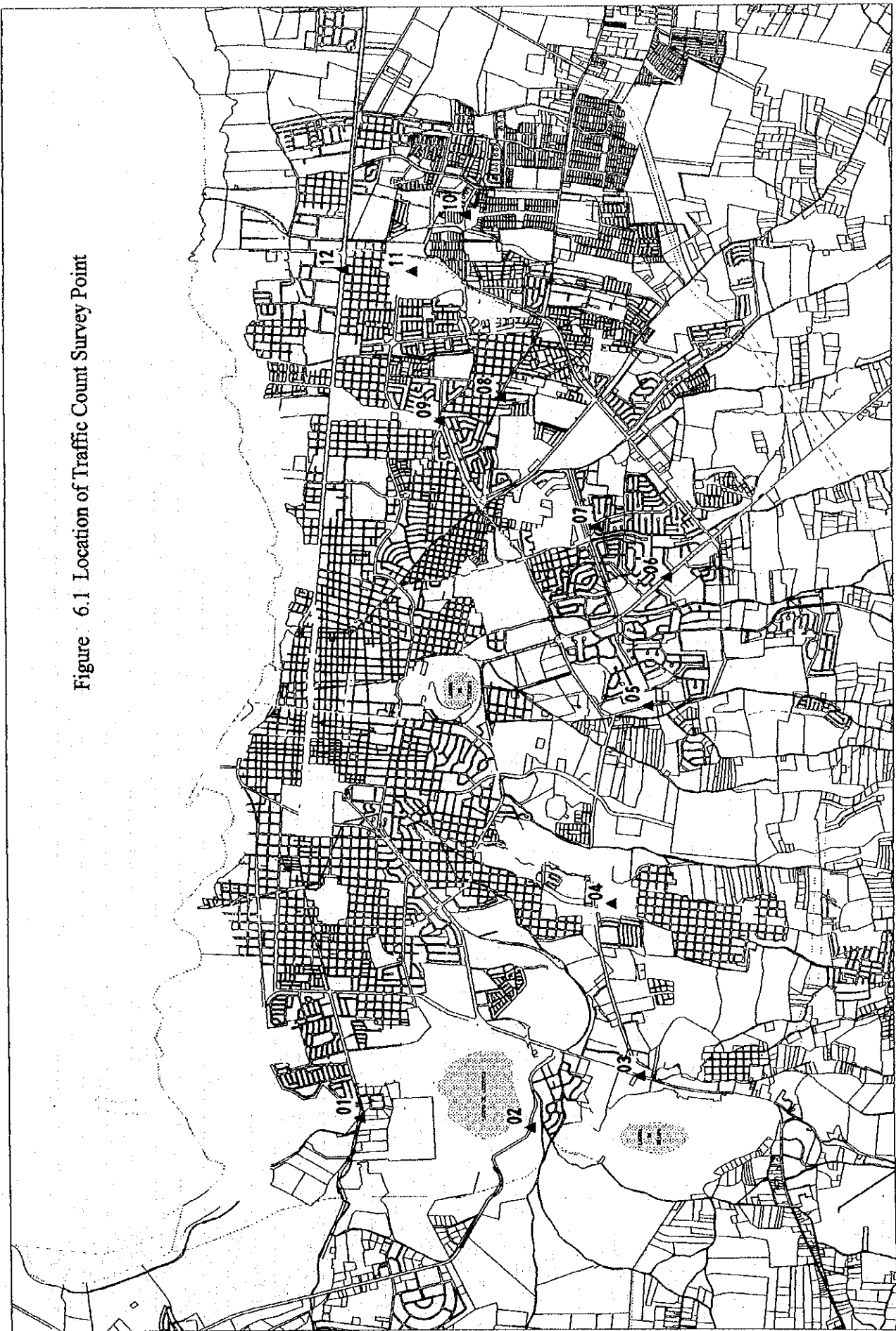


Figure 6.2
Traffic Count Survey Form

TRANC : _____ ANCTO: _____ CODIGO: _____
 FECHA : _____ HOFA FINAL: _____
 SENTIDO : _____ SENTIDO : _____

HORA	AUTOMOVIL	TAXI	BUSES	MICRO BUSES	MOTOS	BICIC.	CAYIONES LIVIANOS	CAMICNES GRAUDE	CS/RENCLQ. TRAILER	OTROS
07 00 - 07:15										
07 15 - 07:30										
07 30 - 07:45										
07 45 - 08:00										
08 00 - 08:15										
08 15 - 08:30										
08 30 - 08:45										
08 45 - 09:00										
09 00 - 09:15										
09:15 - 09:20										
09 30 - 09:45										
09 45 - 10:00										
10 00 - 10:15										
10 15 - 10:30										
10 30 - 10:45										
10 45 - 11:00										
11 00 - 11:15										
11 15 - 11:30										
11 30 - 11:45										
11 45 - 12:00										
12 00 - 12:15										
12 15 - 12:30										
12 30 - 12:45										
12 45 - 13:00										

PLANITRA XLS-HC-JAG

7. Intersection Traffic Count Survey

1) Objectives

This survey intends to count the traffic volume of major intersections of Managua in order to know the traffic characteristics in relation to the capacity, signal allocation and design of intersections. The result of this survey is used to evaluate the performance of existing intersections as well as to plan the improvement of traffic flows for the future.

2) Methodology

The survey was conducted for 12 hours (7:00 – 19:00) at all survey stations. Traffic was counted by vehicle type, by direction and by time of the day. The vehicles were categorized, unlike other surveys, into six (6) types, viz:

- | | |
|----------------------|---------------|
| 1. Passenger vehicle | 2. Bus |
| 3. Truck | 4. Motorcycle |
| 5. Bicycle | 6. Others |

The possible directions of traffic flow were identified for each intersection prior to the survey using a sketch of the intersection. Sequential numbers were allocated to these directions and the survey was conducted based on this numbering.

However, for a roundabout (No. 32, Rotonda Metrocentro), usual traffic count for each direction could not be conducted due to the scale and layout of the roundabout. Hence, a supplementary number plate survey was conducted at this roundabout so that the counted volume could be broken down into directional flows after some data processing.

The survey form used is presented in Figure 7.2.

3) Survey Location

Figure 7.1 and Table 7.1 show the location of survey stations. There are 38 intersections surveyed, and the number of possible direction ranges from 6 to 27.

Figure 7.1 Location of Intersection Traffic Survey Point

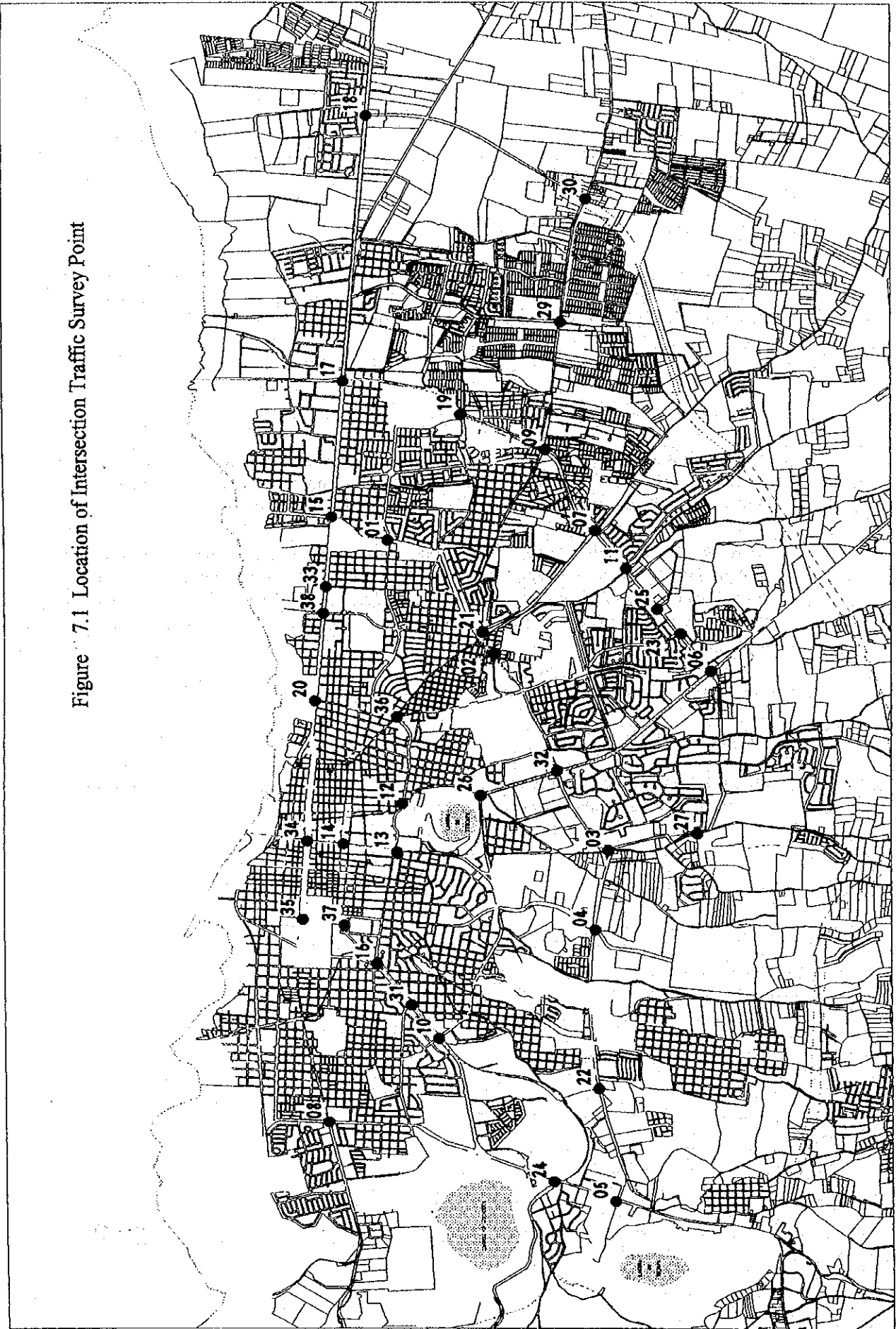


Table 7.1
Intersection Traffic Count Survey Stations

No.	Intersection	Date	Direction	No. of Surveyors
1	Larreynaga Traffic Light	Feb-13	12	9
2	Riguero	Mar-4	12	8
3	E.N.E.L.	Feb-9	12	13
4	Country Club	Feb-17	12	12
5	7 Sur	Feb-26	12	10
6	Plaza de Compras	Feb-18	12	10
7	El Adoquin	Feb-16	12	11
8	Linda Vista	Feb-11	12	12
9	Rubenia	Feb-16	12	13
10	"Lang" Hardware	Feb-17	12	12
11	Central Market	Feb-12	12	14
12	Ministry of Government	Feb-19	12	9
13	Intercontinental Hotel	Feb-11	12	12
14	Government House	Feb-12	12	10
15	Plasticos Robelo	Feb-9	18	13
16	Montoya	Feb-23	22	22
17	Portezuelo Traffic Light	Feb-19	15	14
18	La Subasta	Feb-13	9	8
19	Villa Progreso	Feb-20	21	17
20	Brewer Victoia	Feb-10	23	15
21	El Dorado	Feb-20	6	7
22	Boer Market	Feb-10	6	8
23	Lozelsa	Feb-18	6	6
24	Las Piedrecitas	Feb-13	6	6
25	Entrance to Centro Comercial Managua	Mar-5	8	6
26	Pasó a Desnivel (Tiscapa)	Feb-25	6	8
27	Entrance to the American College	Mar-5	10	8
28	Entrance to Ciudad Sandino	Mar-5	6	6
29	San Miguel Market	Feb-24	12	9
30	Highway Sabanagrande -- Mayoreo	Mar-5	6	8
31	Las Palmas	Mar-1	24	25
32	Metrocentro Roundabout	Feb-18	8	11
33	Armando Guido	Mar-6	27	17
34	Gonzalez Theatre	Feb-24	14	12
35	Ministry of Work and Ministry of Work 1 block North	Feb-25	14	15
36	Gancho de Camino	Feb-26	12	13
37	M.C.T	Mar-4	25	15
38	Antigua Pepsi	Mar-3	25	20

4) Survey Schedule

The survey was carried out during the period February 9 to March 6, 1998 excluding Saturdays and Sundays as shown in Table 7.1.

Figure 7.2
Intersection Traffic Count Survey Form

PLANTAJLS
HORA #E

ALCALDIA DE MANAGUA
DEPARTAMENTO DE VIALIDAD - CONTEO VEHICULAR DE TRANSITO

INTERSECCION: _____
 ARIOTO : _____
 FECHA : _____ HORA FINAL _____
 GIRO IZQUIERDO: _____ GIRO DE FRENTE: _____

HORA/INICIO: _____
 GIRO DERECHO: _____

HCRA	AUTO MOVIL	BUSES	CAMIONES	MOTOS	BICICLETA	OTROS
07:00 - 07:15						
07:15 - 07:30						
07:30 - 07:45						
07:45 - 08:00						
08:00 - 08:15						
08:15 - 08:30						
08:30 - 08:45						
08:45 - 09:00						
09:00 - 09:15						
09:15 - 09:30						
09:30 - 09:45						
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10:15 - 10:30						
10:30 - 10:45						
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11:00 - 11:15						
11:15 - 11:30						
11:30 - 11:45						
11:45 - 12:00						
12:00 - 12:15						
12:15 - 12:30						
12:30 - 12:45						
12:45 - 13:00						

12

8. Travel Speed Survey

1) Objectives

This survey aims to know the travel speed and stopping situation for major arterial roads of Managua. The results of the survey are used to outline the extent of traffic congestion and to identify the bottleneck sections and intersections. The levels of services of Managua's road network can also be identified.

2) Methodology

The survey was conducted by the "floating car method" which requires the survey vehicle to keep the same position in the traffic flow; i.e. if the survey vehicle is overtaken by other vehicles, it should overtake the same number of vehicles. While the driver runs the survey vehicle in this manner, the surveyors on board record the time and reason of stoppings. The survey form is presented in Figure 8.2.

The survey was conducted for the following time periods:

- i. Morning peak hours (7:00 – 10:00)
- ii. Interpeak hours (12:00 – 15:00)
- iii. Evening peak hours (16:00 – 19:00)

For each time period, three (3) or more samples (round trips) were taken for each of the selected routes.

3) Routes Surveyed

Table 8.1 and Figure 8.1 show the eight (8) routes surveyed.

Table 8.1
Travel Speed Survey Routes

Route No.	Starting Point	End Point	Date of Survey
1	The Refinery	Monte Fresco (km.14)	16/2/98
2	"Lang" Hardware	Entrance to Ticuantepe	16/2/98
3	El Malecón Park	Intersection Road to Masaya	16/2/98
4	Country Club Traffic Lights	El Triunfo Road	16/2/98
5	Calasanz College	Central Park	17/2/98
6	7 Sur Traffic Lights	Plasticos Robelo	17/2/98
7	Intersection Suburban Ring Road, Paseo Rubén Darío	Portezuelo Traffic Lights	17/2/98
8	INAA	MCT/National Stadium	17/2/98

4) Survey Schedule

The survey was conducted on February 16 and 17, 1998

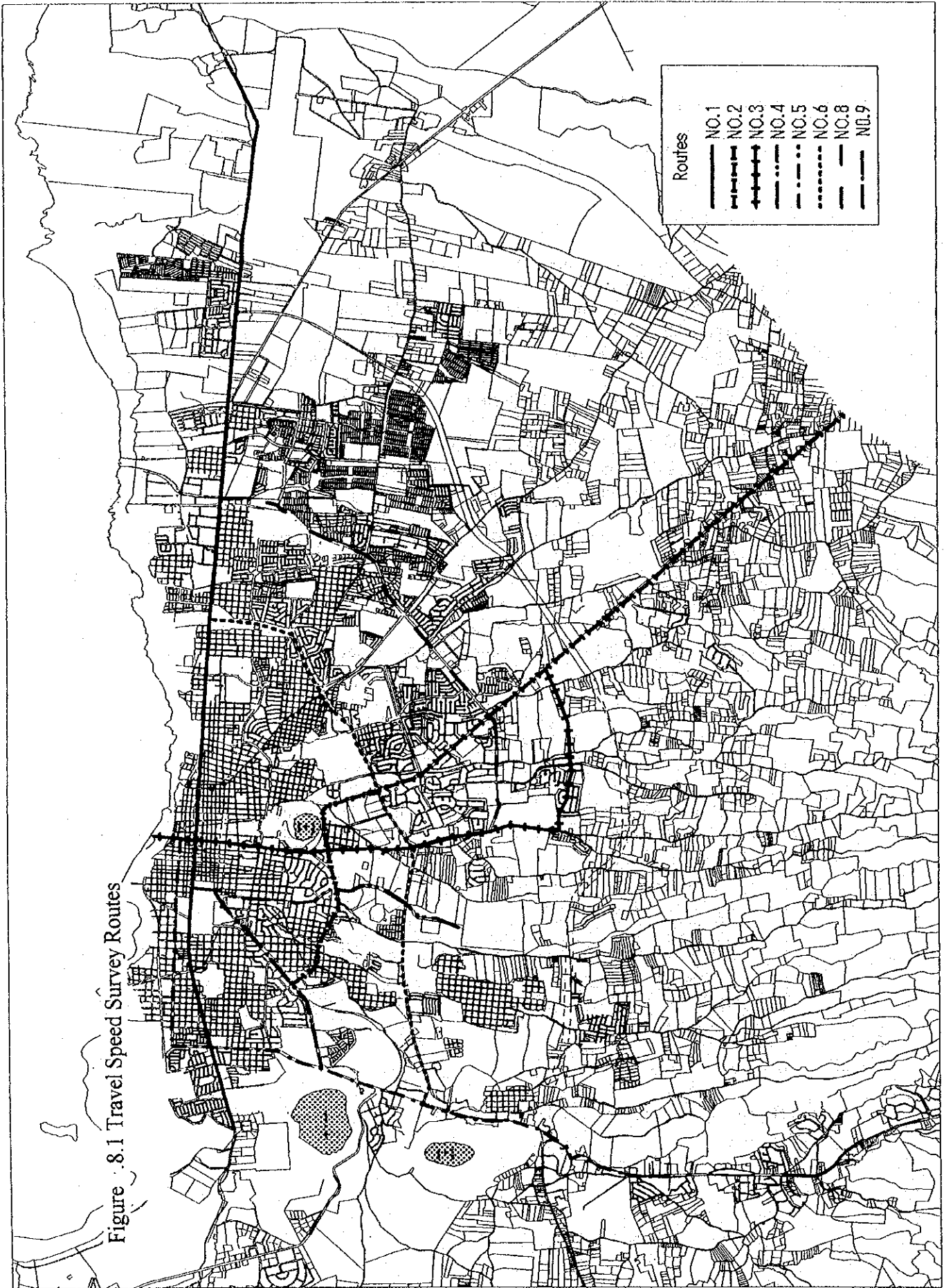


Figure 8.1 Travel Speed Survey Routes

Figure 8.2
Travel Speed Survey Form

ESTUDIO DE VELOCIDADES

NOMBRE DE LA RUTA: _____
 DIRECCION DE: _____
 MUESTRA N°.: _____

ENCUESTADOR: _____
 A: _____
 FECHA: _____

- Horas Pico Mañana
- Horas Pico Tarde
- Horas Pico Medio

Nombre de Intersección	Tiempo de Viaje Acumulativo	Retraso 1			Retraso 2			Retraso 3			Retraso 4			Accidente de Tráfico por favor chequee
		CAUSA	Tiempo Parada	Tiempo Salida	CAUSA	Tiempo Parada	Tiempo Salida	CAUSA	Tiempo Parada	Tiempo Salida	CAUSA	Tiempo Parada	Tiempo Salida	

SIMBOLOS DE LAS CAUSAS DE RETRASO

LT - Vuelta Izquierda	BP - Subida o Bajada de pasajeros de Bus	DP - Doble Parqueo	OT - Otra especificación
RT - Vuelta Derecha	SI - Señal de Tráfico	MB - Bloqueo en el Medio	
PED - Peatones	S2 - Policía Tráfico	SS - Alto	
PC - Carros Parqueados		T - Congestión General	

Formulario de Encuesta de Velocidad

9. Airport Survey

1) Objectives

The Managua International Airport is one of the important public facilities in Managua where a number of trips are generated and attracted. This is a survey supplemental to the person-trip survey since the airport is considered to be one of the cordonline stations. The movement of cargo vehicles, which is difficult to capture by the person-trip survey, is also taken by this survey in relation to the airport.

2) Methodology

Three (3) surveys were conducted at the entrances and the exits of the airport, i.e.:

- i. Traffic count
- ii. Vehicle occupancy survey
- iii. Roadside OD interview

The former two (2) surveys were conducted by vehicle type, by direction and by time of the day in the same manner as the screenline survey. The duration, however, was 12 hours (7:00 – 19:00).

The Roadside OD Interview was conducted on a sampling basis separately for passenger vehicles and cargo vehicles using different survey forms (see Appendix 2.9.1 and 2.9.2). For passenger vehicles, OD, trip purpose, address, number of passengers on board, etc. were asked, and for cargo vehicles, OD, cargo item loaded, loading capacity, load weight, type of load, etc. were interviewed. In addition, the type of cargo vehicles was classified in to nine (9) categories as follows:

- | | |
|------------------------------|------------------------|
| 1. Van/Pick-up/Station Wagon | 2. Light Cargo Truck |
| 3. Truck 2-axle | 4. Truck 3-axle |
| 5. Dump Truck | 6. Trailer w/Container |
| 7. Trailer Head Only | 8. Tank Lorry |
| 9. Mixer | |

3) Survey Location

Survey stations selected were:

- A. Entrance and exit of the airport terminal
- B. Entrance/exit of airport workers
- C. Two (2) gates of the customs

The location is shown in Figure 9.1.

4) Survey Schedule

The survey was conducted on February 13, 1998 for 12 hours (7:00 – 19:00).

Figure 9.1 Airport Survey Stations

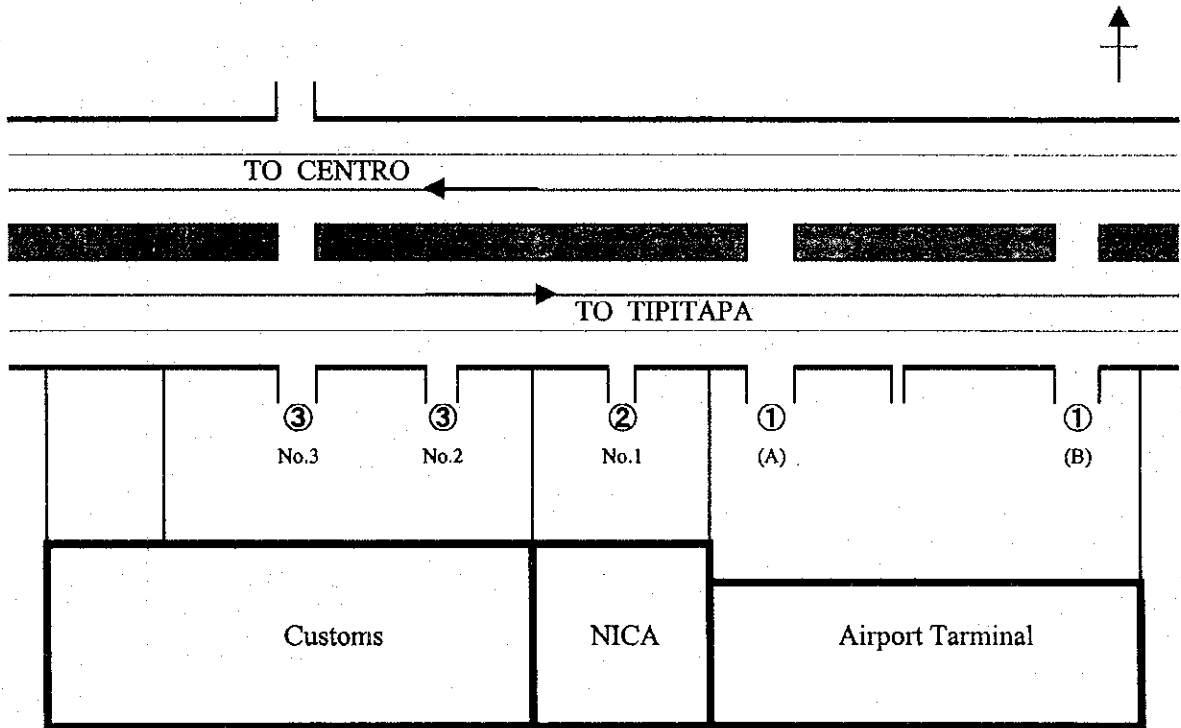


Figure 9.2

Airport OD Interview Survey Form

Encuesta de Tráfico de Aeropuerto	JICA - ALMA PLAN MAESTRO DE TRANSPORTE DE LA MUNICIPALIDAD DE MANAGUA
-----------------------------------	--

Control de Dato:	
Numero de Estación: _____ Dirección: _____ Encuestador: _____ Jornada: <input type="checkbox"/> 1ra <input type="checkbox"/> 2da <input type="checkbox"/> 3ra	Nombre de la Estación: _____ Fecha: _____ Hora: _____ Clima (condiciones) _____

Datos de Encuesta:	1	2	3
1. MODO DE VIAJE			
1. Vehículo de Pasajeros 6. Camión Grande 2. Minibus 7. Camión Articulado 3. Autobus 8. Motocicleta 4. Taxi 9. Bicicleta 5. Camión Pequeño 10. Otros	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. ORIGEN			
Dónde empezó este Viaje? (De la dirección, o edificio conocido o localidad cercana)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. DESTINO			
Dónde termina este viaje? (De la dirección, o edificio conocido o localidad cercana)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. PROPOSITO DEL VIAJE			
1. A la Casa 4. Privado 2. Al Trabajo 5. De Negocios 3. Al Colegio/Universidad 6. Otros	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. NUMERO DE PASAJEROS			
(incluyendo al Conductor)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. CAPACIDAD O NUMERO DE ASIENTO	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. BARRIO DE RESIDENCIA Y MUNICIPIO	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 9.3

Airport OD Interview Survey Form (Cargo Vehicles)

ENCUESTA OD VEHICULOS DE CARGA EN AEROPUERTO

Nombre Estación: _____ Fecha: _____
 Dirección: _____ Zona Horaria: _____ Ciudad: _____

No.	Información del Vehículo			Tipo de Embarque		Origen (de dónde viene)	Destino (a dónde va)
	Tipo Vehículo	Capacidad de Carga	Conocimiento	Factor de Carga	Compañía		
						Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____
					Tamaño: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____
					Tamaño: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____
					Tamaño: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____
					Tamaño: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____
					Tamaño: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____
					Tamaño: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____	Nombre Compañía: _____ Tipo de Negocio: _____ Dirección: _____

Tipo de Carga de Vehículo	Factor de Carga		Compañía	
	Compañía	Factor de Carga	Compañía	Factor de Carga
1. Van / Pick-up	1. Elenco	1. Vacio	1. Paleta	1. Paleta
2. Camión de Carga Liviana	2. 3/4	2. 3/4	2. Saco	2. Saco
3. Camión 2- ejes	3. 1/2	3. 1/2	3. Otros (especificar)	3. Otros (especificar)
4. Camión 3- ejes	4. 1/4	4. 1/4	4. Estuche	4. Estuche
	5. 1/4 >	5. 1/4 >	5. Barril	5. Barril
	6. Vacio	6. Vacio	6. Canal	6. Canal
			7. Otros (especificar)	7. Otros (especificar)

10. Road Inventory Survey

1) Objectives

The survey aims to establish a base road network for data collection, analysis and planning of various tasks with regard to roads and their network configuration in the study area, particularly for the identification of the existing road condition.

2) Coverage of the Survey

The survey covers all major roads in Managua, as shown in Figure 10.1. Road network for the inventory survey contains 253 road sections with a total length of approximately 200km. Survey items were identified by road section as follows:

1. Road Name, Section Length (km), Regulations (one-way)
2. Road Width: Number of Lanes
Carriageway Width (m)
Pedestrian Walk (m)
Shoulder, Median and Side Strip (m), etc.
3. Pavement Type (Asphalt/Concrete/Block/Earth)
Pavement Condition (indicative)
- Potholes, Crack, Rutting, Flatness, etc.
4. Bridges and Other Structures
5. Side Friction (indicative), Land Use and Parking
6. Terrain
7. Traffic Safety, Control and Management Facilities/Equipment
8. Others (Flooding and Drainage)
9. Road Cross Section

3) Survey Method and Schedule

The survey was conducted by two groups. Each group consisted of six (6) surveyors, one (1) supervisor and one (1) vehicle. Six surveyors were divided into three sub-groups. The surveyors walked down along the streets by sub-group and filled up the field survey form. (Refer to Figures 10.2)

The field survey was conducted for two (2) weeks in early February 1998.

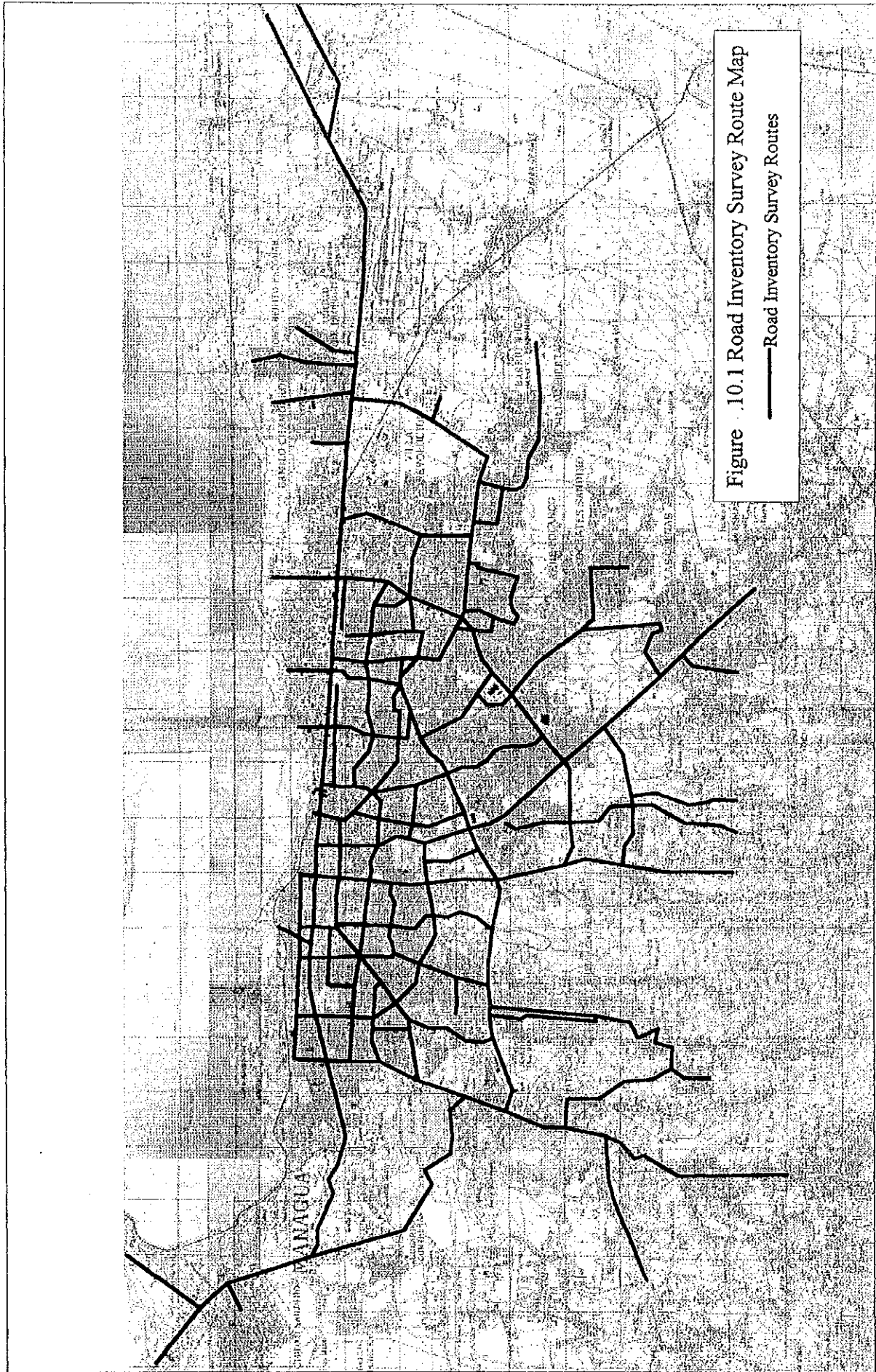


Figure 10.1 Road Inventory Survey Route Map
—— Road Inventory Survey Routes

Figure 10.2

Road Inventory Survey Form

**ESTUDIO DE INVENTARIO VIAL
ENCUESTA DE CAMPO**

(Field Chart)

0.1 Año Mes Día Hora 1998				0.2 Día de la Semana L M Me J V S			0.3 Clima Claro Nublado Lluvia		
0.4 Ubicación de Estación					0.5 Nombre de Calle				
1.1 Tramo Numero		1.2 Nombre de Calle			1.3 Longitud		1.4 Regulaciones		
2 Ancho	2.1 Andenes/Acera		2.2 Hombros		2.3 Calzada			2.4 Num. De Carriles	
2.5 Mediana			2.6 Separador Lateral		2.7 Área verde			2.8 Ancho total	
3. Pavimento		3.1 Tipo Asfalto Concreto Adoquin Tierra				3.2 Baches Muchos Pocos Nada			
3.3 Grietas Muchas Pocas Ninguna			3.4 Hundimiento x Huellas MUchas Pocas Ninguna			3.5 Plano/Llanura Buena Regular Mala			
3.6 Bombeo Existe No hay			3.7 Superficie Peatonal Pavimento Adoquin Tierra						
4.1 Puentes		Cantidad	Longitud	Ancho	4.2 Otras Estructuras		Cantidad	Tipos	
5.1 Circunstancias en la Vía Oficinas Tiendas Casas Fabricas Parques Parques Mercados						5.2 Parques en la Vía Muchos Pocos Nada			
6.1 Terreno Plano Ondulado Lomas			6.2 Terraplen		6.3 Cortes		6.4 Pendientes Empinada Moderada Ninguna		
7.1 Barreras de protección Muchas Pocas Ninguna				7.2 Señales Viales Muchas Pocas Ninguna					
7.3 Iluminación Muchas Pocas Ninguna				7.4 Postes Muchos Pocos Nada			Maraciones Muchas Pocas Nada		
8. Otros (Cauces y Drenajes, Ing.D.Gaitan)									
9 Sección Transversal de la Vía (Cruces)									
10. Observaciones al Punto 4.1 (hacer dibujo del tipo puente y breve descripción)									

11. Signal and Traffic Sign Survey

1) Objectives

Signal and Traffic Sign Survey aims to obtain the existing data/information on the major intersections in order to examine the present traffic control and management situation in the Study Area.

There is an argument on the capacity of signal controlled intersections. It is generally believed in Managua that the capacity of signalized intersections is lower than that of roundabouts. Eventually, some signalized intersections are reconstructed to roundabouts. However, various studies indicate that the signal system ensures safe and smooth traffic flows, and provides higher capacity than the roundabout when traffic flow exceeds a certain threshold. It is one of the intentions of the Signal Survey to evaluate the efficiency of the present signal system in Managua.

2) Coverage of the Survey

The signal and traffic sign survey was conducted basically at the same stations as the Intersection Traffic Count Survey. There are two (2) locations added, and the total of 40 intersections were selected (refer to Table 7.1). The two (2) added intersections are:

No.39 Av Bolivar y Pista B.Zeledon
No.40 Pista Buenos Aires y Carretera Norte

The location of the surveyed intersections is shown in Figure 11.1. Out of the 40 survey stations, 34 stations are signal controlled, one (1) station is roundabout intersection and the remaining five (5) intersections are only with traffic signs and road marking.

Survey items were as follows:

1. Intersection Name
2. Traffic Signal: Location and Type
Phasing
3. Traffic Sign: Location and Type
4. Intersection layout

The survey form is shown in Figure 11.2.

3) Survey Method and Schedule

A team of two (2) surveyors visited all the survey stations in the Study Area using a car. Firstly, they observed the layout of intersection and location of signal, signs as well as road markings. For signalized intersection, they measured signal phases in three (3) time periods; morning peak, off peak and evening peak.

The field survey started and ended in March 1998 and the survey duration (2 surveyors and 1 driver) was seven (7) days.

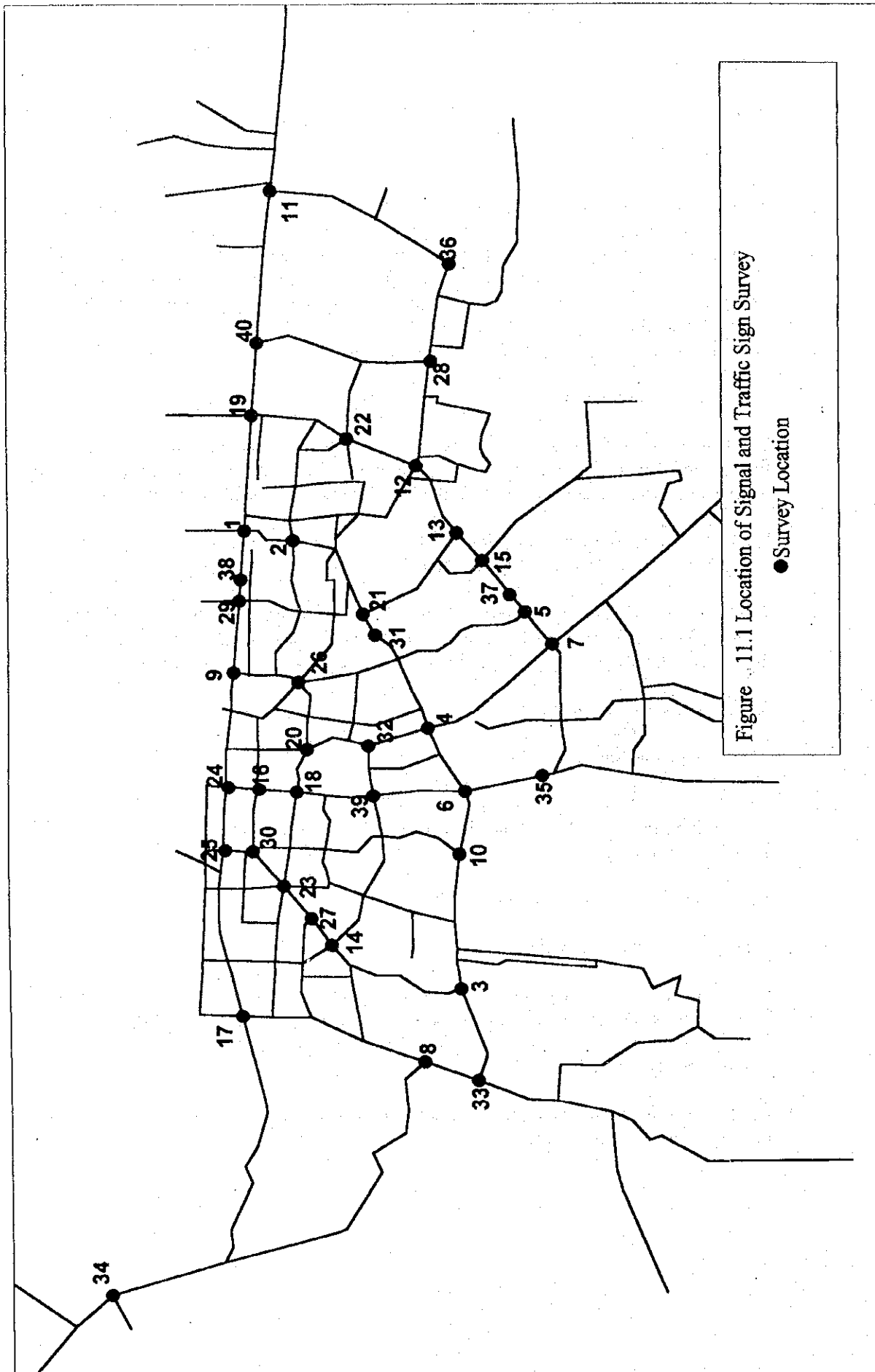


Figure 11.2

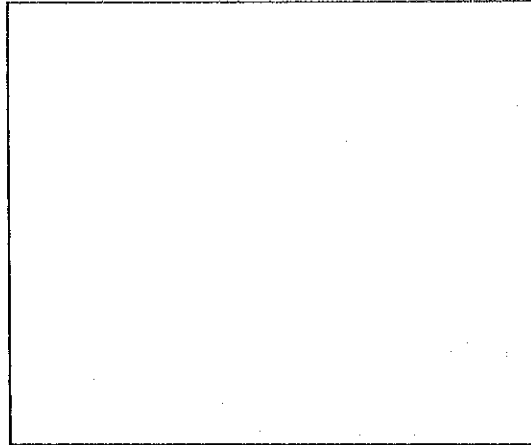
INTERSECTION INVENTORY SURVEY
(TRAFFIC SIGNAL AND ROAD SIGN)

No.00	Sheet No.1
-------	------------

1. Location No. 00

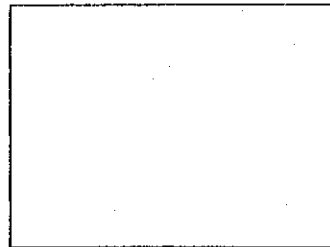
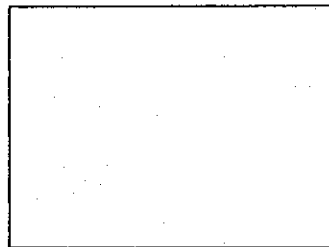
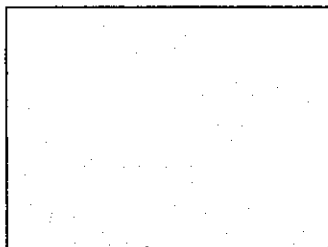
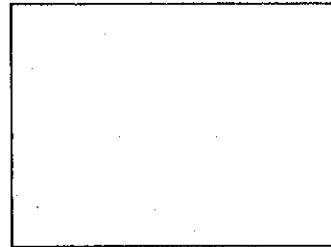
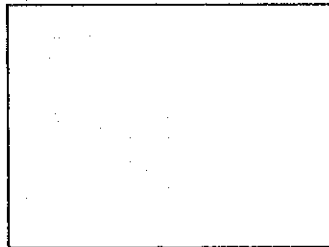
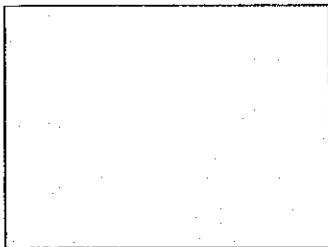
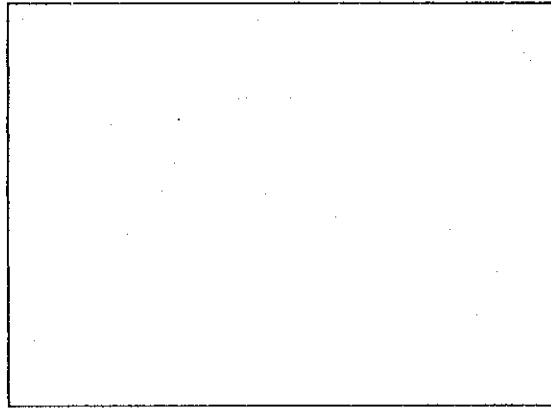
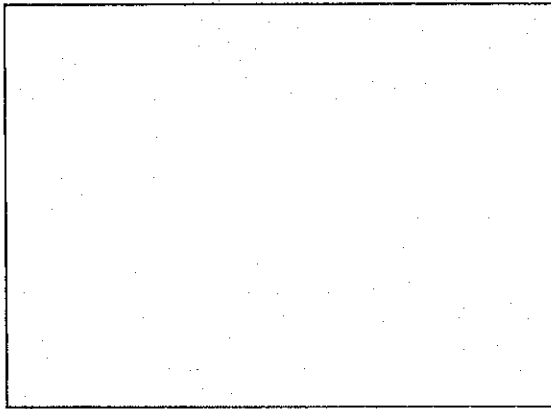
2. Name of Intersection / Road Name

3. Survey Date



4. Traffic Signal Survey

4.1 Signal Location and Existing Condition



4.2 Phasing and Interval

No.00 | Sheet No.2

a. Signal Phase

		$\phi 1$	$\phi 2$	$\phi 3$	$\phi 4$
C					
B	A				
D					

b. Signal Time

(1) Morning Peak

No.	Time	8:00	Cycle Length (sec)				120
A	G+L	G	Y	AR	R	AR	
	10	60	5	2	41	2	
B	R	G	Y	AR	R	AR	
	10	60	5	2	41	2	
C		R	AR	G	Y	AR	
		75	2	36	5	2	
D		R	AR	G	Y	AR	
		75	2	36	5	2	

(2) Off Peak

No.	Time	Cycle Length (sec)				
A	G+L	G	Y	AR	R	AR
B	R	G	Y	AR	R	AR
C		R	AR	G	Y	AR
		R	AR	G	Y	AR

(3) Evening Peak

No.	Time	Cycle Length (sec)				
A	G+L	G	Y	AR	R	AR
B	R	G	Y	AR	R	AR
C		R	AR	G	Y	AR
		R	AR	G	Y	AR

5.Road Sign and Marking Survey

No.00	Sheet No.3
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12. Parking Survey

1) Objectives

The parking survey aims to analyze the current situation of parking in the Study Area, including capacity and utilization of parking spaces on and off street. However, information on on-street parking could be obtained by the Road Inventory Survey. Thus, the parking survey was conducted on the off-street parking.

Parking is an important issue in the urban transportation system. Normally, the problem becomes obvious in old downtown constructed before motorization. However, in Managua, the situation is somewhat different from other urban areas in developing countries, because Managua's CBD area was destroyed by the earthquake in 1972 and has not yet redeveloped. The parking problem in Managua therefore is not significant currently. Hence, this parking survey was carried out mainly to obtain information useful for planning the future transportation system in Managua.

For this purpose, the following two (2) surveys were conducted:

1. Parking Inventory Survey
2. Parking Utilization Survey

2) Coverage of the Survey

1. Parking Inventory Survey

Parking Inventory Survey was conducted for off-street parking lots in the commercial and business areas as well as institutional facilities in Managua.

2. Parking Utilization Survey

Parking Utilization Survey was conducted to obtain parking demand characteristics including its hourly fluctuation by counting incoming and outgoing traffic with the time. The major commercial areas surveyed are shown in Table 12.1 and Figure 12.1.

The duration of the survey was 12 hours, starting from 7 a.m.

Table 12.1
Location for the Parking Utilization Survey

Location	Land Use Feature
1. Customs Building	Institutional
2. Centro Civico (Civic Center) (Municipality Building)	Institutional
3. Bello Horizonte Mall	Commercial and Business (East, Old developed area)
4. Central Market (Mercado R.Huembes)	Commercial (Low/Medium class)
5. Metro Center Mall	Commercial (High class)
6. Camino de Oriente Mall	Commercial and Business (South, New developed area)

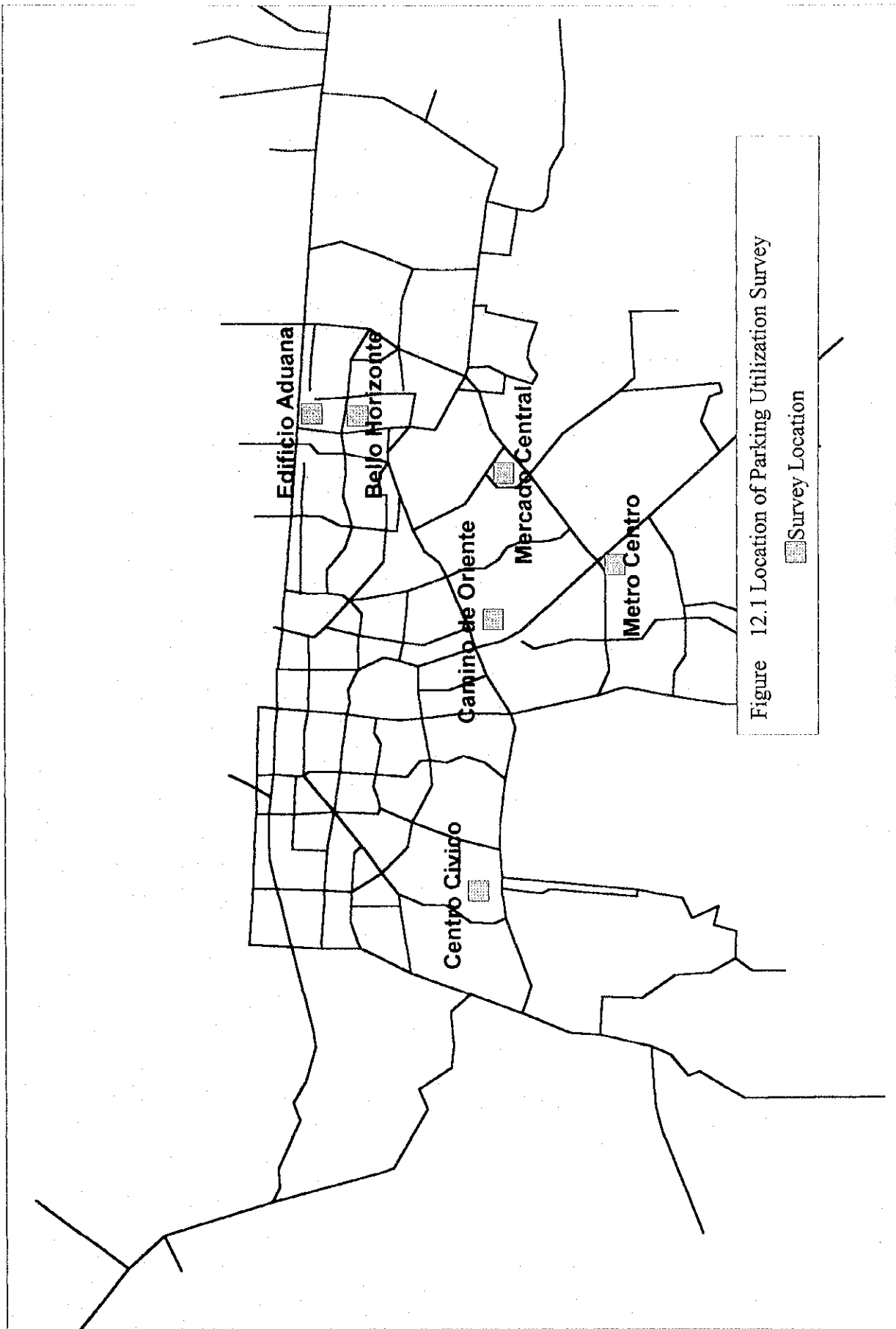


Figure 12.1 Location of Parking Utilization Survey

3) Survey Method and Schedule

1. Parking Inventory Survey

The survey was conducted by two (2) surveyors with a car. They visited all major off-street parkings and filled the survey form presented in Figure 12.2.

The survey was carried out in early March, 1998. The survey duration was three (3) days.

2. Parking Utilization Survey

Ten (10) surveyors and one (1) supervisor carried out the survey in two (2) days, in early March 1998, using the same traffic count survey form as the Traffic Count Survey (refer to Figure 6.2).

Figure 12.2

Parking Inventory Survey Form

ENCUESTA DE INVENTARIO DE PARQUEOS

Fecha: / / 1998 Nombre del Area: Encuestador:

No.	Nombre del Edificio	Nombre de la Calle	Uso del Edificio	Tipo de Parqueo	No. de Parques por el tipo de uso		Periodo de Operación
					TOTAL	Usos para Visitantes	

- 1.- Oficinas Privadas
- 2.- Oficinas de Gob.
- 3.- Centro de Compras
- 4.- Hoteles
- 5.- Otros (especificar)

13. Bus Units Survey

1) Survey Objectives

The objectives of Bus Units Survey is to obtain actual number of operating bus units and other related operational indices by bus route in Managua.

2) Survey Method

In the beginning of the survey period (February 11), an official request letter for the interview was sent from the Ministry of Construction and Transportation (MCT) to all bus cooperative operators and companies. Then the surveyors visited all bus operators and interviewed. The survey continued for two (2) weeks. The letter is attached as Figure 13.1.

The information collected by the interview is as follows:

(by operator)

Operator's name
Service route
Number of vehicles by vehicle type

(by route)

Route number
Terminals to be passed
Route length
Operating hours
Frequency
Average travel time

(by vehicle)

Plate number
Vehicle maker
Seat capacity
Operating/non-operating
Vehicle age
Route
Operating days a week
Average number of passengers

The interview forms used are presented in Figure 13.2 and 13.3.

3) **Survey Coverage**

The interviewed bus cooperative operators and companies are listed in the following table:

Table 13.1
Interviewed Bus Operators

No.	Bus Operator's Name
1	Unitarios R.L.
2	Unidos R.L.
3	ETBUSA
4	Omar Baca
5	Ricardo Morales Avilez
6	Nicarao
7	Andres Castro
8	Independiente Colon
9	Camilo Chamorro
10	Transporte La Divina Luz
11	Cambio En Marcha
12	Pedro Joaquin Chamorro
13	25 de Abril/Samuel Mairena
14	COOSPETEC
15	Marlon Zelaya
16	Unidad y Esfuerzo
17	Democracia en Marcha
18	Camilo Ortega
19	Ivan Montenegro
20	Cootrasude
21	22 de Octubre
22	Empetrunsa
23	Transporte Unidos 17 de Octubre
24	Las Jaguitas
25	Casimiro Sotelo
26	Reconcilacion
27	Nueva Nicaragua Democrática
28	Cotranspav R.L.

Figure 13.1

Letter Requesting Cooperation



MINISTERIO DE CONSTRUCCION Y TRANSPORTE
Dirección General de Planificación

Managua, 11 de febrero de 1998

Señores
Junta Directiva
Cooperativa Parrayes Vallejos

Estimado Señores:

Actualmente la Alcaldía de Managua (ALMA) en coordinación con el Ministerio de Construcción y Transporte y con la colaboración de la Agencia de Cooperación Internacional de Japón, está llevando a cabo un **ESTUDIO DEL PLAN INTEGRAL DE TRANSPORTE Y VIALIDAD DEL MUNICIPIO DE MANAGUA**, el cual tiene como objetivos principales la elaboración de planes de corto, mediano y largo plazo de mejoramiento y desarrollo de la red de transporte público de la ciudad, de la red vial del Municipio, de las terminales, de la organización del tráfico vehicular general, etc., y el análisis de alternativas para mejorar la circulación de las unidades del transporte colectivo, y para ello se requiere un conocimiento general de la situación actual, principalmente de como es que ahora funciona el Sistema de Rutas de la ciudad.

La Unidad Ejecutora del Estudio es Coordinada por la ALMA y nuestro Ministerio, además de apoyar con la designación de técnicos a tiempo completo, debemos proporcionar a la misma toda aquella información concerniente a la operación de las rutas del Transporte Urbano Colectivo, por lo que solicitamos a Ustedes el llenado de los formatos que adjuntamos, relacionados con la descripción de toda su flota vehicular y del trazado de las ruta que atienden.

Un equipo de profesionales del MCT estará en constante coordinación con Ustedes y les visitará el día sábado 14 de los corrientes para concluir la actividad, para lo que les solicitamos muy encarecidamente su mejor colaboración.

Agradeciendo mucho su atención a la presente, les saludo.

Atentamente

RM
ING. RAFAEL URBINA MARTINEZ
Director General de Planificación

cc: Ing. Pablo Hurtado Vigil
Dr. Orlando Castrillo
Ing. Mario Palacios G.
Archivo/cronológico

[Circular stamp: REPUBLICA DE NICARAGUA, MINISTERIO DE CONSTRUCCION Y TRANSPORTE, DIRECCION GENERAL DE PLANIFICACION]
Vice Ministro
Director General Transporte Terrestre
Dirección General de Planificación

[Handwritten signature]
12/02/98
16:32

Figure 13.2
Survey Form for Bus Routes by Operator

LISTA DE RUTA DE BUSES

Operador: _____

Código de Ruta	Nombre de la Ruta	Puntos de Terminal / Via	Longitud de la Ruta	Horas de Operación		Frecuencia	Tiempo Prom. De Viaje
				Desde	Hasta		

Figure 13.3
Bus Units Survey Form

ENCUESTA POR UNIDAD DE BUSES

OPERADOR: _____

ENTREVISTADO: _____

DIRECCION: _____

TELEFONO: _____

Nº Placa	Marca	Capacidad Sentados	Operando Si/No	Año del Vehículo	Nombre de la ruta asignada	Nº de pasajeros Transporte por día	Días operando por semana

14. Bus Occupancy Survey

1) Survey Objective

Bus Occupancy Survey has been conducted to obtain average load factor (average occupancy ratio) of bus in the center of Managua City. The average occupancy ratio will be used as a converter between the number of passengers and buses.

2) Survey Method

13 stations were selected for the Bus Occupancy Survey as shown in the table below. They are located in a manner to formulate an inner cordonline (see Figure 14.1).

Table 14.1
Location of Bus Occupancy Survey Points

No.	Survey Location
1	Between Valle Dorado and Refineria
2	Between Las Piedrecitas and Satelite Asososca
3	Between 7 km and 8 km of Carretera Sur
4	Exit from San Judas
5	Between INCEG and UNICIT
6	On Carretera Masaya between Mexican Embassy and Commercial Center San Francisco
7	Between Lozelasa and Radial Santo Domingo
8	300 mts below from Rubenia signal
9	Between Cementerio Oriental and El Eden bridge
10	Between RUPAP and Villa Progreso
11	Roundabout Bello Horizonte – Tacos Charros
12	La Perfecta – Portezuelo
13	Entrance to San Judas

The Survey was conducted for 12 hours, starting from 7 a.m. and ending at 7 p.m. February 19, 1998.

Surveyors were assigned to each station according to the number of routes. Each surveyor was in charge of two routes and counted the number of passengers on board and seating capacity of sampled vehicles. The information was obtained for all bus routes with a few exceptions of low-frequency routes.

The survey form used is presented in Figure 14.2.

Figure 14.1 Location of Bus Occupancy Survey Point

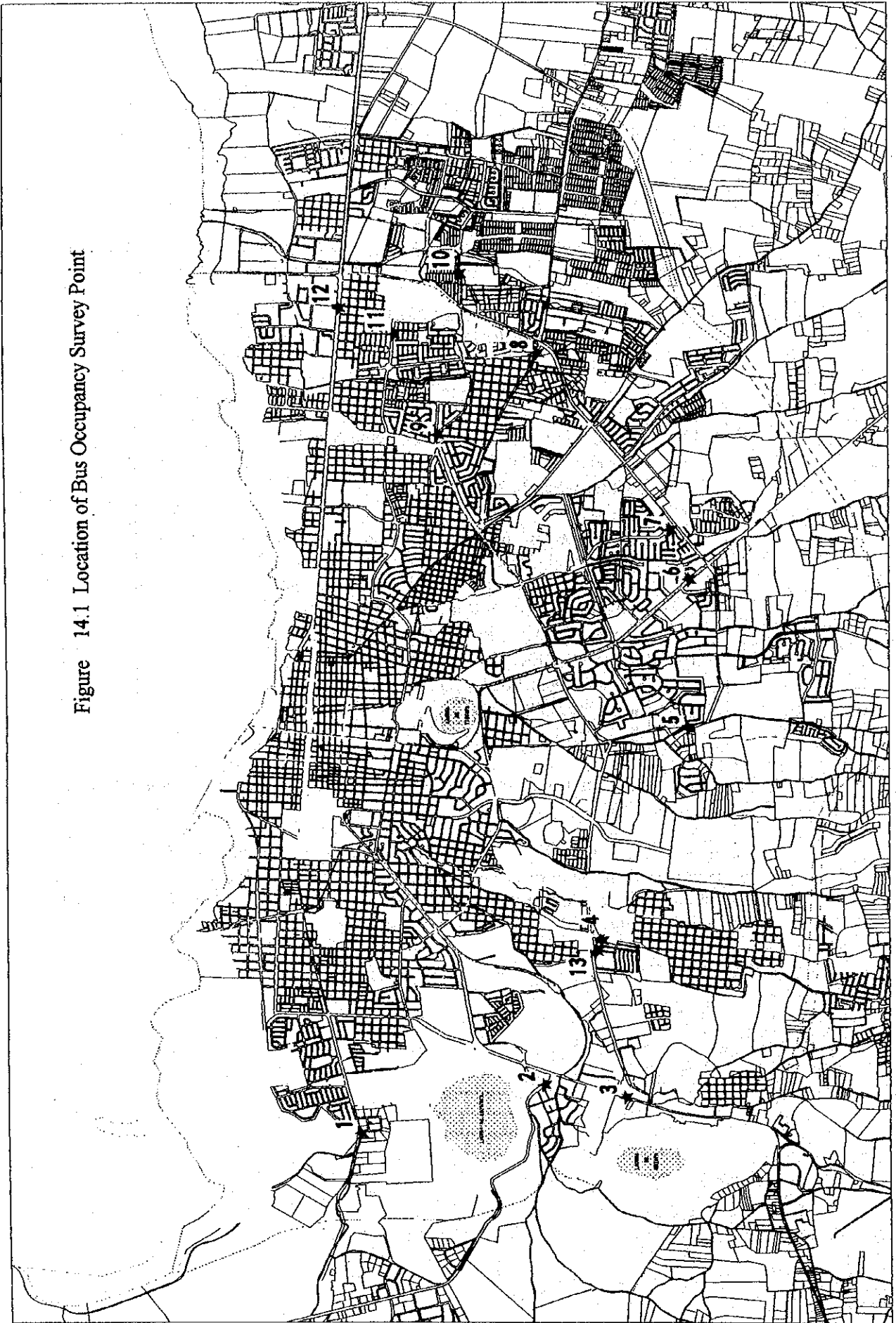


Figure 14.2
Bus Occupancy Survey Form

ENCUESTA DE OCUPACION VEHICULAR

No. Estación : _____ Nombre de la Estación : _____

Dirección : De _____ A _____

Fecha: _____ 1998 _____ Tiempo: _____ Registrador : _____

Hora: _____ AM PM

RUTA:		
No.	NO. DE PAS ABORDO	CAPACIDAD SENTADOS
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Total		

RUTA:		
No.	NO. DE PAS ABORDO	CAPACIDAD SENTADOS
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
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15		
16		
17		
18		
19		
20		
Total		

RUTA:		
No.	NO. DE PAS ABORDO	CAPACIDAD SENTADOS
1		
2		
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4		
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16		
17		
18		
19		
20		
Total		

RUTA:		
No.	NO. DE PAS ABORDO	CAPACIDAD SENTADOS
1		
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19		
20		
Total		

RUTA:		
No.	NO. DE PAS ABORDO	CAPACIDAD SENTADOS
1		
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Total		

RUTA:		
No.	NO. DE PAS ABORDO	CAPACIDAD SENTADOS
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Total		