

volume count at the cordon line stations has two objectives. One is to supplement the ordinary traffic count, while the other is to obtain expansion factors. The cordon line survey was carried out on July 30, 1991.

1) Interview and Counting Location

128. Roadside interview and traffic volume count were carried out on the cordon line as shown in Figure 3.3-2. The cordon line was set on the municipality boundary and two (2) cordon line survey stations were set at the points on the two national roads across the boundary which are;

- on the national road for Barranquilla
- on the national road for Medellin

2) Survey Form

129. It is difficult to stop and detain vehicles for driver interviews on roads, especially when traffic is heavy. Normally, less than a minute can be spared. Thus, it is indispensable to limit the items of questionnaire to an absolutely necessary minimum. Therefore, questionnaire items were limited to only trip information.

130. The items are shown below:

- Origin/Destination
- Passing Time
- Purpose
- Type of Vehicle
- Number of Passengers accompanied
- Type and Weight of Freight carried

3) Survey Period

131. The roadside interview was carried out for a period of 14 hours between 6:00 a.m and 8:00 p.m, while the traffic volume count was conducted for 24 hours.

4) Type of Vehicle

132. Vehicular classification of the interview and counting surveys is shown below.

- Passenger car
- Taxi
- Truck
- Bus (passenger capacity 45 seats)
- Buseta (25 seats)

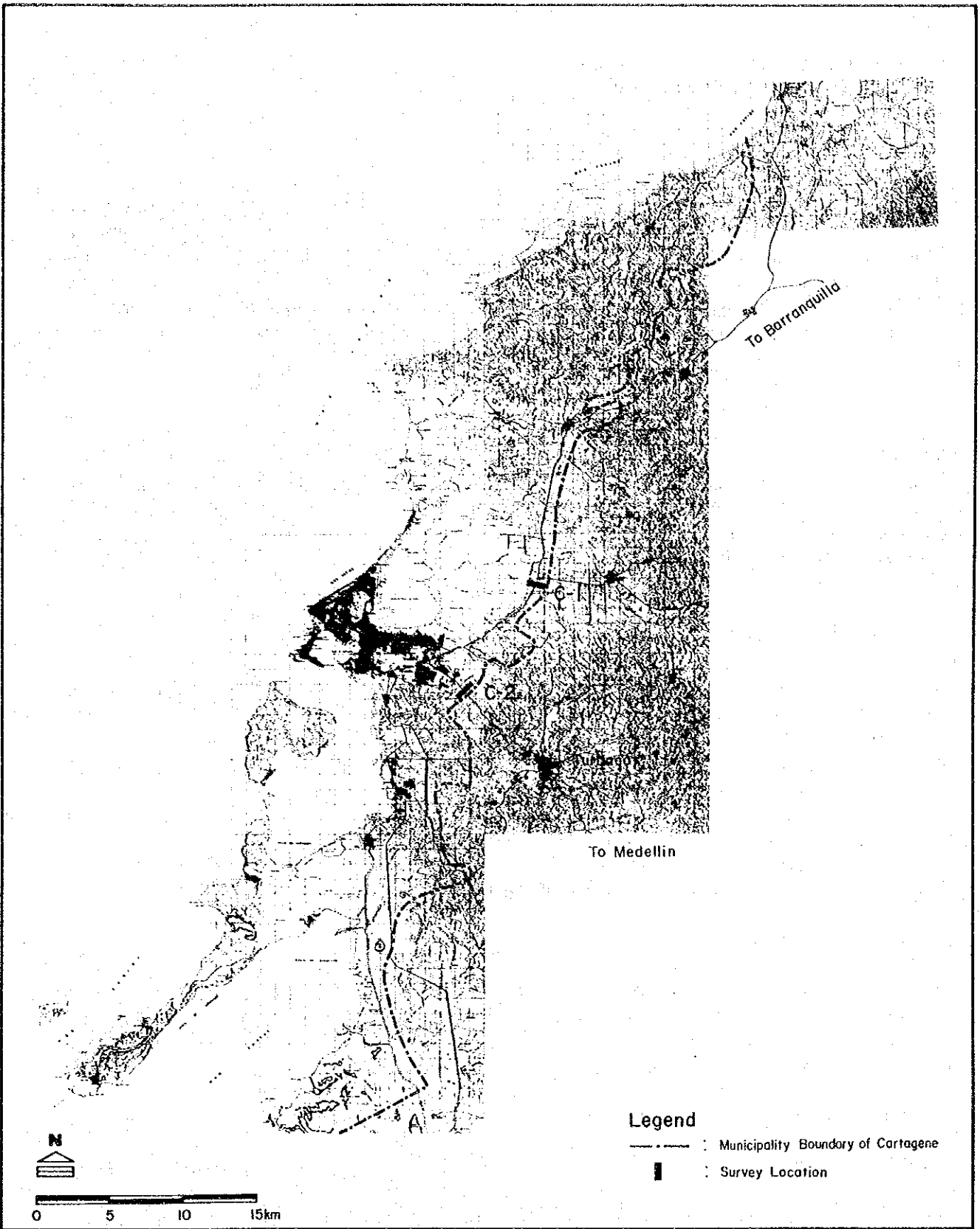


Figure 3.3-2 Cordón Line Location

- Colectivo (12 seats)
- Intermunicipal Bus

5) Interview and Counting Method

133. From among the above type of vehicle, the drivers in passenger car and truck were interviewed on the roadside, while interview for the passengers was made for taxi and buses. The interview on the roadside is carried out in both inbound and outbound directions of the central area of Cartagena. The vehicle counting and passenger counting were carried out for 24 hours and 14 hour (6:00 a.m to 8:00 p.m), respectively.

(4) Screen Line Survey

134. Screen Line Survey has two objectives. One is to supplement traffic volume data, while the other is to confirm the accuracy of the OD survey results obtained from Vehicle OD Trip Survey by comparing traffic volume on the screen line and the expanded OD trips supposed to cross the screen line. The Screen Line Survey was carried out on July 31, 1991.

1) Survey Location

135. The location of screen line was set up across the narrowest place surrounding with Ciénaga de Tesca in the northern side and Bahía de Cartagena in the southern side. Three stations were set along the screen line. Figure 3.3-3 shows the location of screen line.

- Av. Carrera 30 (Barrio la Maria)
- Av. Don Pedro de Heredia
- Puente Bazurto (Bazurto Bridge)

2) Survey Method

136. Number of vehicles and passengers on board were counted in the same manner as the cordon line survey. The vehicle counting was carried out for 24 hours, while 14 hours (6:00 a.m to 8:00 p.m) count was used for the passenger counting.

(5) Traffic Volume Survey

137. Traffic Volume Survey consists of road sectional traffic volume count and intersection traffic volume count. The traffic volume count accompanied with passenger counting on selected sections aims to get information for modal shear of private and public transport on each imaginary section in the whole urban area. Trip information for public bus passenger is obtained from

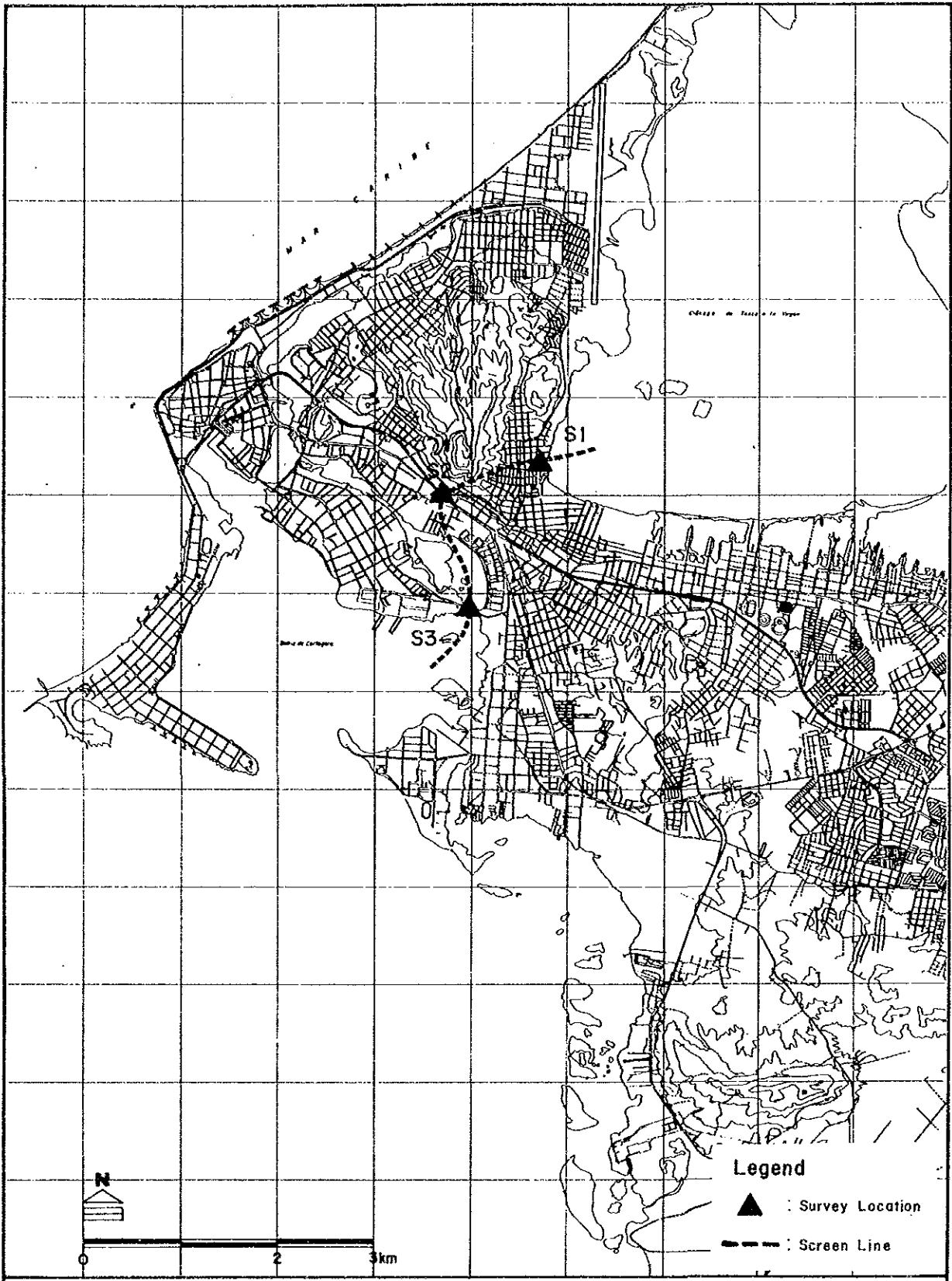


Figure 3.3-3 Screen Line Location

the Bus Passenger Interview Survey in which surveyor directly interviews on board. On the other hand, the private vehicle trip information is obtained from Vehicle OD Trip Survey. Therefore, it is necessary to obtain the whole information of private and public transport at the same time in the field to check the total number of trips in Cartagena.

138. The other purpose of the traffic volume survey is to know the traffic conditions of each road. The existing traffic data is presently quite limited and is to be updated in the Study Area. Therefore, the traffic volume survey was carried out in the period of the end of July and the middle of August, 1991.

1) Traffic Volume Count on Road Sections

139. Traffic volume counts were carried out at 15 stations along the major roads. The vehicle volume and passengers on board were counted manually for each of 7 vehicle types which is the same way as that of the Cordon Line Survey, for 14 hours between 6:00 a.m and 8:00 p.m. Besides these locations, 3 locations (Av. Santander, Carretera a Mamonal and Av. Via de la Cordialidad) were surveyed for 24 hours exclusive of the passenger count (14 hours). The survey locations are shown in Figure 3.3-4.

2) Intersection Traffic Volume Count

140. Intersection traffic volume count was made at 11 major intersections. The directional movement of all the traffic approaching to these intersections were recorded manually for each of 4 vehicle types (passenger car, truck, taxi and buses) for 14 hours. Figure 3.3-5 shows the location of the intersection traffic volume counts.

(6) Traffic Volume Survey on Transport Facilities

141. Traffic Volume Survey on major transport facilities which includes airport, market and sea port was carried out to obtain information for OD trip distribution as well as trip generation and attraction of these facilities. The information is used to estimate trip movement made by inhabitants outside the Study Area, which is the same purpose as that of the Cordon Line Survey. At the same time, this information will be used for estimating future travel demand from those major transport facilities.

142. The transport facilities which generate and attract much traffic volume were selected as the survey location as shown below and in Figure 3.3-4:

- Cartagena International Airport

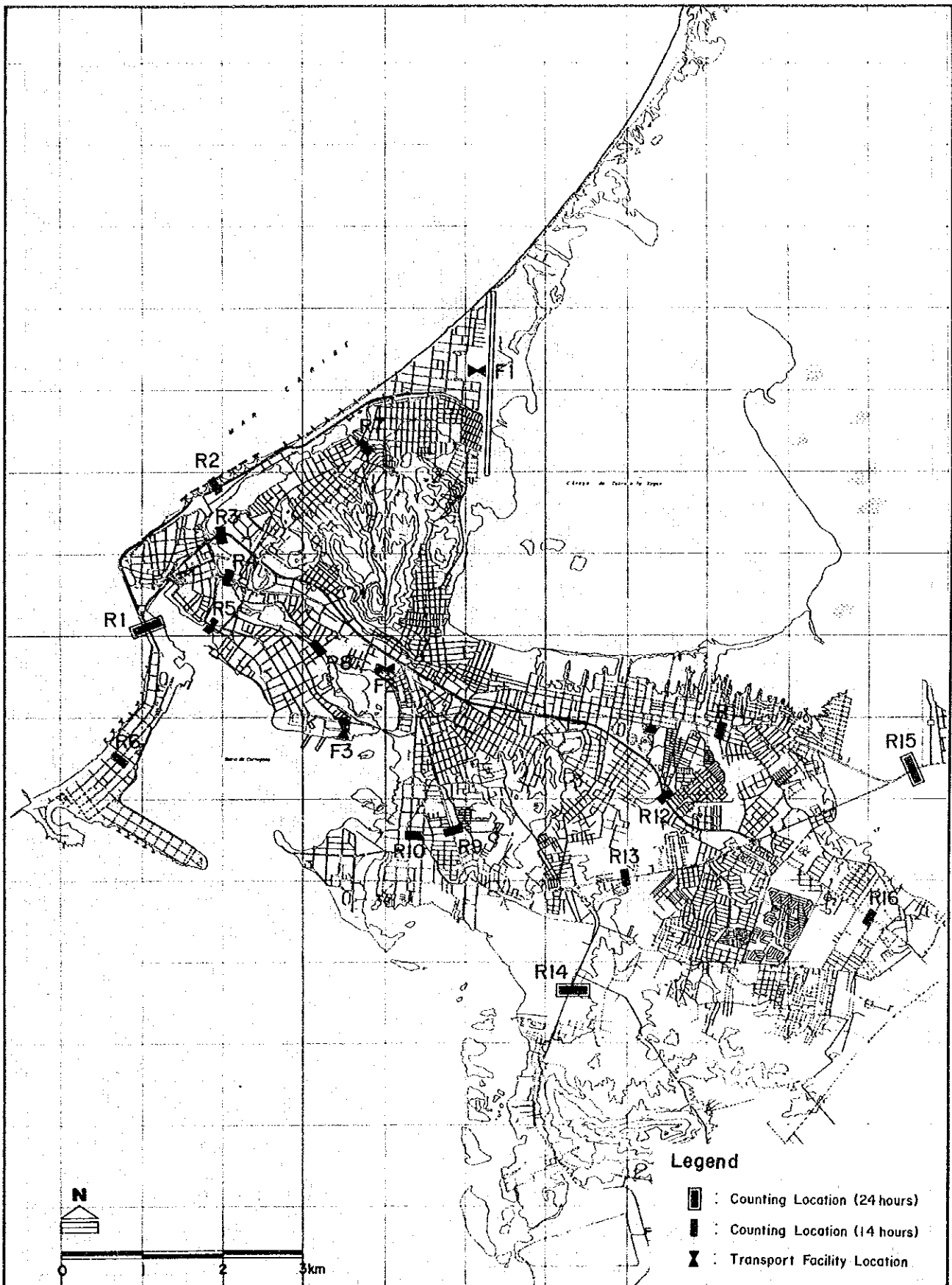


Figure 3.3-4 Traffic Volume Counting Locations and Transport Facility Survey Locations

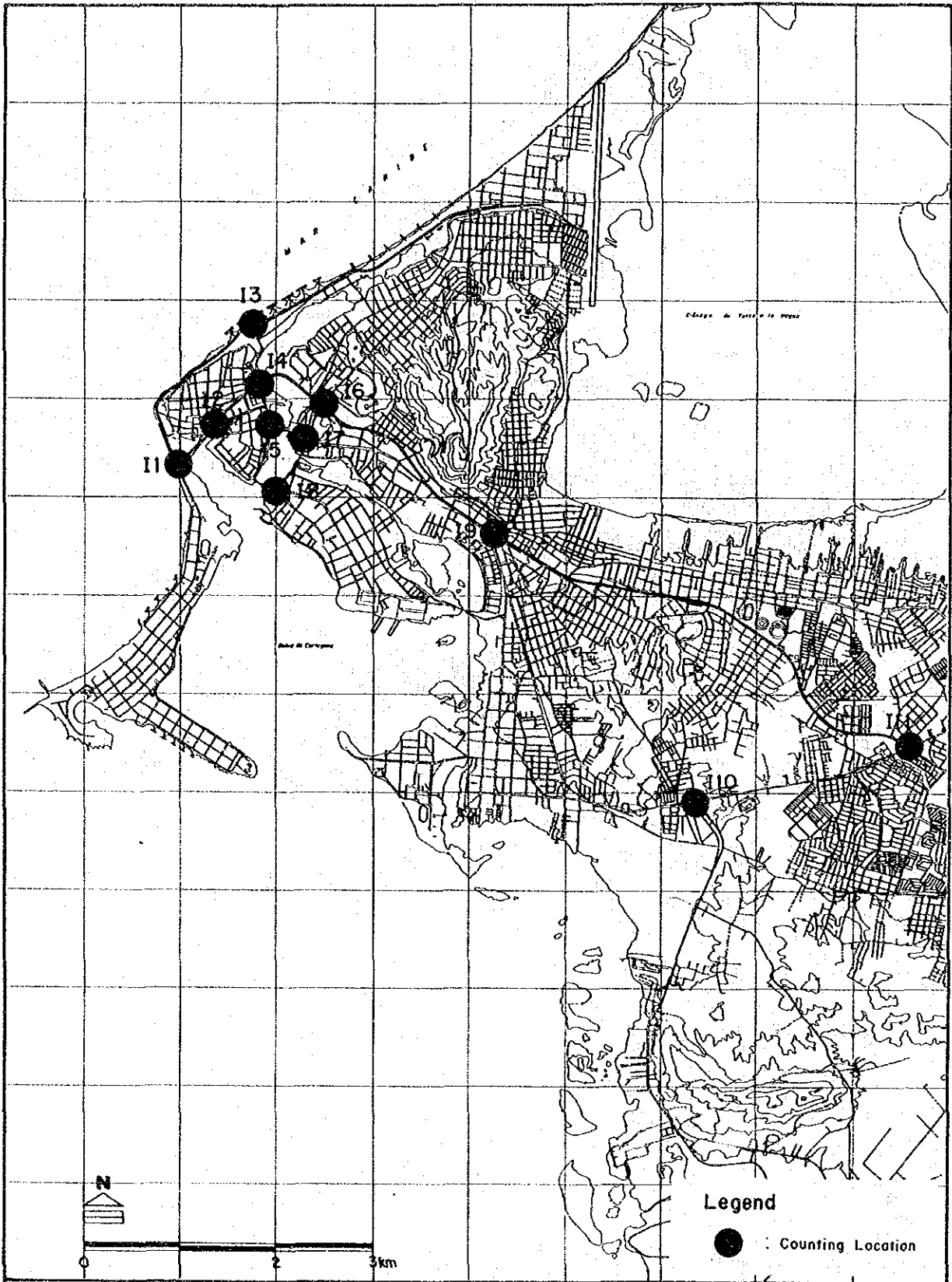


Figure 3.3-5 Intersection Traffic Volume Counting Locations

- Terminal Maritimo (Seaport Cargo Terminal)
- Mercado Publico (Public Market)

143. In the survey on Terminal Maritimo and Mercado Publico, the purpose is to mainly obtain truck movement registered outside the Study Area. In those transport facilities, there are many trucks operated of which trip length are long and destination are the outside of the Study Area as well as the registered places. Therefore, it is not possible to obtain such trip information from Vehicle OD Trip Survey.

144. As for tourism spots, there are few locations where many tourists visit by vehicles exclusive of El Laguito and Boca-grande where many hotels concentrate along the sea shore. Many tourists, mostly seasonal, mainly move inside those places on foot. Therefore, the information of tourist was collected on statistical data, instead of counting survey.

1) Survey Method

145. Those facility surveys consist of roadside interviews and traffic volume count which are conducted simultaneously at the selected facility. The survey method for questionnaire form, and interview, and counting methods were almost same as those used for the Cordon Line Survey exclusive of survey period in which traffic counting period and interview period were carried for 14 hours. The survey was carried out on August 1, 1991.

2) Type of Vehicle

146. As for type of vehicle at Terminal Maritimo (Seaport Cargo Terminal) and Mercado Publico (Public Market), only trucks were interviewed for the survey purpose. Only counting was conducted for other types of vehicles. No public buses, however, were surveyed because of no operation in those places. At the airport, the same type of vehicle as the Cordon Line Survey was investigated in the interview survey, excluding the public buses under the same reason.

a. At Airport

- Passenger car: Interview/ Counting
- Taxi : Interview/ Counting
- Truck : Interview/ Counting

b. Others

- Passenger car: Counting
- Taxi : Counting
- Truck : Interview/ Counting

(7) Household Characteristic Survey

147. Through the Vehicle OD Trip Survey, it is difficult to obtain the socioeconomic data for all levels of households by each traffic zone because only families who own vehicles would be interviewed. The data, however, is indispensable for forecasting future socioeconomic factors and vehicle ownership.

148. In order to supplement the existing 1985 population census data, Household Characteristic Survey through home interviews was planned and conducted in the Study. Approximately 400 households were randomly surveyed in relation to the population size of the traffic zones on August 3 and 4, 1991.

149. The planned questionnaire items covered household information and household member information as shown below:

a. Household Information

- Household composition
- Household income
- Car ownership

b. Household Member Information

- Sex, age, occupation (primary and secondary), work place, school address and education level

(8) Survey Data Processing

150. Since Vehicle OD Trip Survey and Cordon Line Survey data were obtained on the random sampling basis, the collected survey data has to be expanded to represent real values based on the present registered vehicles as a mother group. In addition, both the survey data have to be adjusted to avoid double counting due to the fact that the vehicles owned by the persons who live in the inside of the Study Area are included in the interview data from Cordon Line Survey. The data processing was made in many steps from expansion of survey data to screen line check.

1) Expansion for Vehicle OD Trip Survey

151. Expansion of the Vehicle OD Trip Survey data which is on random sampling basis was made by the procedure which multiplies the ratio of the number of registered vehicles divided by the number of collected vehicles by traffic zone and by type of vehicle (passenger car and truck). As for taxi which has no relationship between taxi owner's address and its operating places, and has an operating territory where taxi driver waits for passengers at same taxi stop, the expansion was made by taxi stop, which multiplies the ratio of all the number of taxis operated at taxi

stop divided by the number of interviewed taxis.

2) Screen Check

152. The adjustment called "Screen Check" is made by comparing number of traffic volume (T_p) which passes through the screen line estimated from the Vehicle OD Trip Survey data, with the traffic volume (T_s) counted on the screen line. The traffic (T_c) which passes through not only the screen line, but also the cordon line, must be erased from the traffic on the screen line. The equation for the screen check is shown below:

$$T_s - T_c = a * T_p$$

where

a : coefficient of adjustment

3) Expansion for Cordon Line Survey

153. Expansion for the interview data in Cordon Line Survey was basically made according to the following classification:

- Location
- Type of vehicle
- Time range

4) Relation between Vehicle OD Trip and Other Surveys

154. The trip OD table is made from the data of Vehicle OD Trip Survey, Cordon Line Survey and Traffic Volume Survey on Transport Facilities. The Vehicle OD Trip Survey data represents the information for the vehicles owned by the persons who live inside the Study Area. On the other hand, Cordon Line Survey aims at collecting the trip information of the travelers who dwell outside the Study Area. Additionally, the purpose of the survey on the transport facilities is the same as that of the Cordon Line Survey. Therefore, the trip OD table of the whole Study Area is made by combining the Vehicle OD Trip Survey data with the Cordon Line Survey and the Facility Survey data. When combining them, the trips of the vehicles, counted in both latter two surveys, which is registered inside the Study Area are erased to avoid double counting.

3.3.2 Traffic Volume

155. This section presents the general characteristics of traffic movement in the Study Area, mainly analyzing the data of traffic volume surveys composed of Cordon Line, Screen Line and Traffic Volume Surveys. The characteristics of major roads in terms of traffic volumes together with their hourly distribution and vehicular composition and traffic turning movement at inter-sections are discussed.

(1) Traffic Volume in Urban Area

1) Daily Traffic Volume

156. Daily traffic volume in the Study Area is shown in Figure 3.3-6. The figure is presented by a width line proportional to traffic volume. The traffic volume at 14-hour counting locations was converted to daily volume, based on the 24-hour counting data.

157. The heaviest traffic volume is recorded on Av. Don Pedro de Heredia on which shows a set of traffic volumes in both directions of inbound (R3) and outbound (R4) under each one-way regulation to be 56,000 veh/day. Carrera 1 at location No. R1 of Bocagrande (42,000 veh/day), Av. Blas de Lezo (38,000 veh/day), Av. Venezuela (24,000 veh/day) and Puente de Roman at R5 (28,000 veh/day) also carry heavy traffic. These roads are located in Centro and its neighboring areas.

158. In the residential area surrounded by Central and South Oriental Areas, traffic volumes are considerably lower. The figure on Av. Don Pedro de Heredia is 27,000 veh/day, in contrast to 41,000 veh/day at screen line on the same road. Traffic volumes on Calle Antigua (R11) and Carretera Troncal de Occidente (R13) are 5,000 veh/day and 18,000 veh/day, respectively.

2) Hourly Traffic Volume

159. Traffic volume distribution by hour describes the peak demand for roads. Hourly traffic volumes on Locations R1, R14 and R15 where the 24-hour counting surveys were carried are shown in Figure 3.3-7.

Location R1: Av. Carrera 1 in Bocagrande

In the morning peak hour, the hourly traffic volume ratio in outbound direction from Centro to Bocagrande is somewhat higher (7.3% of total outbound traffic) than that (5.4%) in the inbound. Directional movement in the afternoon peak is

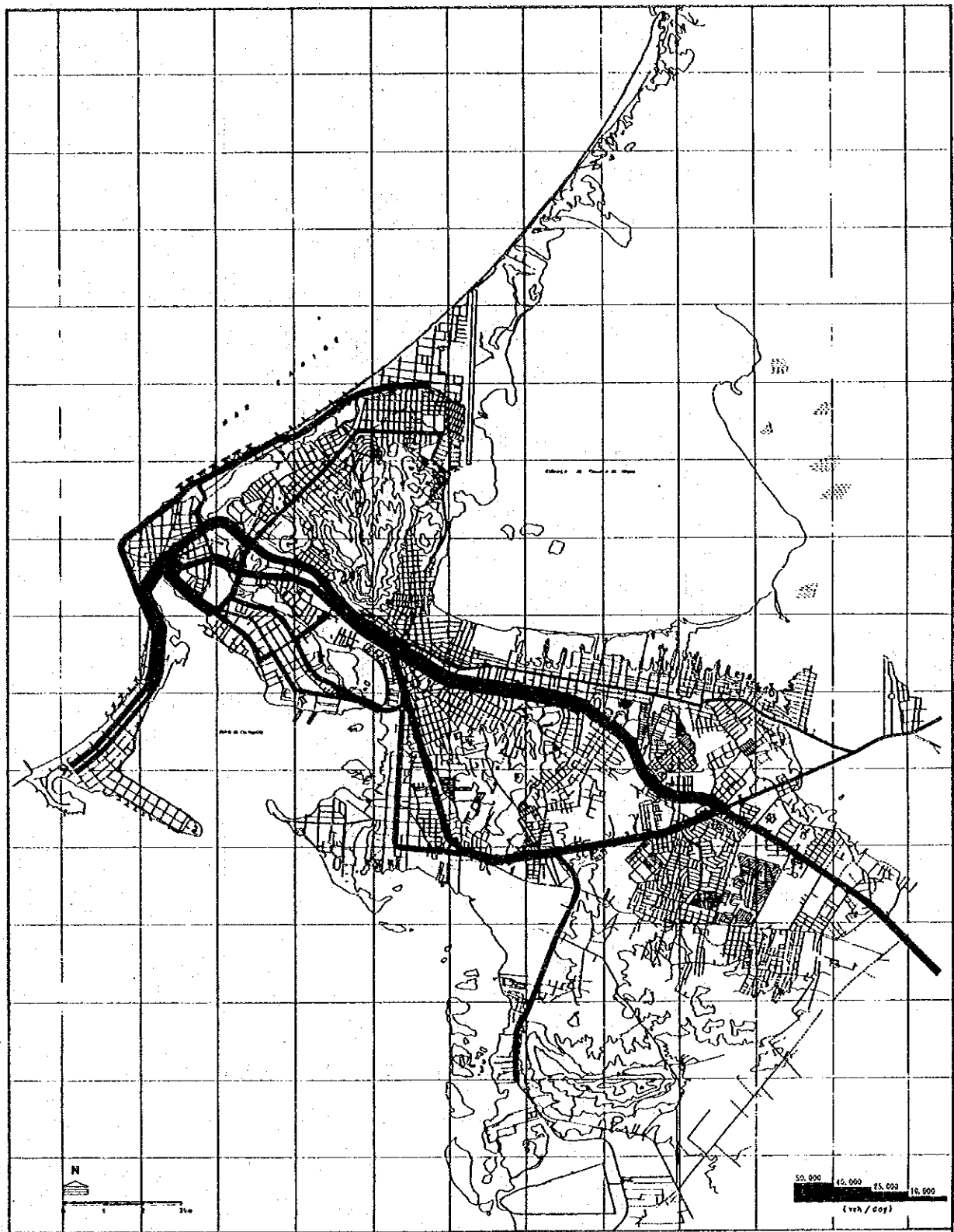


Figure 3.3-6 Traffic Volume in the Study Area

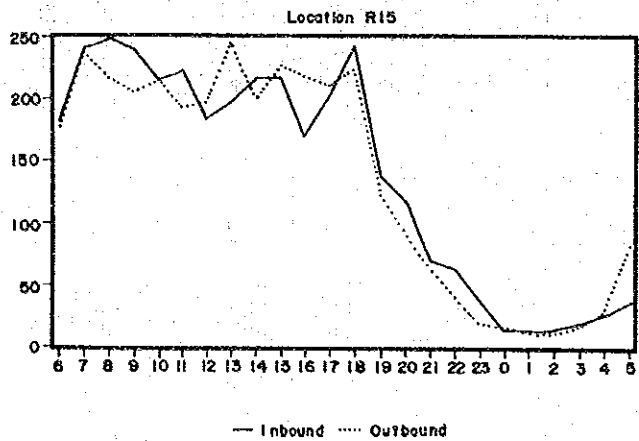
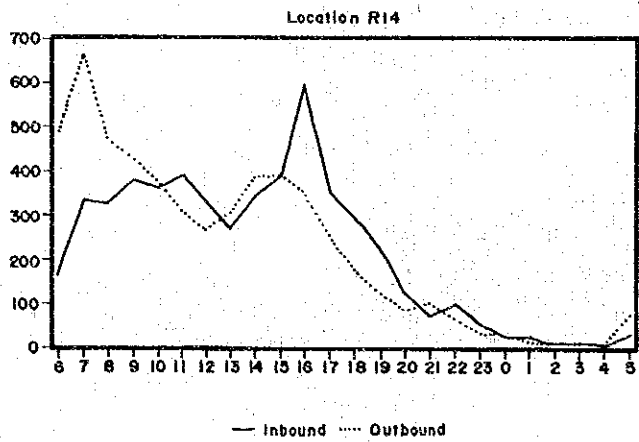
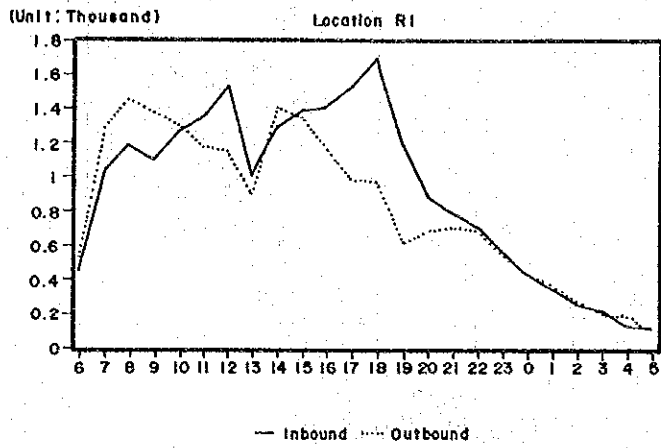


Figure 3.3-7 Hourly Traffic Volume

in reverse. According to hourly fluctuation for a period of 12:00 a.m and 2:00 p.m in the afternoon, it seems to indicate that persons who work in Bocagrande and El Laguito drive a car to go home and later on return to work.

Location R14: Av. Carretera a Mamonal

In the morning from 7:00 a.m to 8:00 a.m, traffic volume bound for work in the factories of Mamonal Industrial Area sharply climbs to about 12.1% of outbound daily traffic, and also by 11.4 % of inbound daily traffic during 4:00 p.m to 5:00 p.m in the afternoon to return home. There is no noon peak for returning home for lunch.

Location R15: Av.Via de la Cordialidad

Hourly traffic volume indicates stability and little fluctuation for a period of daytime. It seems hourly traffic volume remains stable in daytime.

160. As for ratio of daytime to nighttime defined by dividing daily traffic volume by daytime 12-hour traffic, the ratio on Location R1 near Bocagrande is 1.5, in contrast to 1.2-1.3 on Locations R14 and R15 in the suburb, respectively. It indicates that since ratio of night time traffic volume to the daytime on Location R1 is relatively high, this area near Centro is busy in socioeconomic activities for a whole day in comparison with other areas.

3) Vehicular Composition

161. The vehicular compositions on major roads are shown in Figure 3.3-8. These compositions are based on 14 hour counting data during 6:00 a.m to 8:00 p.m. The vehicular composition in each counting location represents the feature of roadside land use as shown below.

162. As for the vehicular composition around Centro, the passenger car ratio at R1 of Bocagrande is higher. Its figure is roughly 60% of the total. Buses at R4 on Puente de Heredia occupy approximately 34%.

163. In Bosque Industrial Area (Location R9), taxis and trucks are predominant. These figures are approximately 30% and 10%, respectively. The ratio of trucks in Mamonal Industrial Area is also higher (23%).

164. In the residential area (Location R12 on Don Pedro de Heredia), buses represent high of about 36%.

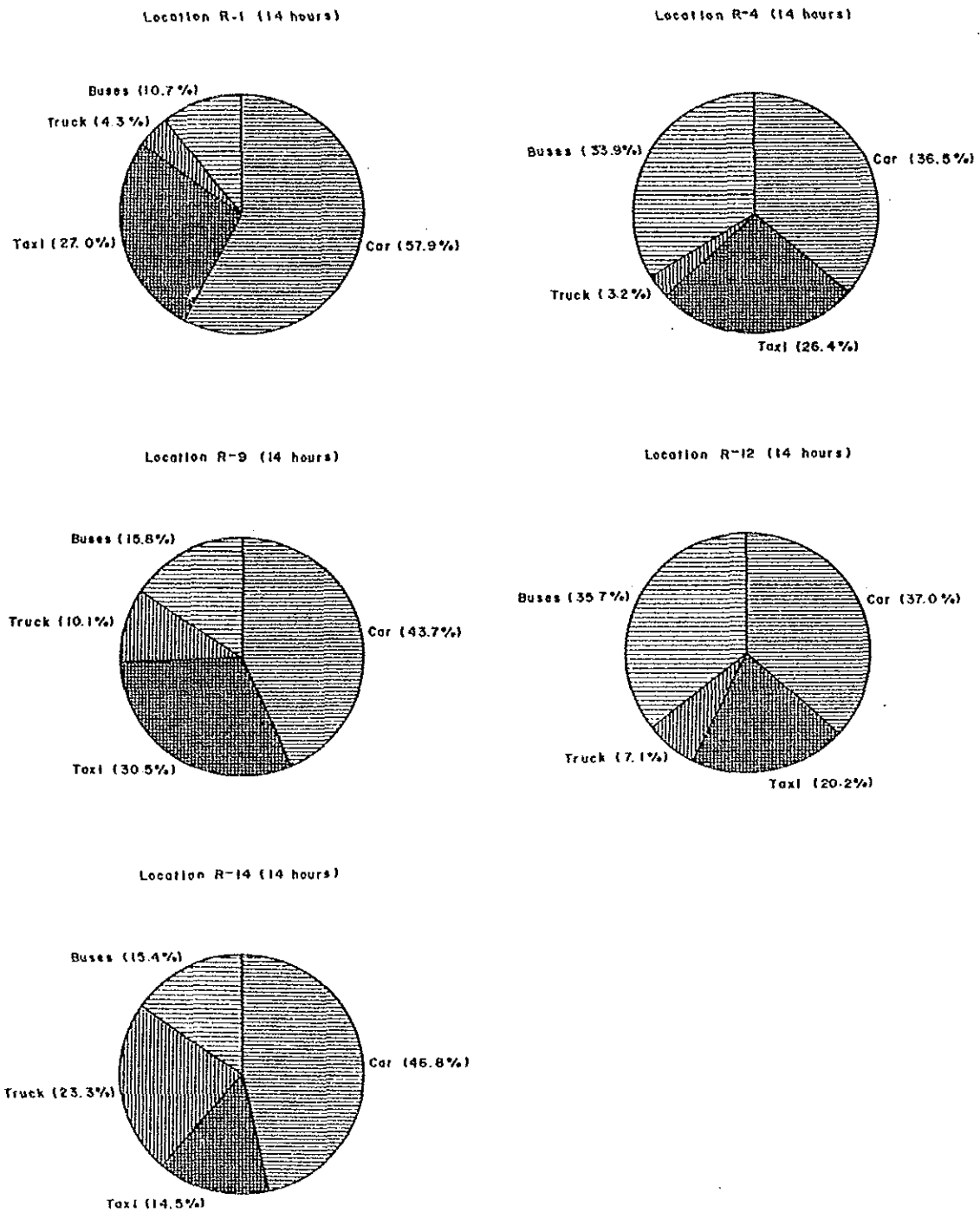


Figure 3.3-8 Vehicular Composition

(2) Traffic Volume on Cordon Line

165. Traffic volume passing through cordon line shows in Table 3.3-3. Approximately 8,600 vehicles pass through cordon line for a whole day, of which 3,300 are in the direction of Barranquilla and 5,300 in the direction of Turbaco.

Table 3.3-3 Traffic Volume on Cordon Line

| Location | Unit | Car | Taxi | Truck | Bus | Total |
|--------------|--------------------|----------------|--------------|----------------|----------------|----------------|
| Barranquilla | Veh/day (ratio) | 1,158 0.353 | 72 0.022 | 1,427 0.434 | 628 0.191 | 3,285 1.000 |
| Turbaco | Veh/day (ratio) | 2,527 0.474 | 310 0.058 | 1,437 0.270 | 1,052 0.198 | 5,326 1.000 |
| Total | Veh/day (ratio) | 3685 0.428 | 382 0.044 | 2864 0.333 | 1680 0.195 | 8611 1.000 |

166. As for vehicular composition on the cordon line, the ratio of trucks is considerably higher (33%), in contrast to that (23%) in Mamonal Industrial Area. The taxi ratio, however, is far lower (4%) than that in the urban area (see Figure 3.3-9).

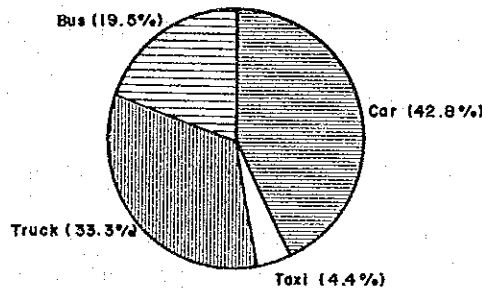


Figure 3.3-9 Vehicular Composition on Cordon Line

167. As can be seen from Figure 3.3-10, which shows the trip purposes by type of vehicle, the composition ratio is different between Barranquilla and Turbaco. Turbaco is relatively high in the composition of "to work" trip purpose by car in comparison with that in Barranquilla. The trip purposes by bus passengers also has similar tendency to that by car. According to those, it is obvious that Turbaco is located within range of distance, of which a worker goes to office every morning and returns to home every evening. The business relationship between Cartagena and Turbaco is also somewhat heavier from the view point of number of "business" trips.

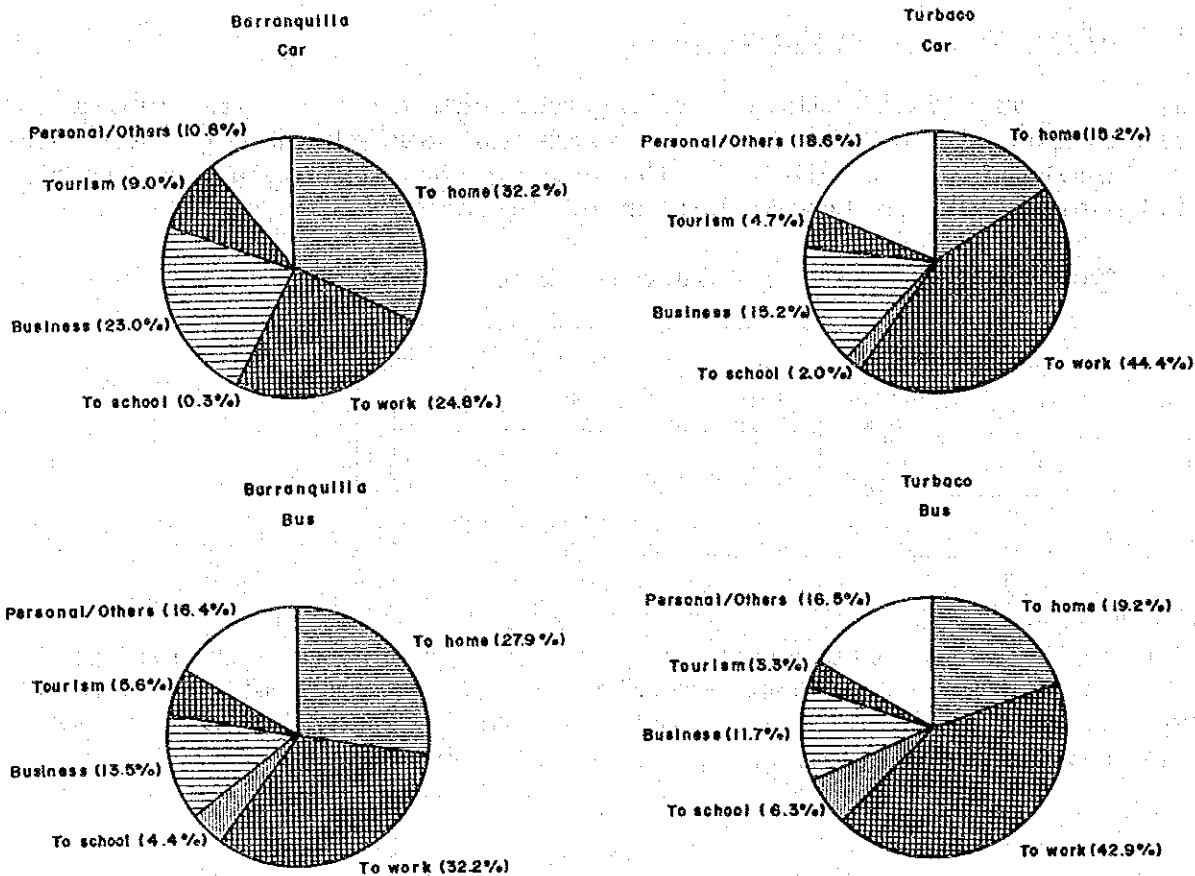


Figure 3.3-10 Trip Purpose on Cordon Line

(3) Traffic Movement in Major Corridors

1) Relationship Between Traffic Demand and Supply

168. In order to identify the comprehensive traffic movement in urban area as well as traffic demand and supply balance at present, traffic volume on each imaginary section in the whole urban area is analyzed. The nine (9) imaginary sections which are included the sections of Screen Line and Cordon Line are within the urban area as shown in Figure 3.3-11.

169. Table 3.3-4 and Figure 3.3-12 show the traffic volumes at the above 9 sections. As seen, Centro has the highest traffic volume among those sections - 98,000 veh/day, followed by 65,700 on the Screen Line, 50,800 on Central/South Oriental Area, and 42,00 on Bocagrande(2), etc.

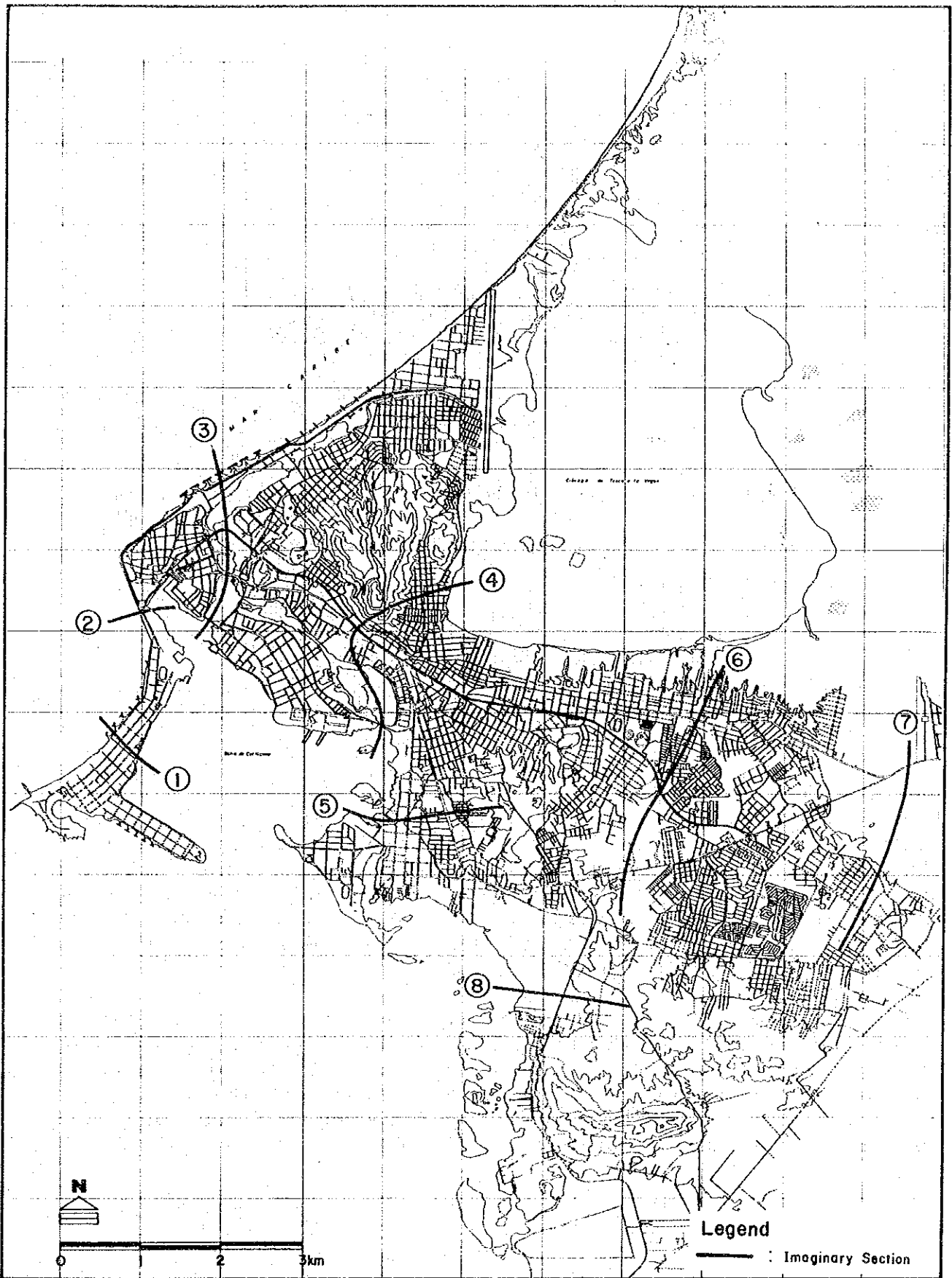


Figure 3.3-11 Locations of Imaginary Section

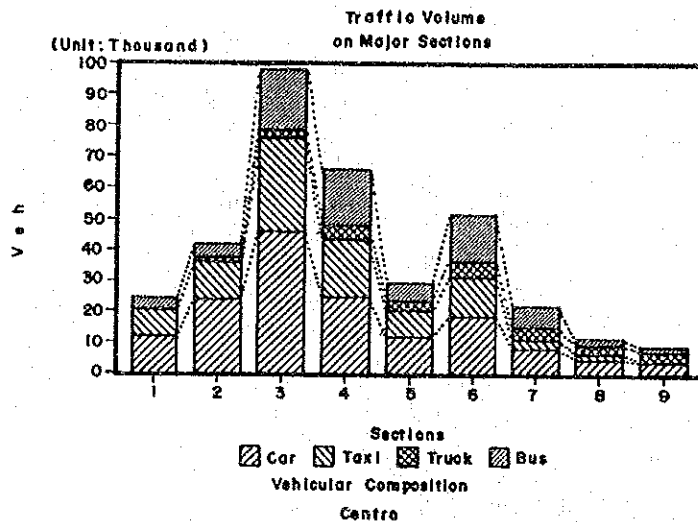


Figure 3.3-12 Traffic Volume on Major Sections

Table 3.3-4 Traffic Volume on Major Sections

| No. Sections | Car | Taxi | Truck | Buses | Total |
|---------------------------|--------|--------|-------|--------|--------|
| 1 Bocagrande (1) | 12,066 | 8,305 | 496 | 3,396 | 24,264 |
| 2 Bocagrande (2) | 24,000 | 12,291 | 1,589 | 4,052 | 41,932 |
| 3 Centro | 46,016 | 29,952 | 2,816 | 19,887 | 98,671 |
| 4 Screen Line | 24,718 | 18,283 | 4,770 | 17,885 | 65,656 |
| 5 Industrial Area | 11,808 | 8,406 | 3,376 | 5,451 | 29,040 |
| 6 Central/South Oriental | 18,055 | 13,360 | 5,153 | 14,238 | 50,805 |
| 7 Boundary of Urban Area | 7,862 | 2,797 | 4,422 | 6,559 | 21,640 |
| 8 Mamonal Industrial Area | 4,874 | 1,724 | 2,402 | 1,702 | 10,702 |
| 9 Cordón Line | 3,685 | 382 | 2,864 | 1,680 | 8,611 |

170. The vehicle composition at the sections extended to daily volume is shown in Figure 3.3-13. The car and taxi ratios in Centro and Bocagrande are higher than in others. They are over 50% for car and just over 30% for taxi, respectively. The bus in the residential area such as Central/South Oriental has higher ratios (27%). As for truck composition, industrial areas such as Mamonal and Bosque are higher than in others.

171. Table 3.3-5 shows the relationship between traffic demand and capacity at morning peak hour at the sections. As seen, the traffic volume and capacity balanced out in the urban area at peak hour. At present there are no saturated sections as well as no overloaded roads in the urban area. These situations will continue in the near future.

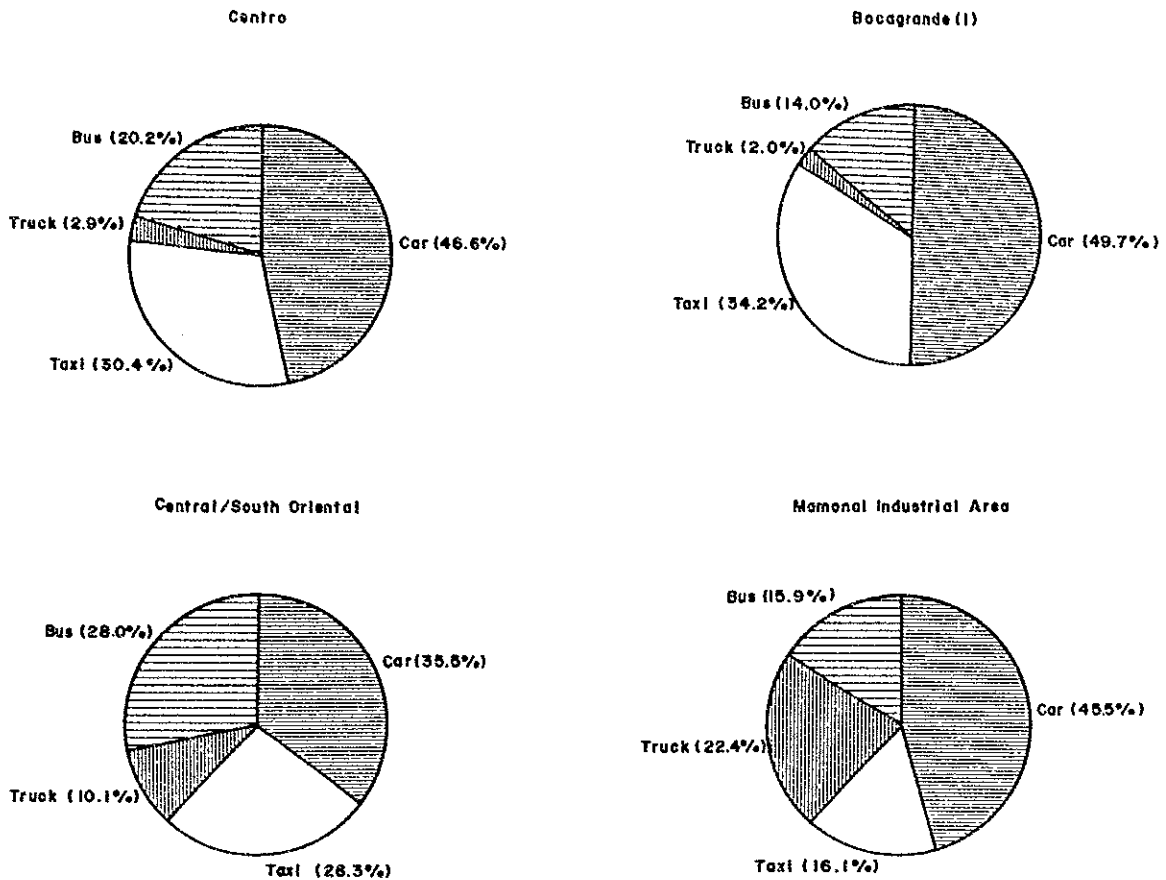


Figure 3.3-13 Vehicular Composition on Major Sections

Table 3.3-5 Traffic Demand and Supply on Major Sections at Peak Hour

| No. Sections | No. of Lanes | Traffic Volume (PCU) | V/C Ratio |
|---------------------------|--------------|----------------------|-----------|
| 1 Bocagrande(1) | 6 | 1,322 | 0.28 |
| 2 Bocagrande(2) | 5 | 2,536 | 0.63 |
| 3 Centro | 16 | 6,775 | 0.53 |
| 4 Screen Line | 11 | 5,556 | 0.63 |
| 5 Industrial Area | 6 | 2,313 | 0.48 |
| 6 Central/South Oriental | 12 | 4,512 | 0.47 |
| 7 Boundary of Urban Area | 4 | 2,105 | 0.66 |
| 8 Mamonal Industrial Area | 2 | 1,217 | 0.76 |
| 9 Cordon Line | 4 | 905 | 0.28 |

2) Number of Passengers by Transportation Mode

172. Table 3.3-6 and Figure 3.3-14 show the number of passengers by transportation mode at the same imaginary sections as that of the traffic volume in Figure 3.3-11. The modal share of private and public transportation in the urban area is disclosed from those.

173. As seen, Centro has the heaviest number of passengers in the urban area - approximately 588,000 persons a day compared to only 83,000 persons per day in Bocagrande(1).

174. Figure 3.3-15 shows the modal share at the same sections. The modal share of public passengers (bus) at Central/South Oriental (residential area) is highest (87%). The figure on the screen line is also higher (86%). Bocagrande(2) and Centro have lower percentage. They are about 61% and 62%, respectively. Comparing vehicular composition with the above, the sections with higher ratio of car composition have substantially lower bus passenger ratio, while the sections with lower car ratio are higher in composition of bus passengers. According to those, the public transportation (bus) plays an important role for resident people, especially those with no car ownership.

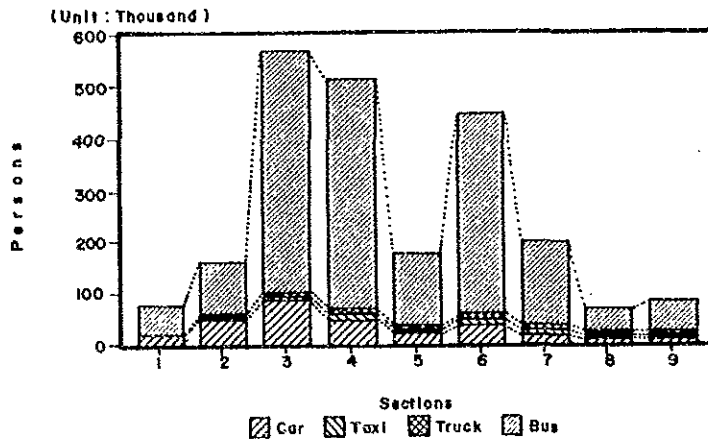


Figure 3.3-14 Number of Passengers by Transportation Mode

Table 3.3-6 Number of Passengers by Transportation Mode

| No. Major Sections | Car | Taxi | Truck | Buses | Total |
|---------------------------|--------|--------|--------|---------|---------|
| 1 Bocagrande(1) | 20,839 | 4,415 | 1,035 | 56,305 | 82,595 |
| 2 Bocagrande(2) | 49,215 | 12,333 | 4,164 | 102,557 | 168,269 |
| 3 Centro | 86,461 | 25,798 | 7,233 | 468,254 | 587,745 |
| 4 Screen Line | 45,743 | 16,075 | 10,800 | 440,304 | 512,923 |
| 5 Industrial Area | 22,119 | 7,958 | 7,361 | 137,621 | 175,060 |
| 6 Central/South Oriental | 35,560 | 11,030 | 11,930 | 387,644 | 446,164 |
| 7 Boundary of Urban Area | 16,624 | 2,770 | 9,241 | 158,722 | 187,356 |
| 8 Mamonal Industrial Area | 10,044 | 1,733 | 6,128 | 41,076 | 58,981 |
| 9 Cordon Line | 8,114 | 437 | 6,289 | 58,058 | 72,898 |

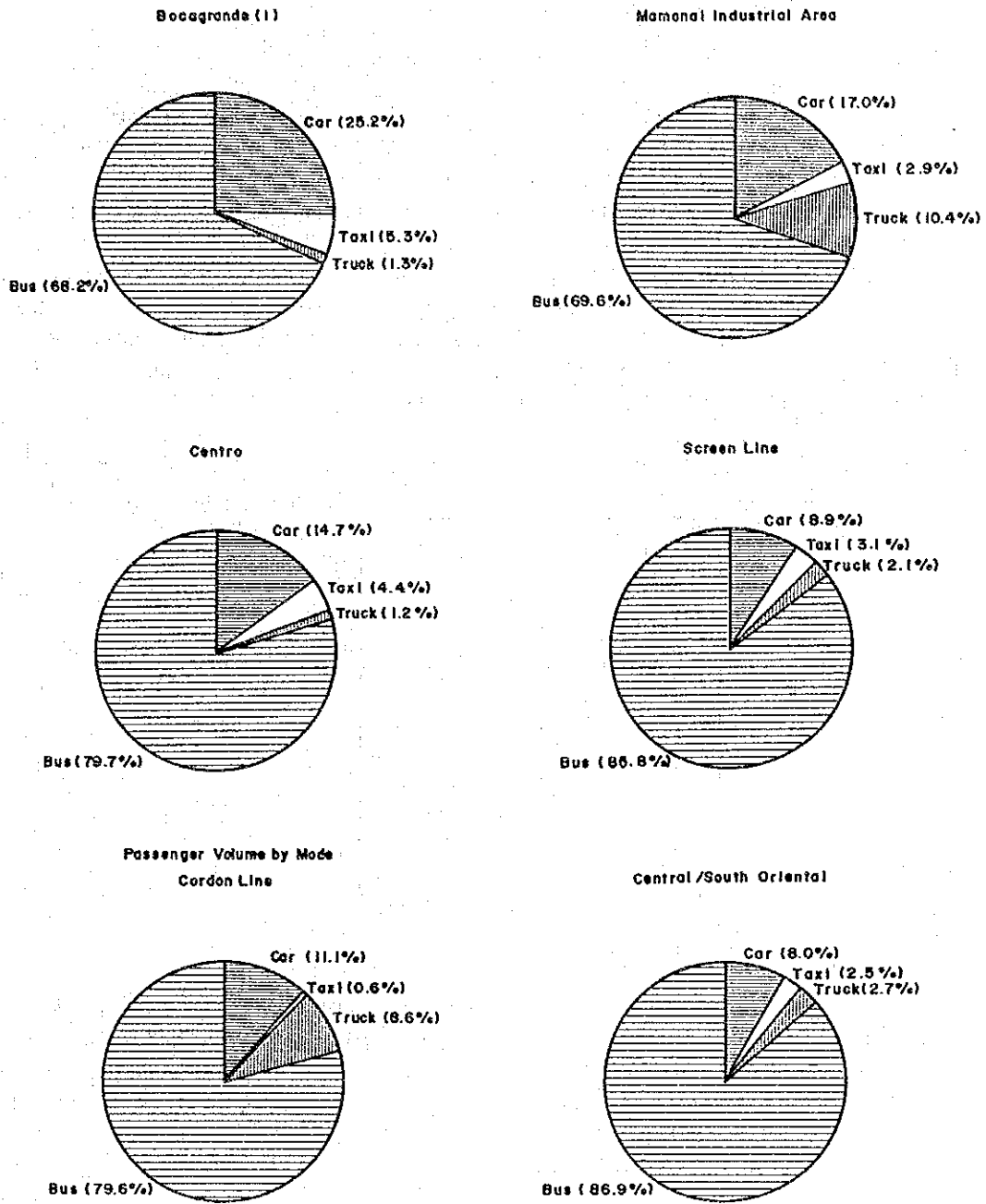


Figure 3.3-15 Modal Share on Imaginary Sections

(4) Intersection Traffic Volume

1) Turning Movement at Major Intersections

175. Inflow traffic volume which is accumulated traffic volume from every approach is shown in Table 3.3-7. The heaviest inflow traffic volume is recorded at Intersection I-11 (Av. Don Pedro de Heredia/Av. Transversal 54) at which figure is just over 50,000 veh/day. Intersection I-2 (Av. Blas de Lezo/Av. Venezuela/Av. Calle 32,30) also bears heavy inflow traffic (48,000 veh/day). Intersection I-1 (Carrera 1/Av. Santander/Av. Blas de Lezo) and Intersection I-9 (Av. Don Pedro de Heredia/Diagonal 22) also take high rank for the volumes which are approximately 38,500 veh/day and 36,000 veh/day, respectively.

Table 3.3-7 Inflow Traffic Volume at Major Intersections

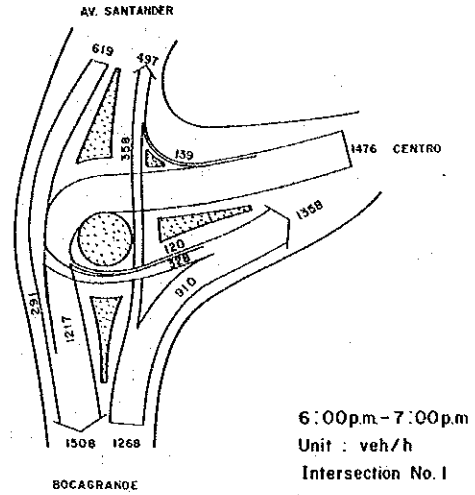
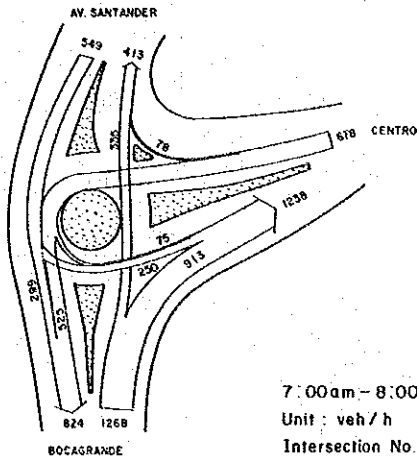
| Intersection No. | Traffic Vol. Veh/day |
|------------------|----------------------|
| I-1 | 38,528 |
| I-2 | 47,832 |
| I-3 | 13,487 |
| I-4 | 26,939 |
| I-5 | 22,797 |
| I-6 | 28,338 |
| I-7 | 28,728 |
| I-8 | 23,133 |
| I-9 | 36,089 |
| I-10 | 23,844 |
| I-11 | 50,401 |

176. In order to know the volume of inflow traffic and their directional movement, i.e., left-turn, right-turn and through, the intersection traffic volume diagrams both in the morning and evening peak hours were drawn as shown in Figure 3.3-16. The figure shows the directional movement and its volume with arrow lines whose width is in proportion to traffic volume.

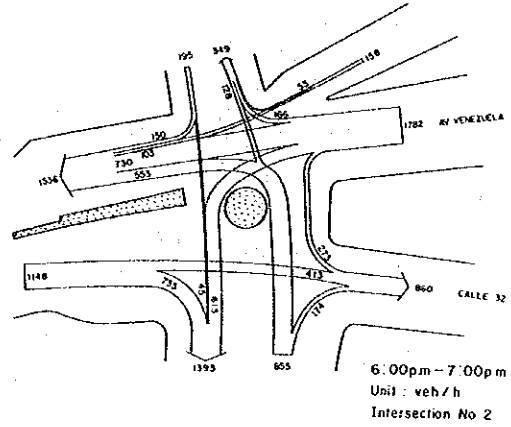
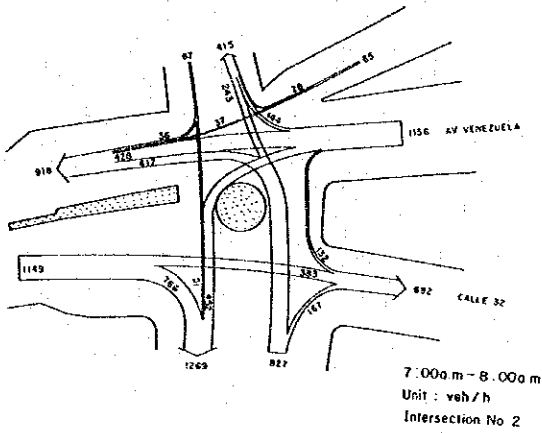
177. Turning movement at typical major intersections is shown below;

At Intersection I-1
of Carrera 1, Av. Santander and Av. Blas de Lezo

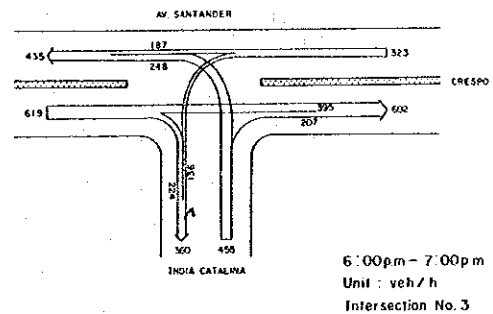
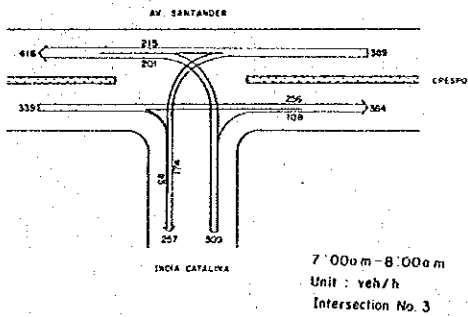
The main traffic flow in the morning peak hour is a stream of vehicles coming from Bocagrande to Centro. In the evening, the main flow becomes reversed.



Intersection No.1

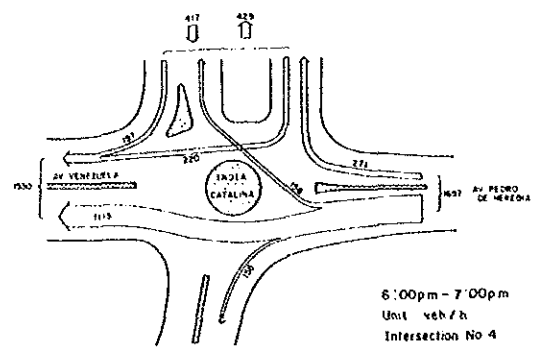
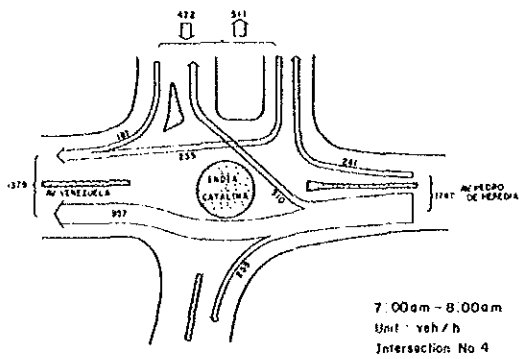


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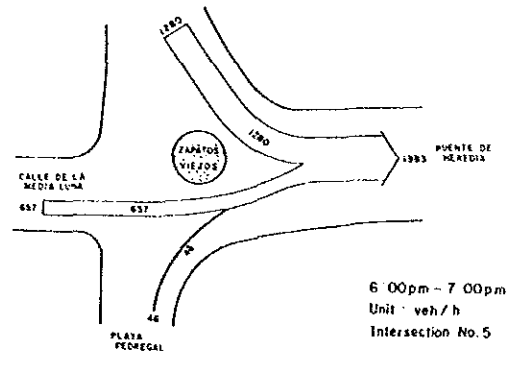
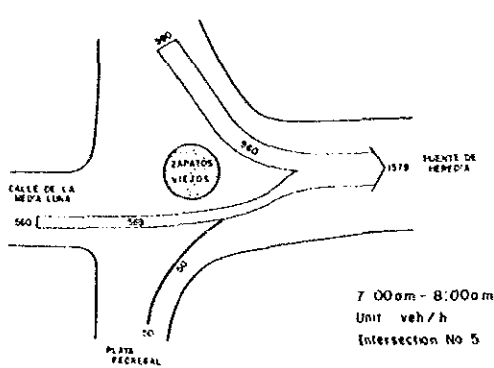


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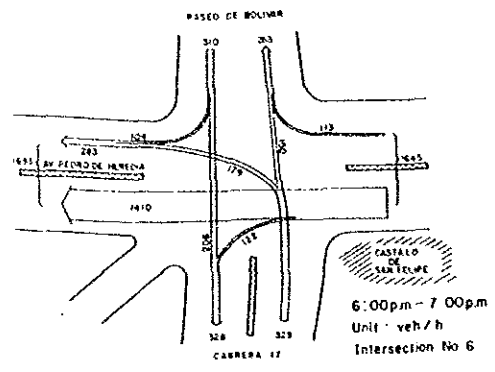
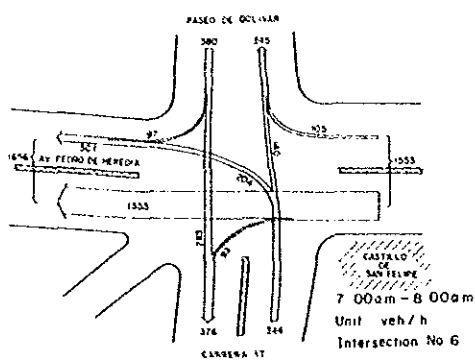
Figure 3.3-16(1) Turning Movement at Major Intersections



Intersection No. 4

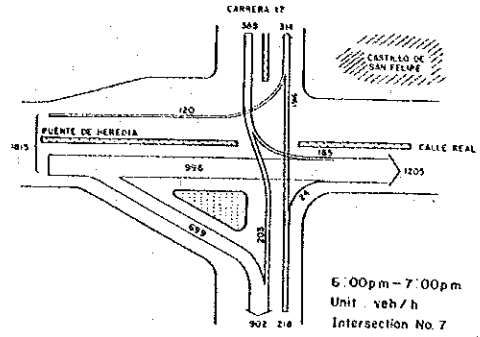
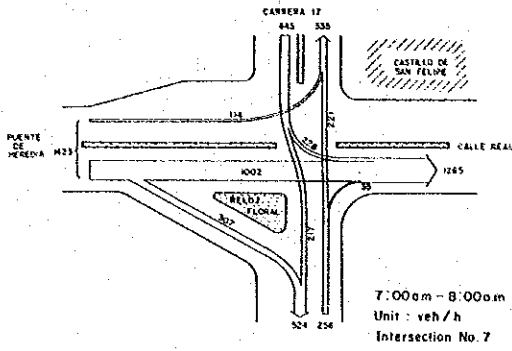


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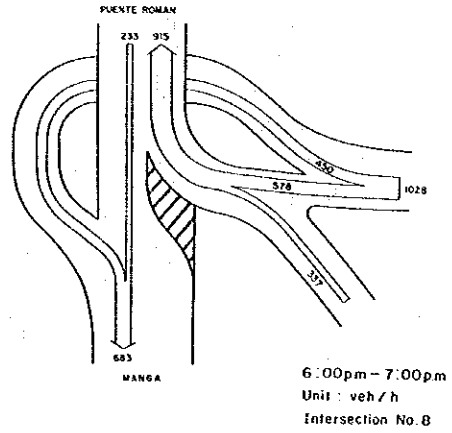
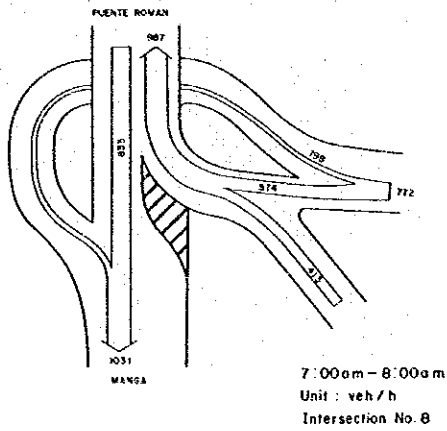


Intersection No. 6

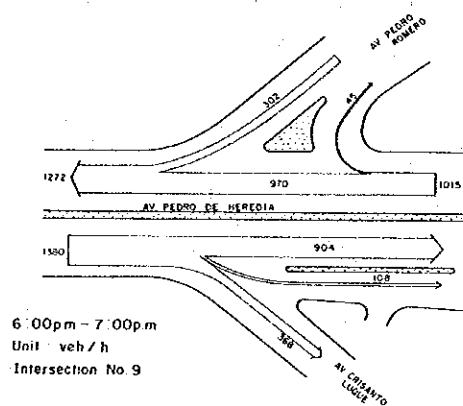
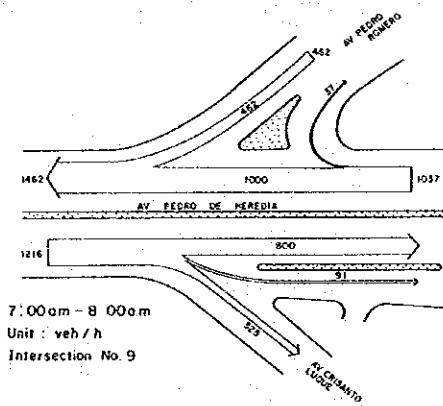
Figure 3.3-16(2) Turning Movement at Major Intersections



Intersection No.7



Intersection No.8



Intersection No.9

Figure 3.3-16(3) Turning Movement at Major Intersections

At Intersection I-2

of Av. Blas de Lezo, Av. Venezuela and Calle 32,30

The movement through Av. Venezuela which is under the oneway regulation in direction from the residential area to Boca-grande, is the main flow both in the morning and the evening. In the morning, the main flow is also from Boca-grande to Manga by way of Calle 24, while the flow changes to the opposite direction by way of Calle 25 in the evening because of the one-way system on Calle 24 and 25.

At Intersection I-9

of Av. Don Pedro de Heredia and Diagonal 22

The change of main flow (on Av. Don Pedro de Heredia) at this intersection where one-way traffic regulation is not executed, occurs only in the opposite direction between the morning and the evening peaks.

At Intersection I-11

of Av. Don Pedro de Heredia and Transversal 54

This intersection, one of the most crowded intersections in the Study Area, has 4 leg approaches with supplemental approach directly connecting with Carretera a Medellin and Transversal 54. The main traffic flow in the morning peak hour is a stream of vehicles coming from Turbaco to Centro. In the evening, the main flow becomes reversed. The flow from Turbaco to the direction of Barranquilla rises by about three times in the evening.

2) Hourly Fluctuation of Intersection Traffic Volume

178. Figure 3.3-17 shows the hourly fluctuations by each approach at major intersections from among the surveyed intersections.

179. The difference between the hourly traffic volume on the main flow approaches and on the minor approaches is clearly shown from this figure. The hourly volume on main approach draws the fluctuations which have peaks with heavy traffic volume in the morning, noon and evening. On the other hand, the minor approaches have light traffic and remain stable.

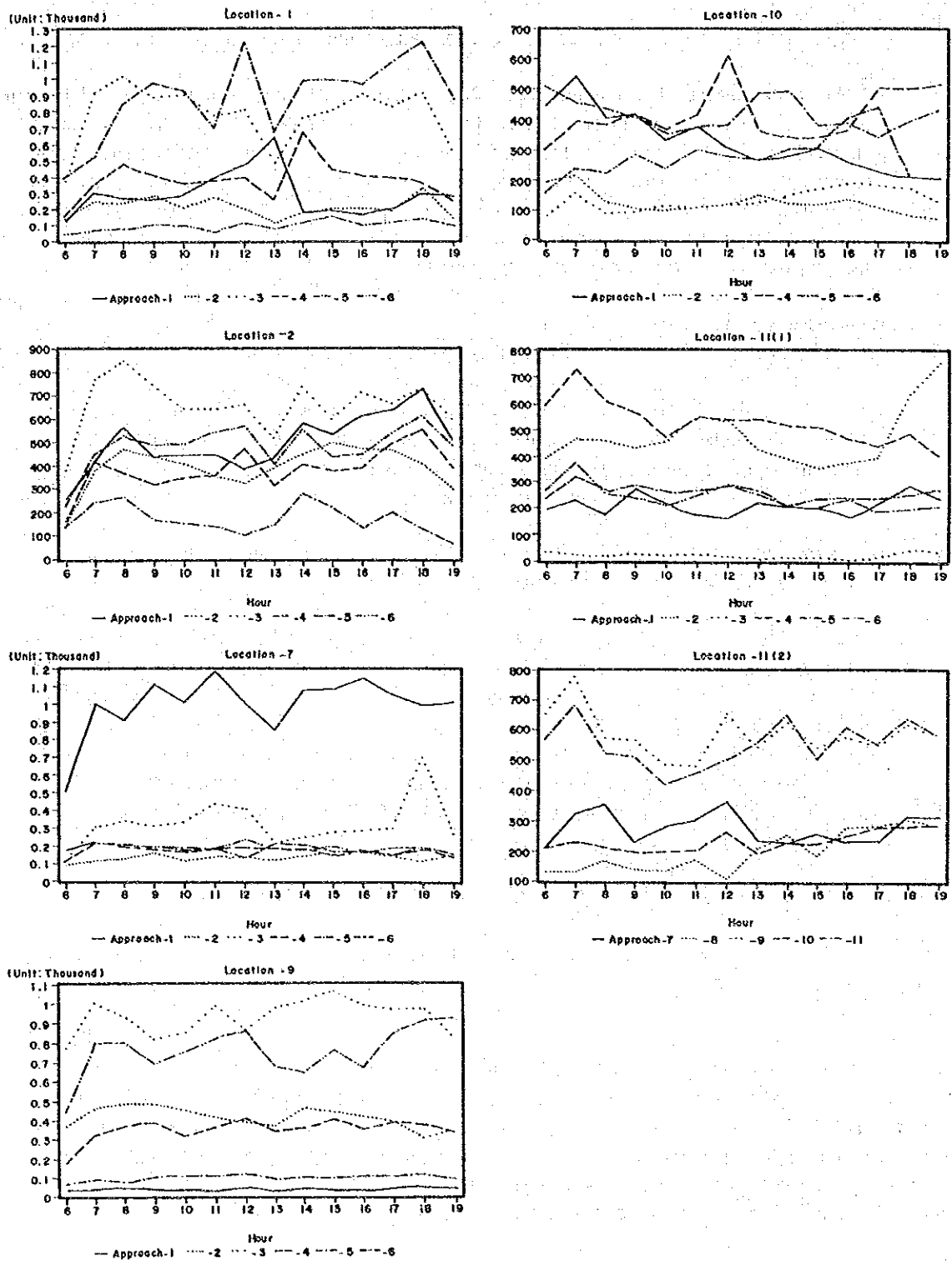


Figure 3.3-17 Hourly Fluctuation by Intersection Approach

(5) Traffic Volume on Major Transport Facilities

180. In the transport facility survey, the following three facilities were surveyed:

- Cartagena International Airport
- Terminal Maritimo (Seaport Cargo Terminal)
- Mercado Publico (Public Market)

In this section, trip generation and attraction and the trip movement at the transport facilities were analyzed based on the survey data.

1) Seaport Cargo Terminal

181. Trip generation and attraction by truck at Seaport Cargo Terminal are approximately 290 trips/day and 300 trips/day, respectively as shown in Table 3.3-8. Out of the total truck trips, 460 trips, equivalent to 78% of the total, are made within the Study Area. On the other hand, 130 trips (22%) travel passing through the boundary of the Study Area.

182. Figure 3.3-18 shows the total weight in tons of transported freight by type of commodity at the cargo terminal. Out of the total cargo transported from the Cargo Terminal, the largest amount of cargo type is the Metal Product & Machinery. The figure is 590 tons (35% of the total). The Chemical Products are the second largest amount, 280 tons (16%), followed by 130 tons (8%) for Daily Consumer Goods. On the other hand, the largest cargo type arrived to the Cargo Terminal is 705 tons of Minerals (46%), followed by 215 tons (14%) Agriculture/Fishery, 195 tons (13%) Chemical Products and the balance are Daily Consumer, and Metal Products, etc.

2) Public Market

183. At Public Market, trip generation and attraction by truck are approximately 210 trips/day and 240 trips/day, respectively as shown in Table 3.3-8. The external trips in the generation, where destination of trips is outside the Study Area, are approximately 48 trips/day (24% of the total), while the external trips of the attraction, where the origin of trips is outside the Study Area, are 78 trips/day (33%).

Table 3.3-8 Trip Generation and Attraction on Transport Facility

| Facility | | Internal Trips | External Trips | Total Trips |
|----------------|------------|----------------|----------------|-------------|
| Cargo Terminal | Generation | 233 | 57 | 290 |
| | (Ratio) | 0.80 | 0.20 | 1.00 |
| | Attraction | 225 | 73 | 298 |
| | (Ratio) | 0.76 | 0.24 | 1.00 |
| | Total | 458 | 130 | 588 |
| Public Market | Generation | 159 | 48 | 207 |
| | (Ratio) | 0.77 | 0.23 | 1.00 |
| | Attraction | 160 | 78 | 238 |
| | (Ratio) | 0.67 | 0.33 | 1.00 |
| | Total | 319 | 126 | 445 |
| | (Ratio) | 0.72 | 0.28 | 1.00 |

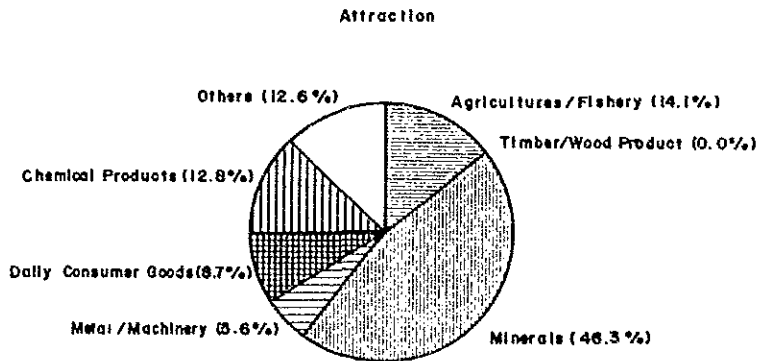
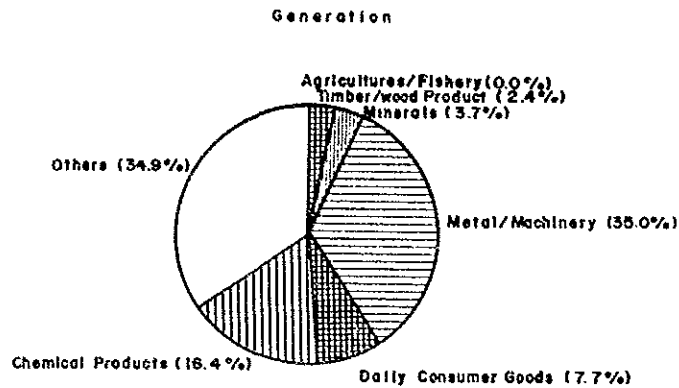


Figure 3.3-18 Transported Load by Type of Cargo at Cargo Terminal

3) Cartagena International Airport

184. Trip generation and attraction at the International Airport by car and by taxi are approximately 1,000 trips/day and 1,400 trips/day, respectively (see Table 3.3-9). Taxi plays an important role for the airport transportation.

Table 3.3-9 Trip Generation and Attraction at Airport

| Item | Car | Taxi | Truck | Total |
|------------|-----|-------|-------|-------|
| Generation | 445 | 701 | 25 | 1,171 |
| Attraction | 499 | 703 | 25 | 1,227 |
| Total | 944 | 1,404 | 50 | 2,398 |

3.3.3 Travel Speed

185. Travel time survey was carried out on seven (7) major traffic corridors on September 2 to 9, 1991 (refer to Figure 3.3-19). Survey vehicle was operated in such a manner as to follow the road traffic flow. Travel speed was measured at three different hours (7:00-8:00, 11:00-12:00 and 17:00-18:00) and on two different week days. Travel time was recorded for several sections of each one way road length (from Centro and to Centro) of the survey routes.

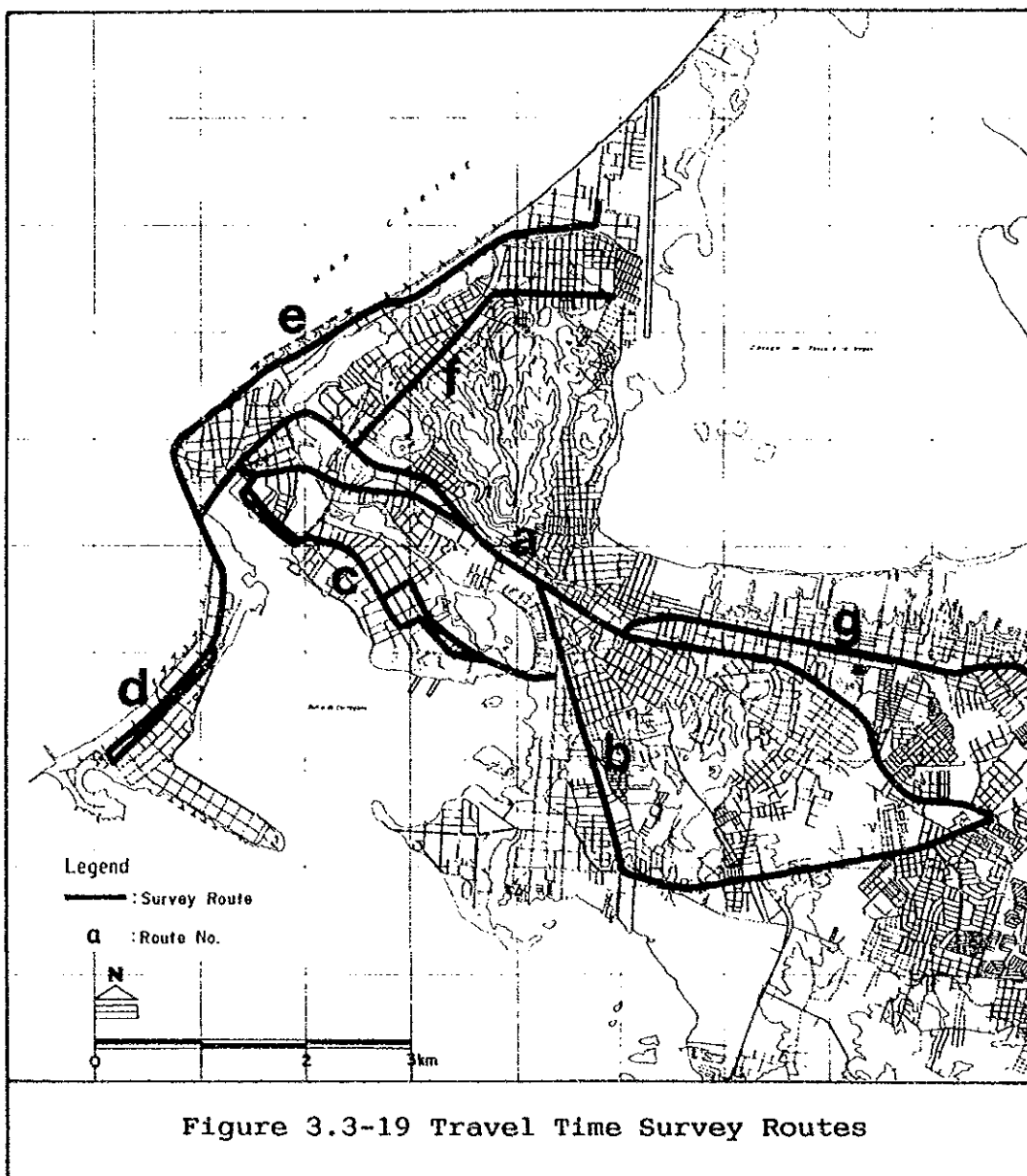


Figure 3.3-19 Travel Time Survey Routes

186. Table 3.3-10 indicates the average travel speed of the vehicle on each survey route.

Table 3.3-10 Average Travel Speed of Vehicle

| Route | Length(km) | Survey Hour | Data 1 | Data 2 | Average(km/h) |
|-------|------------|-------------|-----------|-----------|---------------|
| a | 8.7/9.1 | 7:00- 8:00 | 32.2/33.1 | 29.8/29.8 | 31.0/31.4 |
| | | 11:00-12:00 | 34.2/35.8 | 28.9/31.8 | 31.5/33.8 |
| | | 17:00-18:00 | 26.9/34.4 | 23.0/26.4 | 25.0/30.4 |
| b | 6.6/6.6 | 7:00- 8:00 | 33.2/31.6 | 29.4/33.5 | 31.3/32.5 |
| | | 11:00-12:00 | 37.5/39.0 | 34.7/42.3 | 36.1/40.6 |
| | | 17:00-18:00 | 41.3/34.2 | 38.4/35.0 | 39.8/34.6 |
| c | 4.2/4.3 | 7:00- 8:00 | 32.2/27.3 | 30.4/27.8 | 31.3/27.5 |
| | | 11:00-12:00 | 29.9/32.6 | 30.3/31.1 | 30.1/31.8 |
| | | 17:00-18:00 | 31.3/30.5 | 28.4/22.6 | 29.8/26.5 |
| d | 3.3/3.4 | 7:00- 8:00 | 45.0/31.1 | 41.7/32.7 | 43.3/31.9 |
| | | 11:00-12:00 | 44.2/41.4 | 40.8/37.0 | 42.5/39.2 |
| | | 17:00-18:00 | 38.3/37.0 | 36.2/29.6 | 37.2/33.3 |
| e | 6.3/6.3 | 7:00- 8:00 | 59.5/51.9 | 57.1/53.0 | 58.3/52.4 |
| | | 11:00-12:00 | 54.7/59.1 | 53.5/47.9 | 54.1/53.5 |
| | | 17:00-18:00 | 50.2/49.4 | 55.6/50.7 | 52.9/50.0 |
| f | 3.3/3.3 | 7:00- 8:00 | 35.0/21.4 | 33.8/26.1 | 34.4/23.7 |
| | | 11:00-12:00 | 31.0/25.2 | 28.7/27.4 | 29.8/26.3 |
| | | 17:00-18:00 | 28.7/22.3 | 30.9/24.1 | 29.8/23.2 |
| g | 5.7/5.7 | 7:00- 8:00 | 33.6/34.8 | 38.9/39.4 | 36.2/37.1 |
| | | 11:00-12:00 | 42.3/36.0 | 34.8/37.3 | 38.5/36.6 |
| | | 17:00-18:00 | 37.3/31.6 | 34.4/30.5 | 35.8/31.0 |

note: The length shows each one way route length (from Centro and to Centro).

187. With only a few exceptions, vehicle travel speeds were more than 30 km/h on the average. It can be considered that almost all major roads are in good condition from the stand point of traffic flow because of the low traffic volume compared with its capacities. However, in some routes or road sections such as route (f) or Avenida Venezuela in Centro, travel speeds become less than 30 km/h mainly due to the existence of traffic signals

188. On route (a) of Avenida Venezuela, three (3) traffic signals are located over a short road section and are operated independently. Low vehicle travel speed is considered to be due to this traffic signal operation which should be improved.

189. On route (f) of Cra. 17, travel speed to Centro is nearly 20 km/h. This is due to the waiting time loss for traffic signal at intersection with Avenida P. Heredia. Almost all vehicles need to wait two or more signal cycles (about 3 minutes or more) to pass through the intersection.

190. Apparent relationship between the travel speed and

survey hour is not found. However, in general travel speeds at noon time are higher than those in the morning and in the evening. Travel speed difference by direction (from Centro or to Centro) is not significant.

191. To travel from Cruce el Amparo to Centro, two (2) different routes can be chosen, i.e. route (a) and route (b)+(c). Vehicle travel speed through route (a) is about 32 km/h and that through route (b)+(c) is also about 32 km/h. However, traffic volume concentrates on route (a) due to the differences in road condition (road width, number of signals, number of turnings, etc.) and socioeconomic activity along the road side.

3.3.4 Traffic Demand Characteristics

192. In this section, urban traffic characteristics in terms of number of trips, trip production rate, trip generation and attraction, and trip distribution were analyzed by using the Vehicle OD Survey data and the Public Transportation Survey data to disclose urban traffic movement in the Study Area.

(1) Total Number of Trips

1) Total Number of Trips

193. The total number of trips per day in the Study Area in 1991 is approximately 1.307 millions (person trip base), of which 1.259 million trips are made by residents in the Study Area, and 48 thousands by non-residents who are not dwelling in the Study Area. Since trips by residents in the Study Area have a 96% share, it seems to indicate that the Study Area is a closed area from the traffic point of view. Summarized in Figure 3.3-20 are trips of residents and non-residents according to internal and external trips.

194. Out of the total trips made by residents who are in the Study Area, 1.247 million trips, equivalent to 99.0% of the total, are made within the urban area. The share of internal trip within the urban area by bus passengers is the highest (99.5%) in each transportation mode, followed by 98.2% for taxi, 94.8% for car and 89.0% for truck. In Cartagena, almost all the passengers on vehicles travel inside the urban area, while travel in the sub-urban area is very small.

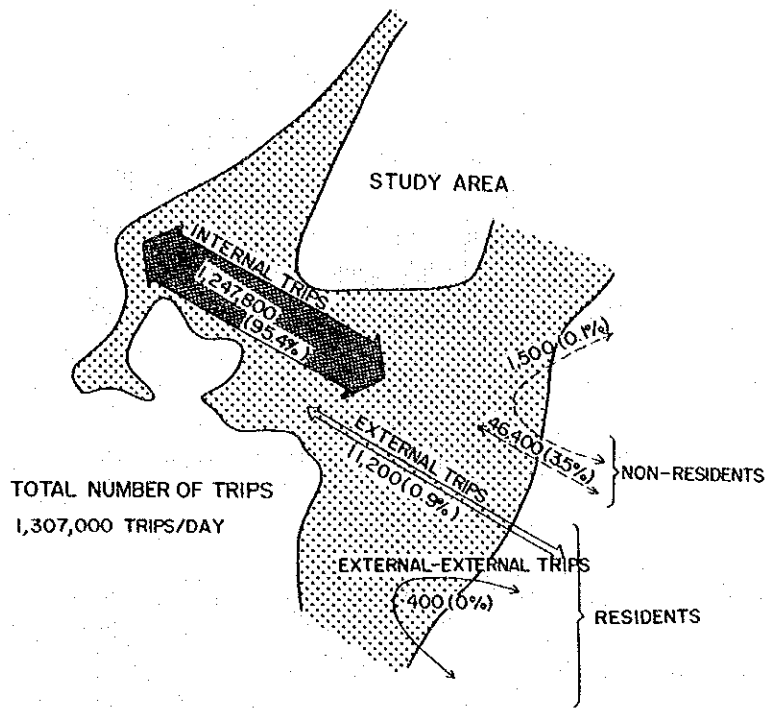


Figure 3.3-20 Total Number of Trips in the Study Area

195. Table 3.3-11 shows the summary of travel characteristics made by residents in the Study Area. The trips made by person who dwells outside the Study Area are excluded from this table.

Table 3.3-11 Summary of Travel Characteristics

| Items | | Ratio |
|----------------------------|-----------|-------|
| Non-Motorized Households | 114,045 | 0.90 |
| Motorized Households | 12,860 | 0.10 |
| Total Households | 126,905 | 1.00 |
| | | |
| No. of Vehicles | 16,944 | |
| Population (5 years above) | 598,800 | |
| Motorization (veh/1000psn) | 25.7 | |
| | | |
| Total Trips (person trip) | 1,259,400 | 1.00 |
| Car | 145,769 | 0.12 |
| Taxi | 52,480 | 0.04 |
| Truck | 32,153 | 0.02 |
| Bus | 1,028,998 | 0.82 |
| No. of Trips per person | 2.05 | |

source: Study Team estimation

2) Trip Composition by Mode

196. As can be seen from Figure 3.3-21, which shows the ratio of passenger trips by each transportation mode, the composition of bus passengers is highest (82%), followed by 12% for car, 4% for Taxi and 2% for truck. The bus transport is predominant over other transports, especially for non-motorized households.

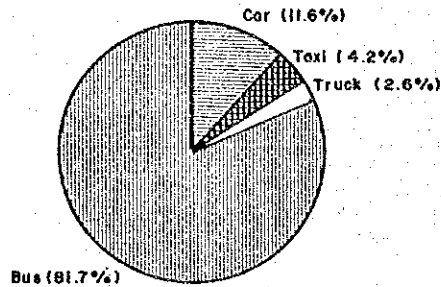


Figure 3.3-21 Trip Composition by Transportation Mode

3) Car and Bus Trip Composition by Purpose

197. Figure 3.3-22 shows trip purposes made by car passengers. As for "to work", "business" and "private/others" trip purposes, each trip ratio is at the same level about 20%. On the other hand, the bus is mainly used for such home-based trip as "to work/to school" (32%) and "private/others" (26%) purposes. The share of "business" purpose is as low as 4%, in contrast to 22% for car (see Figure 3.3-23).

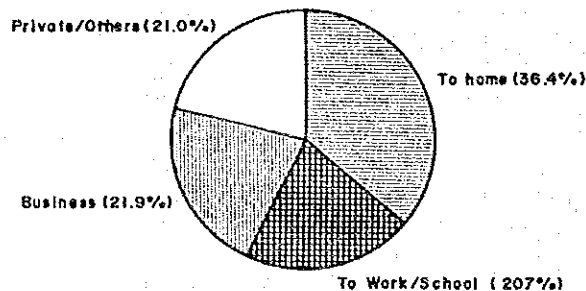


Figure 3.3-22 Car Trip Composition by Purpose

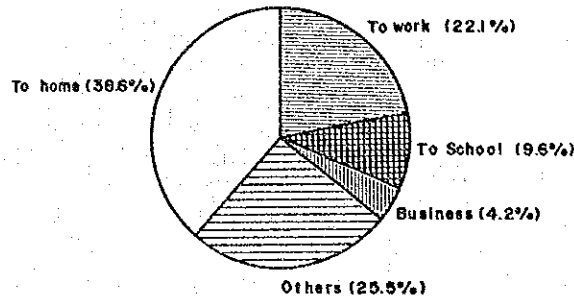


Figure 3.3-23 Bus Trip Composition by Purpose

(2) Car Trip Production Rate

1) Trip Production Rate by Occupation

198. Car production rate by occupation is shown in Figure 3.3-24. For making the travel demand model the car trip production rate is defined by number of trips per car owner no matter what the purpose of the trip. The car production rate is roughly 3.0-4.0 trips per day (the average rate is 3.7). The production rates for agriculture and hotel/tourist service are higher and those figures exceed 4.0. On the other hand, financial business shows a low rate.

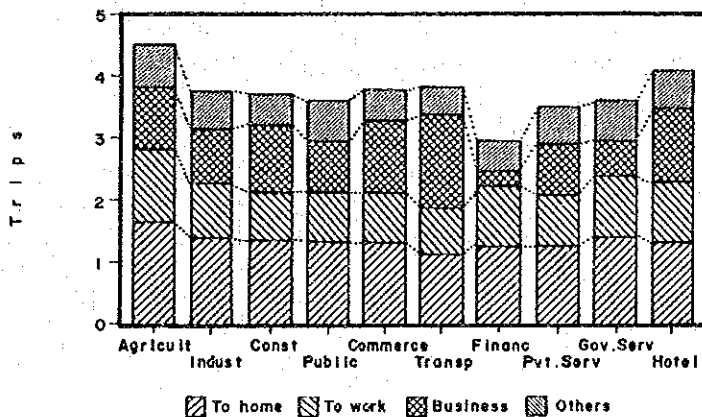


Figure 3.3-24 Trip Production Rate by Occupation

2) Trip Production Rate by Household Income Level

199. Figure 3.3-25 shows the trip production rate by household income level of car owner. As can be seen, the relationship between income level and the trip production is not obviously shown. The trip production rate indicates stability and fluctuation, not related to whether the income level is high or not.

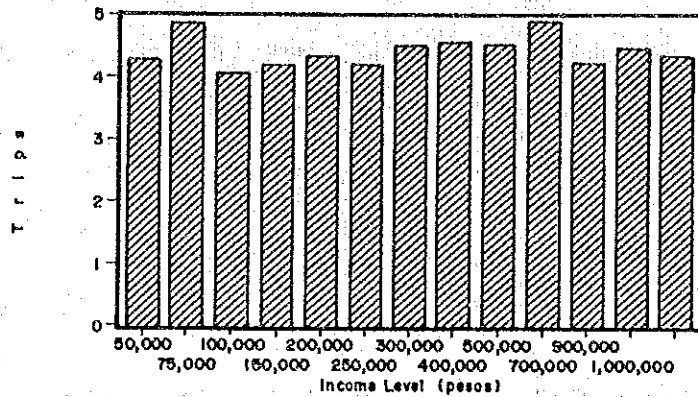


Figure 3.3-25 Trip Production Rate by Household Income Level

(3) Trip Generation and Attraction

1) Trip Generation and Attraction by Mode

200. Trip generation and attraction by transportation mode according to the integrated zone are shown in Figures 3.3-26 and 3.3-27. Looking at a integrated zone where the numbers of generation and attraction trips are higher, those of zone No. 2, Centro, stand at approximately 260 thousands for generation and at 280 thousands for attraction, respectively. Approximately 20% of the total generation or attraction in the Study Area converges and diverges in this zone. The other higher concentrated zones in generation and attraction are zone Nos.10 (10%) and 11 (15%) whose land use are residential and mixed commercial/residential area with major bus terminal, respectively.

201. According to those figures by car and taxi modes, those compositions in zone Nos. 1, 2 and 5 are high. The zone Nos.1 and 5 are areas where medium and upper income classes with car are residents, and Zone No.2, Centro, is the commercial area. On the other hand, almost all the zones take the higher share of public transportation (bus).

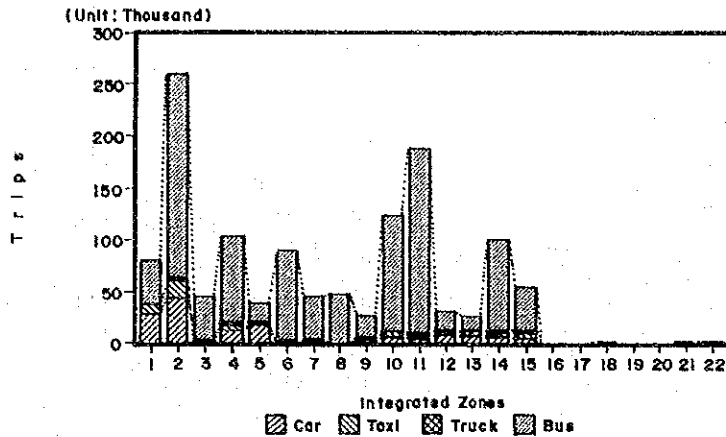


Figure 3.3-26 Trip Generation by Mode

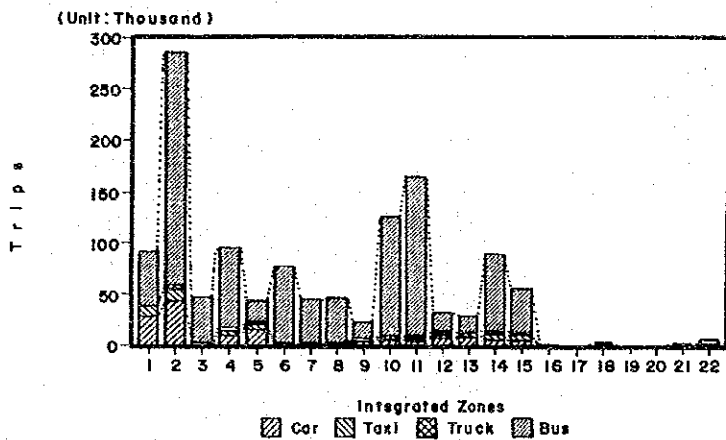


Figure 3.3-27 Trip Attraction by Mode

2) Car Trip Generation and Attraction by Purpose

202. Figures 3.3-28 and 3.3-29 show car trip generation and attraction by zone according to trip purpose. Car trip generation and attraction in zone Nos. 1, 2 and 5 are higher, especially zone No. 2 which is dramatically higher in trip attraction. It indicates that there is much traffic concentrated into Centro which is the commercial and business center in Cartagena. This also shows that in zone No. 2, Centro, the ratios of "to work" and "business" purposes to the all purposes are higher. Those figures are 28% and 22%, respectively, in contrast to 15% or less in the others.

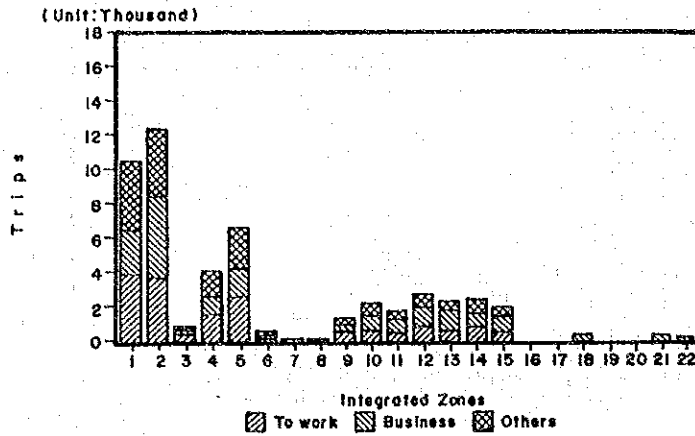


Figure 3.3-28 Car Trip Generation

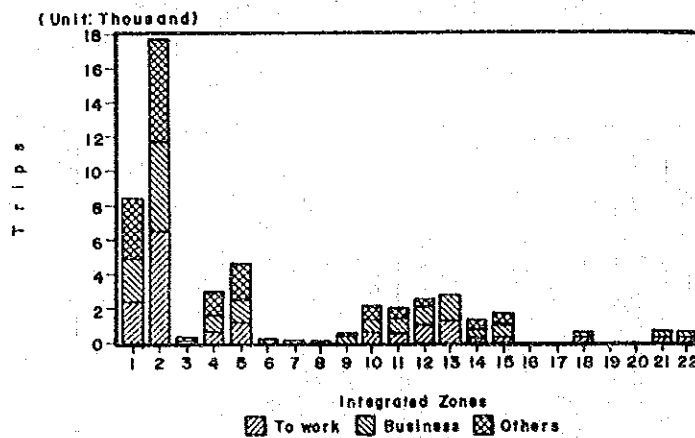


Figure 3.3-29 Car Trip Attraction

3) Bus Trip Generation and Attraction by Purpose

203. Figures 3.3-30 and 3.3-31 show bus trip generation and attraction by zone according to purpose. The distribution of trip generation and attraction by zone is different in each zone. The bus trip generation fluctuates, but remains stable in its volume. On the other hand, the trip attraction in only two zones, Nos.2 and 11 which are Centro and Mercado (Public Market), have heavy volume. Those figures are 200 thousand trips (32% of total attraction) in Zone No.2 and 110 thousands (15%) in zone No.11. This tendency relates to those zone characteristics which have a function of major bus terminal in the urban area.

204. As for trip generation by purpose, both the shares of "to work" and "to school" trip purposes in the residential area are higher. Those figures are in range from 30% to 50%. In zone No.2 and 11, the "business" and "Private/Others" purposes in trip attraction take high percentages which account for about 40%, in

contrast to 15% - 30% in others, due to those zone characteristics explained above.

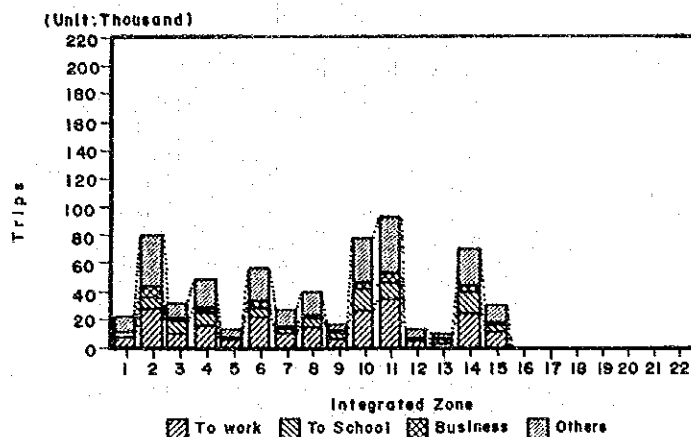


Figure 3.3-30 Bus Trip Generation by Purpose

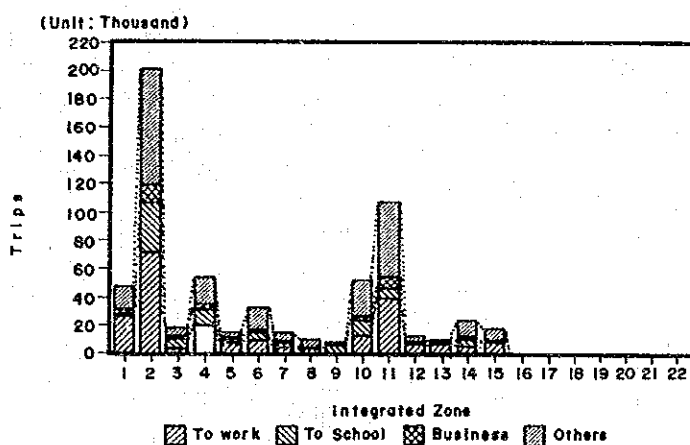


Figure 3.3-31 Bus Trip Attraction by Purpose

4) Hourly Trip Generation by Mode

205. The hourly number of trips by mode is shown in Figure 3.3-32, which shows the hourly fluctuation of trips at the departure time. As can be seen, both the morning and afternoon peak hour ratios by all vehicles exclusive of bus are approximately 9%, occurring between 7:00 a.m. and 8:00 a.m. and between 12:00 a.m. and 1:00 p.m., respectively. The afternoon peak occurs upon return to home for lunch.

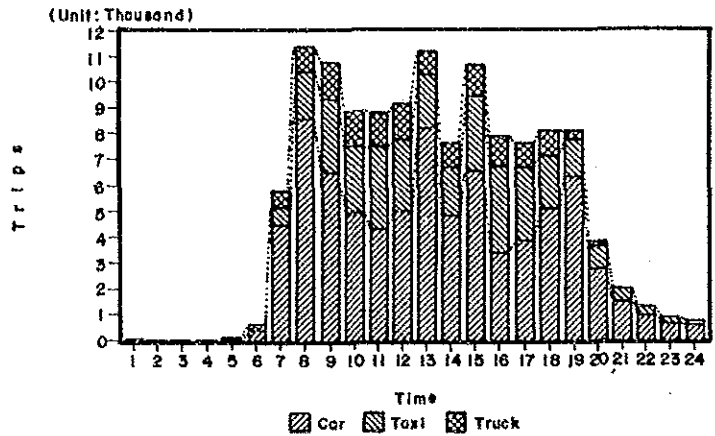


Figure 3.3-32 Hourly Trip Generation by Mode

206. Hourly car trip generation by purpose also shows in Figure 3.3-33. The peak hour percentage for "to work" trip rises by 30% in the morning from 7:00 a.m. to 8:00 a.m. And also, the hourly trip ratio in the afternoon from 2:00 p.m. to 3:00 p.m. is considerably higher due to the fact that workers come back to office. The "to home" trip peak occurs twice: from 12:00 a.m. to 1:00 p.m. and 6:00 p.m. to 7:00 p.m., as mentioned above. The "business" trip starts around 7:00 a.m. and ends around 5:00 p.m.

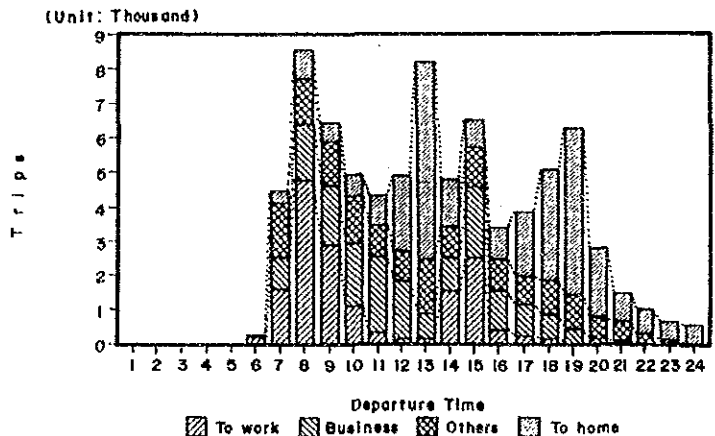


Figure 3.3-33 Hourly Car Trip Generation by Purpose

(4) Trip Distribution

1) Car Trip Distribution

207. Trip distribution by car is shown in Figure 3.3-34 by desire line charts. In this figure, two-directional movement between each pair of integrated zones is drawn by a straight line whose width is proportional to the number of trips between the zones. As can be seen, there are large movements between zone No.2

(Centro) and its surrounding residential area composed of zone Nos. 1, 4, 5 and 12. In conclusion, strong desire lines by car concentrate to Centro from its neighbor zones due to the fact that high motorization area defined by number of cars per 1000 persons only concentrates into zones No.1 (183 car/1000), No.2 (98), No.4 (34), No.5 (228) and No.12 (43), and the remaining are 20 or less.

2) Bus Trip Distribution

208. The desire lines by bus are shown in Figure 3.3-35. The desire lines for bus transportation show that there are two heavy traffic movements: between the Centro and every residential area and between Mercado (Public Market) and every residential area. This is because those zones have a function as commercial and business areas as well as major bus terminal.

3) Taxi Trip Distribution

209. The taxi desire lines show that the heavy traffic movement is similar to that by car due to the fact that taxi serves as a private conveyance similar to passenger cars (refer to Figure 3.3-36).

4) Truck Trip Distribution

210. The desire lines by truck are shown in Figure 3.3-37. The truck is different from other modes in trip movement. It shows the connection between Centro and others for commercial service and also, between industrial areas (Mamonal and Bosque) and others for transport service.

5) Travel Time by Mode

211. Travel time distribution by mode is shown in Figure 3.3-38. The average travel time by car mode is approximately 21 minutes. The travel time for taxi passengers is somewhat shorter (18 minutes) than that by car. The truck travel time is an average of 27 minutes. Approximately 4% of the total trips for truck have a travel time of 100 minutes or more, in contrast to 0.5% and 0.1% for car and taxi, respectively. Approximately 90% of the total for car and taxi have a travel time within 30 minutes, in contrast to 40 minutes for truck.

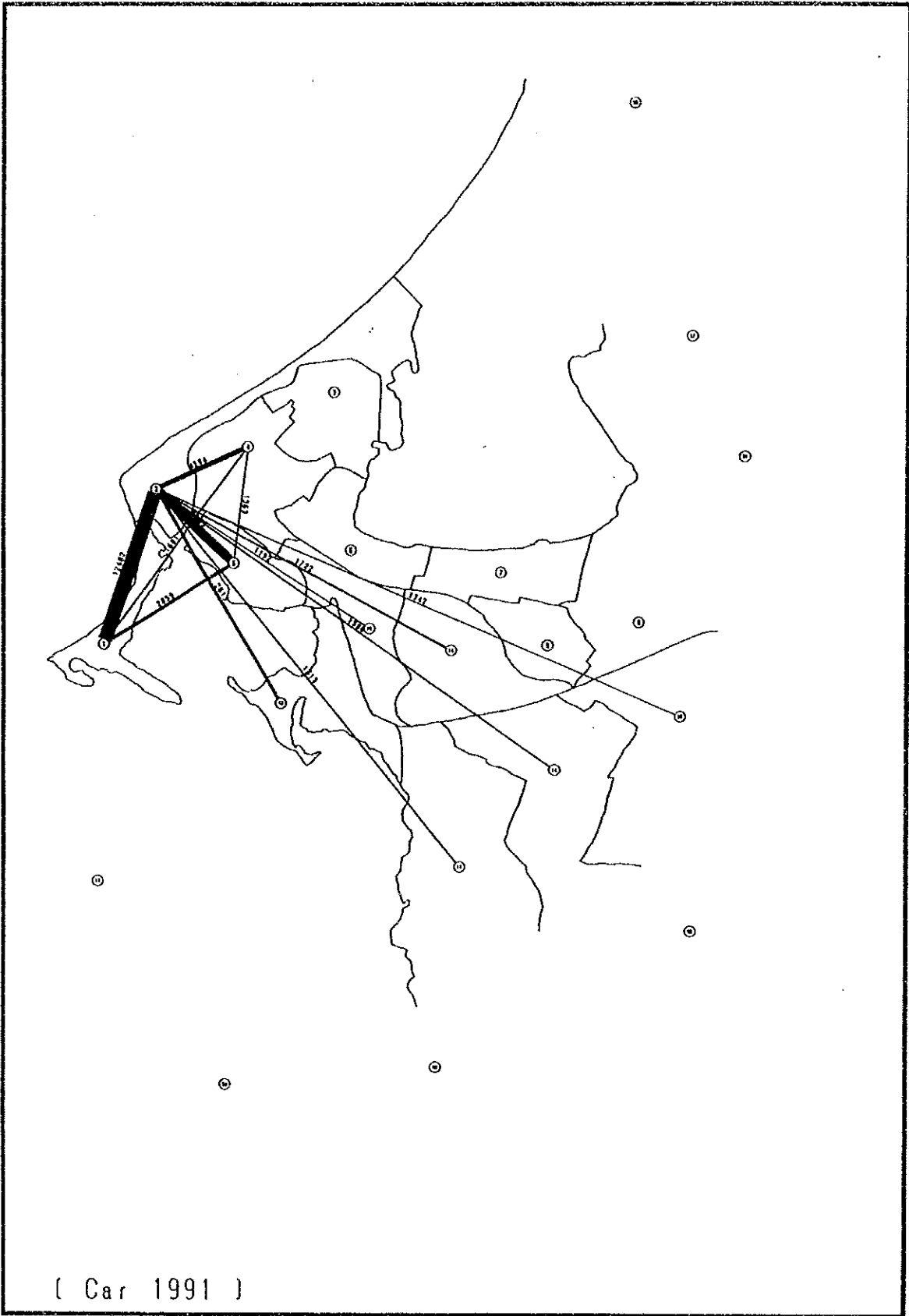


Figure 3.3-34 Car Trip Distribution

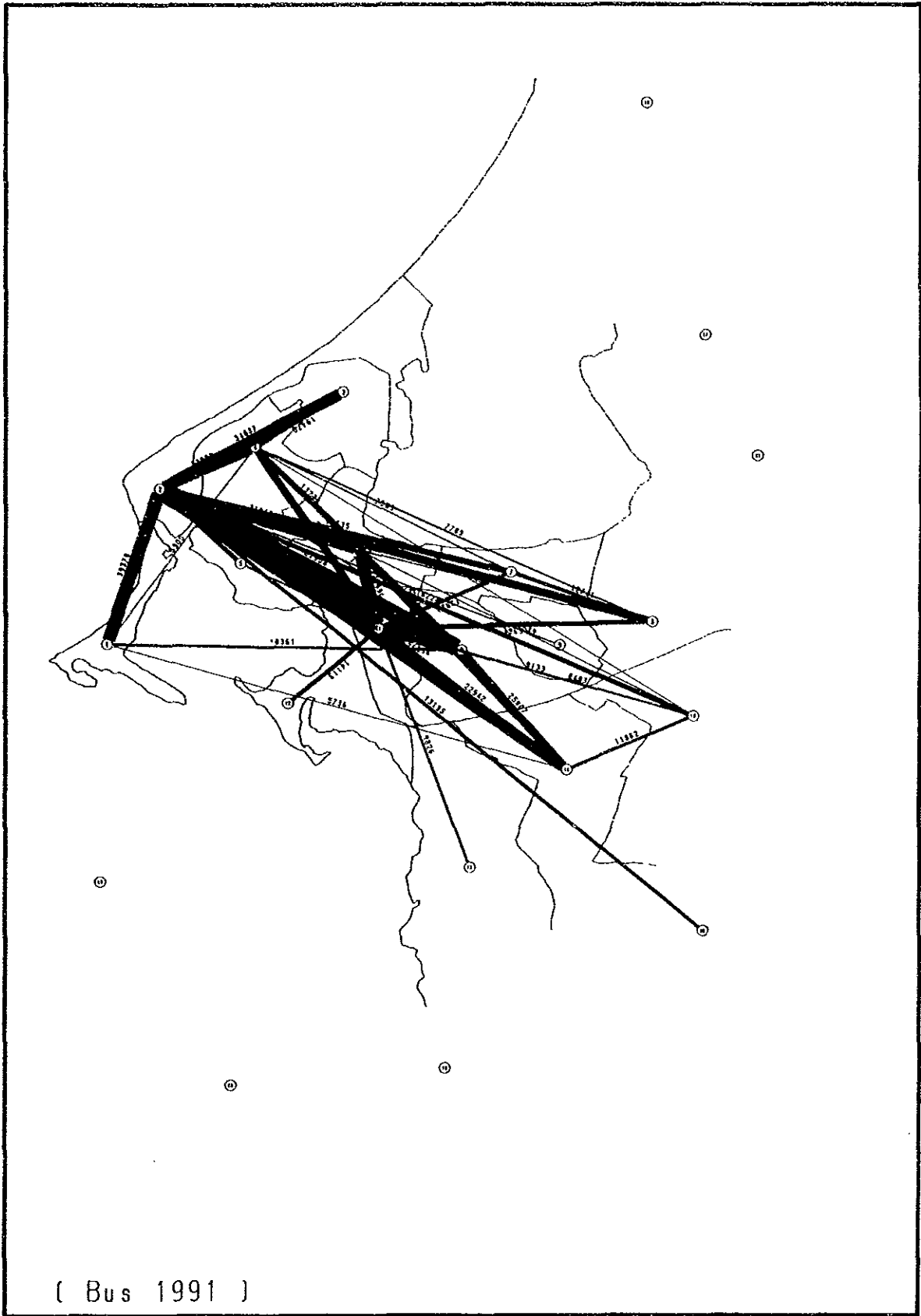


Figure 3.3-35 Bus Passenger Trip Distribution

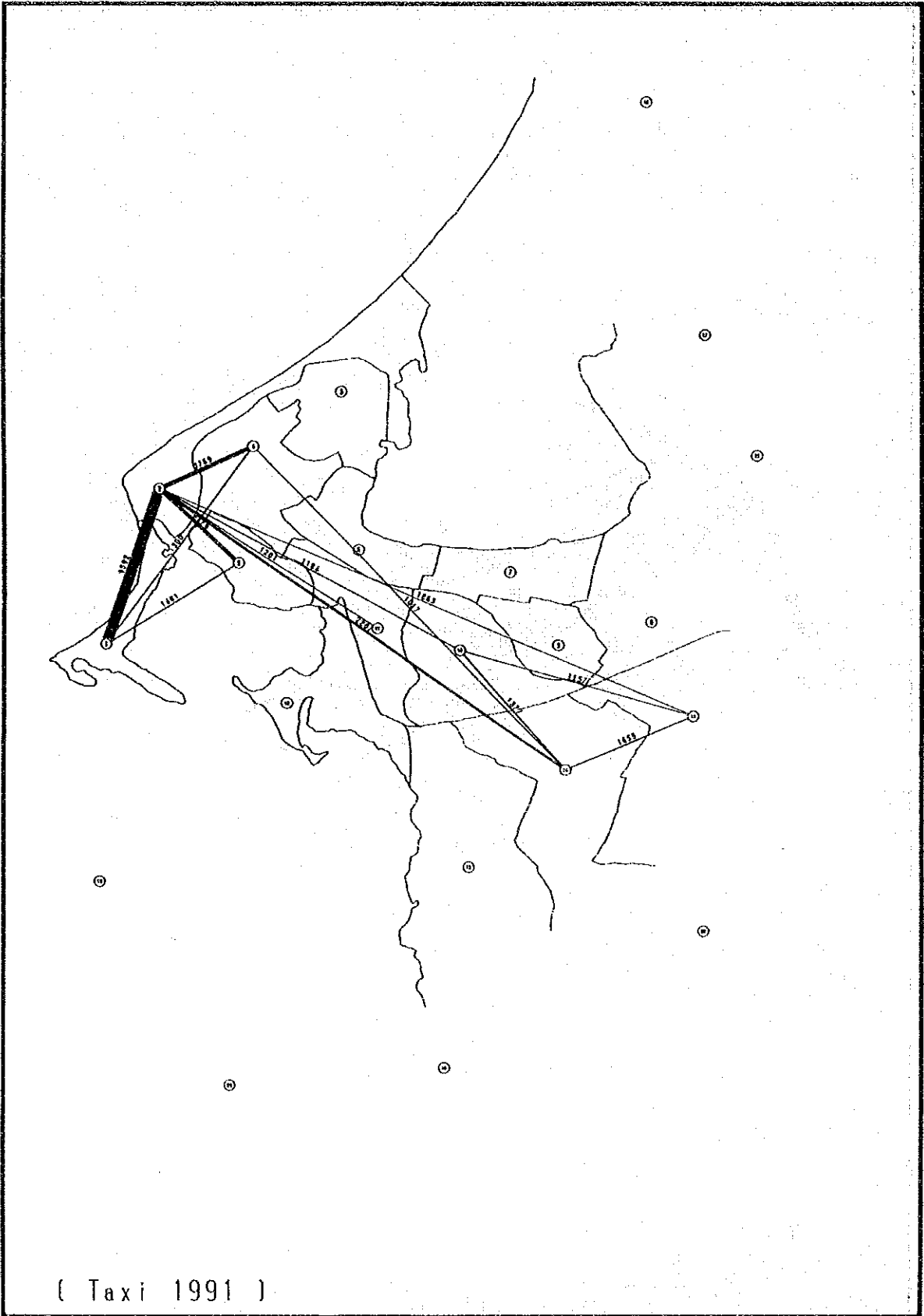


Figure 3.3-36 Taxi Trip Distribution

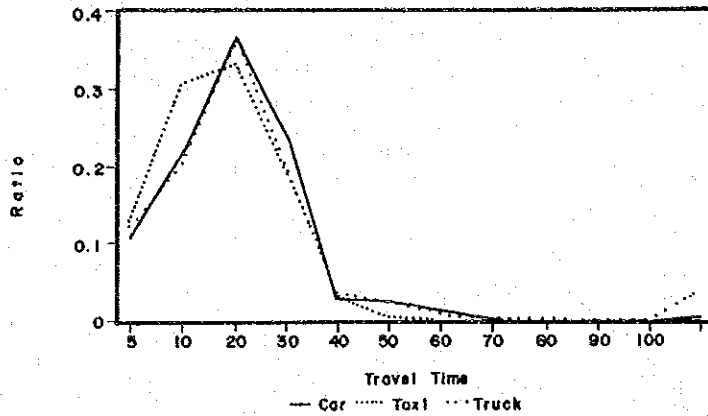


Figure 3.3-38 Travel Time by Mode

212. Car travel time distribution by purpose is shown in Figure 3.3-39. The travel times of all purposes have a peak around 20 minutes. Approximately 90% of the total trips by "to work" and "business" trip purposes have travel time within 30 minutes. The accumulative percentage of "Private/Others" purpose reaches to 95% by 30 minutes.

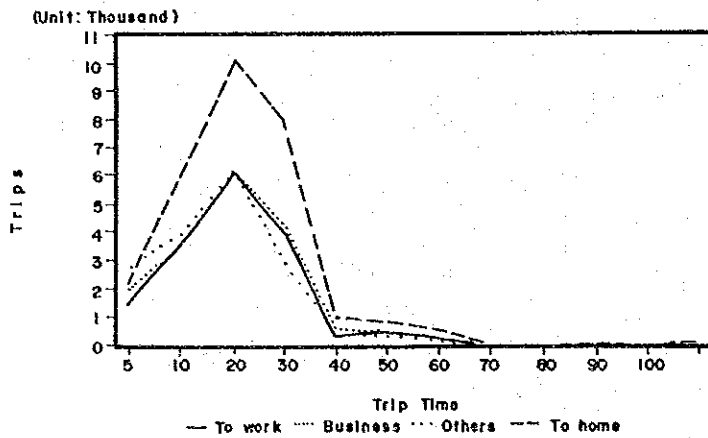


Figure 3.3-39 Travel time by Purpose

(5) Operating Trips by Taxi and Truck

213. The distribution of number of operating trips by taxi is shown in Figure 3.3-40. The average number of operating trips with passengers is 11 per day. On the other hand, the number of trips by truck is an average of 6 per day (refer to Figure 3.3-41).

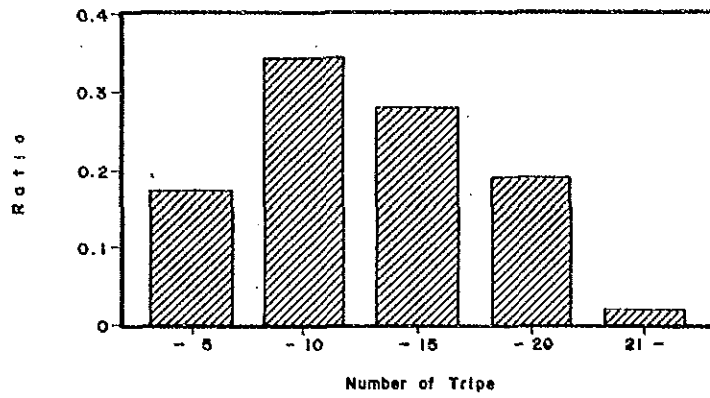


Figure 3.3-40 Distribution of Operating Trips by Taxi

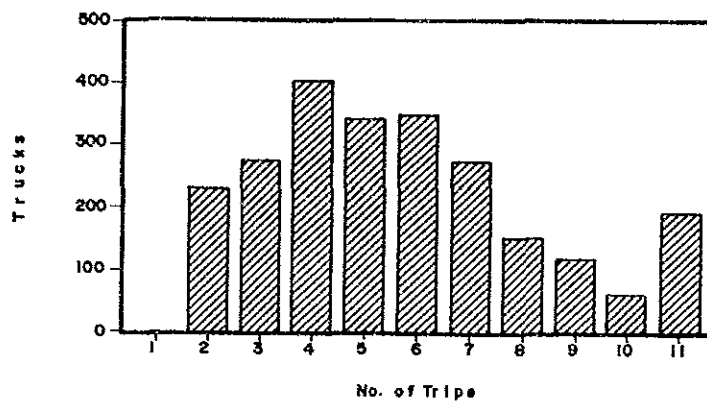


Figure 3.3-41 Distribution of Operating Trips by Truck

3.4 Tourism Trip

214. Cartagena is the major commercial, financial and political center of Bolivar State, functioning as supplier of goods and services for other cities in the State. On the other hand, Cartagena located on the Caribbean Coast is the most famous tourist place in Colombia with historical monuments and tropical climate.

215. There are many tourists coming into Cartagena by the land, air and sea transportation. In 1990, approximately 561,000 persons stayed in hotels. At present, there is no data on the tourism trips and also no transport study on tourism in Cartagena in spite of it being a famous tourist place. It is indispensable to estimate the present tourism trip in this urban transport study.

216. The tourism spots where many tourists visit are limited to a few places like El Laguito, Bocagrande (where many hotels located) and Centro (historic down town). The feature of tourist movement is classified into 2 or 3 typical types: hotel - sea shore, hotel - Centro, and hotel - shopping/restaurants within these places. The tourists generally move inside the limited area. Therefore, the tourism trips taken into consideration in the Study are two types: one is a trip in the small area including several tourism spots, not in the whole urban area, and the other is a trip from/to the outside of Cartagena when tourists visit.

(1) Number of tourists

1) Aircraft

217. The annual total number of passengers arrived at Cartagena International Airport in 1990 is approximately 537,000, of which 25,000 are international tourists and 512,000 are domestic as shown in Table 3.4-1. Approximately 95% of the total are domestic tourists. Since the mid-1980s the number of passengers indicates stability with a little fluctuation.

218. The international tourists by region and domestic tourists by city are shown in Tables 3.4-2 and 3.4-3. In 1988, approximately 31,000, equivalent to 90% of the total is from North America, of which 26,000 (84%) are from Canada and the balance (16%) from U.S.A and Mexico. As for the domestic passengers in 1988, Bogota is highest (60%), followed by Medellin (17%), Cali (8%), San Andres (7%) and the others as low as 0.8%.

Table 3.4-1 Number of Passengers at Cartagena Airport

(Source: Tourist Authority)

| Year | Number of Passengers | | | Growth Rate | | |
|------|----------------------|----------|---------|-------------|----------|-------|
| | International | Domestic | Total | Internatio | Domestic | Total |
| 1985 | 9,650 | 523,607 | 533,257 | | | |
| 1986 | 16,357 | 515,858 | 532,215 | 1.70 | 0.99 | 1.00 |
| 1987 | 25,433 | 525,702 | 551,135 | 1.55 | 1.02 | 1.04 |
| 1988 | 34,781 | 518,297 | 553,078 | 1.37 | 0.99 | 1.00 |
| 1989 | 27,681 | 496,495 | 524,176 | 0.80 | 0.96 | 0.95 |
| 1990 | 24,846 | 511,741 | 536,587 | 0.90 | 1.03 | 1.02 |

Table 3.4-2 Number of International Passengers at Cartagena Airport by Region

(Source: Tourist Authority)

| Place | 1985 | | | | 1986 | | | | 1987 | | | | 1988 | | | |
|-----------------|-------|--------|--------|--------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 1985 | 1986 | 1987 | 1988 | 1985 | 1986 | 1987 | 1988 | 1985 | 1986 | 1987 | 1988 | 1985 | 1986 | 1987 | 1988 |
| Europa | 1,323 | 1,189 | 1,528 | 884 | 0.14 | 0.07 | 0.06 | 0.03 | | | | | | | | |
| North America | 5,759 | 13,171 | 21,067 | 30,697 | 0.60 | 0.81 | 0.83 | 0.88 | | | | | | | | |
| Central America | 1,222 | 1,013 | 1,473 | 1,859 | 0.13 | 0.06 | 0.06 | 0.05 | | | | | | | | |
| Zone Caribe | 212 | 138 | 161 | 357 | 0.02 | 0.01 | 0.01 | 0.01 | | | | | | | | |
| South America | 516 | 467 | 454 | 547 | 0.05 | 0.03 | 0.02 | 0.02 | | | | | | | | |
| Others | 616 | 379 | 750 | 437 | 0.06 | 0.02 | 0.03 | 0.01 | | | | | | | | |
| Total | 9,650 | 16,357 | 25,433 | 34,781 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | |

Table 3.4-3 Number of Domestic Passengers by Domestic City

| City | 1987 | | 1988 | | 1988/1987 Ratio |
|--------------|---------|-------|---------|-------|-----------------|
| | Persons | Ratio | Persons | Ratio | |
| Bogota | 149,536 | 0.584 | 152,718 | 0.605 | 1.02 |
| Medellin | 44,106 | 0.172 | 42,683 | 0.169 | 0.97 |
| Cali | 22,875 | 0.089 | 19,608 | 0.078 | 0.86 |
| Barranquilla | 98 | 0.000 | 176 | 0.001 | 1.80 |
| Cucuta | 5,986 | 0.023 | 5,539 | 0.022 | 0.93 |
| San Andres | 18,194 | 0.071 | 18,120 | 0.072 | 1.00 |
| Pereira | 8,062 | 0.031 | 7,040 | 0.028 | 0.87 |
| Bucaramanga | 4,613 | 0.018 | 4,487 | 0.018 | 0.97 |
| Santa Marta | 992 | 0.004 | 77 | 0.000 | 0.08 |
| Pasto | 0 | 0.000 | 1 | 0.000 | 0.00 |
| Leticia | 0 | 0.000 | 0 | 0.000 | 0.00 |
| Others | 1,698 | 0.007 | 1,986 | 0.008 | 1.17 |
| Total | 256,160 | 1.000 | 252,435 | 1.000 | 0.99 |

219. Figures 3.4-1 and 3.4-2 show the monthly fluctuation of international and domestic passengers arrived at the airport, respectively. The international figures fluctuate considerably both in 1989 and 1990. In January, July and August, the international passengers are relatively high at just over 10% of the yearly total in both years exclusive of January in 1990. As for the domestic figures, they also fluctuate considerably. The month with over 10% of the year is January, July and August in 1989, in contrast to January, October and December in 1990. In both years, the tendency of monthly fluctuation is similar.

220. The trip purpose of passengers is different at each airport as shown in Figure 3.4-3 which shows the trip purpose by major cities in Colombia. In Cartagena, "Tourism" purpose is predominant as well as that of San Andres at over 80% of the total, while the other cities, Bogota, Barranquilla, Cali and Medellin, have higher percentage on the "Business" and "Others".

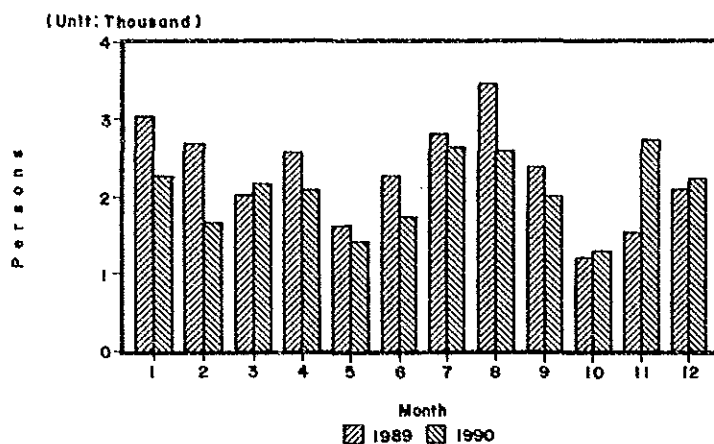


Figure 3.4-1 Monthly Fluctuation of International Passengers at Cartagena Airport

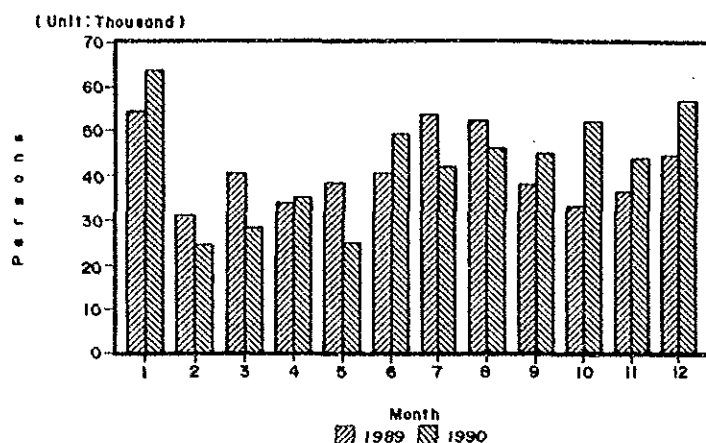


Figure 3.4-2 Monthly Fluctuation of Domestic Passengers at Cartagena Airport

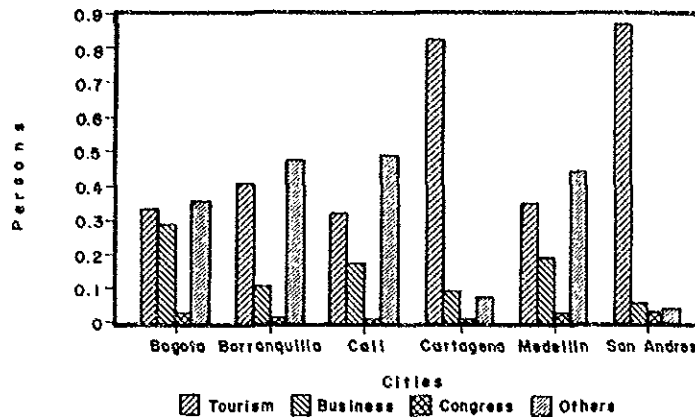


Figure 3.4-3 Trip Purpose by Airport

2) Vessel

221. The passengers visiting Cartagena by cruising ships steadily decreased in number since 1985. In the 4-years period 1985-1988, the number of passengers fell by more than 81,000, roughly decreasing 70%. The cruising passengers travel sightseeing spots in the city during a few hours and stay one night in the ship, not in hotel, and leave for next destinations. This travel will not be taken into consideration as tourism trips in the Study.

(2) Accommodation of Tourist

222. Table 3.4-4 shows the accommodation of tourist in Cartagena in terms of number of hotels, bed rooms and beds in 1990. The total number of hotels and residencias is 46, of which 31 are hotels and 15 are residencia. The residencia has the same functions as hotel but the owner stays together with customers and serves them under more familiar atmospheres. The numbers of modern five (5) and four (4) star hotels are 2 and 3, respectively.

223. The number of bed rooms available in hotel and residencia is 2,551. Approximately 90% of the total bed rooms are for hotel and the remaining 10% is for residencia. Over 40% of the total are sheared by only 5 higher class hotels with 5 and 4 stars. The share of bed rooms in residencia is as low as 9%.

Table 3.4-4 Accommodation in Cartagena

| Class of Hotel | No. of Hotels Hotels (Ratio) | No. of Bed Rooms Bed Rooms (Ratio) | No. of Beds Beds (Ratio) |
|----------------|---------------------------------|---------------------------------------|-----------------------------|
| 1) Hotel | | | |
| 5***** | 2 (0.065) | 650 (0.279) | 2,752 (0.408) |
| 4**** | 3 (0.097) | 373 (0.160) | 830 (0.123) |
| 3*** | 3 (0.097) | 648 (0.278) | 1,378 (0.204) |
| 2** | 3 (0.097) | 252 (0.108) | 590 (0.087) |
| 1* | 5 (0.161) | 213 (0.091) | 592 (0.088) |
| Others | 15 (0.484) | 192 (0.082) | 601 (0.089) |
| Sub-Total | 31 (0.674) | 2,328 (0.913) | 6,743 (0.911) |
| 2) Residencia | | | |
| 4**** | 1 (0.067) | 49 (0.220) | 123 (0.187) |
| 3*** | 1 (0.067) | 15 (0.067) | 50 (0.076) |
| 2** | 2 (0.133) | 44 (0.197) | 150 (0.228) |
| 1* | 1 (0.067) | 45 (0.202) | 85 (0.131) |
| Others | 10 (0.667) | 70 (0.314) | 250 (0.379) |
| Sub-Total | 15 (0.326) | 223 (0.087) | 659 (0.089) |
| Total 1)+2) | 46 (1.000) | 2,551 (1.000) | 7,402 (1.000) |

(3) Number of Persons Stayed in Hotel

224. The number of persons registered in hotels and residencias in 1990 is approximately 560,000, of which 506,000 are domestic persons and 54,000 are the international. Figure 3.4-4 shows monthly fluctuation of registered persons in hotels/residencia during 1988 to 1990. In comparison to the fluctuations in 1988 and 1989, the figure in 1990 shows a different fluctuation in which in the 6-months period of July to December, the number of registered persons are considerably higher .

(4) Tourism Facility

225. The old town, important tourism resource in Cartagena, was built in the 16th century in two sections, an inner and outer town. Both were surrounded by walls and separated from each other by a canal to protect from enemies. The inner walled town, traditionally where the upper classes lived, has many traditional and historical architecture and monuments.

226. Cartagena has become something of a resort because of the climate and its beaches. The resort area spreads up on Bocagrande, along the peninsula which fronts the Caribbean Sea. This area has top class hotels and restaurants. It is the main destination for many tourists.

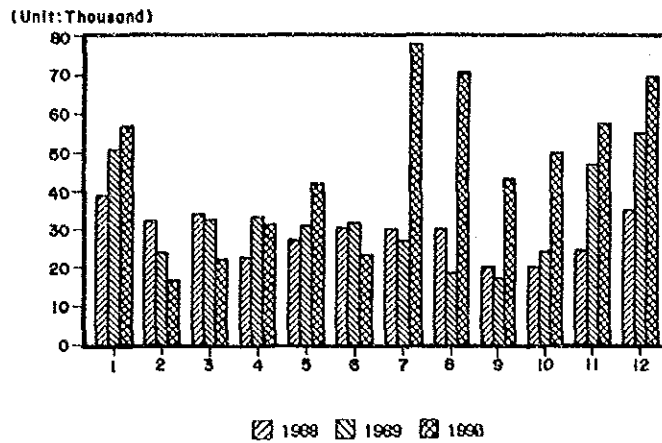


Figure 3.4-4 Monthly Fluctuation of Persons Registered in Hotels

(5) Tourism Trip

1) Vehicle trip for tourism

227. According to the hotel associations in Cartagena, there are many apartment hotels and apartments offering accommodation for seasonal tourists. It is difficult to accurately count the tourists staying at such accommodation. The associations say that number of persons stayed there reaches about twice that of hotel. Moreover, some tourists stay in their friend's or relative's houses. Therefore, the total number of persons staying in Cartagena is 3 to 4 times of the hotel registered tourists exclusive of international tourists.

228. The number of persons staying in all the accommodations is estimated as shown in Table 3.4-5. The number of passengers by road is also estimated as shown in Table 3.4-5.

Table 3.4-5 Estimation of Passengers by Road

| Year | No. of Persons Stayed in Hotel/ Apartment | No. of Passengers by Aircraft | No. of Passengers by Road |
|------|---|-------------------------------|---------------------------|
| 1990 | 1,960,000 | 537,000 | 1,423,000 |

note: 560,000 x 3.5 = 1,960,000

source: Study Team

2) Car and bus passenger trips for tourism purpose

229. The estimated figures in Table 3.4-5 are divided into tourism purpose and others, and passenger car and bus modes. The trip purpose is referred to in Figure 3.4-3, trip mode is obtained

from the interviewed information from the associations. They say the passenger ratio of car to bus is 6:4. Car and bus passenger trips for tourism purpose are estimated in Table 3.4-6.

Table 3.4-6 Car and Bus Passenger Trips for Tourism Purpose

| Year | Tourism Purpose (82%) | | Total |
|------|-----------------------|---------|-----------|
| | Car (person/day) | Bus | |
| 1990 | 700,000 | 467,000 | 1,167,000 |

note: $1,423,000 \times 0.82 = 1,167,000$
source: Study Team

3) Average daily passenger trips

230. Average daily passenger trips arriving at Cartagena is estimated by dividing the yearly figure by 365. Taking into account the monthly fluctuation, the ratio of maximum monthly registered persons in hotels to the average monthly figure is used as (1.5). The projection of average daily trips is shown in Table 3.4-7.

Table 3.4-7 Daily Trips by Mode in 1990

| Items | Car | Bus | Total (person/day) |
|---------|-------|-------|--------------------|
| Average | 1,918 | 1,279 | 3,197 |
| Maximum | 2,877 | 1,919 | 4,796 |

note: Number of arrivals daily trip is estimated.
source: Study Team

231. Based on the tourist sample interview survey done by the Study Team during January 4 to 8, 1992, 7 days for domestic tourists and 3 days for international ones represent the average staying in days in Cartagena. The trips made by these tourists give influences on urban traffic flow.

232. The influence on the urban traffic flow by tourism trips in the urban area is investigated by counting the traffic volume at several road sections in high tourist seasons (July 1991 and December 1991/January 1992) and off season (August 1991). Table 3.4-8 shows the result of traffic volume counts at five (5) road sections. Car and taxi traffic volumes at R1 and R12 increased at high seasons, which seem to be the influence from tourist trip increase.

233. Traffic volume at high season increased by 10 -20 per cent at R1 (entrance to Bocagrande). However, at R14 (entrance to

Mamonal industrial area), traffic volume rather decreased. Between the inside and the outside of the Study Area, traffic volume increased by about 30 per cent. As for the influence on the traffic flow from tourist trip, therefore, it is considered to be limited to specific areas and during peak tourist seasons (two periods of three weeks each per year).

Table 3.4-8 Traffic Volume Count Results (veh./day)

| Date | Traffic Count Road Section | | | | |
|---------------------|----------------------------|--------|--------|---------|----------|
| | R1 | R12 | R14 | Bayunca | Turubaco |
| July 1991 | | | | | |
| Car | 27,412 | 10,718 | 4,429 | - | - |
| Truck | 1,316 | 1,907 | 2,495 | - | - |
| Taxi | 12,386 | 7,221 | 1,629 | - | - |
| Bus | 4,150 | 9,007 | 1,162 | - | - |
| Total | 45,264 | 28,853 | 10,160 | - | - |
| August 1991 | | | | | |
| Car | 24,000 | 9,950 | 4,874 | 1,158 | 3,765 |
| Truck | 1,589 | 1,793 | 2,402 | 1,427 | 1,437 |
| Taxi | 12,291 | 6,439 | 1,724 | 72 | 310 |
| Bus | 4,052 | 9,506 | 1,702 | 628 | 1,052 |
| Total | 41,932 | 27,679 | 10,702 | 3,285 | 5,326 |
| Dec. 1991/Jan. 1992 | | | | | |
| Car | 28,880 | 12,430 | 4,618 | 1,996 | 3,558 |
| Truck | 1,114 | 1,574 | 1,761 | 1,387 | 1,791 |
| Taxi | 15,740 | 6,860 | 1,768 | 123 | 457 |
| Bus | 3,634 | 8,741 | 1,257 | 671 | 995 |
| Total | 49,368 | 29,605 | 9,404 | 4,177 | 6,801 |

note: Traffic volumes at Bayunca and Turubaco are from/to outside of the Study Area.
source: Study Team

3.5 Transport Problems

234. The existing traffic conditions were evaluated through analyzing the numerous data from the many types of traffic surveys and the existing data available. The existing urban transport problems were identified from the following view points.

- Existing road network
- Road traffic

(1) Existing Road Network

235. The road network in Cartagena is limited by geographical restrictions. Especially, the narrow belt surrounded by Cienga de Tesca (swamp) in the northern side and Bahia de Cartagena (the bay of Cartagena) in the southern side becomes the narrow neck of road construction. At present, there is only one major road

serving for the east-west traffic in this corridor, Av. Don Pedro de Heredia. This is also the busiest traffic corridor in Cartagena. In the future, this belt will become the bottleneck of traffic if no action will be taken.

236. The arterial roads to handle the heavy traffic and make the road frame are composed of;

Av. San Martin in Bocagrande,
Av. Santander between Bocagrande and Cartagena Airport,
Av. Don Pedro de Heredia, and
Diagonal 22 and Carretera a Mamonal.

Road classifications, however, have to take into consideration the road function.

237. The cross section in those roads at present is not enough for width or number of lanes as a major road. However, according to the City Act No. 426 dated January 2, 1990, expansion of cross section on those existing roads will be planned taking into account road classification as a part of the future road network.

238. The collector roads supporting the arterial roads such as Av. Alfonso Araujo, Av. Buenos Aires and Carretera de La Cordialidad, etc., are not sufficient enough for width and number of lanes to serve for the traffic volume from the view point of road function.

239. As for the local road to connect arterial and collector roads in the residential area, the road conditions such as alignment, width and pavement are not enough to serve for vehicles and public buses. There are many local roads which are not linked between arterial or collector roads. It is difficult to steer vehicles and conduct public bus operation on those roads.

240. In suburban area, the road network is coarse and poor in both quantity and quality. There are two national roads to serve to the neighboring cities, which have 2 lanes. The other roads are poorly developed only connecting small towns. Those roads are served with unpaved surface and are not sufficient for running vehicles.

241. On the other hand, estimating the road inventory data in the urban area, approximately 65% of the total length is with 2 lanes road. From among them, approximately 10% of 2 lanes road length is unpaved surface. In contrast to 2 lanes road, 4 or more lanes roads are well improved; 80% is installed with Median, 96% with sidewalk, about 100% are paved and 85% have good conditions of road surface.

(2) Road Traffic

242. In Cartagena, the traffic movement concentrates into the corridor on the narrow belt from the whole urban area. Approximately 40% of the total trips in passenger number pass through on the Screen Line where Av. Don Pedro de Heredia handles the traffic volume together with some roads in Manga.

243. Under the geographical restriction, since the traffic from/to Bocagrand/Castillogrande flows to/from other area by way of Centro, almost all traffic converges in Centro, including the through traffic which does not end inside Centro. Therefore, traffic congestion in this area rises more and more.

244. The roads carrying heavy traffic volume are located in Centro and its neighbor areas, while in the residential area, traffic volume considerably falls.

245. From the relationship between traffic demand and capacity at morning peak hour, at present there are no saturated sections as well as no overloaded roads in the urban area. These situations will continue during the near future but not for so many years before the target year when traffic volume will be a great deal higher.

CHAPTER 4 PUBLIC TRANSPORTATION

4.1 General

246. From 1988, the Municipality of Cartagena has been able to control directly the public transportation for passengers, including both mass-transit (Bus and Buseta) and individual modes (Taxi). The duty was transferred to the Municipality from the national control by the City Decree 080 in 1987, which was ruled by the Republic Congress Law referring to the administrative decentralization. As the executing agency of the Municipality, DATT (Departamento Administrativo de Transito y Transporte, Cartagena) is in charge of transit and transportation control in the city.

247. Urban public transportation system is controlled by the transport division of DATT. This division is in charge of executing the study of new network and examining the introduction of new enterprises, and also is involved in the operation of public transport vehicles.

248. On the other hand, the intermunicipal or inter-regional transportation for passengers is still controlled by INTRA (Instituto Nacional del Transporte, Ministerio de Obras Publicas y Transporte).

249. Public transportation means in Cartagena are basically bus and taxi. There is another smaller scale mean, ie. water transportation. One is a ferryboat to Baru Island whose capacity is about 3 - 4 vehicles. Another one is some small boats to Tierra Bomba Island which transport people who live there. These are used for commuting to the city center.

250. Concerning land transportation, the majority of people generally use a bus system. They use taxi as complementary system. Bus system can be classified into two categories, urban bus services and inter-city bus services.

251. Urban bus services have been accomplished by two types of vehicles, bus and buseta. These, bus and buseta, have three different levels of services, such as "Ordinario", "Ejectivo" and "Servicio Especial". There is another type of conveyance called "Colectivo". It can be said that the service of Colectivo is intermediate between bus and taxi, and don't have fixed routes and time tables.

252. Inter-city bus services have two categories of services. One is inter-city bus services, which is connecting the cities within the Bolivar region. Another is inter-region

(inter-Departamento) bus services, which is connecting the cities outside of Bolivar region. Inter-city bus service system has an exclusive terminal near at the intersection of Carretera de la Cordialidad with Camino a Campania. Almost all the inter-city bus routes gather in this terminal.

253. The number of passengers by bus transport was about 354 thousand, equivalent to 89.3% of total transport demand in 1983 by the result of Person Trip Survey done by HIDROTEC/EDURBE (refer to Table 4.1-1). In this Study the total demand of public transportation is estimated about 1,011 thousand passengers in 1991. This figure is 2.856 times as much as HIDDROTEC Survey nine (9) years earlier. Growth rate is about 12.3% annually. The growth rate of public transport demand is about 3.5 times as much as that of population which is 3.5% per annum in recent 5 years.

Table 4.1-1. Total Demand of Transportation in 1983

| Category | No. of Trip | Share |
|------------|-------------|-------|
| Bus/Buseta | 354,003 | 89.3 |
| Car/Taxi | 42,230 | 10.7 |
| Total | 396,233 | 100.0 |

Note: This value doesn't include water transport possibility.

Source: Study Report by HIDROTEC/EDURBE

4.2 Urban Bus Transportation

4.2.1 Bus Companies and Fleets

(1) Bus Company

254. Urban bus services are operated by 10 companies. There is no public body. All of them are private bus companies. One (1) company has only the bus type vehicles. Another one (1) company has the buseta and colectivo type vehicles. Eight (8) other companies have the bus and buseta type vehicles. The list of these companies is shown in Table 4.2-1. These 10 companies supply three (3) different kinds of services, such as Ordinario, Ejectivo and Servicio Especial. Officially permitted bus lines are 35. Some bus lines have still not been operated. Some bus lines are divided into two or three routes. Therefore, at present (August, 1991), 36 bus routes are actually operated. Several bus companies enter into the operation on the same route. Approximately, 5 - 9 bus companies operate their buses simultaneously in same one (1) bus route.

Table 4.2-1 Bus Companies

| Type | Company Name |
|------------------|----------------------------|
| Bus | 1. Flota de Lujo |
| Buseta/Colectivo | 2. Cointracar |
| Bus/Buseta | 3. Transporte Media Luna |
| | 4. Cootransbol |
| | 5. Transporte R. Torices |
| | 6. Castellanos Gracia Etul |
| | 7. Montero |
| | 8. Pemape |
| | 9. Renaciente |
| | 10. Contrasurb |

(2) Association of Bus Companies

1) ADESTRACOSTA

255. Nine (9) urban bus companies organize the association as "ADESTRACOSTA". The tenth one, "COINTRACAR", has not yet joined in the above association. COINTRACAR operates one (1) bus route independently.

256. ADESTRACOSTA handles most matters of interest to bus companies, such as the administration of operation in each bus route which all bus companies of this association join in, the adjustment and guidance on problems among the bus companies, making up the improvement plan or guidelines, etc.

2) Asociacion de Transportadores del Servicio Urbano

257. This association has a little different characteristic from ADESTRACOSTA. This association has been organized basically by the firms possessing the bus vehicles. This association has been established as an alternative organization to ADESTRACOSTA by "Afiliados" who own the bus vehicles privately and COINTRACAR.

(3) Bus Vehicles

1) Number of Vehicles

258. The number of bus/buseta vehicles in use actually, in services of Ordinario and Ejectivo, is approximately 1661 owned in Cartagena, as shown in Table 4.2-2 by bus companies;

Table 4.2-2 Number of Bus Fleet in Cartagena

| Company Name | No. of Bus Vehicle |
|--------------------------|--------------------|
| 1. Etul | 135 |
| 2. Flota de Lujo | 79 |
| 3. Transporte Media Luna | 84 |
| 4. Montero | 205 |
| 5. Pemape | 235 |
| 6. Cootransbol | 88 |
| 7. Renaciente | 334 |
| 8. Transporte R. Torices | 285 |
| 9. Cointracar | 71 |
| 10. Cootransurb | 145 |
| Total | 1,661 |

Source: DATT

259. Of these vehicles, the number of buses in operation on each bus route actually is 1357, as shown in Table 4.2-3.

Table 4.2-3 Number of Bus/Buseta by Routes

| Route No. | Route Name | Veh. No. | Type of Service |
|--------------|---|-------------|------------------|
| 1 | Esperanza-Centro | 37 | bus ordinario |
| 2 | Zaragocilla-Calamares-Centro | 60 | bus ordinario |
| 3 | Tenera-Av. Pedro de Heredia-Centro | 50 | bus ordinario |
| 3A | Tenera-Av. Pedro de Heredia-Centro | 65 | buseta ordinario |
| 4 | Olaya-Av. Pedro Romero-Centro | 107 | bus ordinario |
| 5 | Socorro-Centro | 40 | bus ordinario |
| 6 | Socorro-Centro | 78 | buseta ordinario |
| 7 | Blaz de Lezo-Av. Pedro de Heredia-Centro | 60 | buseta ordinario |
| 8 | Bosque-Blaz de Lezo-Centro | 70 | bus ordinario |
| 9 | Torices-Santa Maria-Centro | 35 | bus ordinario |
| 10 | Paraguay-Junin-Centro | 6 | bus ordinario |
| 11 | Gaviotas-Av. Pedro de Heredia-Centro | 25 | bus ordinario |
| 11A | Gaviotas-Av. Pedro de Heredia-Centro | 1 | buseta ordinario |
| 12 | Alto Bosque-Centro | 33 | bus ordinario |
| 13 | Trece de Junio-Centro | 38 | bus ordinario |
| 14 | Seguros Bolivar-Centro | 6 | bus ordinario |
| 15 | Caracoles-Av. Pedro de Heredia-Centro | 80 | buseta ordinario |
| 16 | Albornoz-Bosque-Centro | 33 | bus ordinario |
| 17 | Chile-Los Cerros-Centro | 20 | bus ordinario |
| 18 | Daniel Lemaitre-Centro | 60 | bus ordinario |
| 19 | Daniel Lemaitre-Bazurto | 24 | bus ordinario |
| 20 | Crespo-Centro-Manga-Paraguay | 35 | buseta ordinario |
| 20A | Crespo-Centro-Castillo | 30 | bus ordinario |
| 21 | Carnero-Blaz de Lezo-Crisanto Luque-Centro | 12 | buseta ordinario |
| 22 | Manga-Bazurto-Centro | 20 | bus ordinario |
| 22A | Manga-Popa-Centro | 1 | bus ordinario |
| 22B | no operation | | |
| 22C | Laguito-Centro | 15 | bus ordinario |
| 23 | Guillerao Posada-Centro | 22 | bus ordinario |
| 24 | Tenera-Centro-Laguito | 60 | bus eectivo |
| 25 | Socorro-Bosque-Castillo | 37 | bus eectivo |
| 26 | Paraguay-Manga-Popa-Centro-Castillo | 35 | bus ordinario |
| 27 | Campestre-Bosque-Laguito | 15 | bus eectivo |
| 28 | Campestre-Avenida-Castillo | 44 | bus eectivo |
| 29 | no operation | | |
| 30 | no operation | | |
| 31 | Zaragocilla-Bosque-Bocagrande | 24 | buseta eectivo |
| 32 | Pozon-Trece de Julio-Centro-Paseode Bolivar | 39 | bus eectivo |
| 33 | no operation | | |
| 34 | no operation | | |
| 35 | Simon Bolivar-St. Fernando | 20 | buseta ordinario |
| Total | | 1357 | |

Source: DATT

260. The difference between the above mentioned numbers is due to the buses used for operation of the "special service". The number of buses in use of the special services is a total 239 (refer to Table 4.2-4).

Table 4.2-4 Bus fleets for Special Services

| Company Name | No.of Bus | No.of Buseta | Total |
|-----------------------|------------|--------------|------------|
| 1. Flota de Lujo | 6 | - | 6 |
| 2. Cointracar | - | 16 | 16 |
| 3. Trans. Media Luna | 4 | 1 | 5 |
| 4. Cootransbol | 10 | - | 10 |
| 5. Trans. R.Torices | 23 | 8 | 31 |
| 6. Castillanos G.Etul | 15 | - | 15 |
| 7. Montero | 52 | 8 | 60 |
| 8. Pemape | 18 | 13 | 31 |
| 9. Renaciente | 37 | 4 | 41 |
| 10. Cootransurb | 16 | 3 | 19 |
| Total | 185 | 54 | 239 |

Source: DATT

2) The Ages of Vehicles

261. The average age of bus vehicles in use is approximately 19.0 years for bus and 9.0 years for buseta in 1990, from the data of DATT (refer to Table 4.2-5).

262. From the data of INTRA in July, 1991, the Study Team calculated the average age in use and arrived at about 18.0 years for bus and about 12.4 years for buseta (refer to Table 4.2-6).

Table 4.2-5 The Ages of Bus Vehicles (1) unit: year

| Company | Bus | | Buseta | |
|------------------|--------------|--------------|-------------|-------------|
| | 1985 | 1990 | 1985 | 1990 |
| 1. Flota de Lujo | 17.50 | 22.00 | 11.25 | 16.00 |
| 2. Cointracar | - | - | - | - |
| 3. Media Luna | 19.87 | 24.00 | 6.93 | 11.22 |
| 4. Cootransbol | 12.90 | 17.00 | 6.09 | 10.50 |
| 5. R. Torices | 13.06 | 17.80 | 5.46 | 10.20 |
| 6. C. G. Etul | 14.00 | 18.20 | 10.41 | 14.40 |
| 7. Montero | 5.15 | 8.90 | 2.56 | 7.00 |
| 8. Pemape | 12.40 | 15.00 | 3.25 | 8.00 |
| 9. Renaciente | 17.37 | 21.00 | 4.62 | 9.00 |
| 10. Cootransurb | 10.78 | 15.00 | 1.00 | 5.50 |
| Average | 14.50 | 19.00 | 4.40 | 9.00 |

Source: DATT

Table 4.2-6 The Age of Bus Vehicles (2) unit: vehicle

| Company | Make of Bus Vehicles | | | | | | | | | | | | | | Total | Average Age | |
|---------------|----------------------|----------|-----------|-----------|----------|----------|----------|-----------|-----------|-----------|----------|------------|------------|------------|------------|-------------|--------------|
| | 90 | 89 | 88 | 87 | 86 | 85 | 84 | 83 | 82 | 81 | 80 | 79-75 | 74-70 | 69-60 | | | 59- |
| Etul | | | | | | | 1 | | 1 | 5 | | 29 | 19 | 44 | 9 | 108 | 18.97 |
| Cootransurb | | | 1 | | | | | 6 | 14 | 7 | 2 | 37 | 34 | 11 | 3 | 115 | 14.77 |
| Renaciente | | | | | | | | 1 | 4 | 9 | 1 | 39 | 44 | 66 | 81 | 245 | 21.34 |
| Penape | 1 | 2 | 1 | | | 1 | | | 1 | 3 | | 30 | 12 | 15 | 9 | 75 | 16.74 |
| Media luna | | | | | | | | 1 | | | | 7 | 4 | 14 | 19 | 45 | 21.33 |
| Flota de Lujo | | | | | | | | | 1 | | | 10 | 10 | 21 | 16 | 58 | 21.55 |
| Cootransbol | | | | | | | | | | 1 | | 28 | 5 | 11 | 9 | 54 | 17.94 |
| Torices | | 3 | 1 | 1 | | | 2 | | 1 | | | 77 | 56 | 93 | 35 | 209 | 18.10 |
| Montero | | 3 | 7 | 11 | 2 | | | 7 | 5 | 20 | | 25 | 11 | 5 | 1 | 97 | 10.80 |
| Q | 1 | 8 | 10 | 12 | 2 | 1 | 3 | 15 | 27 | 45 | 3 | 282 | 195 | 220 | 182 | 1006 | 17.95 |

| Company | Make of Buseta Vehicles | | | | | | | | | | | | | | Total | Average Age | | |
|---------------|-------------------------|----|----------|----|----|----------|-----------|------------|------------|-----------|-----------|-----------|-----------|----------|----------|-------------|--------------|-------|
| | 90 | 89 | 88 | 87 | 86 | 85 | 84 | 83 | 82 | 81 | 80 | 79-75 | 74-70 | 69-60 | | | 59- | |
| Etul | | | | | | | | 85 | 4 | 3 | | | | 6 | 1 | 1 | 100 | 9.05 |
| Cootransurb | | | 1 | | | | | 2 | 12 | 28 | 11 | 2 | 7 | 2 | | | 65 | 9.80 |
| Renaciente | | | | | | | | 3 | 7 | 53 | 12 | 2 | 8 | 7 | 3 | 6 | 101 | 13.89 |
| Penape | | | | | | 5 | 16 | 15 | 21 | 17 | 2 | 13 | 24 | | | | 113 | 11.00 |
| Media luna | | | | | | | | | 3 | 1 | 2 | | | 7 | 1 | | 14 | 14.40 |
| Flota de Lujo | | | | | | | | | | | | 2 | 1 | | | 1 | 4 | 18.00 |
| Cootransbol | | | | | | | | 3 | 6 | 3 | 3 | 1 | 3 | 1 | 1 | 21 | 12.28 | |
| Torices | | | | | | 1 | 3 | 8 | 11 | 10 | 3 | 10 | 28 | | | | 74 | 12.93 |
| Montero | | | | | | 1 | 19 | 20 | 8 | 12 | 1 | 5 | 10 | | | | 76 | 9.82 |
| Total | | | 1 | | | 7 | 43 | 150 | 134 | 69 | 15 | 46 | 88 | 6 | 9 | 568 | 12.37 | |

Source: INTRA

263. Based on the data from DATT and INTRA, the average ages of bus show approximately the same numbers. However the average ages of buseta show much differences. The reason why is not clear. The average age of bus vehicles by each bus company has a wide range from 9 years to 22 years in 1991. That of buseta is not so wide compared with bus, especially the data from INTRA about 9 - 14 years.

3) The Capacity of Passengers

264. By the information from DATT and ADESTRACOSTA, it is understood that generally the capacity of a bus is approximately 45 seats and 12 standings and that of buseta is approximately 25 seats and 5 standings. Using the data from INTRA, the capacity of a bus is 45.2 passengers and that of buseta is 25.0 passengers (refer to Table 4.2-7).

Table 4.2-7 Capacity of Bus/Buseta

| Company | -20 | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | Total | Average Capacity |
|---------------|----------|-----------|------------|------------|------------|-----------|------------|------------------|
| Etul | | 1 | 14 | 64 | 25 | | 104 | 45.86 |
| Cootransurb | 1 | 23 | 7 | 41 | 24 | | 96 | 42.10 |
| Renaciente | | | 67 | 122 | 50 | 3 | 242 | 44.55 |
| Peaspa | | | 9 | 38 | 15 | 5 | 67 | 47.38 |
| Media luna | | | 6 | 19 | 5 | 3 | 33 | 43.83 |
| Flota de Lujó | | | 8 | 31 | 16 | | 55 | 46.25 |
| Cootransbol | | | 12 | 31 | 10 | | 53 | 44.62 |
| Torices | | | 44 | 116 | 52 | | 212 | 45.37 |
| Montero | | | 4 | 60 | 16 | | 80 | 46.59 |
| Total | 1 | 24 | 172 | 328 | 215 | 11 | 951 | 45.17 |

| Company | -20 | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | Total | Average Capacity |
|---------------|----------|------------|----------|-------|-------|-------|------------|------------------|
| Etul | 1 | 16 | 1 | | | | 18 | 25.00 |
| Cootransurb | | 66 | | | | | 66 | 25.00 |
| Renaciente | 5 | 49 | 3 | | | | 97 | 23.71 |
| Peaspa | | 113 | 1 | | | | 114 | 25.08 |
| Media luna | | 13 | 1 | | | | 14 | 23.71 |
| Flota de Lujó | | 4 | | | | | 4 | 25.00 |
| Cootransbol | | 21 | | | | | 21 | 25.00 |
| Torices | | 71 | 9 | | | | 74 | 23.40 |
| Montero | | 52 | | | | | 52 | 25.00 |
| Total | 6 | 445 | 9 | | | | 460 | 24.98 |

Source: DATT/ADESTRACOSTA

4) The Ownership of Vehicles

265. There are three different kinds of categories related to the type of ownership for bus vehicles, as follows;

- a. Bus vehicles owned by company
- b. Bus vehicles owned by "Socios"
- c. Bus vehicles owned by "Afiliados"

266. Type (a), the bus fleet owned by company, is the normal type of the ownership. It means the bus vehicles are registered by the bus companies. Type (b), the bus fleet owned by "Socios", is the type where the bus vehicles are registered by "Socios", who are the persons managing a small bus company. Bus companies make a contract with Socios to lease their bus vehicles usually for 1 - 2 years. Therefore, it can be classified as one of the types of individual ownership.

267. Type (c), the bus fleet owned by "Afiliados", is an usual personal ownership of bus vehicles. "Afiliados" means the person who has no relation with a bus company but own bus vehicles privately. They make a contract with a bus company to rent their bus vehicles for 1 - 2 years. Sometimes, a bus company borrow (lease) the bus vehicles from "Afiliados" for very short time length, in order to make up for a damaged vehicle. At present, the number of bus vehicle of this type is approximately 900, that represent about 75% of the total bus fleet.

4.2.2 Service Network

(1) Permission and Authorization

268. At present, DATT is responsible for permitting and licensing of bus network. There are approved/licensed 35 lines which are composed of 41 routes. However, actually operated routes are 36. The reasons for the discrepancy are not clear. It might be basically due to erroneous information from the bus companies.

269. Concerning to the bus route formation, since the bus routes proposed by the bus companies would be easily approved as submitted, the bus companies tend naturally to form the bus routes from the following points of view;

- a. Bus routes that can easily be patronized by a large number of passengers,
- b. Bus routes for vehicle to be easily operated and controlled considering the condition of roads.

270. Owing to the realistic consideration, bus routes are formed to pass through the Centro or Mercado de Bazaruto. Therefore, it is natural for the bus routes to concentrate into the several roads. Especially in Av. Pedro de Heredia many routes and much number of buses are concentrated. Furthermore, major bus routes tend to form their routes passing through the Centro and returning to the origin points. This is the main reason why the many routes have so much long travel distance.

(2) Network Pattern

271. The bus network of urban area in Cartagena is formed by 36 bus routes, at present, which are shown in Figure 4.2-1. The characteristics of this bus network pattern can be classified into four categories as follows;

- a. the routes directly connecting with the Centro
- b. the routes passing through the Centro
- c. the routes circulating through the Centro
- d. the routes which have no relation with the Centro

272. In these categories, the type (a) has the largest number of routes concentrated, such as 21 routes going down from north to south and 6 routes going down from east to west. The circulating routes are 2, the routes passing by the Centro are 5 and the route without any relation with the Centro is only one (1). This shows the important relationship with the Centro. The

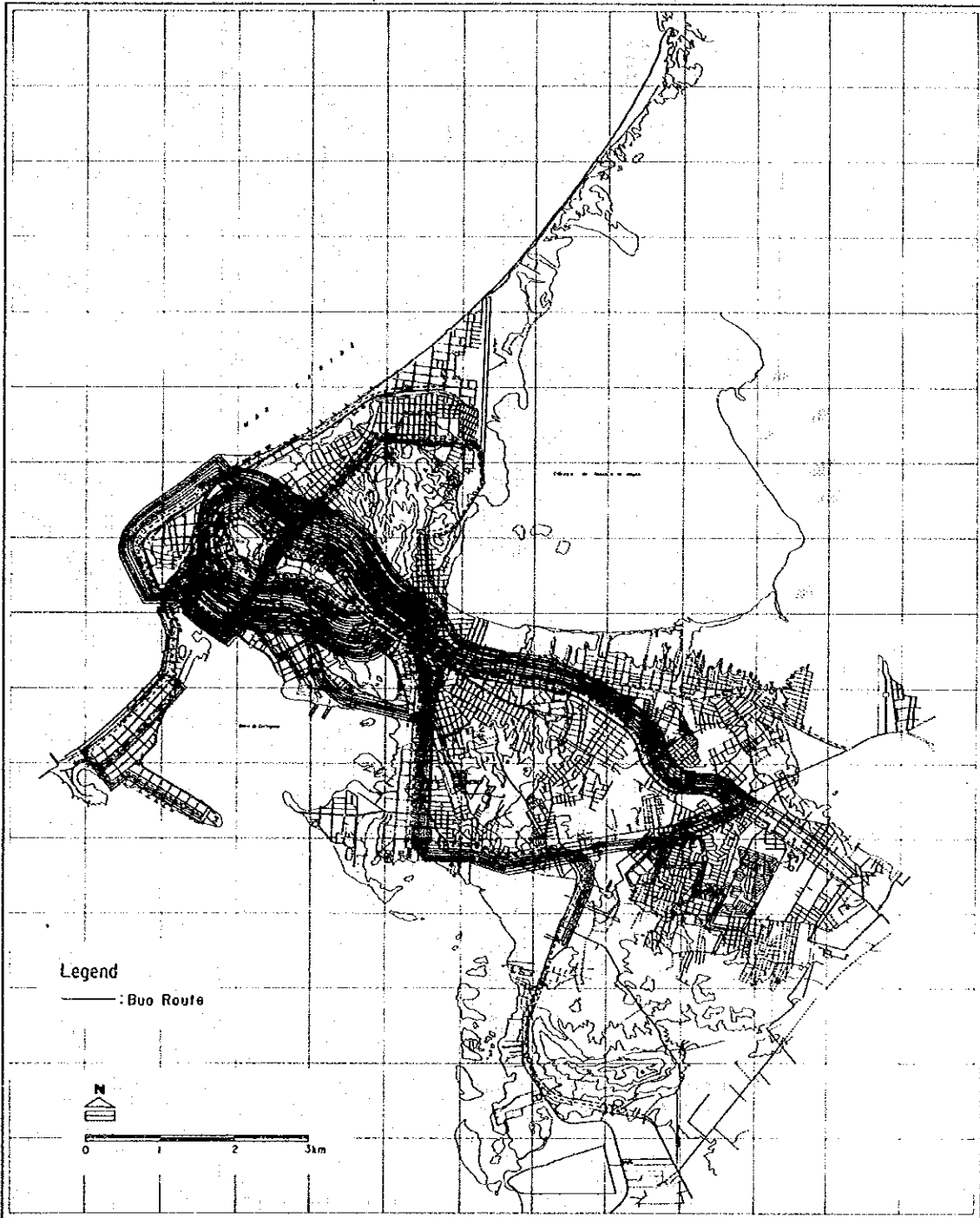


Figure 4.2-1 Bus Network

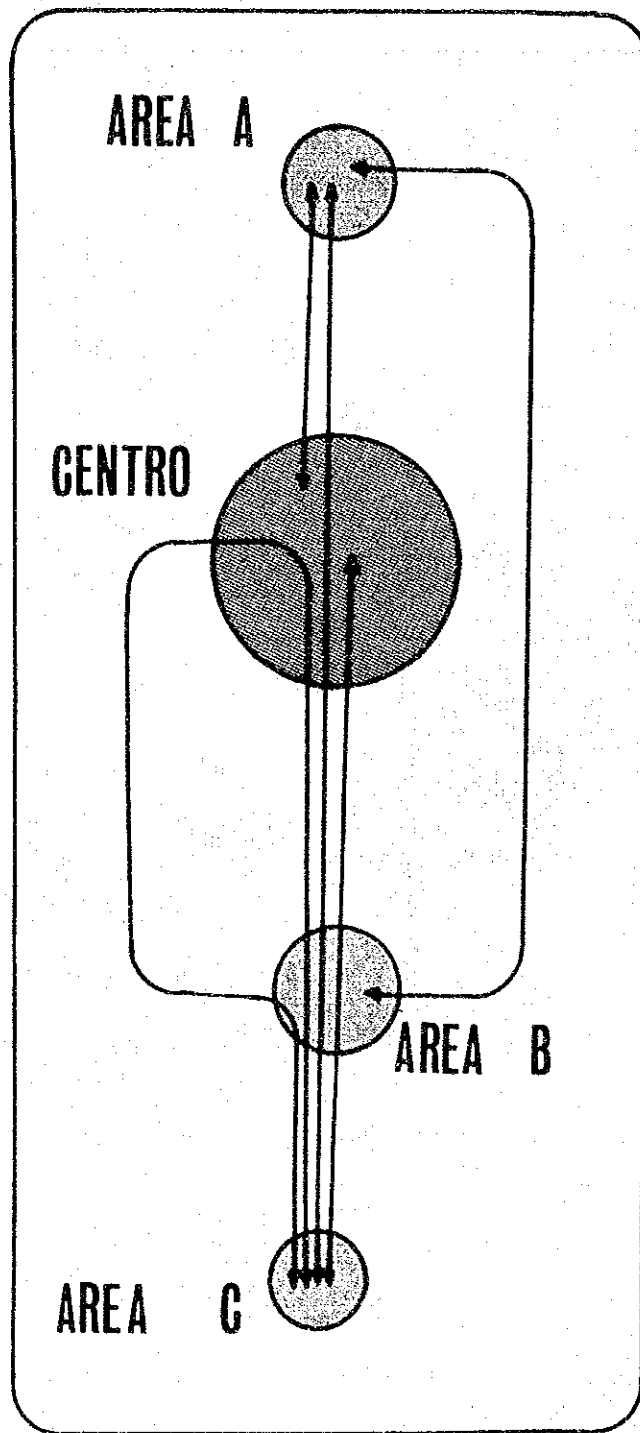


Figure 4.2-2 Bus Route Pattern

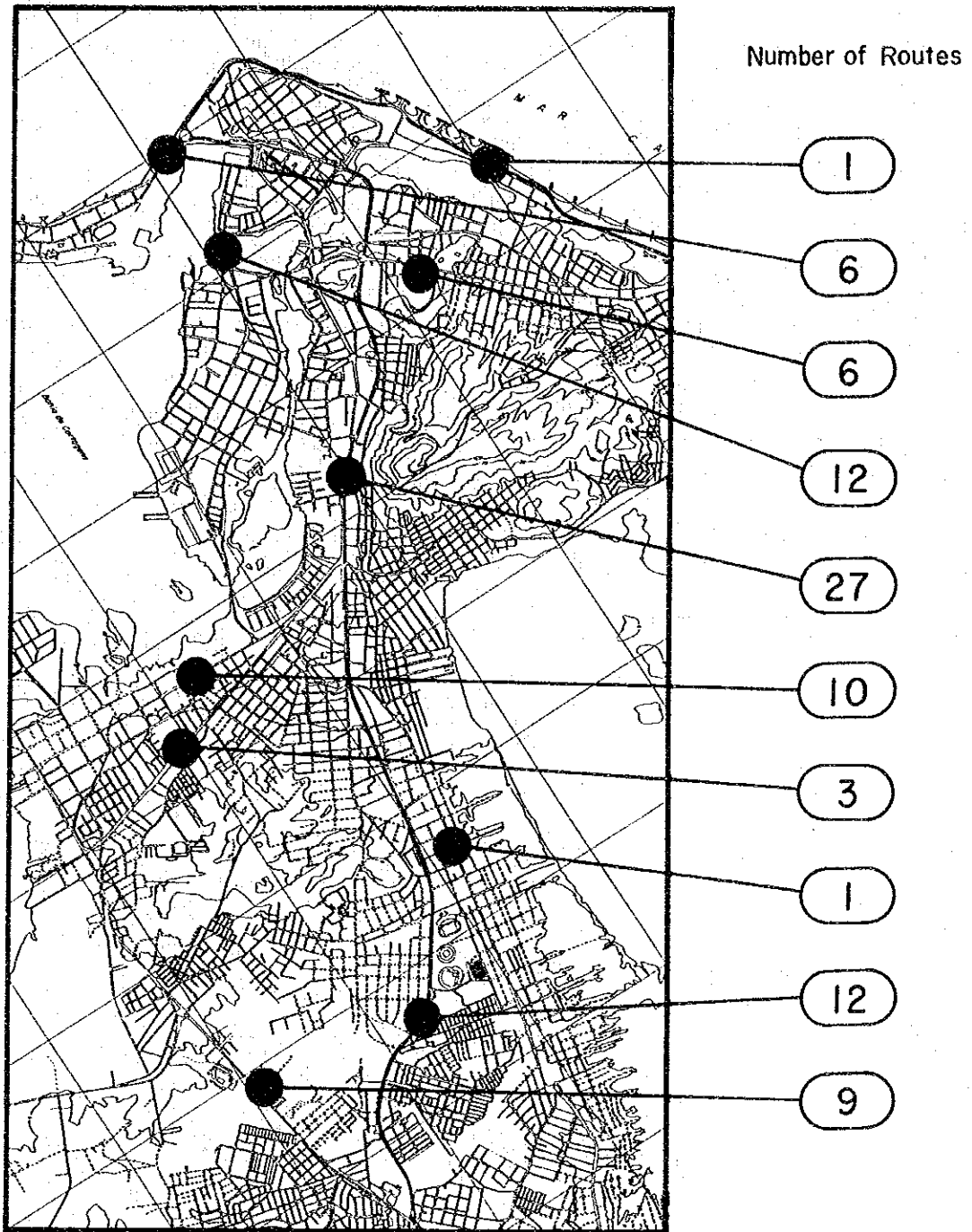


Figure 4.2-3 Bus Route Overlapping

network pattern can be shown as simplified in Figure 4.2-2.

273. There are a few routes which have some relations with Laguito and Bocagrande that are main places for the tourist interest. They are the routes passing through the Centro, the routes which have no relation with the Centro and one (1) route connecting with Laguito and the Centro.

274. Under these situations, for almost more than half the routes are operating round trips with the Centro. On the main trunk roads so many number of bus routes overlap. Av. Pedro Heredia has 27 routes, the Bridge Roman has 12 routes and Av. Diagonal 21 (Av. Buenos Aires) has 10 routes (refer to Figure 4.2-3).

275. If the number of bus vehicles is in proportion to the number of demand of passengers, a high number of people spend a long time traveling, as shown in Figure 4.2-4. The travel time which ranges between one hour and two hours is required at approximately 60% of routes.

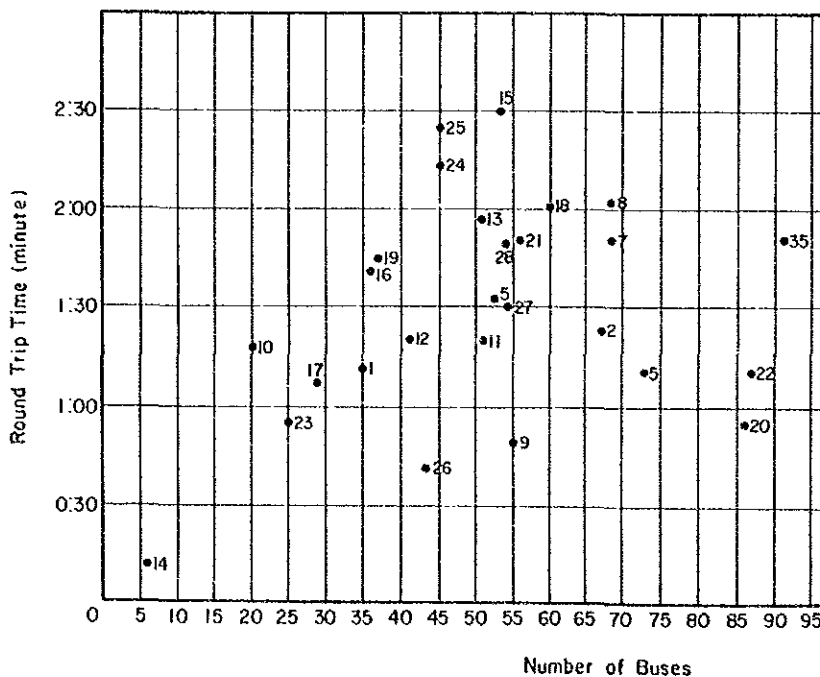


Figure 4.2-4 Travel Time and Number of Bus

4.2.3 Operation

(1) Number of Bus Vehicles in Operation

276. At present, based on the actual operation data by bus companies, the number of bus vehicles in use on all bus routes are 1373. In ordinario service, the number of Buses is 764 vehicles, almost 3.5 times the number of Busetas. In Ejectivo service, the number of Buses is 370 vehicles and about 7% as much are Busetas (refer to Table 4.2-8).

Table 4.2-8 Total Number of Bus/Buseta in Use

| Service Type | Number of Vehicle |
|------------------|-------------------|
| Bus Ordinario | 764 |
| Bus Ejectivo | 370 |
| Buseta Ordinario | 215 |
| Buseta Ejectivo | 24 |
| Total | 1,373 |

Source: DATT

277. The number of bus fleet for Special Services is shown in Table 4.2-4, and the number of Colectivo is shown in Table 4.2-9, using data from DATT.

Table 4.2-9 Number of Colectivo

| Service Type | Number of Vehicle |
|--------------|-------------------|
| Publico | 280 |
| Paticular | 150 |
| Total | 430 |

Source: DATT

(2) Type of Services

278. The word bus generally refer to three types of vehicles. They are (1) Bus, (2) Buseta and (3) Colectivo. "Buseta" is a small/medium-sized bus. "Colectivo" is a jeep type vehicle converted into a bus type. Bus and Buseta offer a mix of three different kinds of services. Those are services of (1) Ordinario, (2) Ejectivo and (3) Servicio Especial.

1) Service of Ordinario

279. This is an usual bus passenger transport service. Passengers can take a bus/buseta at bus stop and anywhere on the road. The legal limitation on the interval of bus stops is less than 200m. Fundamentally, bus/buseta should not stop just any-

where on the road as per the legal guidelines of DATT. But since the drivers want to get more passengers, they make unauthorized stops.

280. At the peak hours, bus/buseta is operated with many standing passengers, and especially in the evening peak at Centro, busetas are observed to move with passengers hanging outside their entrances.

2) Service of Ejectivo

281. "Ejectivo" contrasts so much with "Ordinario". Bus/buseta stop at fixed bus stops. The interval of these bus stops are longer than Ordinario's. The legal limitation of this interval is more than 300 m. That makes Ejectivo some kind of express bus service.

282. Number of passengers is kept up below the capacity of seats, thus standing passengers are not allowed by the Decreto. Therefore, the characteristics of "Ejectivo" are;

- a. travel time is short compared with ordinario's, and
- b. the passengers can always have a seat.

283. In the legal guideline by the Decreto of municipality, there are other obligations such as;

- a. time control,
- b. capacity of passengers,
bus ; min. 35 - max. 45 seats
buseta ; min. 21 - max. 30 seats
- c. provide two entrance/exit for Bus,
- d. provide one entrance/exit and another one exit in emergency for Buseta,
- e. to use the vehicles after the model 1987 for Bus,
- f. to use the vehicles after the model 1984 for Buseta,
- g. to have an engine at the front-end of vehicle,
- h. to have a bell to ring for passengers who want to get off,
- i. to equip windows with glass,
- j. to equip with lights and safety equipment,
- k. to provide min. 188cm for bus and min. 180cm for buseta as vertical headroom inside, and
- l. to provide 40cm for the width of seats.

3) Servicio Especial

284. All the enterprises of urban bus services in Cartagena have a department of special services for the students, the tourists and the workers of factories, as regulated by the

Decreto. 10% of the total vehicles which are affiliated by the enterprises have to be offered for these services. The vehicles of these services should not be older than 5 years.

285. These special service for the students, the tourists and the workers have been introduced when the "Ejectivo" service was begun.

4) Colectivo

286. "Colectivo" is a type of vehicle used also for transport service. It is a type of jeep, landcruiser or landrover converted into a bus. Its capacity of passengers is about 12 passengers.

287. "Colectivo" has no fixed routes or time table. Therefore, the characteristics of "Colectivo" is very similar to a taxi. Generally, they offer their service at the area where bus/buseta has no any routes or where their services are not properly rendered. Also, they concentrate in the Centro area, after 8:00 pm when the regular service of bus/buseta decreases remarkably, in order to pick up students who have finished the night shift study in colleges.

(3) The Number of Operation

288. The average number of round-trips (recorrido) is approximately 8 round-trips per one (1) bus vehicle in a day from the data of DATF as shown in Table 4.2-10.

Table 4.2-10 Number of Operation per Bus

| Type of Service | No. of Operation |
|------------------|------------------|
| Bus Ordinario | 8 |
| Bus Ejectivo | 8 |
| Buseta Ordinario | 6 |
| Buseta Ejectivo | 8 |

Source: DATF

289. The average number of round-trips from the data of ADESTRACOSTA shows almost the same, 8.1 round trips per day. This value is estimated from the original recorded tables of the dispatchers at the terminals on July 1st - 10th, 1991 (refer to Table 4.2-11). Those original tables had been recorded about each bus departure time by the dispatchers.

Table 4.2-11 Average Number of Round-Trips

| Route No | No. of Bus | Total Trip | Average |
|----------|------------|------------|---------|
| 1 | 265 | 2159 | 8.15 |
| 2 | 430 | 3587 | 8.34 |
| 3 | 208 | 1063 | 5.11 |
| 3A | 489 | 4277 | 8.75 |
| 4 | 877 | 5371 | 6.12 |
| 5 | 284 | 2232 | 7.86 |
| 6 | 88 | 707 | 8.03 |
| 7 | 460 | 3744 | 8.14 |
| 8 | 615 | 3887 | 6.32 |
| 9 | 273 | 2367 | 8.67 |
| 10 | 48 | 439 | 9.15 |
| 11 | 156 | 1618 | 10.37 |
| 12 | 217 | 2550 | 11.75 |
| 13 | 326 | 2963 | 9.09 |
| 16 | 248 | 1840 | 7.42 |
| 17 | 175 | 1239 | 7.08 |
| 18 | 483 | 3026 | 6.27 |
| 19 | 114 | 1018 | 8.93 |
| 20 | 276 | 1864 | 6.75 |
| 20A | 214 | 1502 | 7.02 |
| 21 | 166 | 1391 | 8.38 |
| 22 | 126 | 952 | 7.56 |
| 22C | 138 | 1266 | 9.32 |
| 23 | 139 | 1452 | 10.45 |
| 24 | 536 | 4729 | 8.82 |
| 25 | 512 | 4324 | 8.45 |
| 26 | 259 | 2233 | 8.62 |
| 27 | 148 | 1542 | 10.42 |
| 28 | 413 | 3527 | 8.54 |
| sf | 176 | 1809 | 10.28 |
| 31 | 209 | 1964 | 9.49 |
| 32 | 323 | 2736 | 8.47 |
| 35 | 377 | 3666 | 9.72 |
| Total | 9768 | 79084 | 8.10 |

Source: ADESTRACOSTA, July 1-10, 1991

Source: ADESTRACOSTA

290. The Table shows that the number of buses in operation on each route is quite different. However, the daily average number of round-trips per bus is almost same.

291. From the view point of the route length, there is not so much difference in round trip number. Average number of round trips on the long distance routes is 7.9 per bus and on the short distance routes is 8.3 (refer to Table 4.2-12 and 4.2-13).

292. However, there is much difference in the total number of buses in operation. On the routes of long distance bigger volume is required compared with the routes of short distance, approximately twice as much. 6,078 bus vehicles, that is 66.2% of total, are operated on long distance routes.

Table 4.2-12 Average Number of Trips
in Long Distance Routes

| Route | No. of Bus | Total Trip | Average |
|-------|------------|------------|---------|
| 3 | 208 | 1,063 | 5.1 |
| 3A | 489 | 4,277 | 8.7 |
| 4 | 877 | 5,371 | 6.1 |
| 5 | 284 | 2,232 | 7.9 |
| 6 | 88 | 707 | 8.0 |
| 7 | 460 | 3,744 | 8.1 |
| 8 | 615 | 3,887 | 6.3 |
| 13 | 326 | 2,963 | 9.1 |
| 16 | 248 | 1,840 | 7.4 |
| 21 | 166 | 1,391 | 8.4 |
| 24 | 536 | 4,729 | 8.8 |
| 25 | 512 | 4,324 | 8.4 |
| 27 | 148 | 1,542 | 10.4 |
| 28 | 413 | 3,527 | 8.5 |
| sf | 176 | 1,809 | 10.3 |
| 31 | 209 | 1,984 | 9.5 |
| 32 | 323 | 2,736 | 8.5 |
| Total | 6,078 | 48,126 | 7.9 |

Source: ADESTRACOSTA

Table 4.2-13 Average Number of Round-Trips
in Short Distance Routes

| Route | No. of Bus | Total Trip | Average |
|-------|------------|------------|---------|
| 1 | 265 | 2,159 | 8.1 |
| 2 | 430 | 3,587 | 8.3 |
| 9 | 273 | 2,367 | 8.7 |
| 10 | 48 | 439 | 9.1 |
| 11 | 156 | 1,618 | 10.4 |
| 12 | 217 | 2,550 | 11.8 |
| 17 | 175 | 1,239 | 7.1 |
| 18 | 483 | 3,026 | 6.3 |
| 19 | 114 | 1,018 | 8.9 |
| 20 | 276 | 1,864 | 6.8 |
| 22 | 126 | 952 | 7.6 |
| 22C | 138 | 1,286 | 9.3 |
| 23 | 139 | 1,452 | 10.4 |
| 26 | 259 | 2,233 | 8.6 |
| Total | 3,099 | 25,790 | 8.3 |

Source: ADESTRACOSTA

293. As for the number of round trips, there are two other different sets of data. One is the results of the survey that was done by INTRA on Oct. 24 - 30, 1988 (refer to Table 4.2-14). This survey chose some samples of buses on each of 24 selected

routes. The number of round-trips by those buses in a whole day was recorded. The results show that the average number of trips is 5.2 round-trips per bus. This value is about 64% of the value from ADESTRACOSTA data.

294. Another one is the results of the bus counting survey that has been done by the Study Team on August 20 - 27, 1991. From the results of this survey, the average number of round-trips is 4.7 per bus in total (refer to Table 4.2-15). This survey carried out from 6:00 am to 6:00 pm and did not cover the whole operation hours. It can be said that this value is somewhat too low. The unofficial survey of last year carried out by INTRA indicates that about two (2) round trips should be added in operation number for before 6:00 am and after 6:00 pm. If this result is taken into consideration, the above value becomes approximately 7 round trips per bus.

Table 4.2-14 Average Trips by INTRA Survey

| Route No. | Vehicle Surveyed | | | | | | | | | Average |
|-----------|------------------|-----|-----|-----|-----|-----|-----|---|-----|---------|
| | A | B | C | D | E | F | G | H | I | |
| 1 | 4 | 4 | 5 | 3 | 4 | 5 | | | | 4.7 |
| 2 | 7 | 5 | 8 | 4 | 4 | 7 | 4.5 | | | 4.2 |
| 3 | 3 | 6 | 5 | 4 | 6 | 4.5 | 5 | 5 | 6 | |
| | 5 | 5 | 4.5 | 5.5 | | | | | | 5.0 |
| 4 | 6 | 7 | 5 | 5 | 5 | 5.5 | 5 | 5 | | 5.4 |
| 5 | 6 | 4.5 | 4.5 | 7 | 4 | 6 | 4.5 | | | 5.2 |
| 6 | 5 | 6 | 5 | 6 | 4 | 5 | 5 | | | 5.1 |
| 7 | 6.5 | 4 | 6 | 6 | | | | | | 5.6 |
| 8 | 5 | 6 | 5 | 5 | 3 | 5 | 4 | | | 4.7 |
| 10 | 5 | 4 | 4.5 | 3 | 5 | 3 | | | | 4.0 |
| 11 | 7 | 6 | 6 | 6 | | | | | | 6.3 |
| 12 | 6 | 6 | 5 | 4 | 5 | 5 | | | | 5.2 |
| 13 | 6 | 6 | 4 | 5 | 5 | 5 | 5.5 | | | 5.2 |
| 15 | 4 | 5 | 6 | 6 | 7 | 5 | 6 | 6 | 5.5 | 5.6 |
| 16 | 4 | 4 | 3 | 4.5 | 4.5 | 4 | 4.5 | | | 4.0 |
| 17 | 7 | 6 | 5.5 | 4 | 6 | 6 | | | | 5.8 |
| 18 | 6 | 6 | 5.5 | 5 | 5 | 6 | 5.5 | | | 5.8 |
| 20 | 8 | 5 | 5 | 6 | 4 | 5 | 5 | 5 | 6 | |
| | 9 | 5 | 5 | 4.5 | 4 | | | | | 5.5 |
| 21 | 7 | 7 | 6.5 | 6 | 6 | | | | | 6.5 |
| 22 | 3 | 3 | | | | | | | | 3.0 |
| 26 | 5 | | | | | | | | | 5.0 |
| 27 | 3 | 4.5 | 5 | 3 | 4 | 4 | 3.5 | | | 3.9 |
| 28 | 5 | 3.5 | 4 | 4 | 5 | 4.5 | | | | 4.5 |
| 29 | 5 | 4 | 4 | 5 | 4.5 | | | | | 4.0 |
| 36 | 3.5 | 3.5 | 4 | | | | | | | 3.7 |
| Total | | | | | | | | | | 5.2 |

Source: INTRA, October 1988

Table 4.2-15 Average Trips by Bus Counting Survey

| Route | No. of Bus | No. of Trip | Average |
|--------------|------------|--------------|------------|
| 1 | 33 | 169 | 5.1 |
| 2 | 48 | 231 | 4.8 |
| 3 | 21 | 68 | 3.2 |
| 4 | 112 | 442 | 3.9 |
| 6 | 29 | 110 | 3.8 |
| 8 | 65 | 282 | 4.3 |
| 12 | 28 | 166 | 5.9 |
| 13 | 36 | 190 | 5.3 |
| 15 | 64 | 365 | 5.7 |
| 16 | 29 | 102 | 3.5 |
| 17 | 15 | 70 | 4.7 |
| 18 | 52 | 283 | 5.4 |
| 20 | 25 | 106 | 4.2 |
| 22 | 12 | 62 | 5.2 |
| 24 | 60 | 321 | 5.4 |
| 25 | 17 | 66 | 3.9 |
| 28 | 46 | 223 | 4.8 |
| 32 | 38 | 161 | 4.2 |
| Total | 730 | 3,417 | 4.7 |

Source: Study Team, Survey time; 6 am to 6 pm

(4) Average Number of Passengers

295. Average number of passengers per Bus Ordinario in a day is 655 passengers and per Buseta Ordinario is 601 passengers from the data of DATT on July 1991 (refer to Table 4.2-16). The results of Survey done by INTRA, Oct. 1988, shows a little lower value, approximately 430 passengers per bus. The Study Team also carried out the bus passenger survey in August 1991. The results of this survey show the average number of passenger per bus in whole day was 568 passengers. This value is somewhere in between the values of DATT and INTRA.

Table 4.2-16 Average Number Passengers per day

| Type of Service | Number of Passenger |
|------------------|---------------------|
| Bus Ordinario | 655 |
| Buseta Ordinario | 601 |
| Bus Ejectivo | 450 |
| Buseta Ejectivo | 400 |

Source: DATT

296. The results of INTRA's survey, 24-30 Oct. 1988, show that the average number of passengers for a round trip per bus is 102 passengers (refer to Table 4.2-17). The Study Team confirms that the value is approximately 105 passengers per one (1) round trip (refer to Table 4.2-18), essentially the same level.

Table 4.2-17 Average Number of Passenger by INTRA

| Route No. | Vehicle Surveyed | | | | | | | | | Ave. No. |
|-----------|------------------|-------|-------|-------|-------|-------|-------|------|-------|----------|
| | A | B | C | D | E | F | G | H | I | |
| 1 | 112.8 | 107.5 | 101.6 | 96.3 | 77.3 | 77.6 | | | | 95.4 |
| 2 | 108.1 | 126.2 | 125.5 | 97.8 | 107.8 | 41.4 | 100.0 | | | 95.0 |
| 3 | 155.7 | 90.5 | 111.6 | 90.7 | 87.8 | 98.2 | 110.4 | 97.5 | 119.8 | 109.8 |
| 4 | 123.2 | 132.4 | 95.1 | | | | | | | 95.4 |
| 5 | 98.2 | 78.4 | 88.0 | 101.4 | 92.0 | 72.0 | 64.6 | 71.4 | | 92.5 |
| 6 | 67.5 | 97.3 | 105.6 | 59.9 | 98.0 | 102.5 | 84.0 | | | 86.5 |
| 7 | 93.8 | 62.2 | 116.8 | 95.8 | 79.5 | 71.2 | 57.2 | | | 109.9 |
| 8 | 99.7 | 158.2 | 79.0 | 102.7 | | | | | | 151.3 |
| 9 | 147.6 | 109.5 | 168.0 | 146.6 | 171.0 | 154.4 | 162.0 | | | 81.9 |
| 10 | 104.6 | 77.0 | 92.9 | 81.3 | 80.4 | 55.3 | | | | 70.4 |
| 11 | 67.4 | 67.3 | 77.2 | 69.8 | | | | | | 90.4 |
| 12 | 99.3 | 98.3 | 114.8 | 113.0 | 71.2 | 88.2 | | | | 90.5 |
| 13 | 105.7 | 68.8 | 103.5 | 72.8 | 70.6 | 101.8 | 82.5 | | | 94.1 |
| 15 | 163.3 | 62.4 | 126.2 | 68.7 | 58.7 | 58.6 | 105.5 | 53.3 | 60.2 | 84.4 |
| 16 | 93.5 | 81.3 | 102.3 | 119.3 | 94.7 | 71.5 | 95.8 | | | 80.2 |
| 17 | 107.3 | 74.7 | 92.0 | 74.3 | 84.5 | | | | | |
| 18 | 83.8 | 62.3 | 106.7 | 67.8 | 72.6 | 86.0 | 82.9 | | | |
| 20 | 71.1 | 114.6 | 95.0 | 128.7 | 121.3 | 125.8 | 75.6 | 99.5 | | |
| | 171.0 | 80.8 | 129.8 | 72.7 | 118.3 | | | | | 108.5 |
| 21 | 81.9 | 98.4 | 92.3 | 113.0 | | | | | | 96.4 |
| 22 | 177.3 | 113.6 | | | | | | | | 145.5 |
| 26 | 114.0 | | | | | | | | | 114.0 |
| 27 | 103.7 | 81.6 | 101.3 | 103.3 | 124.3 | 113.3 | 130.3 | | | 108.3 |
| 28 | 123.8 | 109.1 | 88.0 | 113.0 | 106.2 | | | | | 106.2 |
| 29 | 127.2 | 120.0 | 113.5 | 85.0 | 129.1 | 96.9 | | | | 114.9 |
| 36 | 134.0 | 115.1 | 115.8 | | | | | | | 124.6 |
| Total | | | | | | | | | | 101.6 |

Note: Data from INTRA, Survey has been done on Oct. 24-30, 1988
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Table 4.2-18 Average Number of Passengers by Study Team

| Route | No. of Trip | Total Passenger | Passenger per Trip |
|--------------|-------------|-----------------|--------------------|
| 1 | 27 | 2,300 | 85.2 |
| 2 | 36 | 4,460 | 123.9 |
| 3 | 54 | 6,361 | 117.8 |
| 4 | 52 | 6,489 | 124.8 |
| 6 | 12 | 1,428 | 119.0 |
| 8 | 41 | 6,183 | 150.8 |
| 12 | 28 | 2,461 | 87.9 |
| 13 | 30 | 3,028 | 100.9 |
| 15 | 38 | 3,746 | 98.6 |
| 16 | 16 | 2,281 | 142.6 |
| 17 | 24 | 2,120 | 88.3 |
| 18 | 31 | 3,522 | 113.6 |
| 20 | 30 | 3,532 | 117.7 |
| 22 | 18 | 975 | 54.2 |
| 24 | 30 | 2,020 | 67.3 |
| 25 | 23 | 1,769 | 76.8 |
| 28 | 30 | 2,114 | 70.5 |
| 32 | 17 | 1,355 | 79.7 |
| Total | 537 | 56,143 | 104.5 |

Source: Study Team

297. The total number of passengers were not transported by each bus company and each bus route were not available from DATT and/or ADESTRACOSTA. Such data is not announced officially.

(5) Average load factor

298. Average load factor means the efficiency of transported passenger volume per one round trip for the number of seats of the vehicle. Average load factor is 90% for bus ordinario from the data of DATT (refer to Table 4.2-19).

Table 4.2-19 Average Load Factor

| Type of Service | ALF(%) |
|------------------|--------|
| Bus Ordinario | 90 |
| Buseta Ordinario | 95 |
| Bus Ejectivo | 80 |
| Buseta Ejectivo | 90 |

Source: DATT

299. According to the results of Bus Passenger Survey by the Study Team, the load factor is shown in Table 4.2-20. Bus-Ordinario shows 96.9%. This is calculated from the result and assumption that the number of seats of bus is 45 with 12 standing passengers for one round trip. Since the number of its round-

trips is 366, the total number of seats of bus ordinario becomes 41,724. This compares with an actual total number of passengers in a day of 40,444. Bus-Efectivo shows 79.7%. Its assumed capacity is 45 seat passengers for one way trip. Total seats for interviewed bus becomes 7470 and the total actual passenger is 5950. Average load factor for bus-ordinario and bus-efectivo indicates 94.3%. The value of efectivo is almost same level as that of DATT, however, that of ordinario is much higher than DATT.

Table 4.2-20 Average Load Factor
by Study Team Survey

| Type of Service | ALF(%) |
|------------------|--------|
| Bus Ordinario | 96.9 |
| Bus Ejectivo | 79.7 |
| Buseta Ordinario | 179.2 |

300. In the case of buseta, the load factor is 179.2%. This is calculated on the assumption that the number of seats of buseta-ordinario is 25 with 6 standing for the one way trip. Total number of round trips is 79 and the total number of passengers is therefore 8,777. This represents a load factor of 179% due to the short trip length of the passengers.

301. Table 4.2-21 shows the average occupancy rate of bus passengers on the surveyed bus routes, estimated on the basis of the passenger-km transported and bus-km operated. Compared with seat capacity of the vehicle (bus 45 and buseta 25 in average), occupancy rate indicates a moderate number except on a few buseta routes such as No. 4 and 6. Total number of passengers transported in a round trip depends on the route length and passenger's trip length. Generally ejectivo service tends to show low total number of passengers and low occupancy rate.