

Appendix C-2 Major Congested Sections

Table C-2-1 Major Congested Sections

Hours	Street	Direction	Congested Section	Average Speed	Main Reasons for Stop															
					1	2	3	4	5	6	7	8	9	10						
Midday hours 12 - 14	C 47	TO Circun.	K 30 - K 45	12 - 18 km/h	○															○
	C 53	TO K 38	K 46 - K 54	About 18 km/h	○															
		TO Via 40	K 45 - K 46	About 4 km/h	○															
	C 72	To Via 40	K 43 - K 46	8 - 15 km/h	○															
		TO K 38	K 53 - K 54	About 17 km/h	○															
			TO K 38	K 43 - K 45	6 - 18 km/h	○														
C 76	TO Via 40	K 53 - K 54	12 - 14 km/h	○																
Evening hours 16 - 19	K 38	TO Centro	C 17 - C 50	7 - 19 km/h	○			○	○	○									○	
		TO Circun.	C 17 - C 50	2 - 18 km/h	○			○	○	○										
	K 40	TO Centro	C 34 - C 45	3 - 15 km/h	○		○	○	○											○
		TO C 45	C 34 - C 45	3 - 14 km/h	○		○	○	○	○										
	K 41	TO Centro	C 34 - C 45	2 - 20 km/h	○		○		○	○									○	○
Midday hours 12 - 14	K 43	TO C 96	C 34 - C 45	5 - 20 km/h	○		○	○	○											○
			C 70 - C 72	7 - 19 km/h	○			○	○											
	K 44	TO Centro	C 34 - C 53	5 - 20 km/h	○			○	○											
	K 45	TO C 45	C 34 - C 53	8 - 18 km/h	○				○	○	○									
		TO Centro	C 45 - C 53	About 19 km/h	○															
	K 46	TO Centro	C 45 - C 59	7 - 17 km/h	○					○										
C 70 - C 72			About 16 km/h	○																
C 76 - C 79			10 - 19 km/h	○																
Evening hours 16 - 19	K 46	TO Circun.	C 45 - C 59	14 - 20 km/h	○															
			C 70 - C 79	9 - 19 km/h	○															
	K 51 B	TO Centro	C 76 - C 80	About 18 km/h	○				○											
	K 14	TO C. 30	C 30 - C 45	About 16 km/h						○										○
		TO K 21 B	C 45 - C 47	About 19 km/h	○					○										○
C 30	TO Centro	K 24 - K 38	5 - 20 km/h	○				○	○										○	

1 Waiting for signal light change 2 Traffic Accident 3 Pedestrian's crossing 4 Congestion of buses near bus stops. 5 Traffic congestion 6 Merging from alley 7 Diverging to alley 8 Influence of cars turning to the left 9 Parking on street 10 Poor condition of pavement maintenance

Table C-2-1 (Cont'd)

Hours	Street	Direction	Congested Section	Average Speed	Main Reasons for Stop																
					1	2	3	4	5	6	7	8	9	10							
Midday Hours 12 - 14	K 43	TO C 96	C 30 - C 45	8 - 17 km/h	○		○	○	○	○											
			C 70 - C 74	11 - 19 km/h	○					○											
	K 44	TO Centro	C 34 - C 38	5 - 14 km/h	○		○	○		○											
			C 37 - C 45	8 - 14 km/h	○		○	○	○	○											
	K 45	TO Centro	C 45 - C 53	About 16 km/h	○																
			C 45 - C 53	About 15 km/h	○																
	K 46	TO Centro	C 70 - C 72	10 - 13 km/h	○																
			C 76 - C 79	10 - 15 km/h	○																
			C 84 - C 90	About 15 km/h	○																
			C 38 - C 45	About 19 km/h																○	
	TO Circun	C 30 - C 45	5 - 18 km/h	○																	
		C 70 - C 72	16 - 19 km/h	○																	
K 51 B	TO Centro	C 76 - C 80	19 - 20 km/h	○																	
C 17	TO Centro	K 35 - K 38	About 12 km/h	○																	
Midday Hours 12 - 14	C 30	TO Centro	K 24 - K 38	16 - 19 km/h	○	○		○											○	○	
			TO Circun.	K 24 - K 38	18 - 19 km/h				○		○										○
	C 34	TO K 46	K 38 - K 45	3 - 20 km/h	○		○	○	○											○	
			TO K 38	K 38 - K 46	7 - 19 km/h	○		○	○	○	○										
	C 37	TO K 46	K 38 - K 44	8 - 18 km/h	○																
	C 38	TO K 30	K 38 - K 46	5 - 17 km/h	○																
	C 38	TO K 38	K 35 - K 38	About 16 km/h	○																
	C 45	TO Centro	K 31 - K 33	About 11 km/h	○																
			K 38 - K 40	About 16 km/h	○																
			K 43 - K 44	About 12 km/h	○																
K 45 - K 46			About 11 km/h	○																	
	TO Circun.	K 24 - K 27	10 - 20 km/h	○																	
		K 45 - K 46	About 6 km/h	○																	
	TO Centro	K 24 - K 45	About 16 km/h	○																	

1 Waiting for signal light change 2 Traffic Accident 3 Pedestrian's crossing 4 Congestion of buses near bus stops. 5 Traffic congestion 6 Merging from alley 7 Diverging to alley 8 Influence of cars turning to the left 9 Parking on street 10 Poor condition of pavement maintenance

Table C-2-1 (Cont'd)

Hours	Street	Direction	Confested Section	Average Speed	Main Reasons for Stop															
					1	2	3	4	5	6	7	8	9	10						
Evening Hours 16 - 19	C 30	TO Circun.	K 24 - K 38	15 - 18 km/h				○												
	C 34	TO K 46	K 38 - K 46	3 - 17 km/h	○		○	○	○	○					○	○				
		TO K 38	K 38 - K 46	2 - 19 km/h	○		○	○	○	○						○				
	C 37	TO K 46	K 38 - K 41	About 3 km/h				○	○							○				
			K 43 - K 46	13 - 19 km/h	○			○									○			
	C 38	TO K 30	K 35 - K 46	7 - 20 km/h	○				○							○				
		TO K 38	K 30 - K 46	10 - 18 km/h	○			○		○										
	C 45	TO Circun.	K 35 - K 44	8 - 17 km/h	○				○											
			K 45 - K 46	About 17 km/h	○															
		K 24 - K 27	About 17 km/h												○					
		TO Circun.	K 24 - K 27	8 - 16 km/h	○															
C 45	TO Circun.	K 35 - K 38	About 18 km/h	○																
		K 41 - K 46	5 - 19 km/h	○																
C 47	TO Centro	K 18 - K 30	13 - 20 km/h	○			○													
Evening Hours 16 - 19	C 47	TO Circun.	K 6 - K 14	About 15 km/h				○												
			K 21 - K 30	14 - 20 km/h	○															
	C 53	TO K 38	K 46 - K 53	12 - 18 km/h	○															
		TO Via 40	K 45 - K 46	About 9 km/h	○															
	C 72	TO Via 40	K 43 - K 46	3 - 17 km/h	○				○	○										
			K 53 - K 54	10 - 20 km/h	○															
		TO K 38	K 43 - K 45	9 - 14 km/h	○				○											
	C 76	TO Via 40	K 46 - K 54	7 - 18 km/h			○	○												
			K 44 - K 55	6 - 20 km/h	○				○	○						○				
		TO K 43	K 46 - K 51	14 - 20 km/h	○				○											

1 Waiting for signal light change 2 Traffic Accident 3 Pedestrian's crossing 4 Congestion of buses near bus stops. 5 Traffic congestion 6 Margining from alley 7 Diverging to alley 8 Influence of cars turning to the left 9 Parking on street 10 Poor condition of pavement maintenance.

Morning Peak Hour (7:00 - 8:00)

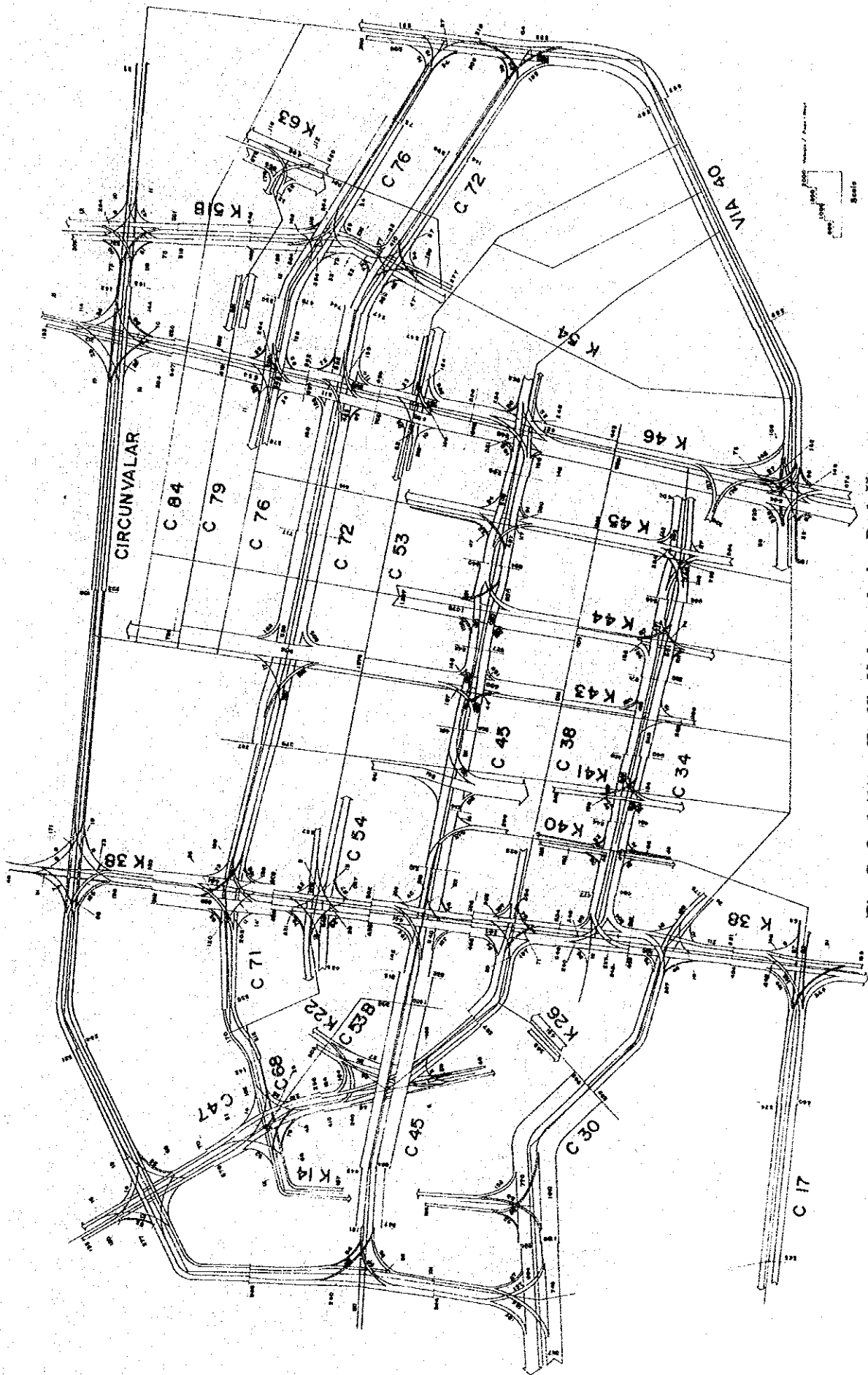


Fig. C-2-1 (1) Traffic Volume during Peak Hour

Midday Peak Hour (12:00 - 13:00)

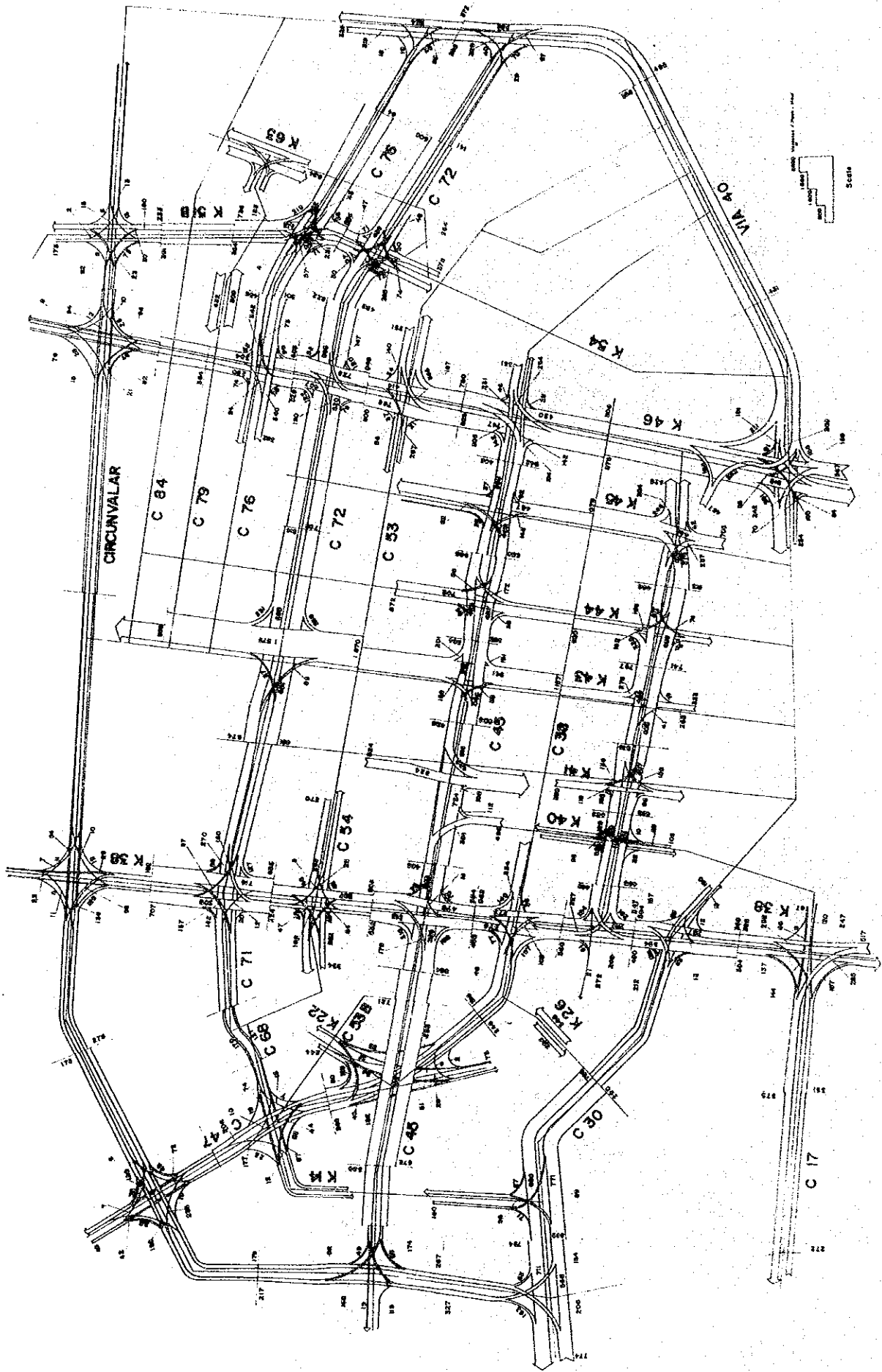


Fig C-2-1 (2) Traffic Volume during Peak Hour

Evening Peak Hour (17:00 - 18:00)

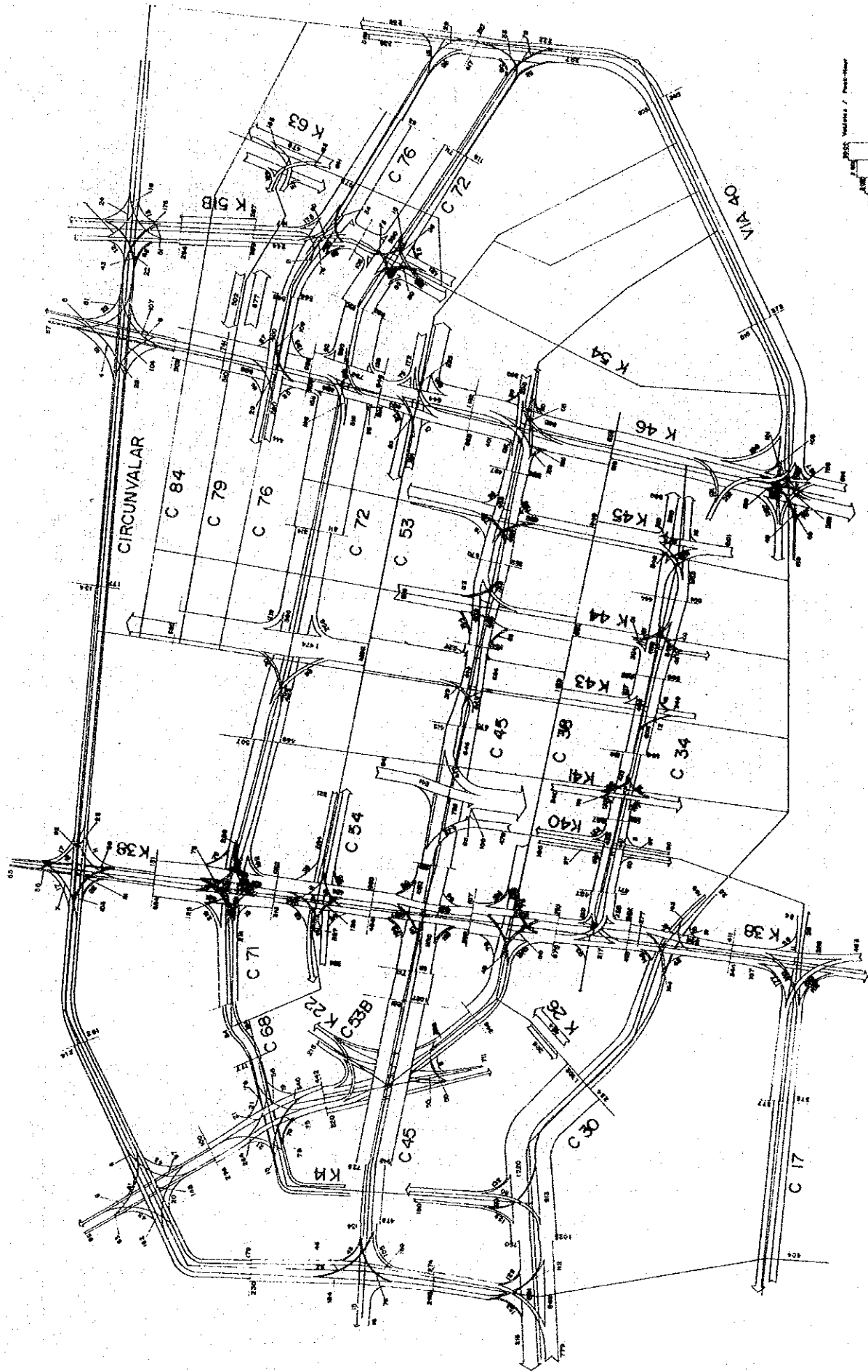


Fig. C-2-1 (3) Traffic Volume during Peak Hour

Appendix C-3 Accident Analysis

Table C-3-1 Accident Analysis

Location	Type of Accident	Type of Violation	Comment
C11 45 - Cr. 33 (16)	Side Swipe collision 31% (5)	Not Enough Head-Way 25% (4)	o Rear-End collision: high-frequency, at Cr. 32 approach on C11 45.
	Rear-End collision 31% (5)	Improper Turning 19% (3)	o Side Swipe collision: -do-, at approaches on C11 45.
	Multiple collision 19% (3)	Careless Driving 19% (3)	o Collision with bus: -do- (about 50%)
	Others 19% (3)	Others 37% (6)	o Left-turning vehicles at both approaches on C11 45: many exist. o Cycle length of signal: very short (about 50 sec.). o Caused by failure to allow sufficient headways.
C11 35 - Cr. 27 (14)	Side Swipe collision 54% (7)	No stop at stop sign 54% (7)	o Side Swipe collision, Right angle collision: high frequency.
	Right Angle collision 38% (5)	Others 46% (7)	o Infinite classification of major/minor street.
	Others 8% (2)		o Collision with bus: about 21%. o Caused by no stop at stop sign. o Caused by indefinite classification of major/minor street.
C11 34 - Cr. 43 (14)	Side Swipe collision 30% (4)	Disregarded Traffic	o Side Swipe collision: high frequency, unless traffic signaled st.
	Rear-End collision 14% (2)	Signal 30% (4)	o Accidents with personal injury: about 14%.
	Right Angle collision 14% (2)	Improper Pedestrian	o Collision with bus: high frequency (about 50%)
	Turning collision 14% (2)	Crossing 21% (3)	o Caused by traffic conflict due to traffic congestion.
	Personal Injury 14% (2)	No Preventive Care 21% (3)	o Caused by disregarded traffic signals.
	Others 23% (3)	Improper Overtaking 14% (2)	o Caused by indiscriminate crossing of pedestrians.
		Others 14% (2)	
C11 30 - Cr. 11 (13)	Rear-End collision 31% (4)	Not Enough Head-Way 31% (4)	o Turning collision/Right angle collision: high frequency at CIRCUNVALAR approach on C11 30.
	Turning collision 23% (3)	Improper Passing 23% (3)	o Rear-end collision: high frequency, at Cr 13 approach on C11 30.
	Right Angle collision 15% (2)	Break Failure 15% (2)	o Accident with personal injury: about 8%.
	Personal Injury 8% (1)	Improper Pedestrian	o Collision with bus: about 30%
	Others 23% (3)	Crossing 8% (1) Others 23% (1)	o Left-Turning vehicle at approach on C11 30: many exist. o Rear-end collisions caused by many left-turning vehicles. o No-signalized intersection.

Table C-3-1 (Cont'd)

Location	Type of Accident	Type of Violation	Comment
C11 84 - Cr. 46 (10)	Multiple collision 30% (3) Side Swipe collision 21% (2) Turning collision 20% (2) Others 30% (3)	Not Enough Head-Way 30% (3) Improper Overtaking 30% (3) No Preventive Care 20% (2) Others 20% (2)	<ul style="list-style-type: none"> o Multiple collision: high frequency, at C11 85 approach on Cr. 46. o Most of multiple collisions consists of rear-end/side swipe collisions. o Collision with bus: about 40%. o Caused by improper overtaking/disregarded traffic signal. o Cycle length of signal: very short (about 40 sec).
C11 72 - Cr. 25B (9)	Side Swipe collision 56% (5) Rear-End collision 11% (1) Right Angle collision 11% (1) Out of Control 11% (1) Others 11% (1)	No stop at stop sign 34% (3) Break Failure 22% (2) No Preventive Care 22% (2) Others 22% (2)	<ul style="list-style-type: none"> o Side swipe collision: high frequency, at central of intersection. o Collision with bus: about 22%. o Caused by no stop at stop sign. o Caused by indefinite classification of major/minor streets.
C11 72 - Cr. 46 (7)	Rear-End collision 29% (2) Side Swipe collision 29% (2) Others 42% (3)	Break Failure 44% (3) Not enough Head-Way 14% (1) Disregarded Traffic Signal. 14% (1) Others 28% (2)	<ul style="list-style-type: none"> o Rear-end collision: relatively high frequency, at Cr. 45 approach C11 72. o Collision with bus: about 29%. o Left-turning vehicles at Cr. 45 approach on C11 72.: many exist o Caused by traffic congestion.
C11 76 - Cr. 46 (7)	Side Swipe collision 42% (3) Multiple collision 29% (2) Others 29% (2)	Break Failure 57% (4) No stop at stop sign 14% (1) Others 29% (2)	<ul style="list-style-type: none"> o Side swipe/multiple collision: high frequency, unless traffic signals exist. o Collision with bus: about 43%. o Caused traffic congestion/disregarded traffic signal.
C 11 72 - Cr. 53 (7)	Rear-End collision 29% (2) Right Angle collision 29% (2) Side Swipe collision 29% (2) Others 13% (1)	No Preventive Care 30% (2) Disregarded Traffic Signal. 14% (1) Not Enough Head-Way 14% (1) Improper Backing 14% (1) No stop at stop sign 14% (1) Improper in Coming out of parking 14% (1)	<ul style="list-style-type: none"> o Right angle/side swipe/rear-end collision: high frequency, at C11 74 approach on Cr. 53, at Cr. 52 approach on C11 72. o Collision with bus: about 43%. o Unless traffic signals exist, those accidents show high frequency, which is caused by traffic congestion/disregarded traffic signal.

Table C-3-1 (Cont'd)

Location	Type of Accident	Type of Violation	Comment	
C11 45 - Cr. 38 (11)	Side-Swipe collision	Break Failure	Side-swipe collision: high frequency, at Cr. 35 approach C11 45.	
	Rear-End collision	Disregarded Traffic	Rear-end collision: do-, at both approaches on C11 45.	
	Personal Injury	Not Enough Head-Way	Accident with personal injury: about 10%.	
	Others	Improper Change of Lane.	Collision with bus: about 36%.	
C11 45 - Cr. 44 (10)	Side-Swipe collision	Improper Pedestrian	Caused by traffic congestion with jams.	
		Crossing.	Left-turning vehicles at Cr. 35 approach on C11 45: many exist.	
	Rear-End collision	Others.	Caused by disregarded traffic signal/improper overtaking.	
		Others	Over Speed	Side-Swipe collision: high frequency, unless traffic signal exist.
	Others	Disregarded Traffic	Side-Swipe/right angle collision: high frequency, at C11 46 approach on Cr. 44.	
		Signal.	Signal.	Collision with bus: about 30%.
		No Preventive Care	No Preventive Care	Caused by traffic congestion/disregarded traffic signal.
C11 47 - Cr. 21 (10)	Side-Swipe collision	Others	Caused by congestion of buses near bus stop.	
		Rear-End collision	Side-Swipe/rear-end/multiple collision: high frequency, at C11 45 approach on C11 47.	
	Turning collision	Break Failure	Collision with bus: about 40%.	
		Others	Others	Caused by obstruction of smooth: traffic flow due to poor condition of pavement maintenance.
	Others	Others	Caused by disregarded traffic signal/traffic congestion.	

Appendix D-1 OD Pattern by Purpose

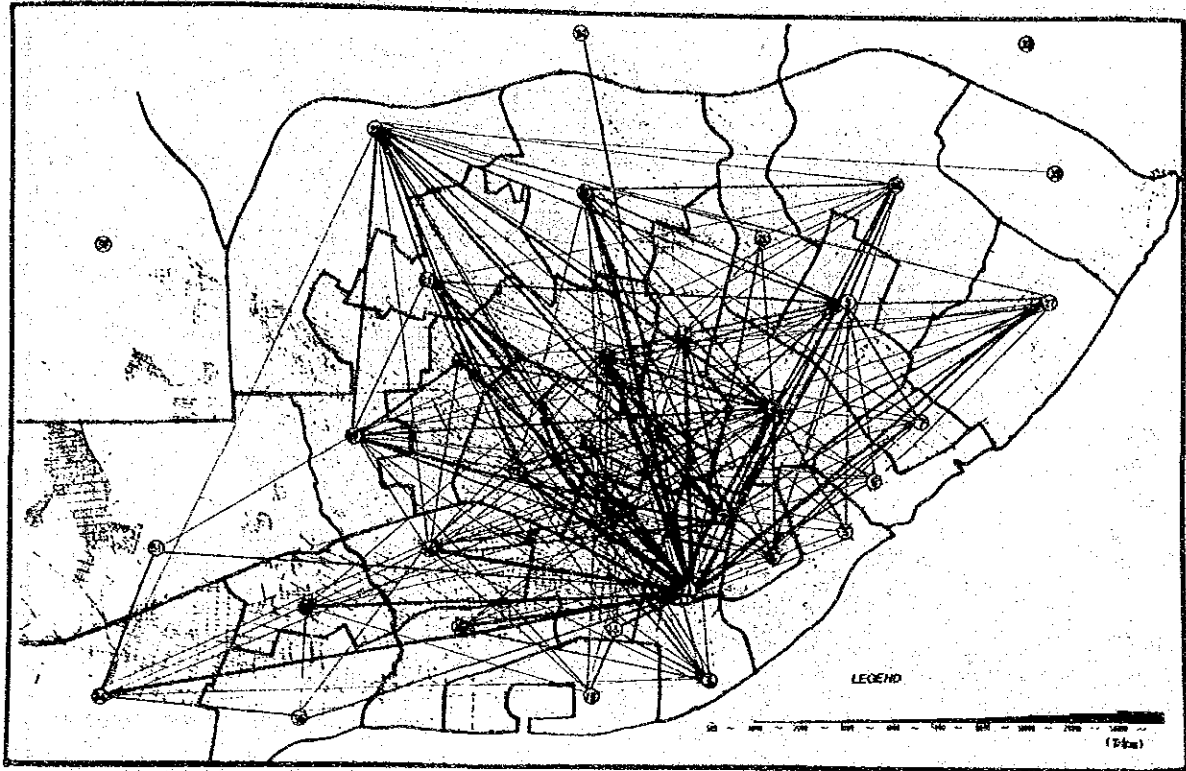


Fig. D-1-1 OD Pattern in 1983 (Work)

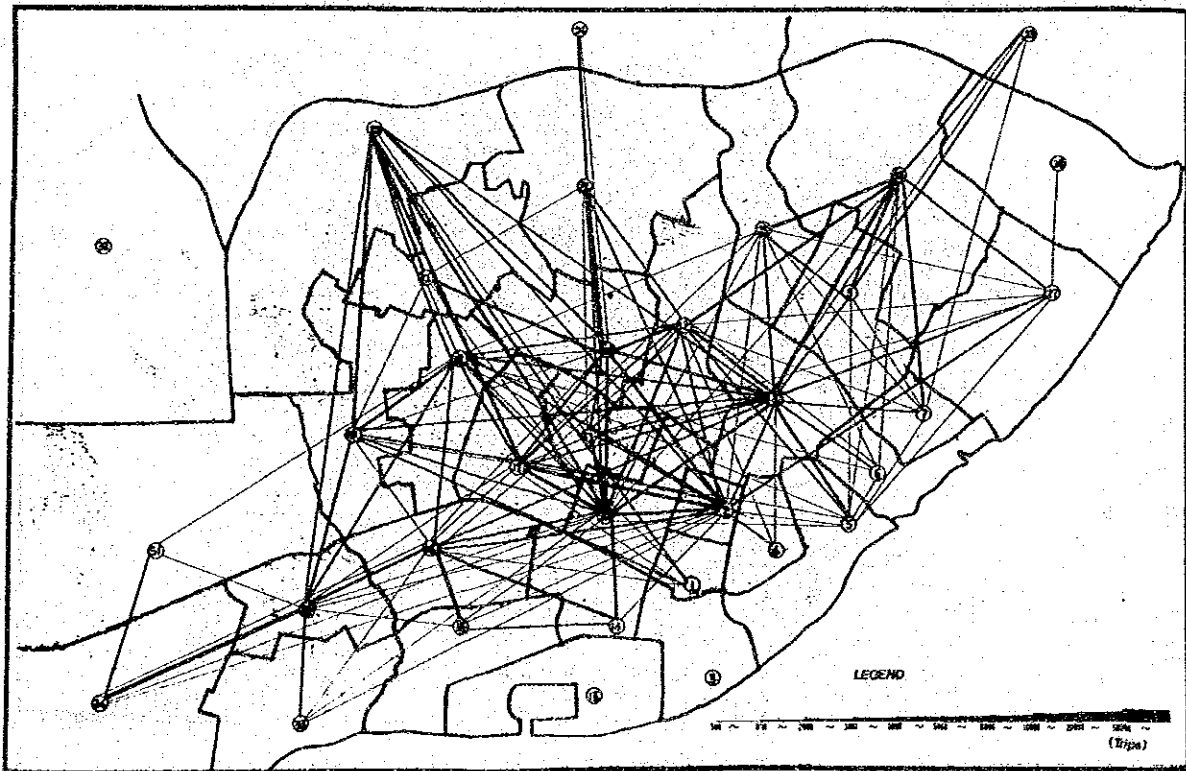


Fig. D-1-2 OD Pattern in 1983 (School)

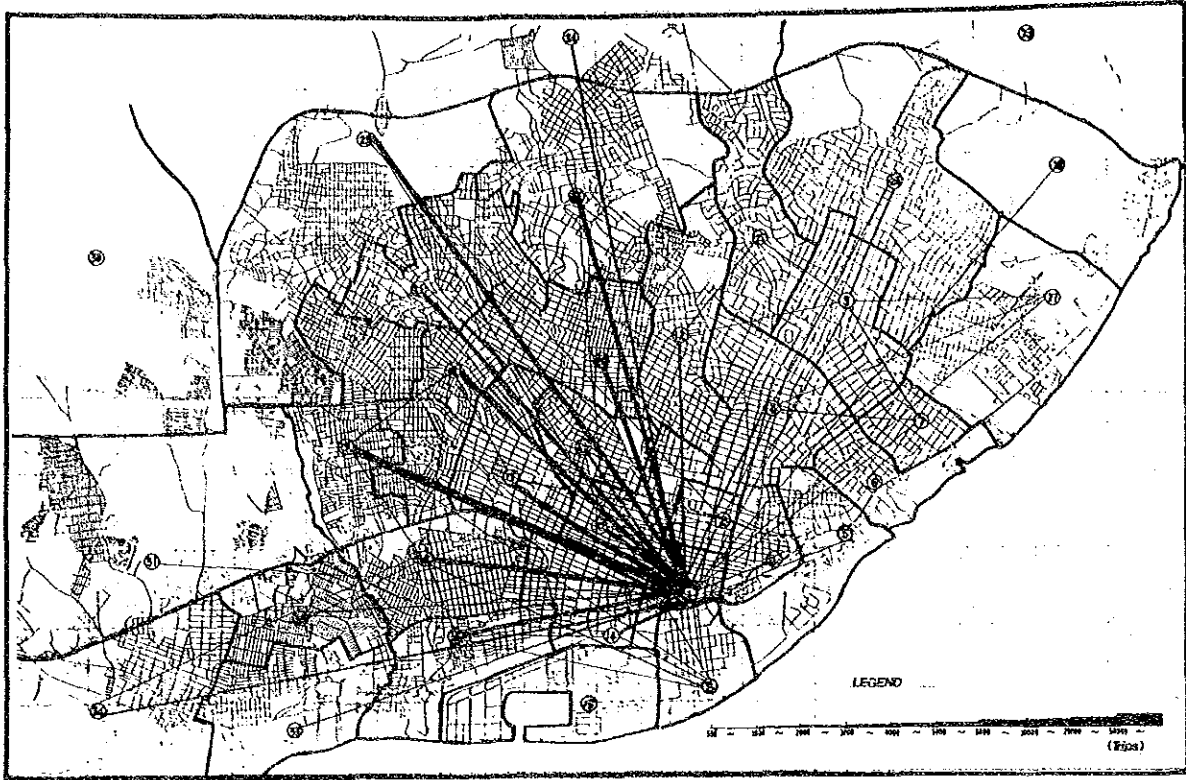


Fig. D-1-3 OD Pattern in 1983 (Shopping)

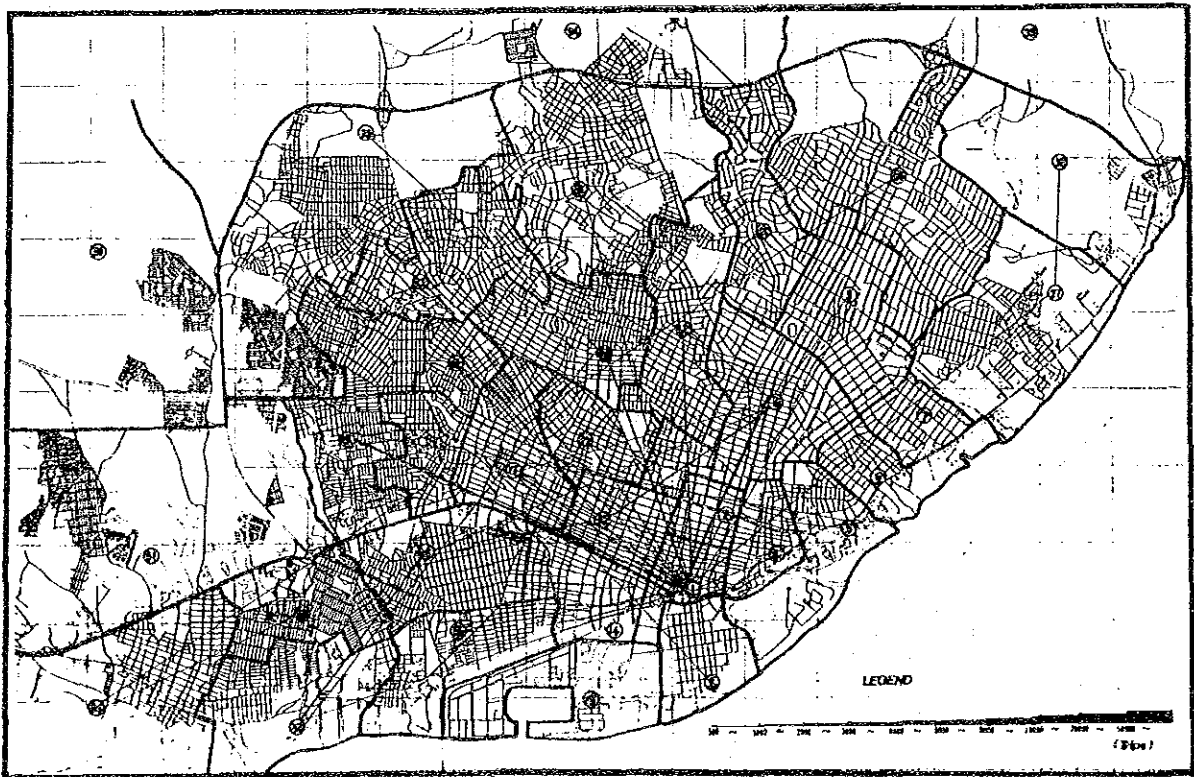


Fig. D-1-4 OD Pattern in 1983 (Business)



Fig. D-1-5 OD Pattern in 1983 (Home)

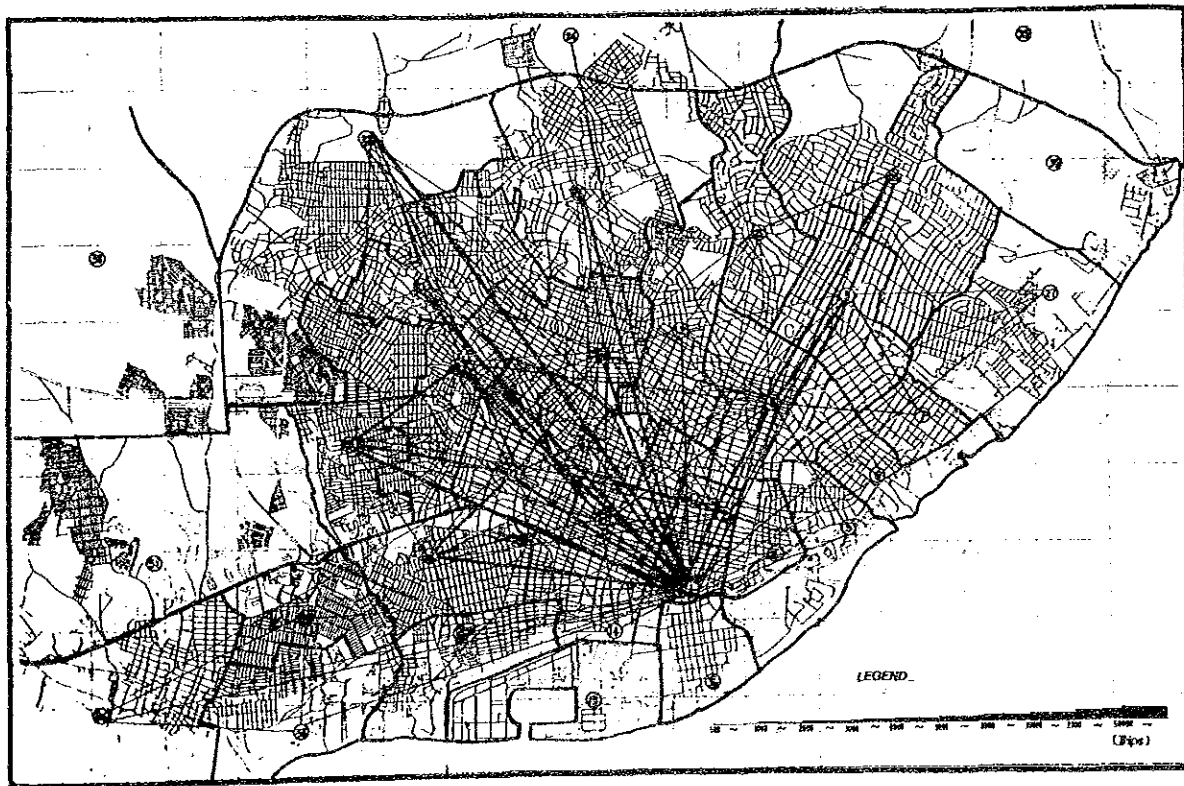


Fig. D-1-6 OD Pattern in 1983 (Private)

Appendix E-1 Present Bus Routes

Table E-1-1 List of Urban Bus Routes

Code No.	Company	Route (Service Area)	Route Length (km)
01	Flota Roja Ltda.	Boston Calle 76	14.3
02	Cootransnorte	Prado Boston	12.5
03	Flota Roja Ltda.	Boston Calle 72	15.2
04	Sobusa S.A.	Paraíso Cra. 50	18.0
05	Sobusa S.A.	Vivero Paraíso	18.0
06	Transdiaz S.A.	Ruto No.3 Andalucía	17.8
07	Flota Angulo Ltda.	Porvenir Prado	17.0
08	Transp. Lolaya Ltda.	Prado Porvenir	17.6
17	Cootransnorte	Prado Lujo	16.3
18	Sobusa S.A.	Cra. 54 Uninorte	26.0
21A	Transp. Coolitoral	Vía 40-Calle 72-Silencio	20.0
	Transp. Trasalfa	Vía 40-Calle 72-Silencio	20.0
21B	Transp. Coolitoral	Silencio-Vía 40	20.0
	Transp. Trasalfa	Silencio-Vía 40	20.0
22	Transdiaz	Porvenir Paraíso Cra. 38	21.0
23	Transdiaz	Porvenir Paraíso Vía 40	21.0
24	Coolitoral	Florida Terminal Cra. 38	22.0
25	Coolitoral	Florida Terminal Cra. 43	22.0
26	Flota Angulo	Expreso Porvenir	18.0
31	Cootratico	Lucero San Felipe	14.0
32	Cootratico	Estudiantes Los Andes	14.0
33	Transp. Lolaya	Murillo Delicias	15.0
	Transp. Trasalfa	Murillo Delicias	15.0
34	Embusa, Transp. Monterrey	Delicias Olaya	15.0
35	Transp. Lolaya y Trasalfa	Valle-Silencio	18.0
36	Embusa y Monterrey	Silencio-Valle	18.0
37	Transp. Sodetrans	Loma Fresca-La Paz	19.0
38A	Cootratico	La Manga-Nva. Colombia	17.0
38B	Cootratico	La Manga-El Pueblo	22.0
39	Sodetrans	Loma Fresca-Hospital Sourdis	17.8
41	Sotrasque	El Bosque-Cra. 18	15.2
42	Transp. Monterrey	Bosque Aduanilla	18.0
47	Sobusa	Caldas Recreo	34.0
48	Sobusa	Las Flores Cevillar	33.0
49	Transurbar	Maria Modelo	44.0
51	Sotrasque	Santuario Cra. 9	15.5
52	Coochofal	Ciudadela-Conidec	22.0
53	Transp. Atlántico	Cra. 14-Ciudadela Conidec	21.5
54	Coochofal	Cra. 19-Realengo	20.7
55	Coochofal	San Luis-Santa María	24.0
56	Coochofal	Cra. 14	24.0
57	Coochofal	Cra. 20	26.6
61	Transp. Atlantico	Palmas Cra. 11	18.0
62	Transp. "	Palmas Cra. 17	18.0
63A	Trasalianco	Galan	21.0
63B	Coochofal	La Victoria	24.0
64	Transurbar	Maria Modejo-El Parque	21.0
65	Cootrasol	Arboleda-El Parque	25.0
71	Cootratlantico	Cra. 15-Las Nieves	7.0
72	Cootratlantico	Ferry-Mercado	11.0
73	Trasalianco	Simon Bolivar-Calle 17	10.5
74	Trasalianco	Pasadena-Los Trupillos	12.0
75	Trasalianco	Simon Bolivar-Cra. 12	15.0
76	Cootratlantico	Vista Hermosa	13.0
81	Transp. Soledad	Hipodromo-INEM-Salamanca	17.0
82	Cootrasol	Hipodromo-Inem-Soledad	27.8
83	Transp. Soledad	Calle 30 American Bar	20.7
84	Transmecar	San Antonio	25.0
85	Cootrasol	Aeropuerto-Calle 30-Hipodromo	18.6
87	Trasalianco	Aeropuerto-Calle 30-Concord	32.0
87B	Trasalianco	Manuela Beltran Soledad 2000	17.6
96	Transmecar	Salamanca Soledad	22.2
97	Transmecar	Ferry-Calle 17	17.9
98	Transmecar	Calle 17-Soledad	19.5

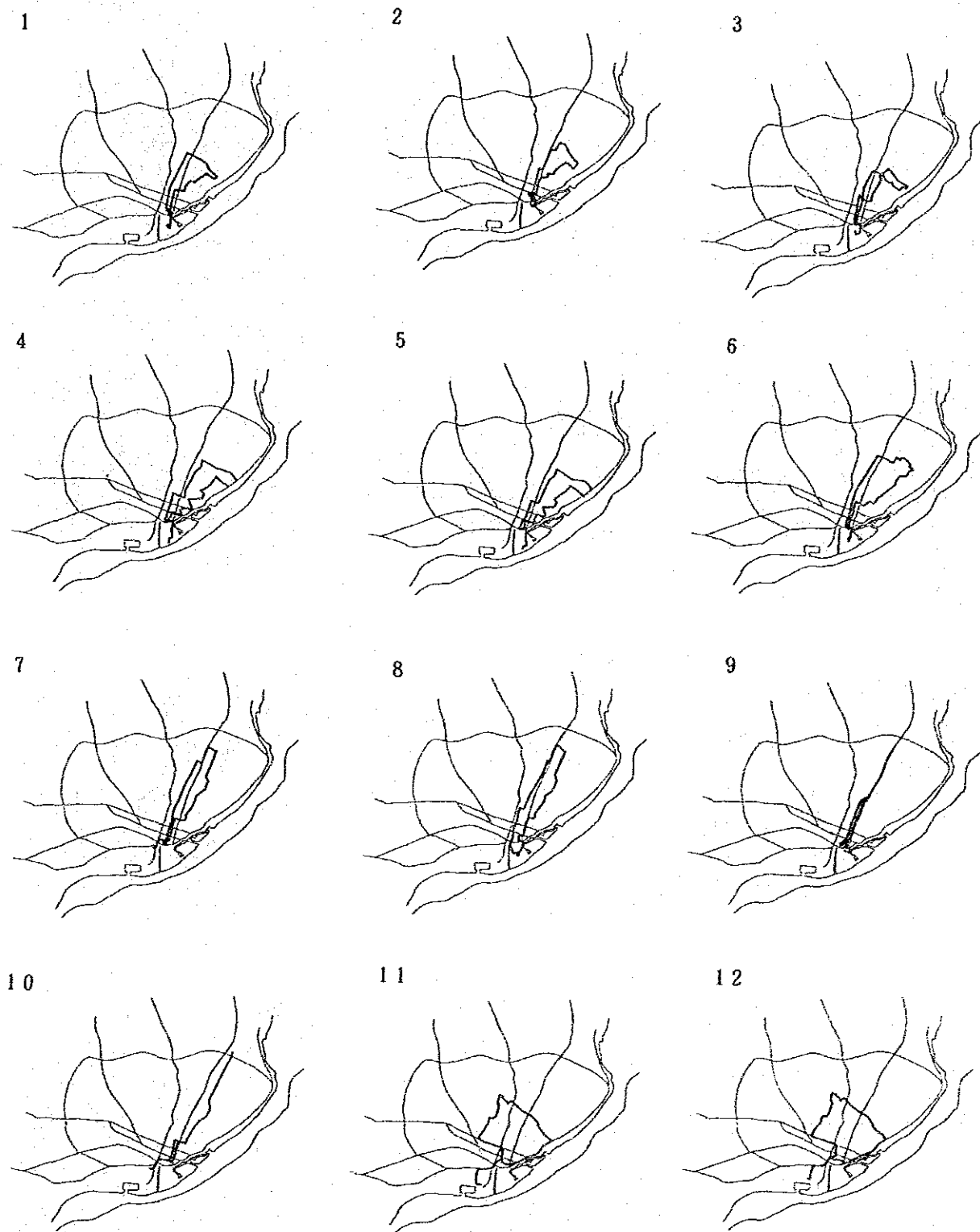
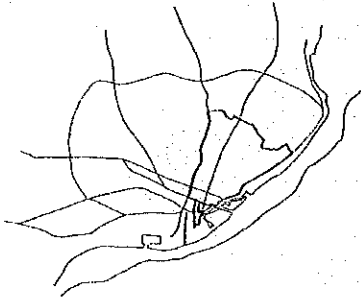
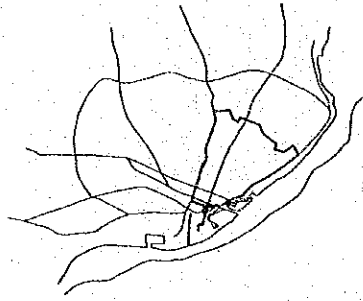


Fig. E-1-1 Existing Bus Routes

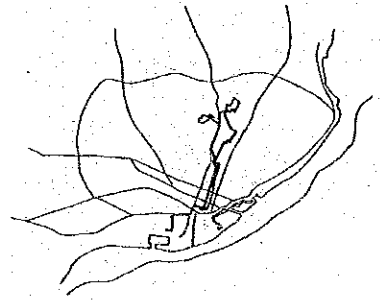
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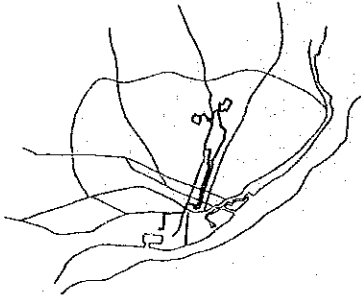
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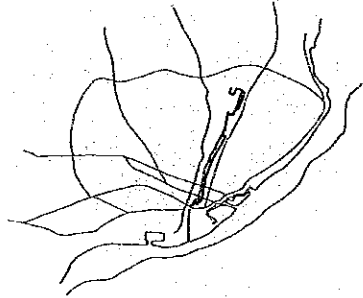
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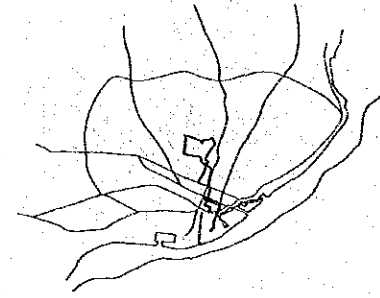
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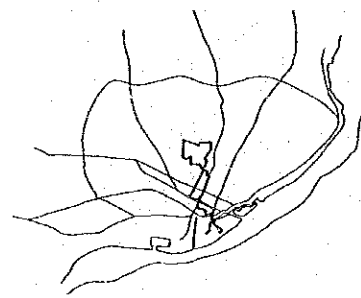
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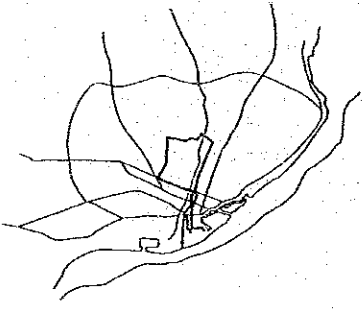
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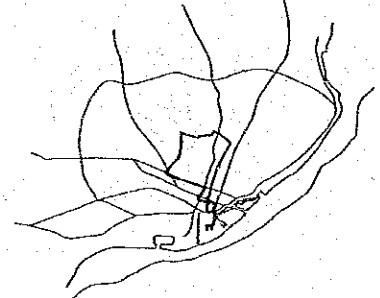
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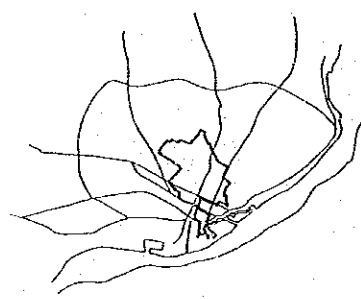
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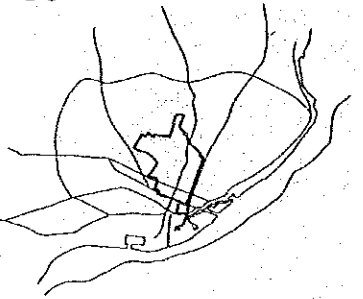
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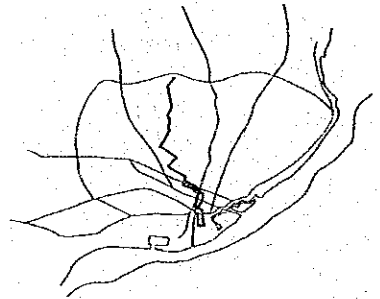
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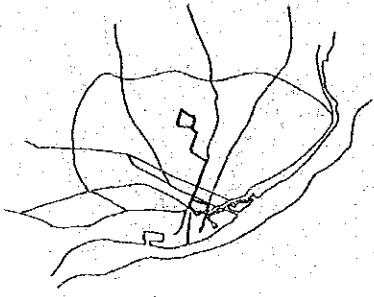
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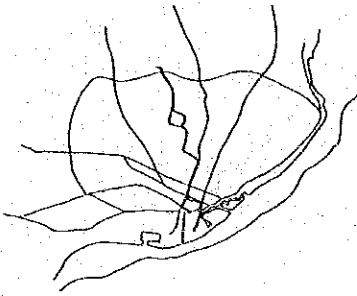
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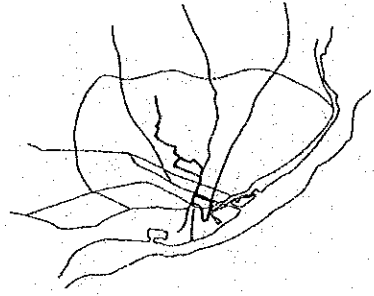
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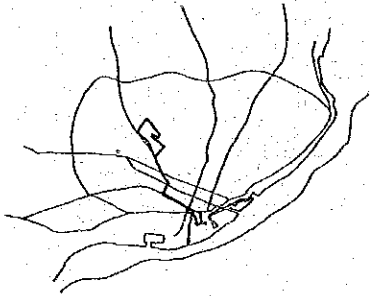
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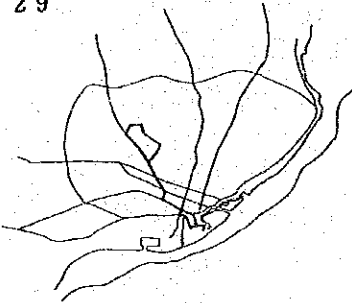
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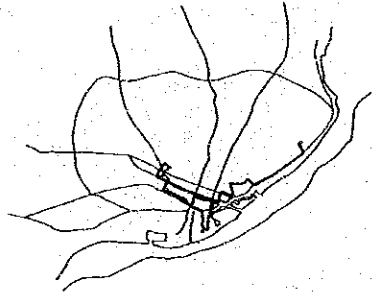
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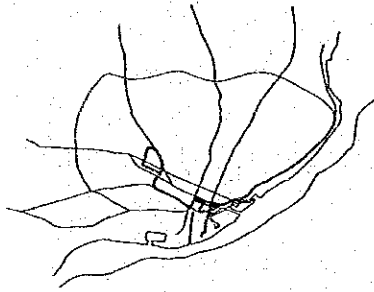
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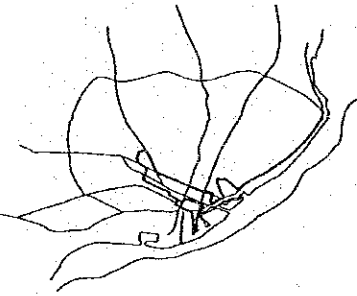
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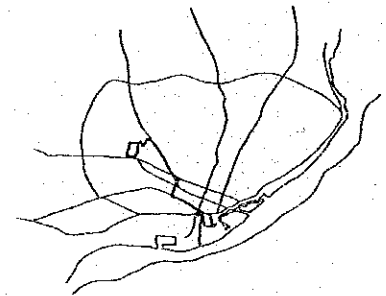
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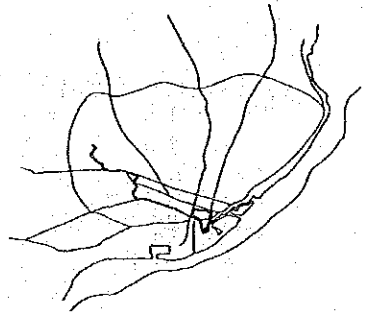
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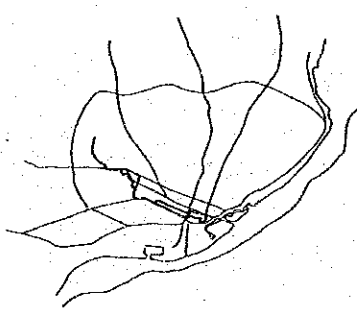
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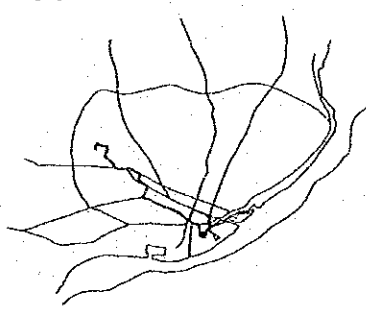
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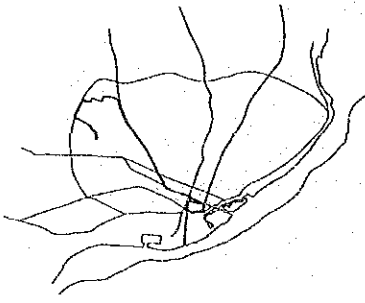
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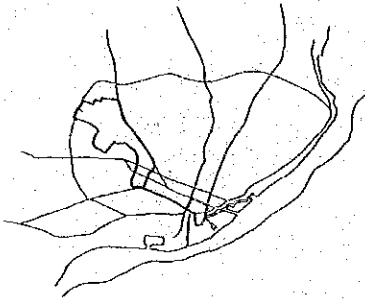
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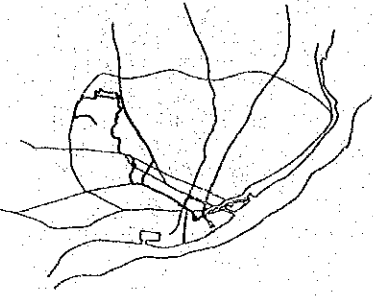
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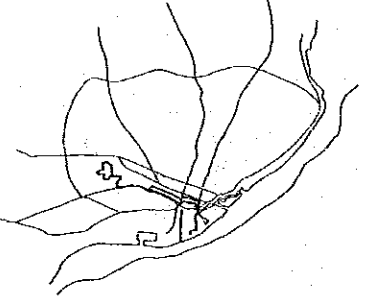
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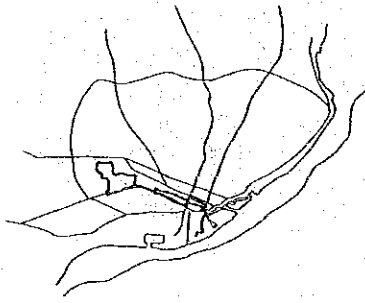
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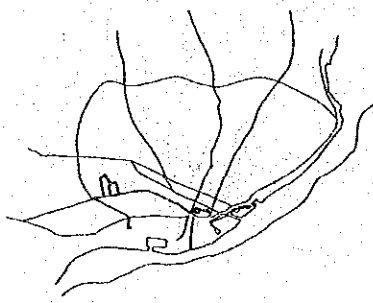
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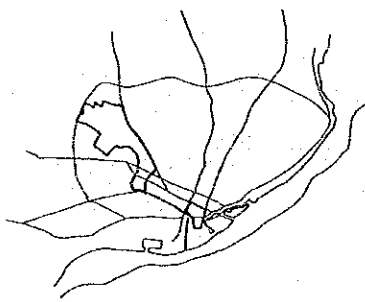
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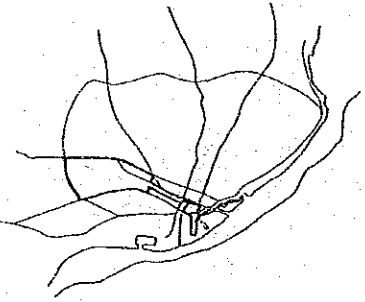
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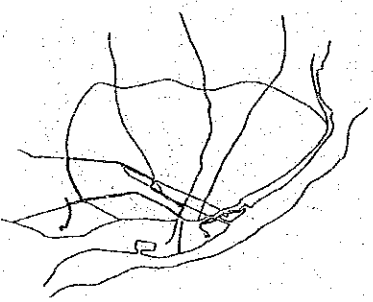
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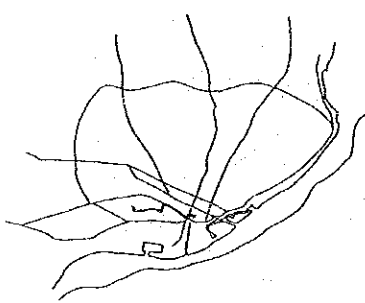
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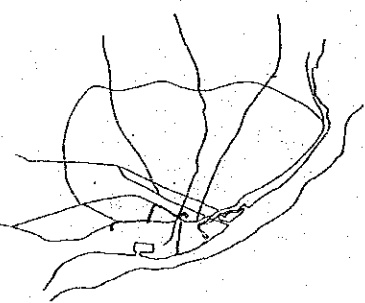
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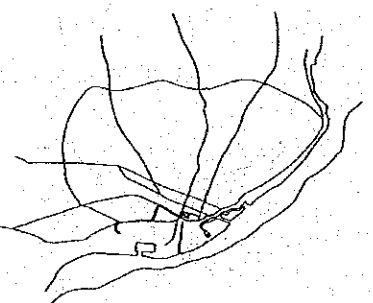
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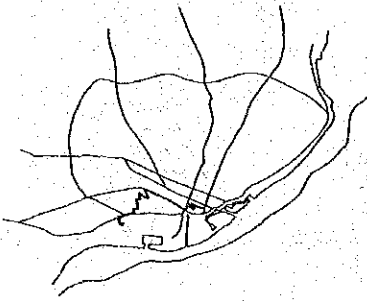
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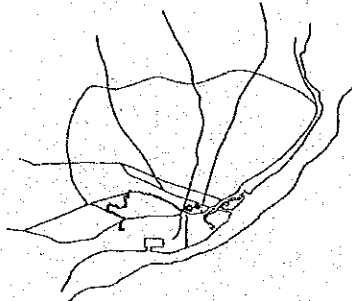
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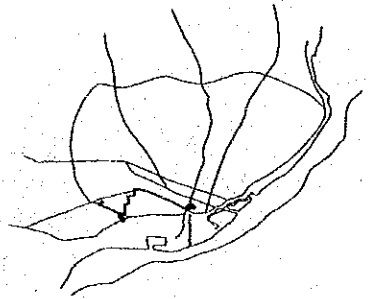
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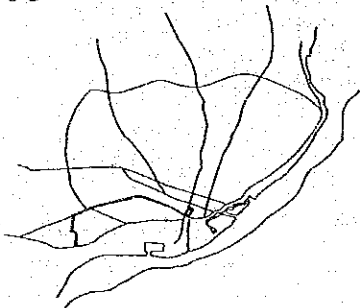
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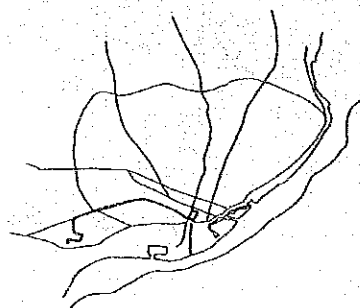
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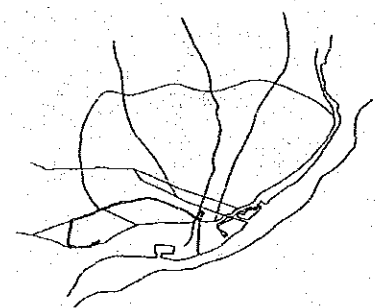
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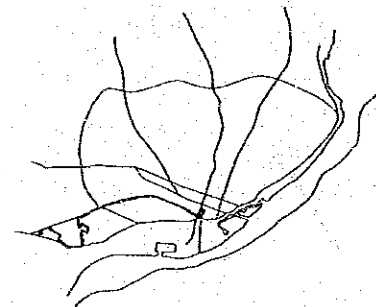
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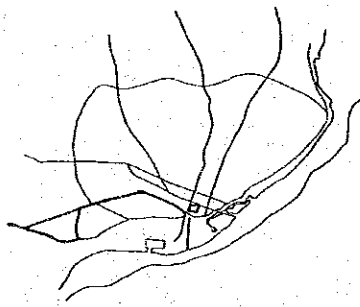
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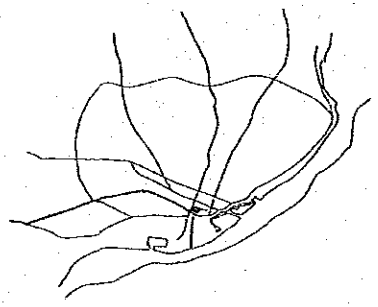
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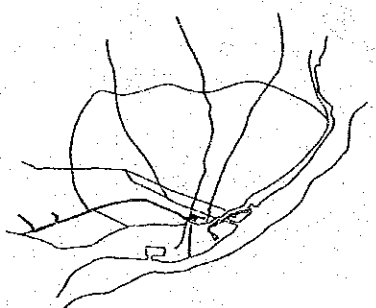
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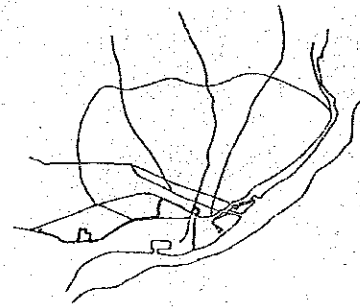
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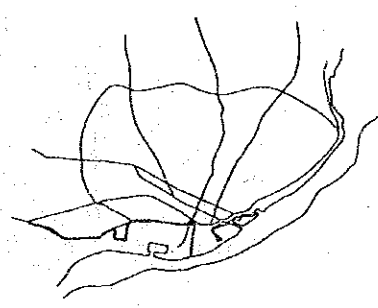
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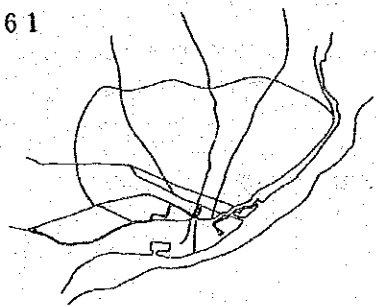
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Appendix E-2 Desire Line of Bus Passengers in 1983

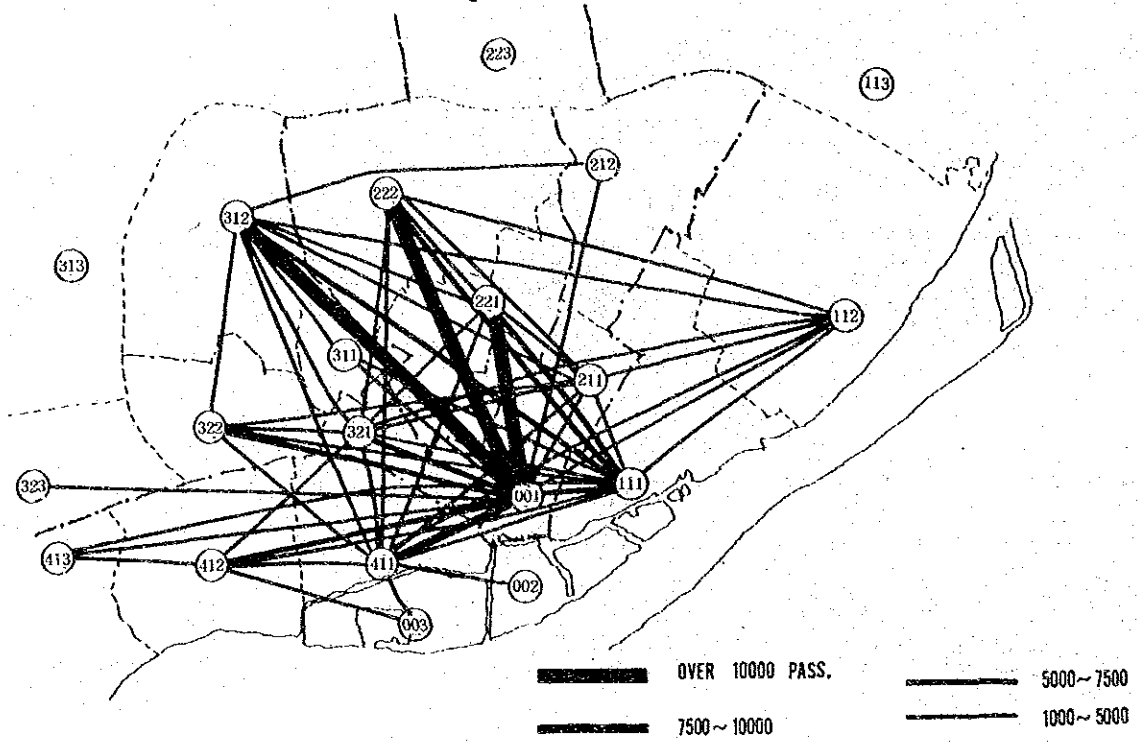


Fig. E-2-1 Desire Line of Bus Passengers in 1983 (Work)

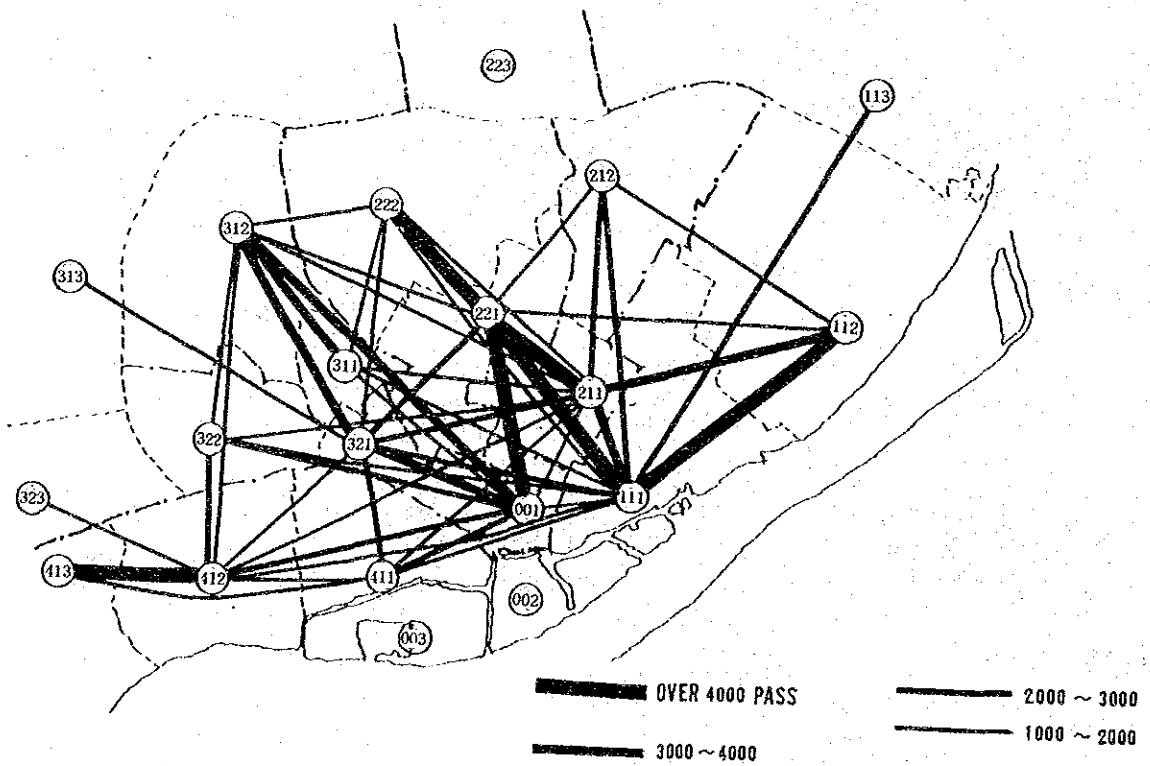


Fig. E-2-2 Desire Line of Bus Passengers in 1983 (School)

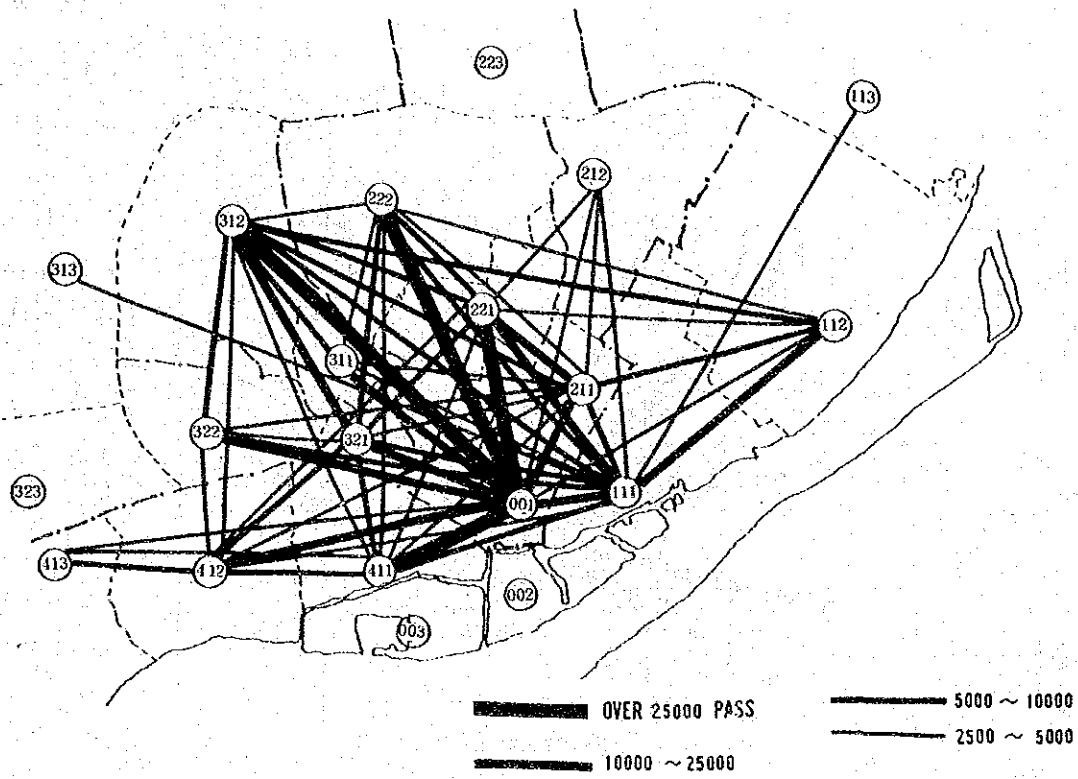


Fig. E-2-3 Desire Line of Bus Passengers in 1983 (Home)

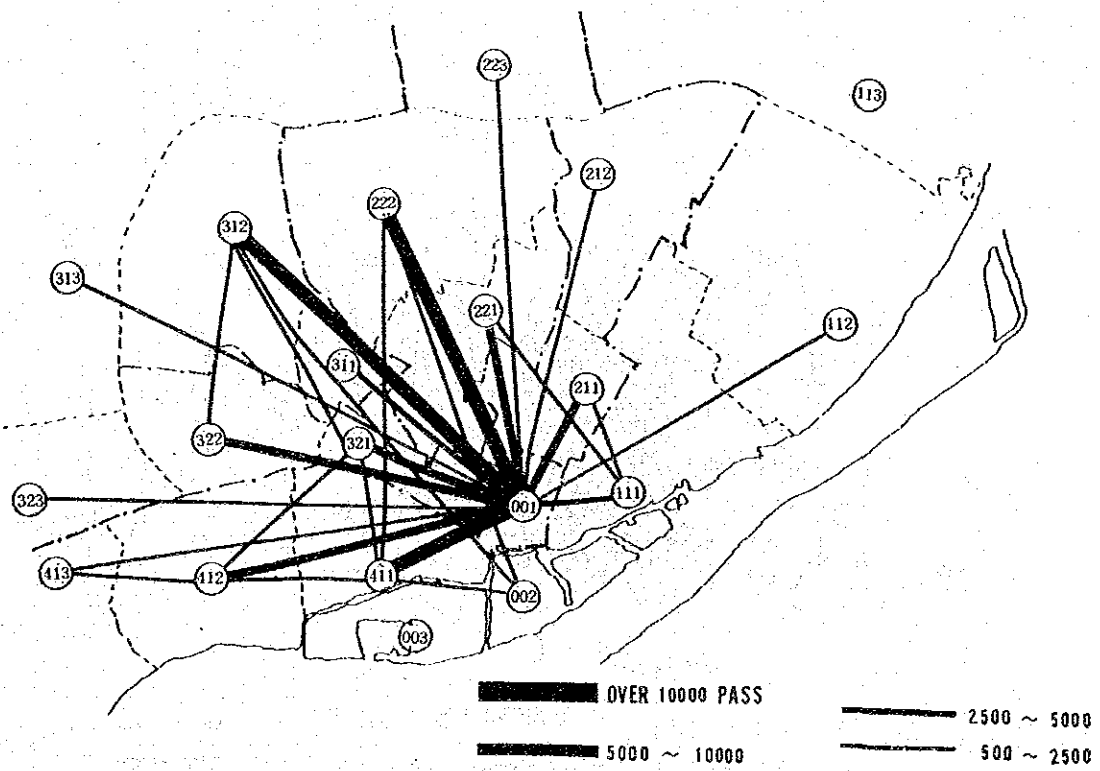


Fig. E-2-4 Desire Line of Bus Passengers in 1983 (Shopping)

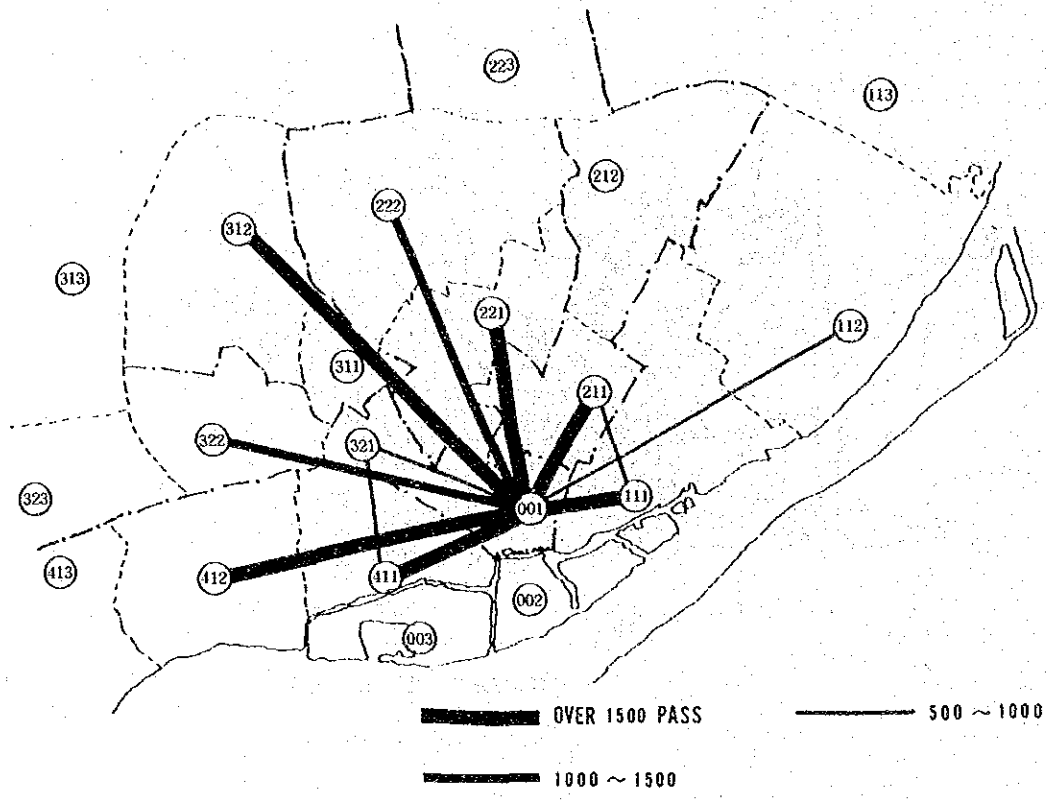


Fig. E-2-5 Desire Line of Bus Passengers in 1983 (Business)

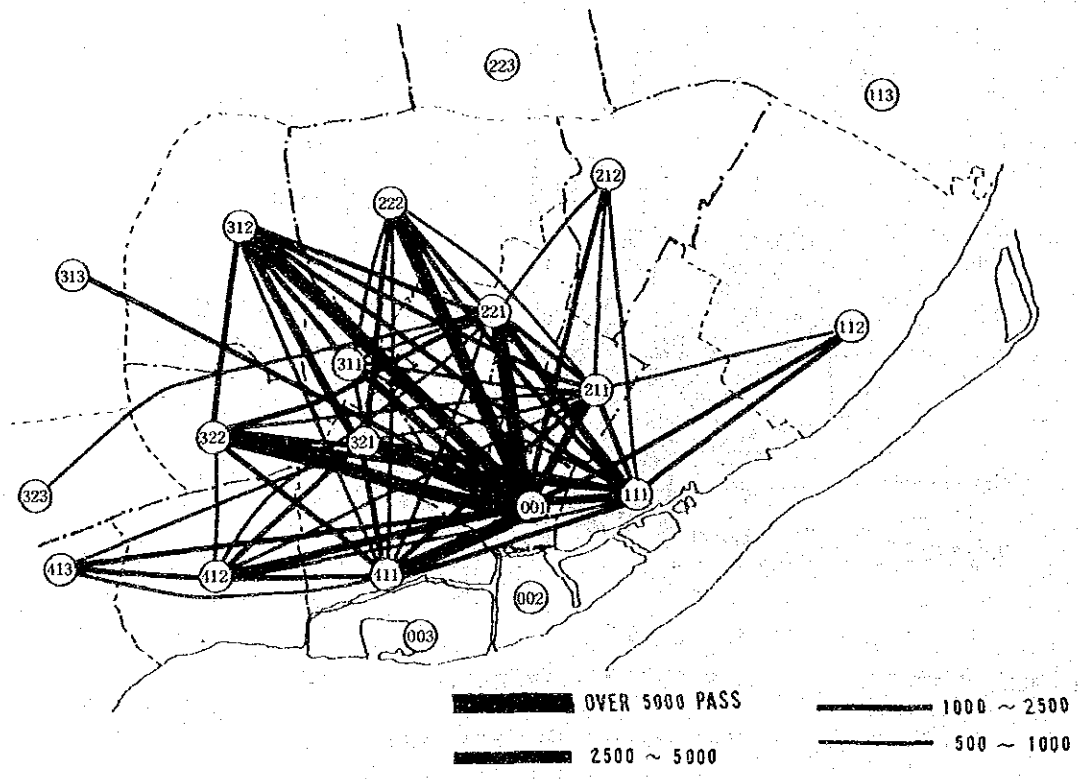


Fig. E-2-6 Desire Line of Bus Passengers in 1983 (Private)

Appendix E-3

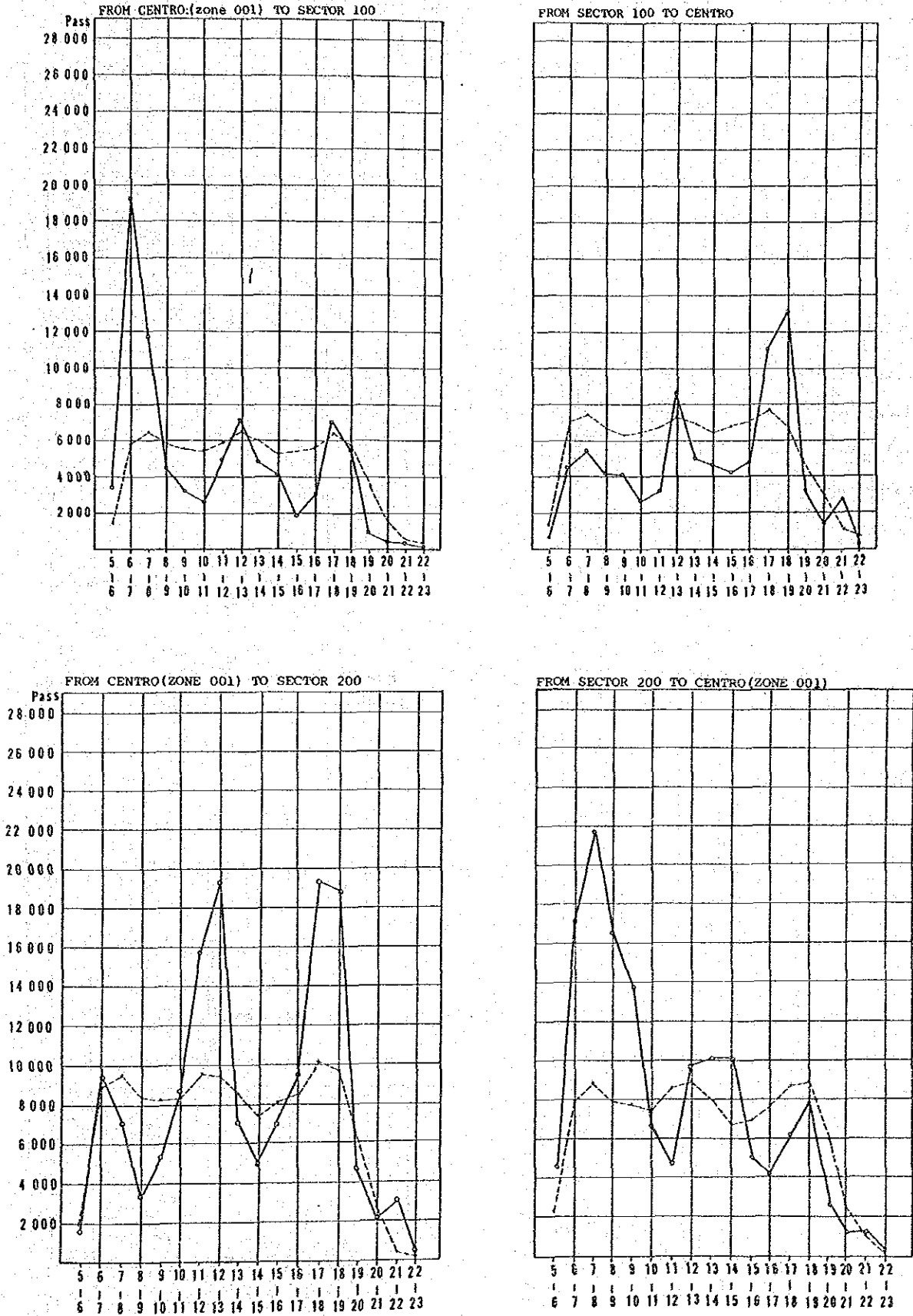


Fig. E-3-1 (1) Relationship of Demand and Supply of Bus Transport at the Boundary of City Center

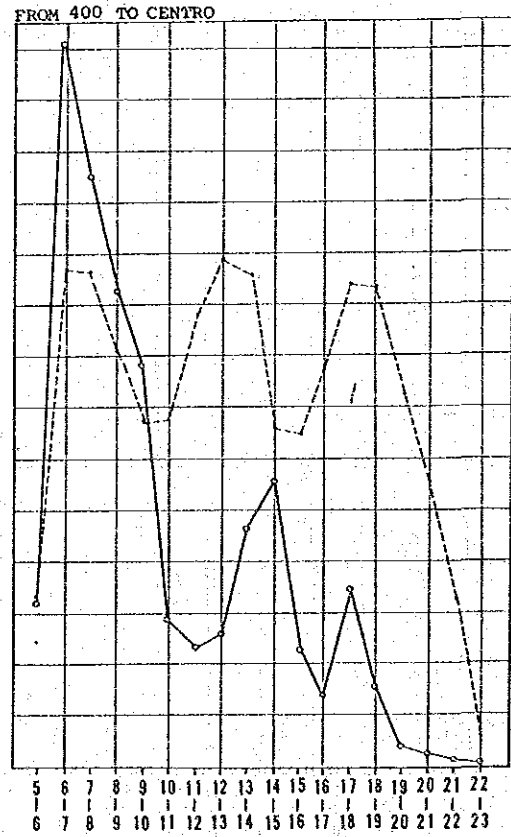
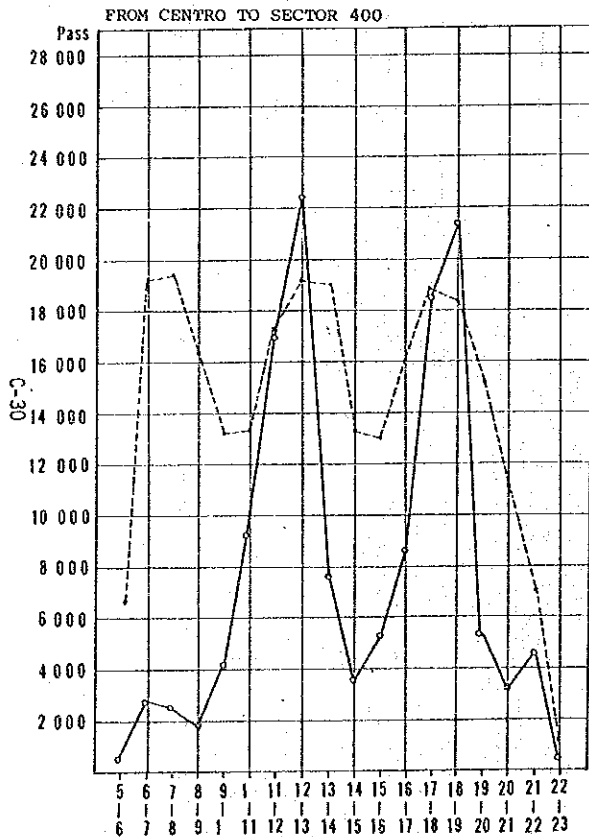
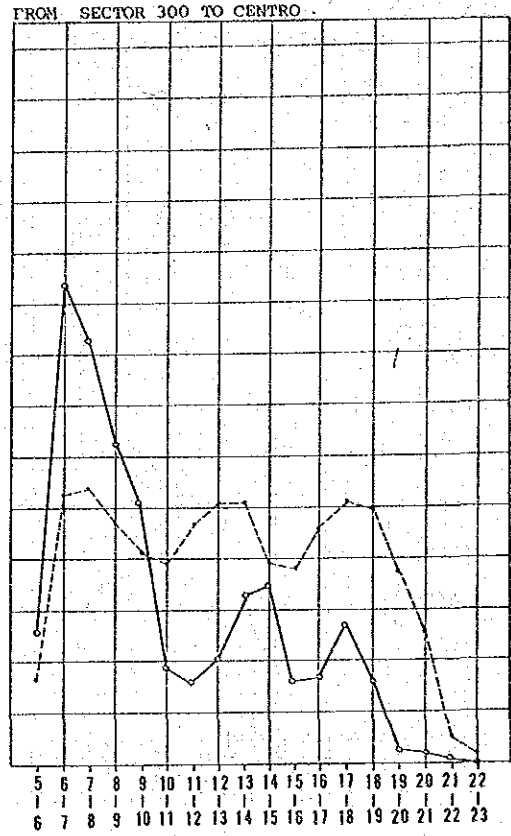
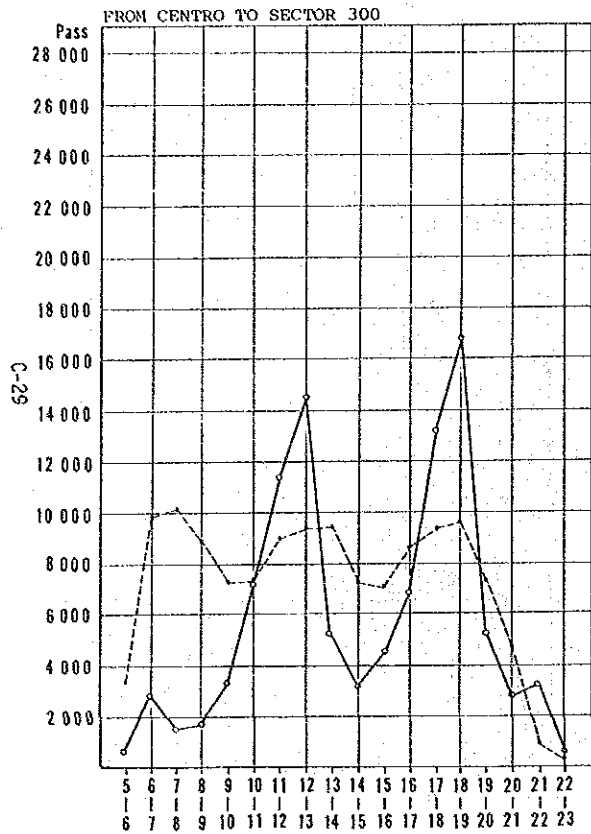


Fig. E-3-1 (2) Relationship of Demand and Supply of Bus Transport at the Boundary of City Center

Appendix E-4 Bus Maintenance Conditions

Table E-4-1 The Maintenance Activities of Each Urban Bus Company

Company	1st Level		2nd Level		3rd Level	
	No. Activ.	No. Activ.	No. Activ.	% of Activ.	No. of Act.	% Activ.
Coochofal	3	23.0%	—	—	1	16.7
Coolitoral	4	30.7%	7	100.0	1	16.7
Cootranorte	—	—	—	—	1	16.7
Cootrantico	—	—	—	—	1	16.7
Cootrasol	—	—	—	—	1	16.7
Cootratlantico	5	38.5%	—	—	1	16.7
Embusa	6	46.1%	2	28.6	5	83.3
Flota Angulo	6	46.1%	4	57.1	5	83.3
Flota Roja	3	23.0%	4	57.1	4	66.7
Sobusa	7	53.8%	4	57.1	5	83.3
Sodetrans	—	—	—	—	—	—
Sotrasusque	—	—	—	—	—	—
Transdiaz	7	53.8%	4	57.1	5	83.3
Transmecar	—	—	—	—	—	—
T. Atlantico	2	15.4%	7	100.0	—	—
T. Lolaya	7	53.8%	3	42.8	5	83.3
T. Monterrey	—	—	—	—	—	—
Transoledad	4	30.8	—	—	1	16.7
Transurbar	—	—	—	—	1	16.7
Trasalfa	2	15.4	—	—	—	—
Trasalianco	7	53.8	4	57.1	5	83.3

Table E-4-2 Number of Company by Level of Maintenance

Maintenance Level	Number of Company	
	Without Maintenance Activity	With Maintenance
1st Level	8 (38.0%)	13 (62.0%)
2nd Level	12 (57.1%)	9 (42.9%)
3rd Level	6 (28.6%)	15 (71.4%)

Table E-4-3 Classification of Maintenance Level by Company

Bus Company	Motor	Gear Box	Clutch	Sus- pension	Steering	Brakes Control	Cooling System	Fuel System	Exhaust System	Other System	Body Repair	Electricity	Washing and Greasing	Oil Change	Station Service	Tire Change
1. Coochofal	-	-	-	-	-	-	-	-	-	-	-	-	1st	1st	3rd	1st
2. Coollitoral	3rd	2nd	-	2nd	2nd	2nd	2nd	2nd	2nd	1st	1st	1st	-	1st	-	-
3. Cootransnorte	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4. Cootrantico	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3rd	-
5. Cootrasol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6. Cootratlantico	-	-	-	-	-	-	-	-	-	1st	1st	-	1st	1st	3rd	1st
7. Embusa Ltda.	3rd	3rd	1st	3rd	1st	2nd	2nd	3rd	3rd	1st	1st	1st	-	1st	-	-
8. Flota Angulo Ltda.	3rd	3rd	1st	3rd	2nd	2nd	2nd	2nd	3rd	1st	1st	1st	-	1st	3rd	1st
9. Flota Roja Ltda.	3rd	3rd	1st	3rd	2nd	2nd	2nd	2nd	3rd	1st	-	1st	-	-	-	-
10. Sobusa S.A.	3rd	3rd	1st	3rd	2nd	2nd	2nd	2nd	3rd	1st	1st	1st	1st	1st	3rd	1st
11. Sodetrans Ltda.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12. Sotrasque Ltda.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13. Transdiaz S.A.	3rd	3rd	1st	3rd	2nd	2nd	2nd	2nd	3rd	1st	1st	1st	1st	1st	3rd	1st
14. Transnecar Ltda.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15. Transp. Atlántico	1st	2nd	1st	2nd	2nd	2nd	2nd	2nd	2nd	-	-	-	-	-	-	-
16. Transp. Lolaya Ltda.	3rd	3rd	1st	3rd	2nd	2nd	3rd	2nd	3rd	1st	1st	1st	1st	1st	-	1st
17. Transp. Monterrey Ltda.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18. Transoledad S en C.	-	-	-	-	-	-	-	-	-	-	1st	1st	1st	1st	3rd	-
19. Transubar Ltda.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3rd	-
20. Trasalfa Sc. A.	-	-	-	-	-	-	-	-	-	-	1st	-	-	1st	-	-
21. Trasalianco S.A.	3rd	3rd	1st	3rd	2nd	2nd	2nd	2nd	3rd	1st	1st	1st	1st	1st	3rd	1st

Table E-4-4 (1) Classification of Maintenance Levels

Part	Motor	Gear Box	Clutch	Suspension	Steering	Brakes/Control	Cooling System	Fuel System
Level	1	2	3	4	5	6	7	8
1st Level	1.7	2.2	3.1	4.1	5.3	6.1	—	8.3
			3.2	4.2	5.4			
		2.6	3.3	4.6	5.5			
2nd Level	—	2.1	—	4.8	5.1	6.2	7.2	8.1
		2.5		4.9	5.2	6.3	7.1	8.2
		2.4		4.10				8.4
		2.7		4.11				
3rd Level	1.1							
	1.2	2.3	—		5.6	—	—	—
	1.4			4.4				
	1.5			4.5				
	1.3							
	1.6							

Table E-4-4 (2) Classification of Maintenance Levels

Part	Exhaust System	Painting and Repairing	Body	Electricity	Washing and Greasing	Oil Change	Station Service	Tire
Level	9	10	11	12	13	14	15	16
1st Level	—	10.1	11.1	12.1	13.1	14.1	—	16.1
		10.2		12.2	13.2	14.2		
		10.3		12.3				
		10.4		12.4				
2nd Level	9.3	—						
3rd Level	9.1	—					15.1	
	9.2							

Appendix F-1 CARGO DISTRIBUTION CENTER

1) Background

Gran Abastos is planned to be constructed at the west of the Barranquilla airport. Its function is mainly the wholesale of agricultural and marine products such as grain, fruits, vegetables, fishes, etc., therefore, many wholesale dealers will shift its location from the present location in Barranquilla to the site of Gran Abastos. In addition to the wholesale market, the following facilities are also included in the plan.

- 1) Warehouse
- 2) Parking area for trucks
- 3) Administration office etc.

Gran Abastos is expected to function as a distribution center in the Metropolitan Area. However, considering the existing situation of cargo transport in Barranquilla, there seems to exist a necessity of an another distribution center with different functions.

According to the survey on the cargo transport companies, the cargo is classified into two types:

- 1) Parcel Cargo
- 2) Massive Cargo

For the first type, two types of trucks are used for its transportation: one is heavy truck for intercity transport, the other is medium or small sized trucks for collecting and distributing cargo inside of the city. The parcel cargo is mainly composed of daily goods such as clothes, paper, furnitures (wooden products), electric utensiles, etc.

Therefore, this type necessitates a place where cargo is unloaded, stored and loaded to change the trucks from one to another. At present, the transport volume of this type is not so large, however it is anticipated to grow rapidly in future in accordance with the population growth in the Metropolitan Region.

The 2nd type is mainly composed of industrial products and imported and exported goods from seaport, therefore their main destinations are factories and ports.

For this type, there is no necessity to change trucks, since the lot size is enough large for heavy trucks. Only the facility required for this type is the parking spaces during the night and for receiving documents prepared by administration offices.

It is also found from the survey that there exist the following problems for cargo transport.

- a. Difficulties to park the trucks in the Central District.
- b. Inadequacy of maintenance and spare parts particularly for small companies.
- c. Security of the cargo and the trucks.
- d. Difficulties to provide a timely transport service in appropriate type of trucks and drivers, due to the irregularity of transport demand.
- e. Necessity of coordination among the transporters.

2) Objectives

The main objectives of a new cargo distribution center is to solve the transport problems in distribution, transportation, storage, safety, use of vehicles and information in general.

3) Estimation of the Required Area

According to the Cordon Line Survey in 1983, the total interregional cargo movement related to Barranquilla was about 32,700 tons/day, of which 78% was either originated or destined in Barranquilla and the rest, 22% was those in transit.

From the daily cargo volume above, the cargo volume, which has a possibility to utilize the cargo distribution center if it is newly constructed, is estimated below on the basis of the following assumptions.

- (1) The cargo without either origin or destination in Barranquilla will not use the said distribution center.
- (2) The agricultural products will be dealt with in the Central de Gran Abastos.
- (3) Growth rate of cargo transport demand from 1983 to 2000 is assumed to be corresponding with the GRDP growth by sector.
- (4) The cargo departed from the industrial area and the port will be excluded since they may be transported directly from the loading spot to the destinations without dropping in the cargo terminal.

As a result, the total cargo transport demand in 2000 is estimated as shown in Table 2.

From 24,416 tons/day required for the cargo distribution center in the year 2000, 20% (4,883 tons/day) are considered to be absorbed by transport companies that have their own terminals and 80% (19,533 tons/day) of the rest of cargo will be assigned to the cargo distribution center. In the same way, it is considered for 1983 and 1990 (See Table F-1-1).

Table F-1-1 Daily Cargo Required for the Cargo Distribution Center

Year	Cargo Required	(tons/day)
		Net Cargo
1983	11,608	9,286
1990	15,583	12,467
2000	24,416	19,533

Source: Based on Table F-1-2.

Note: It is estimated that 80% of the cargo will be assigned to the Cargo Distribution Center.

According to Table F-1-1, for the year 2000 the total cargo is 19,533 tons/day and 30% of it will be assigned to storage, for which a total area⁽¹⁾ of 7.9 ha. is required (Including circulation).

For the warehouse platform area an average of 8.5 tons/truck is estimated according to the result of the total cargo (32,652 tons) over the total loaded trucks (3,849 tons) in Barranquilla. Therefore, 19,533 tons give as a result 2,298 trucks; of which 75% (1,724 trucks) is destined to loading and unloading and 25% (574 trucks) to parking. In this way, in 8 hours of work 639 platforms are required which will use an area⁽²⁾ of 5.1 ha. including 25% for circulation.

For trucks parking, an area of 4.6 ha. was considered and 539 for vehicle parking, the area⁽³⁾ will be 0.84 ha. Includes circulation.

Complementary services, which are areas required to give complementary services to the distribution activities and also for the improvement of the conditions for drivers, workers and

(1) One ton is equivalent to 11.7 m².

(2) One truck occupies an area of 64 m².

(3) One vehicle occupies an area of 12.5 m².

Table F-1-2 Daily Cargo Movement in Barranquilla by Kind of Product

Products	Cargo Flow (tons/day)			
	Origin	Desatination	In transit	Total
Agricultural	1,266	2,595	1,362	5,223
Wood	197	86	46	329
Minerals	483	2,320	659	3,462
Metal-mechanic	793	1,494	80	2,367
Chemical	4,753	1,436	1,651	7,840
Paper products	3,176	5,638	1,496	16,310
Manufactures	186	146	161	493
Junk	314	54	91	459
Especial	388	275	1,506	2,169
TOTAL	11,556	14,044	7,052	32,652

Source : JICA, Cordon Line Survey, 1983.

Table F-1-3 Projection of Total Cargo Movement, Barranquilla - Cargo Terminal

Products	(tons/day)			
	Total Daily Cargo (1)	Terminal Cargo 1983 (2)	Terminal Cargo 1990 (3)	Terminal Cargo 2000 (4)
Wood	283	152	200	296
Mineral	2,803	2,033	2,730	4,280
Metal-mechanic	2,287	444	596	935
Chemical	6,189	2,791	3,748	5,876
Paper	8,814	5,560	7,466	11,706
Manufacture	332	106	142	223
Junk	368	165	222	348
Especial	663	357	479	752
Total	21,739	11,608	15,583	24,416

Source: 1- JICA, Cordon Line Survey, 1983.

2- Estimated based on Table. No. 1-1

Note: 3. Projection based on GRDP growth rate for the secondary sector of 4.3% (1983-1990)

4. Projection based on GRDP growth rate for the secondary sector of 4.6% (1990-2000)

5. Projection based on GRDP growth rate for the primary sector of 4.0%

vehicles, such as the administration building, information, communication, banks, offices of transport companies will have an area of 6.2 ha.

The total operation area is 24.6 ha (See Table F-1-4).

The other area required as an open spaces is classified into: road network (15%), and green zones (10%) of the total operation area, with 6.1 ha., and 4.9 ha. respectively.

After analyzing all these aspects, the spatial needs of the terminal was estimated for the year 2000; It is estimated that the terminal requires 30.8 ha. plus 30% for expansion area, this is a total of 38.2 ha. (See Table F-1-4).

At present, the traffic of trucks and cargo moves mainly by the road to Malambo, with 37%, Puente Pumarejo (29.8%) and Cordialidad Road with 24.8%, and it requires an adequate operation facility with services, equipment, and conditions to meet all their basic needs.

For this, 11 sites were selected and analyzed from the following points of view:

Road connection with the city, its easy access to the city, cargo volumes arriving and departing by each regional road, the future circulation in the city and its development plans.

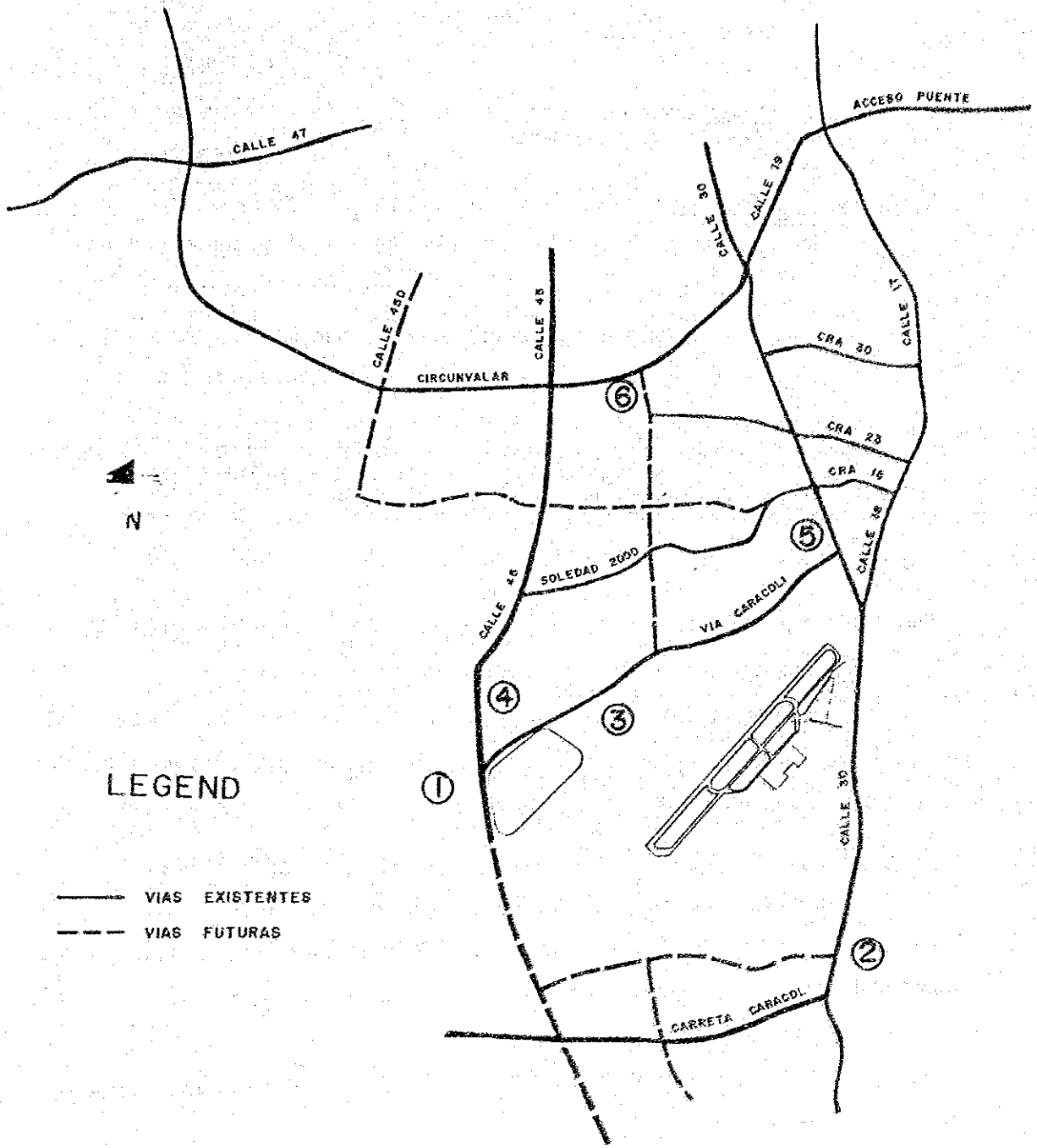
Afterwards, the sites were evaluated, and 5 priority sites were selected (See Fig. F-1-1), because they had the best conditions. For the analysis of the preferential zone of the Cargo Distribution Center, the following aspects were considered: Development pole, functionality and usefulness. As a result, zone 1 was found to be the highest priority site because it presents

Table F-1-4 Areas of the Barranquiola Cargo Dist. Center

	(ha.)		
	1983	I Stage	II Stage
Storage Area	3.8	5.0	7.9
Warehouse Platform Area	2.4	3.3	5.1
Parking Area	2.6	3.3	5.4
Complementary Services Area	3.8	3.8	6.2
Total Operational Area	12.6	15.4	24.6
Urban Works Construction:			
Roads, Green Zones	1.9	2.3	3.7
Required Area	15.7	19.3	30.8
Expansion Area			7.4
Total Terminal Area	15.7	19.3	38.2

Source: Estimated by Study Team

Note: Including 25% for circulation.



LEGEND

- VIAS EXISTENTES
- - - VIAS FUTURAS

Fig. F-1-1 Location of Candidate Site for Cargo Distribution Center

Table F-1-5 Number of Trucks and Areas in the Transport Companies in Barranquilla

	Companie's	Affiliated
No. of trucks with terminal	278	1,983
No. of trucks without terminal	1,119	6,543
Total	1,397	8,526
Terminal Area	64,850 m ²	
Warehouse Area	95,038 m ²	
Office Area	54,062 m ²	
Total Area	231,950 m ²	

Source: Survey of 58 Transport Companies, 1984.

superiority in terms of its location, influence zone and topography. In addition, it is a site by which almost all the cargo pass when arriving or departing to/from the city.

5) Functionality

A Cargo Distribution Center is a place for the concentration of cargo transportation companies and must serve as a storage place for the commercial and industrial companies.

Cargo Distribution Center should be a planned as a transport complex in order to encourage transportation industries, commerce and services, by developing distribution activities, storage, gathering, consolidation and disconsolidation of national and international cargo. And one of the most important function is to transfer cargo from one mode to another.

Therefore, it is classified into 3 zones, which include the following services:

- (1) Truck Terminal: offices, warehouses, and parking lots for all transport companies.
- (2) disconsolidation function of the cargo, modal integration and others, as well as the corresponding infrastructure.
- (3) Complementary Services: the rest of common services, such as restaurants, cafeterias, residences, stores, etc.

The cargo terminal must have an administration unit in charge of coordinating and regulating common services to the users and to promote the interdependent relationship among them, and will also provide maintenance, vigilance and cleaning. It will also ease the companies of transportation, industry, commerce, finance and services, concentrate their efforts in the works of collection, consolidation, storage, distribution, and financing.

* CENCAR -- Based on the Cargo Terminal Financing, Cali, 1981.

6) Requirements and Recommendations

Among the conditions required for the Barranquilla Cargo Distribution Center, the following can be listed:

- The project must be supported by the Government, transport companies, and economic groups.
- The Cargo Distribution Center must be constructed by stages and the first stage is recommended to be started after the completion of Central de Abastos, this is, approximately in the year 1990, with an area of 20 ha. and a value of approximately 2000 millin pesos.
- It is recommended to make a land use regulation for the zone.
- For road plans and transport policies, it is recommended to include the construction of access roads to the site, within the existing road plans.
- In respect to possible land use around the terminal, it is recommended to look for the compatibility, similarity or complement to the activities that will be developed in the terminal.
- Since the construction of the terminal and Gran Abastos will raise the value of the land, it is recommended to buy an additional area in order to obtain income in the future.
- The government should establish legal standards and mechanisms to protect the central district from the circulation of vehicles above 5 tons.
- In order to give a greater encouragement to the project, the Government must give tax incentives to the construction society as well as to the users who will settle in the terminal area.

Appendix F-2 Distribution Plan of Population and Employment

Table F-2-1 (1) Future Population Distribution Plan

Integrated Zone	M. Zone	PT Zone	POPULATION			DENSITY		
			1983	1990	2000	1983	1990	2000
1	1	1	284	0	0	16.0	0	0
		2	137	0	0	12.2	0	0
		3	1,075	210	670	58.1	49.2	36.2
		4	296	0	0	14.0	0	0
		Subtotal	1,792	910	670	26.1	13.3	9.8
	2	5	1,743	1,480	1,090	99.0	84.1	61.9
		6	1,537	1,340	960	68.3	59.6	42.7
		7	1,316	1,110	830	126.5	106.7	79.8
		8	863	730	540	47.9	40.6	30.0
		Subtotal	5,459	4,660	3,420	79.7	68.0	49.9
	3	9	1,485	7,000	7,000	19.9	93.6	93.6
		10	355	3,000	6,000	8.7	73.5	147.1
		11	29	0	7,000	0.7	0	158.7
		19	205	0	0	9.0	0	0
	Subtotal	2,074	10,000	20,000	11.4	54.8	109.6	
4	12	2,498	0	0	54.8	0	0	
	13	3,237	3,380	3,580	109.4	114.2	120.9	
	14	4,840	5,050	5,330	126.4	131.9	139.2	
	Subtotal	10,575	8,430	8,910	93.2	74.3	78.5	
TOTAL			19,900	24,000	33,000	45.9	55.4	76.2
2	5	15	—	—	—	—	—	—
		16	150	160	170	4.2	4.4	4.7
		17	53	60	70	1.7	1.9	2.2
		18	9,874	10,780	11,040	131.3	133.4	146.8
		Subtotal	10,077	11,000	11,280	40.6	44.4	45.5
	6	29	9,652	10,460	10,630	109.1	118.2	120.1
		64	68	70	80	1.2	1.2	1.4
		Subtotal	9,720	10,530	10,710	66.3	71.9	73.1
	7	63	17,147	18,870	19,610	168.6	185.5	192.8
	TOTAL			36,944	40,400	41,600	74.5	81.4	83.8
3	8	27	33,691	36,070	36,460	157.4	168.6	170.4
		28	8,089	8,630	8,720	90.2	96.2	97.2
		Subtotal	41,780	44,700	45,180	137.6	147.2	148.8
9	62	22,237	24,700	26,120	83.2	92.4	97.8	
TOTAL			64,017	69,400	71,300	112.1	121.6	124.9
4	10	24	12,936	13,570	13,690	235.6	247.2	249.4
		25	18,755	18,960	19,050	242.6	245.3	246.4
		26	9,696	10,170	10,270	161.6	169.5	171.7
		Subtotal	41,387	42,700	43,010	215.3	222.2	223.8
	11	35	9,700	10,650	11,200	214.6	235.6	247.8
		36	25,630	27,450	28,150	233.9	250.5	259.1
		Subtotal	35,330	38,100	39,350	228.2	246.1	254.2
	12	38	20,857	21,880	21,910	171.1	179.5	179.7
		60	32,464	34,820	35,830	178.8	191.7	197.3
		Subtotal	53,321	56,700	57,740	175.7	186.8	190.2
TOTAL			130,038	137,500	140,100	199.9	211.4	215.4
13	21	21	—	—	—	—	—	—
		22	—	—	—	—	—	—
		Subtotal	—	—	—	—	—	—

Table F-2-1 (2) Future Population Distribution Plan

Integrated Zone	M. Zone	PT Zone	POPULATION			DENSITY			
			1983	1990	2000	1983	1990	2000	
6	14	20	14,140	17,000	18,780	171.0	205.6	227.1	
		23	22,523	23,630	24,000	266.9	280.0	284.4	
		Subtotal	36,663	40,630	42,780	219.4	243.1	256.0	
	15	30	31,485	37,040	38,520	230.3	271.0	281.8	
		39	8,625	9,730	9,800	81.0	91.4	92.0	
		Subtotal	40,110	46,770	48,320	164.9	192.3	198.7	
	TOTAL			76,773	86,400	91,100	187.1	213.0	222.0
	16	31	41,773	44,900	45,830	239.7	257.6	262.9	
		40	21,798	24,200	25,660	198.9	120.8	234.1	
		Subtotal	63,571	69,100	71,490	223.9	243.4	251.8	
7	17	32	10,742	11,510	11,640	153.5	164.4	166.3	
		33	16,616	17,800	18,000	225.5	241.5	244.2	
		34	12,877	13,930	14,270	372.1	359.0	367.8	
		46	10,806	11,260	11,300	222.8	232.2	233.0	
		Subtotal	51,051	54,500	55,210	221.0	235.9	239.0	
	18	42	12,607	13,290	13,680	223.5	275.6	242.6	
		44	13,289	13,710	13,740	255.6	263.7	264.2	
		45	14,229	14,880	15,170	241.6	252.6	257.6	
		47	14,973	15,470	15,520	242.7	250.7	251.5	
		Subtotal	55,098	57,350	58,110	240.6	250.4	253.8	
	19	41	12,090	13,460	13,960	260.6	290.1	300.9	
		43	21,777	23,280	23,780	253.5	271.0	276.8	
		50	19,530	23,150	34,400	215.3	255.2	269.0	
		52	43,181	46,260	47,250	292.4	313.2	319.9	
		Subtotal	96,578	106,150	109,390	260.5	286.4	295.1	
	TOTAL			266,298	287,100	294,200	238.9	257.6	264.0
	8	20	37	30,555	31,990	32,090	244.2	255.7	256.5
			48	15,372	16,050	16,100	273.0	285.1	286.0
			49	24,419	25,690	25,770	257.3	270.7	272.5
Subtotal			70,346	73,730	73,960	254.6	266.8	267.7	
21		53	25,034	26,820	27,620	210.0	225.0	231.7	
		55	37,210	40,350	42,220	170.6	185.0	193.6	
Subtotal			62,244	67,170	69,840	184.5	199.1	207.1	
TOTAL			132,590	140,900	143,800	216.1	229.6	234.4	
9	22	51	31,735	41,200	50,800	112.3	145.8	170.8	
		54	44,811	53,100	64,800	132.1	156.6	191.1	
		56	11,176	17,900	24,500	77.4	124.0	179.7	
		Subtotal	87,722	112,200	140,100	114.5	146.5	182.9	
	23	57	33,556	36,700	37,630	141.9	155.2	159.1	
		58	16,565	19,600	20,100	112.8	133.5	136.9	
		59	20,188	22,700	23,270	76.8	86.4	88.6	
		Subtotal	70,309	79,000	81,000	108.8	122.3	125.4	
	24	70	7,608	15,000	70,300	10.6	20.8	97.6	
		71	10,754	36,300	57,000	11.6	39.3	61.7	
		Subtotal	18,362	51,300	127,300	11.2	31.2	77.5	
	TOTAL			176,393	242,500	348,400	57.7	79.4	114.0
	25	61	12,825	22,900	33,000	45.5	81.3	117.2	
		26	65	13,381	26,500	39,600	39.6	78.5	117.3
			66	17,887	26,800	39,600	53.0	79.5	117.4
Subtotal			31,268	53,300	79,200	46.3	79.0	117.4	

Table F-2-1 (3) Future Population Distribution Plan

Integrated Zone	M. Zone	PT Zone	POPULATION			DENSITY		
			1983	1990	2000	1983	1990	2000
	27	67	23,255	27,800	39,800	50.6	60.5	86.6
	28	68	3,800	4,800	42,800	2.1	2.6	23.1
	29	69	138	9,500	133,500	0.2	10.6	149.4
	TOTAL	Subtotal	71,286	118,300	328,300	17.1	28.4	78.9
11	30	72	-	53,100	144,000	-	31.9	68.4
	31	73	8,678	73,700	130,000	8.9	75.7	133.6
		78	994	1,000	1,100	2.4	2.4	2.7
		Subtotal	9,672	74,700	131,100	7.0	53.9	94.5
	TOTAL		9,672	127,800	245,100	3.2	41.9	80.3
12	32	74	35,321	38,130	39,100	165.6	178.8	183.3
	33	75	28,045	30,280	31,050	255.0	275.3	282.3
		76	4,731	5,110	5,240	33.8	36.5	37.4
		Subtotal	32,776	35,390	36,290	131.1	141.6	145.2
	34	77	54,632	58,980	60,510	25.6	27.6	28.4
	TOTAL		122,729	132,500	105,900	47.3	51.0	52.3
GRAND TOTAL			1,106,640	1,407,800	1,872,800	63.5	80.8	107.5

Table F-2-2 (1) Future Employment Distribution Plan

Zone	M. Zone	P.T. Zone	1983			1990			2000					
			1°	2°	3°	TOTAL	1°	2°	3°	TOTAL	1°	2°	3°	TOTAL
1	1	1	81	2,235	23,851	26,167	70	2,730	23,900	26,700	70	4,820	23,900	28,790
	2	3	60	1,065	3,902	5,027	60	1,000	3,900	4,960	60	790	3,900	4,750
	3	76	3,196	14,123	17,395	70	3,900	18,400	22,370	70	4,210	20,900	25,180	
	4	149	2,558	15,357	18,064	130	3,220	18,000	21,350	130	4,030	20,000	24,160	
	Subtotal	366	9,054	57,233	66,653	330	10,850	64,200	75,380	330	13,850	68,700	82,860	
2	5	5	46	1,106	4,931	6,037	40	1,350	6,430	7,780	40	1,470	7,300	8,770
	6	7	22	1,385	5,856	7,287	20	1,690	7,640	9,370	20	1,750	8,680	10,470
	7	188	2,032	2,242	20	230	2,650	2,900	20	230	610	3,010	3,640	
	8	395	3,231	3,626	60	800	5,000	5,800	60	1,310	6,500	7,810		
	Subtotal	68	3,074	16,050	19,192	120	4,070	21,720	25,850	120	5,140	25,490	30,690	
3	9	68	758	5,827	4,653	40	900	5,000	5,940	40	1,180	5,860	7,040	
	10	444	1,221	1,734	50	400	1,590	2,040	50	400	2,000	2,400		
	11	432	599	1,031	300	300	790	1,090	220	1,090	1,310			
	19	32	1,284	2,838	4,154	30	1,000	3,700	4,730	30	1,000	4,200	5,200	
	Subtotal	169	2,918	8,485	11,572	120	2,600	11,080	13,800	120	2,800	13,150	15,950	
4	12	25	785	4,232	5,042	20	800	5,000	5,820	20	1,000	10,000	11,020	
	13	872	2,030	2,902	900	2,650	3,550	1,000	4,000	5,000				
	14	675	1,363	2,020	500	1,770	2,270	400	2,020	2,420				
	Subtotal	25	2,314	7,625	9,964	20	2,200	9,220	11,640	20	2,400	16,020	18,440	
TOTAL	628	17,360	89,393	107,381	530	19,720	106,420	126,670	410	24,190	123,360	147,960		
5	15	45	51	96	50	70	150	60	90	150				
	16	143	50	194	160	70	230	190	90	280				
	17	789	521	1,317	900	710	1,610	1,100	910	2,010				
	18	1,091	3,119	4,210	1,250	4,250	5,500	1,520	5,450	6,970				
	Subtotal	8	2,068	3,741	5,817	50	2,360	5,100	7,460	50	2,870	6,540	9,410	
6	29	57	2,368	3,221	5,646	50	2,710	4,390	7,150	40	3,300	5,620	8,960	
	64	1,039	699	1,738	1,190	950	2,140	1,450	1,220	2,670				
	Subtotal	57	3,407	3,920	7,384	50	3,900	5,340	9,290	40	4,750	6,840	11,630	
	63	2,391	4,762	7,153	2,730	6,480	9,210	3,330	8,300	11,630				
TOTAL	65	7,866	12,423	20,354	50	8,990	16,920	15,960	40	10,950	21,680	32,670		
3	27	105	3,674	14,523	18,302	90	4,230	19,690	24,010	70	5,160	25,180	30,410	
	28	1,037	5,100	6,137	1,190	6,920	8,110	1,450	8,850	10,300				
	Subtotal	105	4,711	19,623	24,439	90	5,420	26,610	32,120	70	6,610	34,030	40,710	
	62	2,255	15,244	17,590	2,600	20,640	23,330	3,180	26,400	29,650				
TOTAL	216	6,966	34,847	42,029	180	8,020	47,250	55,450	140	9,790	60,430	70,360		

Table F-2-2 (2) Future Employment Distribution Plan

Zone	M. Zone	P.T. Zone	1983			1990			2000					
			1°	2°	3°	TOTAL	1°	2°	3°	TOTAL	1°	2°	3°	TOTAL
4	10	24	81	2,867	5,539	8,487	70	3,310	7,550	10,930	50	4,050	9,670	13,770
		25	109	1,250	4,883	6,242	90	1,450	6,660	8,200	70	1,770	8,530	10,370
		26	11	1,126	2,787	3,924	10	1,300	3,800	5,110	10	1,590	4,870	6,470
		Subtotal	201	5,246	13,209	18,653	170	6,060	18,010	24,240	130	7,410	23,070	30,610
11	35	35	-	130	1,656	1,786	-	150	2,260	2,410	-	180	2,900	3,080
		36	-	628	2,757	3,385	-	720	3,760	4,480	-	880	4,820	5,700
		Subtotal	-	758	4,413	5,171	-	870	6,020	6,890	-	1,060	7,720	8,780
12	38	38	26	773	3,671	4,470	20	890	5,010	5,920	10	1,090	6,420	7,520
		60	100	688	3,860	4,648	90	800	5,260	6,150	70	980	6,740	7,790
		Subtotal	126	1,461	7,531	9,118	110	1,690	10,270	12,070	80	2,070	13,160	15,310
TOTAL														
5	13	21	47	943	2,310	3,300	40	1,070	3,110	4,220	30	1,300	3,980	5,310
		22	18	2,093	2,493	4,604	10	2,370	3,360	5,740	10	2,870	4,290	7,170
		Subtotal	65	3,036	4,803	7,904	50	3,440	6,470	9,960	40	4,170	8,270	12,480
		TOTAL												
6	14	20	-	1,265	1,597	2,862	-	1,510	2,870	4,380	-	1,870	4,760	6,630
		23	51	808	2,087	2,946	40	950	3,420	4,410	30	1,180	5,450	6,660
		Subtotal	51	2,073	3,664	5,808	40	2,460	6,290	9,790	30	3,050	10,210	13,290
		TOTAL												
15	30	30	169	436	1,680	2,285	140	630	2,460	3,230	110	780	3,120	4,010
		39	32	561	1,034	1,627	30	660	1,390	2,080	20	820	1,770	2,610
		Subtotal	201	997	2,714	3,912	170	1,290	3,850	5,310	130	1,600	4,890	6,620
		TOTAL												
16	31	31	142	2,213	3,716	6,071	120	2,580	5,450	8,150	90	3,170	7,020	10,280
		40	-	1,039	2,347	3,386	-	1,240	3,170	4,410	-	1,530	4,080	5,610
		Subtotal	142	3,252	6,063	9,457	120	3,820	8,620	12,560	90	4,700	11,100	15,890
		TOTAL												
17	32	32	12	501	2,430	2,943	10	580	3,640	4,230	10	710	4,690	5,410
		33	-	1,511	2,108	7,619	-	1,740	3,250	4,990	-	2,140	4,180	6,320
		34	-	1,199	1,832	3,031	-	1,390	2,870	4,260	-	1,710	3,700	5,410
		46	10	348	1,861	2,219	10	410	2,890	3,310	10	500	3,720	4,230
Subtotal	22	3,559	8,231	11,812	20	4,120	12,650	16,790	20	5,060	16,290	21,370		
18	42	42	-	403	1,966	2,369	-	470	2,590	3,060	-	580	3,330	3,910
		44	-	341	900	1,241	-	390	1,630	2,020	-	480	2,100	2,580
		45	-	458	1,473	1,931	-	540	2,390	2,930	-	660	3,080	3,740
		47	25	581	1,526	2,132	20	670	2,450	3,140	20	820	3,150	3,990
Subtotal	25	1,783	5,865	7,673	20	2,070	9,060	11,150	20	2,540	11,660	14,220		

Table F-2-2 (3) Future Employment Distribution Plan

Zone	M. Zone	P.T. Zone	1983			1990			2000					
			1°	2°	3°	TOTAL	1°	2°	3°	TOTAL	1°	2°	3°	TOTAL
8	19	41	-	251	814	1,065	-	310	1,120	1,430	-	380	1,440	1,820
		43	-	1,332	2,143	3,475	-	1,540	3,300	4,840	-	1,890	4,250	6,140
		50	75	829	1,763	70	70	1,060	1,710	2,840	50	1,300	2,200	3,550
		52	41	813	2,249	3,103	30	1,000	3,080	4,110	20	1,230	3,970	5,220
		Subtotal	116	3,255	6,035	9,406	100	3,910	9,210	13,220	70	4,800	11,860	16,730
	TOTAL	305	11,849	26,194	38,348	260	13,920	39,540	53,720	200	17,100	50,910	68,210	
9	20	37	23	793	4,159	4,975	20	970	5,590	6,580	10	1,210	7,040	8,260
		48	-	538	1,137	1,675	-	660	1,530	2,190	-	820	1,930	2,750
		49	24	524	1,825	2,373	20	640	2,450	3,110	20	800	3,080	3,900
		Subtotal	47	1,855	7,121	9,023	40	2,270	9,570	11,880	30	2,830	12,050	14,910
		21	53	-	261	782	1,043	-	320	2,080	2,400	-	400	3,560	3,960
		55	-	203	1,750	1,953	-	240	3,350	3,590	-	290	5,220	5,510
	Subtotal	-	464	2,532	2,996	-	560	5,430	5,990	-	690	8,780	9,470	
	TOTAL	47	2,319	9,653	12,019	40	2,830	15,000	17,870	30	3,520	20,830	24,380	
10	22	51	25	2,358	1,232	3,615	20	2,910	5,620	8,550	10	3,920	10,000	13,830
		54	-	365	866	1,231	-	630	5,090	5,720	-	1,110	9,470	10,580
		56	-	15	78	93	-	180	3,990	4,170	-	420	7,780	8,200
		Subtotal	25	2,738	2,176	4,939	20	3,720	14,700	18,440	10	5,350	27,240	32,600
		23	57	42	307	558	907	40	430	4,430	4,900	30	550	8,580
		58	-	312	334	646	-	420	580	1,000	-	530	750	1,280
		59	-	103	456	559	-	170	720	990	-	230	930	1,160
	Subtotal	42	722	1,348	2,112	40	1,020	5,730	6,790	30	1,310	9,680	11,020	
	24	70	-	299	357	656	-	520	840	1,360	-	2,280	4,370	6,650
		71	19	104	339	462	20	750	1,710	2,480	20	1,530	3,380	4,930
	Subtotal	19	403	696	1,118	20	1,270	2,559	3,840	20	3,810	7,750	11,580	
	TOTAL	86	3,863	4,220	8,169	80	6,010	22,980	29,070	60	10,470	44,670	55,200	
11	25	61	69	749	5,463	6,321	60	1,140	7,600	8,800	50	1,680	10,100	11,830
		65	112	398	2,079	2,589	90	780	5,780	6,650	70	1,340	7,990	9,400
		76	-	1,474	6,374	7,848	-	1,880	8,730	10,610	-	2,670	11,670	14,340
		Subtotal	112	1,862	8,453	10,437	90	2,660	14,510	17,260	70	4,010	19,660	23,740
		27	67	123	5,136	4,923	10,182	100	5,920	6,630	12,650	80	7,540	8,990	16,610
	28	68	403	2,128	2,221	4,752	340	2,430	2,940	5,710	270	4,090	11,750	16,110
	29	69	-	61	624	685	-	300	1,290	1,590	-	4,100	27,130	31,230
	TOTAL	707	9,986	21,684	32,377	590	12,450	32,970	46,010	470	21,420	77,630	99,520	
	30	72	24	113	-	137	20	1,450	7,550	9,020	20	3,590	17,304	20,950
	31	73	27	1,045	958	2,030	20	3,700	13,500	17,220	10	8,690	34,520	43,220
		78	-	528	2,387	2,915	-	600	3,100	3,700	-	730	3,870	4,600
	Subtotal	27	1,573	3,345	4,945	20	4,300	16,600	20,920	10	9,420	38,690	47,820	
	TOTAL	51	1,686	3,345	5,082	40	5,750	24,150	29,940	30	13,010	55,730	68,770	

Table F-2-2 (4) Future Employment Distribution Plan

Zone	M. Zone	P.T. Zone	1983			1990			2000					
			1°	2°	3°	TOTAL	1°	2°	3°	TOTAL	1°	2°	3°	TOTAL
12	32	74	26	844	3,176	4,046	20	1,010	4,270	5,300	20	1,250	5,380	6,640
	33	75	139	526	2,309	2,964	120	630	3,590	4,340	100	780	4,880	5,760
		76	117	459	916	1,492	100	550	1,240	1,890	80	680	1,560	2,320
		Subtotal	256	985	3,225	4,466	220	1,180	4,830	6,230	180	1,460	6,440	8,080
	34	77	189	2,029	2,217	6,435	150	2,410	7,180	9,740	120	2,970	10,160	13,250
	TOTAL		471	3,858	10,618	14,947	390	4,600	16,280	21,270	310	5,680	21,980	27,970
	GRAND TOTAL		3,220	79,321	248,731	331,272	2,700	98,100	372,420	473,220	2,100	135,500	544,540	682,140

Table G-1-1 (3) Person Trips by Bus in 2000

ZONE	ALL PERSON TRIP BY PURPOSE IN 2000															
	BUS		BUS & PRIVATE		BUS		BUS & PRIVATE		BUS		BUS & PRIVATE					
1	276	108	5	197	6	166	7	168	8	2	10	12	13	14	15	16
2	426	182	159	1070	109	168	130	158	118	10	12	12	16	17	18	19
3	420	182	90	637	432	181	157	154	159	10	10	10	12	12	12	12
4	210	88	66	527	272	120	166	120	120	10	10	10	10	10	10	10
5	222	85	1	114	22	185	185	185	303	180	180	180	180	180	180	180
6	10	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
7	16	5	0	22	0	0	0	0	0	0	0	0	0	0	0	0
8	16	5	0	22	0	0	0	0	0	0	0	0	0	0	0	0
9	16	5	0	22	0	0	0	0	0	0	0	0	0	0	0	0
10	16	5	0	22	0	0	0	0	0	0	0	0	0	0	0	0
11	16	5	0	22	0	0	0	0	0	0	0	0	0	0	0	0
12	16	5	0	22	0	0	0	0	0	0	0	0	0	0	0	0
13	16	5	0	22	0	0	0	0	0	0	0	0	0	0	0	0
14	16	5	0	22	0	0	0	0	0	0	0	0	0	0	0	0
15	16	5	0	22	0	0	0	0	0	0	0	0	0	0	0	0
16	16	5	0	22	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	750	285	201	1430	1066	15025	9454	35	2894	6459	1135	151	274	160	1135	151

Table G-1-1 (4) Person Trips by Bus in 2000

ZONE	ALL PERSON TRIP BY PURPOSE IN 2000															
	BUS		BUS & HOME		BUS		BUS & HOME		BUS		BUS & HOME					
1	1074	468	5	742	6	1302	7	1302	8	2	10	12	13	14	15	16
2	1488	614	12514	12514	1342	1302	1207	1207	1877	10	12	12	16	17	18	19
3	1488	614	38394	38394	5635	4107	4107	4107	1977	10	10	10	12	12	12	12
4	1488	614	18790	18790	5170	3527	3527	3527	2023	10	10	10	10	10	10	10
5	1488	614	15987	15987	4450	3226	3226	3226	1389	10	10	10	10	10	10	10
6	1488	614	1102	1102	3605	350	350	350	58	10	10	10	10	10	10	10
7	1488	614	2705	2705	2147	1288	1288	1288	257	10	10	10	10	10	10	10
8	1488	614	2220	2220	27	27	27	27	27	10	10	10	10	10	10	10
9	1488	614	2220	2220	27	27	27	27	27	10	10	10	10	10	10	10
10	1488	614	2220	2220	27	27	27	27	27	10	10	10	10	10	10	10
11	1488	614	2220	2220	27	27	27	27	27	10	10	10	10	10	10	10
12	1488	614	2220	2220	27	27	27	27	27	10	10	10	10	10	10	10
13	1488	614	2220	2220	27	27	27	27	27	10	10	10	10	10	10	10
14	1488	614	2220	2220	27	27	27	27	27	10	10	10	10	10	10	10
15	1488	614	2220	2220	27	27	27	27	27	10	10	10	10	10	10	10
16	1488	614	2220	2220	27	27	27	27	27	10	10	10	10	10	10	10
TOTAL	322	128	6134	9275	15880	8398	463	411	1797	3875	402	18813	274	160	3875	402

Table G-1-1 (7) Person Trips by Bus in 2000

ZONE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	22251	1947	21785	43730	733	13401	1464	2221	243	1896	2046	7689	8129	1795	15	16
2	22372	22406	85946	8107	7388	6599	2540	390	37	762	672	1958	1212	1883	292	17
3	22453	15921	60712	60647	14692	6092	5333	3005	201	3090	4559	3572	1045	3652	455	18
4	22514	18288	54712	31809	16075	9141	1777	1552	5	659	509	1	105	513	40	19
5	22625	18788	57162	2996	3760	8945	337	52	53	466	2475	81	285	24	20	20
6	22736	18889	60228	14768	210	3240	1156	322	5	156	41	1505	358	6	21	21
7	22847	19000	62335	15768	112	537	1345	264	1	20	11	473	58	6	22	22
8	22958	19111	64442	603	48	537	15	159	1	20	10	0	0	0	23	23
9	23069	19222	66549	603	48	537	15	159	1	20	10	0	0	0	24	24
10	23180	19333	68656	3355	37	2122	106	322	1	20	10	4	139	0	25	25
11	23291	19444	70763	1199	65	2233	157	377	1	20	10	0	0	0	26	26
12	23402	19555	72870	1487	139	2344	41	422	1	20	10	0	0	0	27	27
13	23513	19666	74977	1487	139	2344	41	422	1	20	10	0	0	0	28	28
14	23624	19777	77084	1487	139	2344	41	422	1	20	10	0	0	0	29	29
15	23735	19888	79191	1487	139	2344	41	422	1	20	10	0	0	0	30	30
16	23846	19999	81298	1487	139	2344	41	422	1	20	10	0	0	0	31	31
TOTAL	39144	17483	121591	18691	13101	11333	25164	13869	552	1132	10890	4269	2518	7779	10782	27208

Table G-2-1 (3) Person Trips by Car in 2000

ZONE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	281205	921	24440	472	58	600	1035	41	19	118	1201	135	155	155	155	16
2	193504	3024	39707	216	55	90	455	60	19	357	231	1201	152	155	155	16
3	116400	7184	5707	2016	720	1370	702	60	403	333	432	1201	288	288	288	16
4	111400	7336	3235	2016	720	1370	196	35	403	333	432	1201	288	288	288	16
5	111400	4588	4681	141	113	148	148	10	211	388	60	122	168	168	168	16
6	111400	1204	14	1634	0	122	176	128	1	1	122	122	1	1	1	16
7	154400	250	88	14	0	0	0	1	0	0	0	0	0	0	0	19
8	154400	100	160	16228	0	0	40	10	0	0	0	0	0	0	0	19
9	11200	11200	90	1120	0	0	11	11	0	0	0	0	0	0	0	19
10	11200	11200	4452	81	122	495	155	25	0	0	0	0	0	0	0	19
11	1200	13626	67452	7805	7222	495	12354	3813	2767	949	2488	507	405	405	405	15307
12																15307

Table G-2-1 (4) Person Trips by Car in 2000

ZONE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	52484	8208	7812	12732	4155	6	4097	8	9	105	12	12	13	14	15	16
2	444	1208	20312	11922	4846	3812	564	5826	67	49	203	203	203	203	203	203
3	103	103	103	103	21219	14579	13292	51048	47	400	203	203	203	203	203	203
4	103	103	103	103	8316	14579	3622	162	47	400	203	203	203	203	203	203
5	103	103	103	103	1511	1503	311	489	47	400	203	203	203	203	203	203
6	103	103	103	103	15	114	37116	489	47	400	203	203	203	203	203	203
7	103	103	103	103	3089	114	005	005	47	400	203	203	203	203	203	203
8	103	103	103	103	4	6455	436	7304	47	400	203	203	203	203	203	203
9	103	103	103	103	1	17	10	10	47	400	203	203	203	203	203	203
10	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
11	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
12	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
13	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
14	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
15	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
16	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
17	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
18	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
19	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
20	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
21	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
22	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
23	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
24	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
25	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
26	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
27	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
28	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
29	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
30	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
31	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
32	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
33	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
34	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
35	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
36	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
37	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
38	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
39	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
40	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
41	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
42	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
43	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
44	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
45	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
46	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
47	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
48	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
49	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
50	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
51	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
52	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
53	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
54	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
55	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
56	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
57	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
58	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
59	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
60	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
61	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
62	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
63	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
64	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
65	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
66	103	103	103	103	1	1	10	10	47	400	203	203	203	203	203	203
67	1															

Table G-2-1 (7) Person Trips by Car in 2000

ZONE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	227	1	0	0	0	0	0	0	0	0	0	0	0	0	0
3	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	227	1	0	0	0	0	0	0	0	0	0	0	0	0	0
5	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	227	1	0	0	0	0	0	0	0	0	0	0	0	0	0
7	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	227	1	0	0	0	0	0	0	0	0	0	0	0	0	0
9	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	227	1	0	0	0	0	0	0	0	0	0	0	0	0	0
11	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	227	1	0	0	0	0	0	0	0	0	0	0	0	0	0
13	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	227	1	0	0	0	0	0	0	0	0	0	0	0	0	0
15	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	163685	95340	59737	77801	66129	31954	127156	49261	169	7618	4906	11452	9954	14913	127658

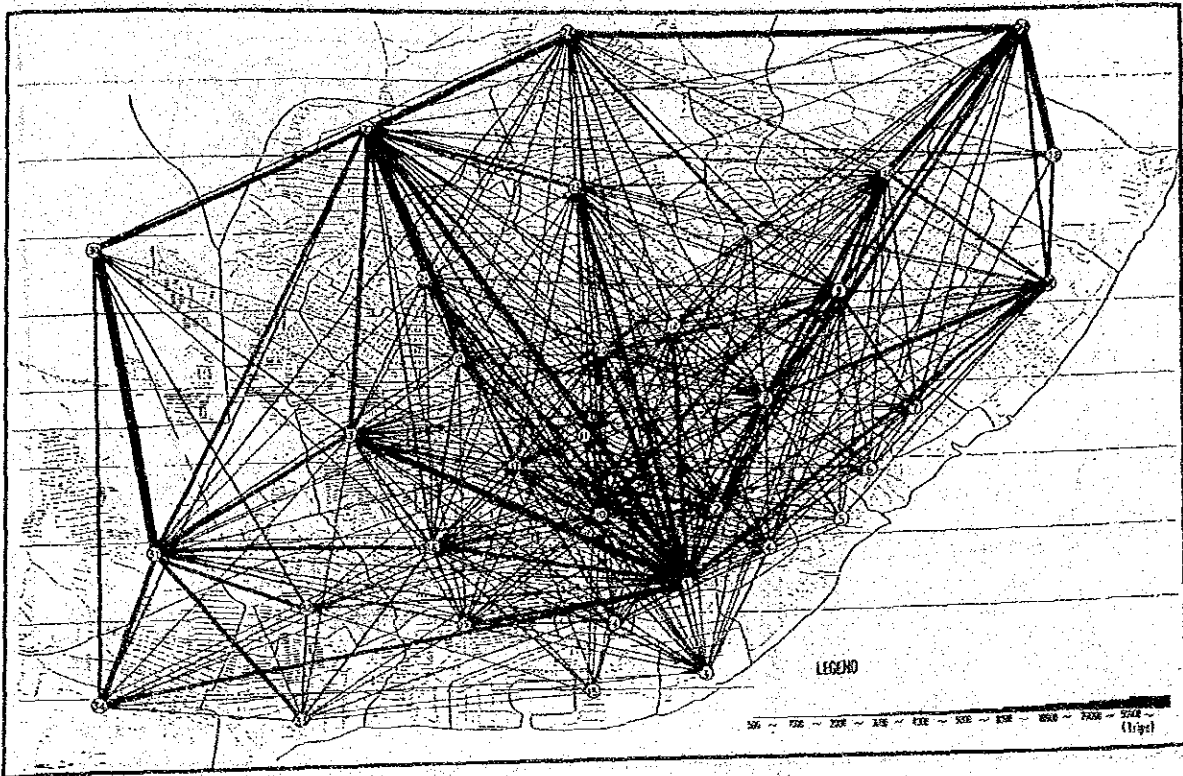


Fig. G-3-1 OD Pattern in 2000 (Work)

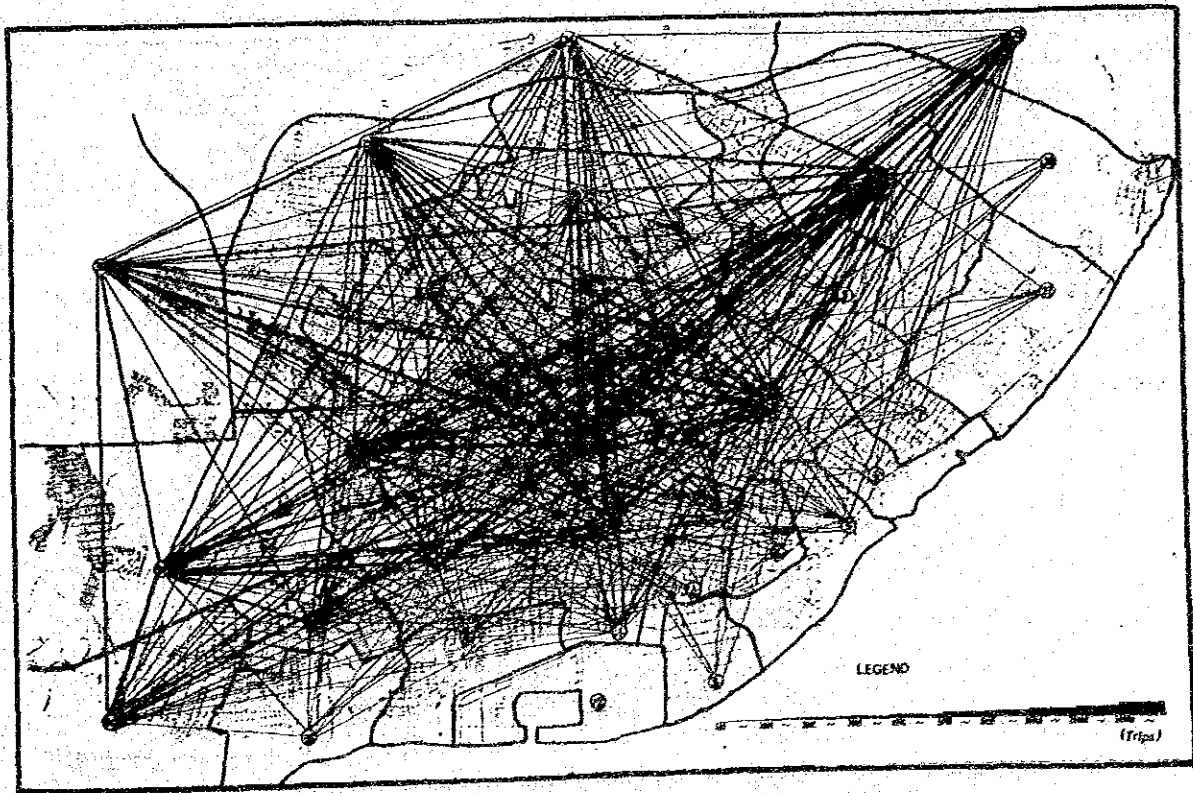


Fig. G-3-2 OD Pattern in 2000 (School)

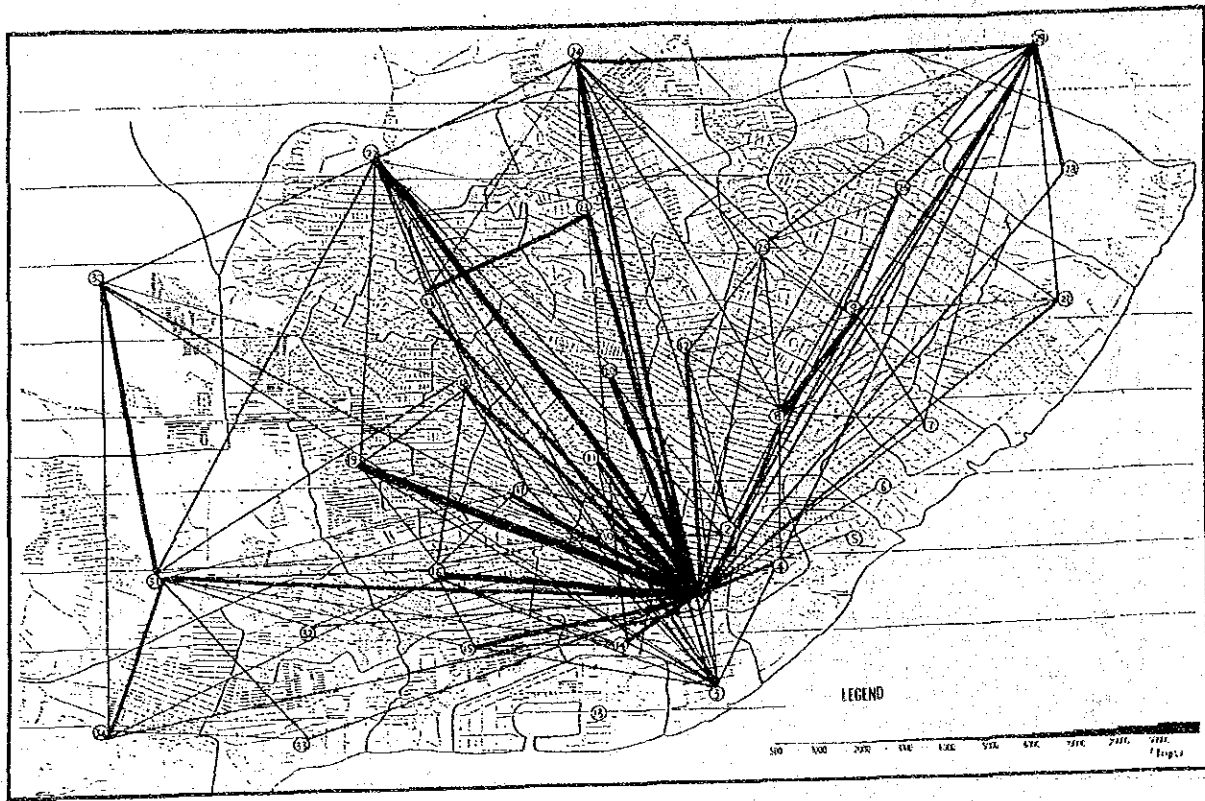


Fig. G-3-3 OD Pattern in 2000 (Shopping)

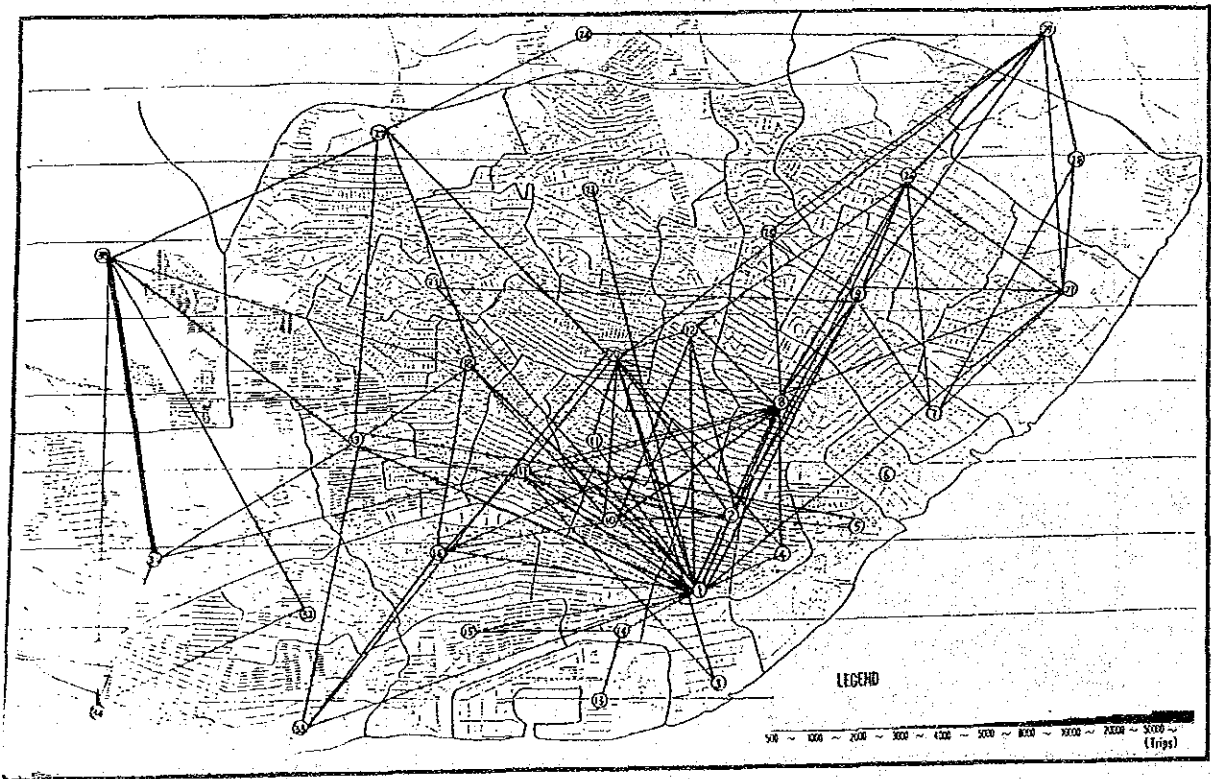


Fig. G-3-4 OD Pattern in 2000 (Business)

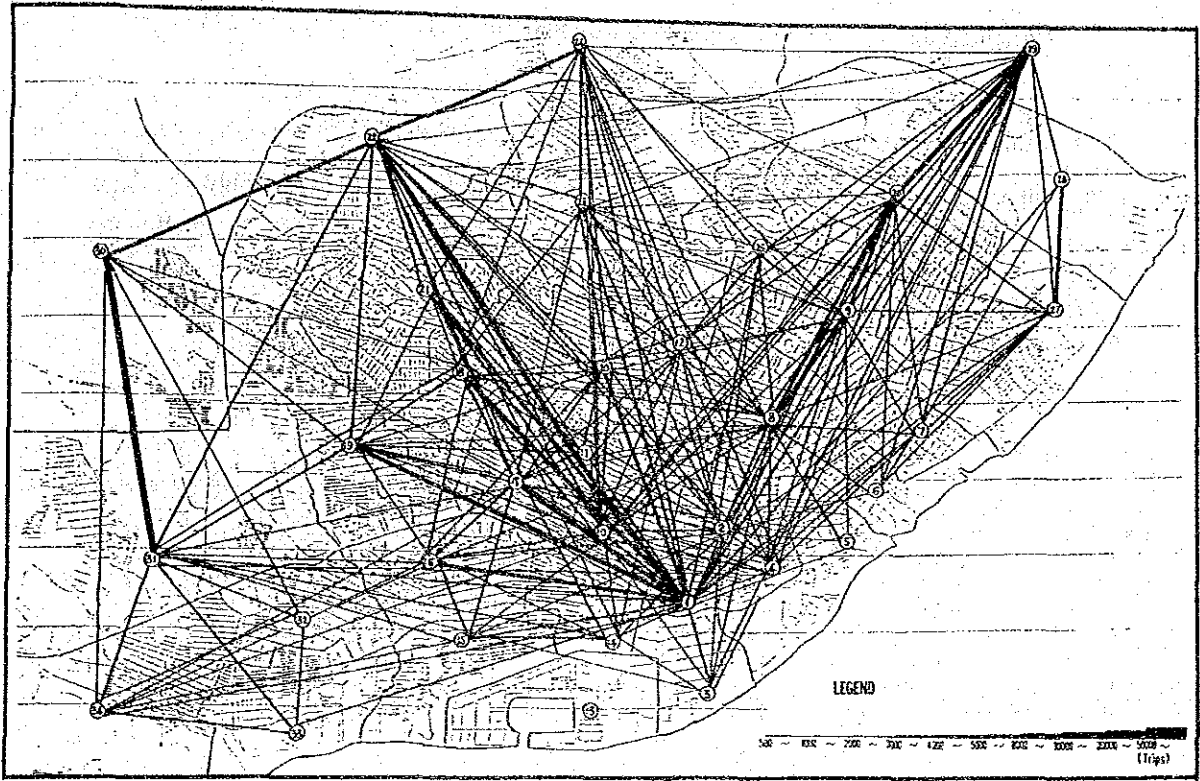


Fig. G-3-5 OD Pattern in 2000 (Private)

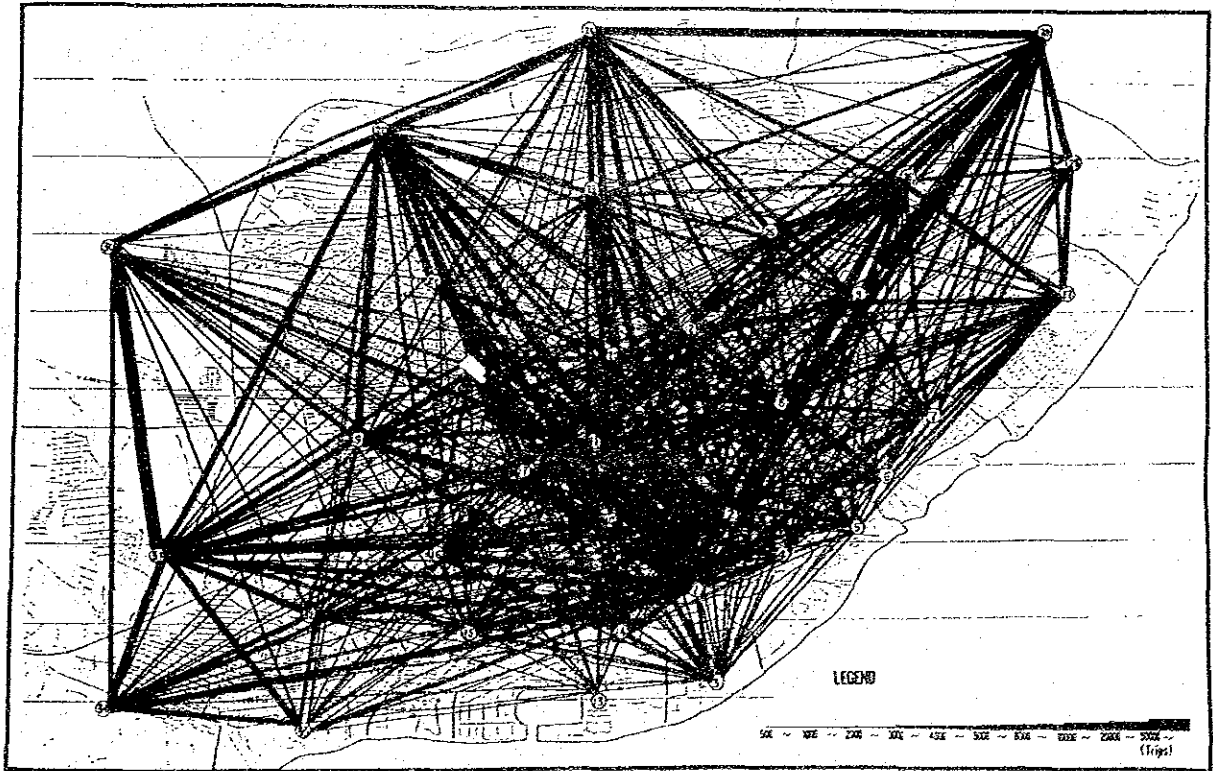


Fig. G-3-6 OD Pattern in 2000 (Home)

Appendix H-1 ESTIMATION OF BENEFITS BY ALTERNATIVES

The total benefit by each alternative plan is calculated by estimating the savings in the total of vehicle operating costs and travel time costs. Namely it is expressed by the following formula.

$$B = (VDC^{WO} + TC^{WO}) - (VOC^W + TC^W)$$

where, VOC^{WO} : Vehicle Operating Cost in Do Nothing Case
 TC^{WO} : Travel Time Cost in Do Nothing Case
 VOC^W : Vehicle Operating Cost in each alternative case
 TC^W : Travel Time Cost in each alternative case

VOC and TC are expressed by the following equations:

$$VOC = \sum_k RC_k \cdot VL_k + \sum_k FC_k \cdot VT_k$$

where, RC_k : Unit running cost of mode k
 Note : Since the operating cost of the rail transit is counted in the cost stream, it is not included here.
 VL_k : Vehicle km per year of mode k
 FC_k : Unit fixed cost of mode k
 VT_k : Vehicle time per year of mode k

$$TC = \sum_k V \cdot T_k$$

where, V : Unit time value of passengers
 T_k : Total passenger time of mode k
 Note (1) In the case with a rail transit, the passengers of the rail are taken into account.
 (2) Only the trips for work and business are considered.

As a calculation result, the total benefits in 2000 by each case are obtained as shown in Table H-1-1.

Table H-1-1 Vehicle Cost and Time Cost in 2000

CASE	Vehicle Operating Cost		Travel Time Cost		Total Cost	Benefit
	Running Cost	Fixed Cost	Vehicle	Rail Transit		
	Do nothing	15,321	18,042	11,287			—	44,650	—
Alternative 1	14,485	15,564	4,133	—	34,181	10,181
Alternative 2	14,583	14,756	4,006	—	33,345	11,305
Alternative 3	14,782	14,194	3,770	—	32,746	11,904
Alternative 4	13,374	13,113	2,905	382	29,774	14,876
Alternative 5	13,546	12,441	2,763	378	29,146	15,504

The benefits generated in each year are estimated in the following manner.

Firstly, the total costs of VOC and TC in 1983, 1990, 2000 for Do Nothing Case are estimated (Points A, B, C).

Since the implementation of the projects is assumed to be started in 1986, the benefits accrued from the projects in 1986 are zero, the total cost of VOC and TC for an alternative plan in 1986 corresponds with that of Do Nothing Case (Point D).

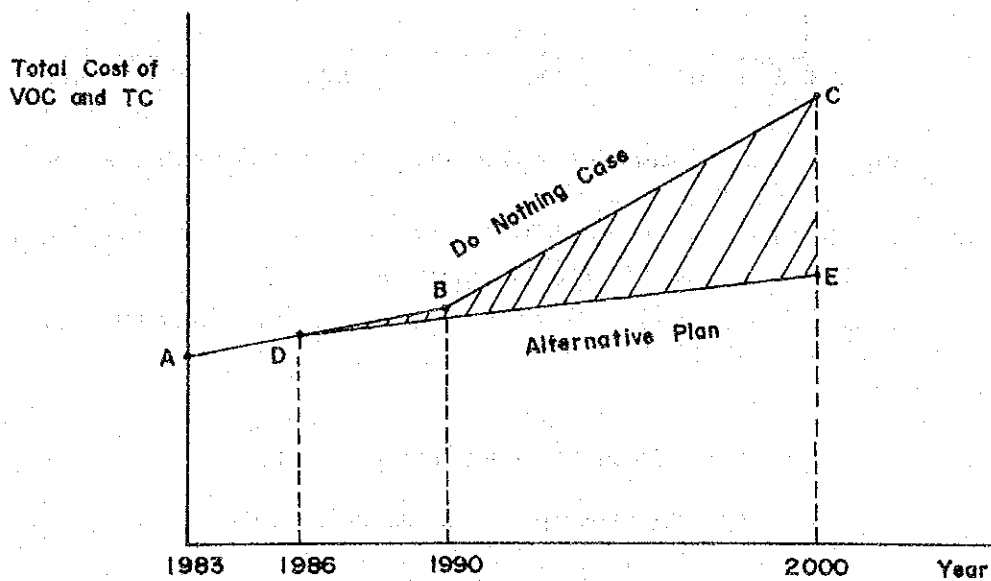


Fig. H-1-1 Estimation of Benefits by Year for Alternatives 1-3

Assuming that the total cost of VOC and TC grows in a linear line for the years from 1986 to 2000, the benefit for each year is expressed by the shaded area in Fig. H-1-1.

In the case of Alternatives 4 and 5, the construction schedule of the rail transit system is assumed as follows:

- 1988 – 1991 Engineering and Land Acquisition
- 1992 – 1995 Construction and Purchase of Rolling Stocks

Therefore, the benefits may have a sudden jump up in 1996 owing to the effects of the rail transit, as shown in Fig. H-1-2.

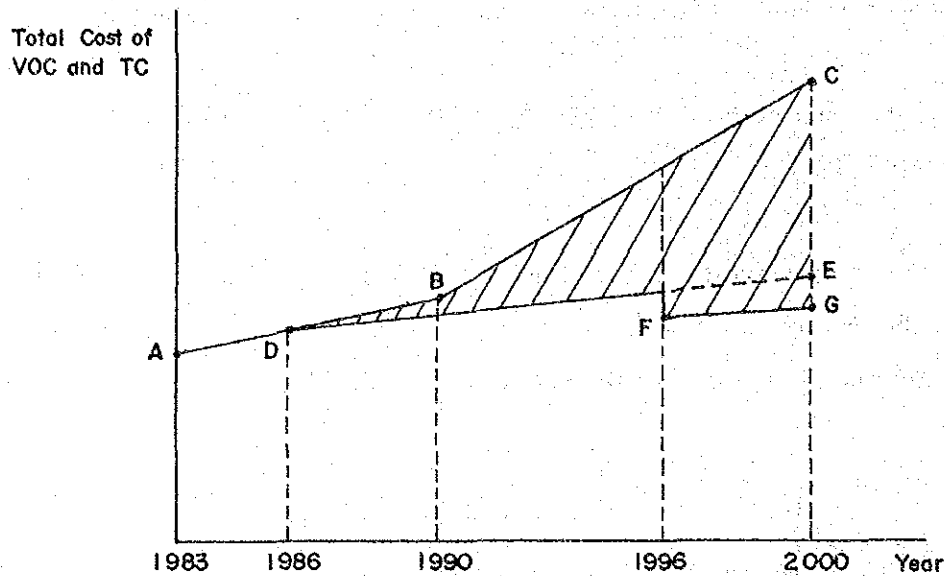


Fig. H-1-2 Estimation of Benefits by Year for Alternatives 4 and 5

Note E: The total costs of VOC & TC for the cases 4 or 5 without a rail transit.
 G: The total costs of VOC & TC for the cases 4 or 5.
 The growth rate from F to G is assumed to be 3.8% per annum which is the growth rate of traffic demand.

Construction Schedule of Rail Transit System

The construction cost for the rail transit is as follows:

Year	Million pesos at 1984 prices	
1988	177	↑ Engineering and Land Acquisition ↓
1989	177	
1990	177	
1991	177	
1992	4,944	↑ Construction Rolling Stocks ↓
1993	4,944	
1994	7,846	
1995	17,158	

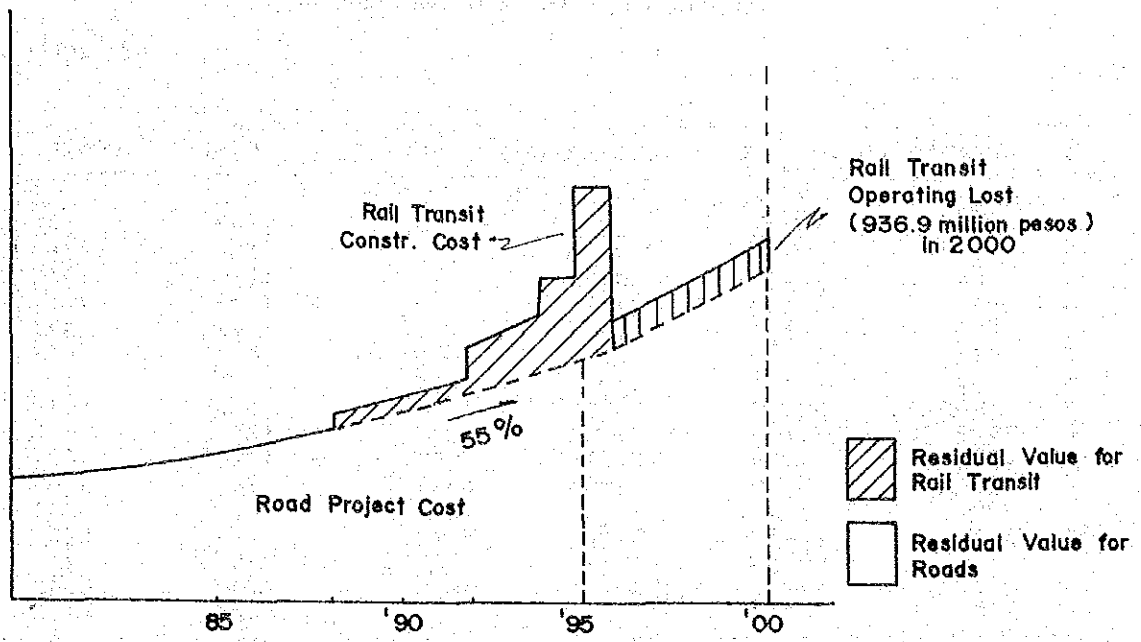


Fig. H-1-3 Project Cost for Alternatives 4 and 5

Appendix H-2

Table H-2-1 (1) Evaluation Results

CASE: ALTERNATIVE I

NO.	YEAR	DO NOTHING	ALTERNATIVE	BENEFIT	COST	BENEFIT-COST
1	1985	15100	15100	0	0	0
2	1986	16378	16378	0	1127	-1127
3	1987	17657	17650	7	1189	-1183
4	1988	18935	18922	13	1255	-1242
5	1989	20213	20193	20	1324	-1304
6	1990	21491	21465	26	1397	-1371
7	1991	23807	22737	1070	1474	-403
8	1992	26123	24008	2114	1555	560
9	1993	28438	25280	3158	1640	1518
10	1994	30754	26552	4203	1730	2472
11	1995	33070	27823	5247	1825	3421
12	1996	35386	29095	6291	1926	4365
13	1997	37702	30366	7335	2032	5303
14	1998	40017	31638	8379	2144	6236
15	1999	42333	32910	9423	2261	7162
16	2000	44649	34181	10468	2386	8082
17	2001	0	0	0	-15123	15123
TOTAL		478419	420665	57754	10141	47612

NPV= 6847.3
 B/C= 1.98
 IRR= 24.15 (%)

CASE: ALTERNATIVE II

NO.	YEAR	DO NOTHING	ALTERNATIVE	BENEFIT	COST	BENEFIT-COST
1	1985	15100	15100	0	0	0
2	1986	16378	16378	0	1141	-1141
3	1987	17657	17597	59	1204	-1145
4	1988	18935	18817	118	1270	-1152
5	1989	20213	20036	177	1340	-1163
6	1990	21491	21255	236	1414	-1177
7	1991	23807	22474	1333	1491	-158
8	1992	26123	23693	2430	1573	856
9	1993	28438	24912	3527	1660	1867
10	1994	30754	26131	4623	1751	2872
11	1995	33070	27350	5720	1848	3872
12	1996	35386	28569	6817	1949	4868
13	1997	37702	29788	7914	2056	5857
14	1998	40017	31007	9010	2170	6841
15	1999	42333	32226	10107	2289	7818
16	2000	44649	33445	11204	2415	8789
17	2001	0	0	0	-16486	16486
TOTAL		956838	415143	63276	9086	54190

NPV= 8527.0
 B/C= 2.24
 IRR= 26.91 (%)

Table H-2-1 (2) Evaluation Results

CASE: ALTERNATIVE III

NO.	YEAR	DO NOTHING	ALTERNATIVE	BENEFIT	COST	BENEFIT-COST
1	1985	15100	15100	0	0	0
2	1986	16378	16378	0	1125	-1125
3	1987	17657	17541	116	1187	-1071
4	1988	18935	18703	232	1252	-1020
5	1989	20213	19865	348	1321	-973
6	1990	21491	21027	464	1394	-930
7	1991	23807	22190	1617	1470	147
8	1992	26123	23352	2771	1551	1220
9	1993	28438	24514	3924	1636	2288
10	1994	30754	25676	5078	1726	3351
11	1995	33070	26839	6231	1821	4410
12	1996	35386	28001	7385	1921	5463
13	1997	37702	29163	8538	2027	6511
14	1998	40017	30325	9692	2139	7553
15	1999	42333	31488	10845	2256	8589
16	2000	44649	32650	11999	2380	9619
17	2001	0	0	0	-16424	16424
TOTAL		478419	409180	69239	8783	60456

NPV= 10370.4
 B/C= 2.53
 IRR= 30.41 (%)

CASE: ALTERNATIVE IV

NO.	YEAR	DO NOTHING	ALTERNATIVE	BENEFIT	COST	BENEFIT-COST
1	1985	15100	15100	0	0	0
2	1986	16378	16378	0	1127	-1127
3	1987	17657	17650	7	1189	-1183
4	1988	18935	18922	13	1432	-1419
5	1989	20213	20193	20	1501	-1481
6	1990	21491	21465	26	1574	-1548
7	1991	23807	22737	1070	1651	-580
8	1992	26123	24008	2114	6499	-4384
9	1993	28438	25280	3158	6584	-3426
10	1994	30754	26552	4203	9576	-5374
11	1995	33070	27823	5247	18983	-13737
12	1996	35386	25299	10087	2791	7296
13	1997	37702	26426	11276	2915	8361
14	1998	40017	27548	12470	3044	9425
15	1999	42333	28664	13669	3180	10489
16	2000	44649	29774	14875	3323	11552
17	2001	0	0	0	-42110	42110
TOTAL		478419	400186	78234	23259	54975

NPV= 2436.3
 B/C= 1.16
 IRR= 14.61 (%)

Table H-2-1 (3) Evaluation Results

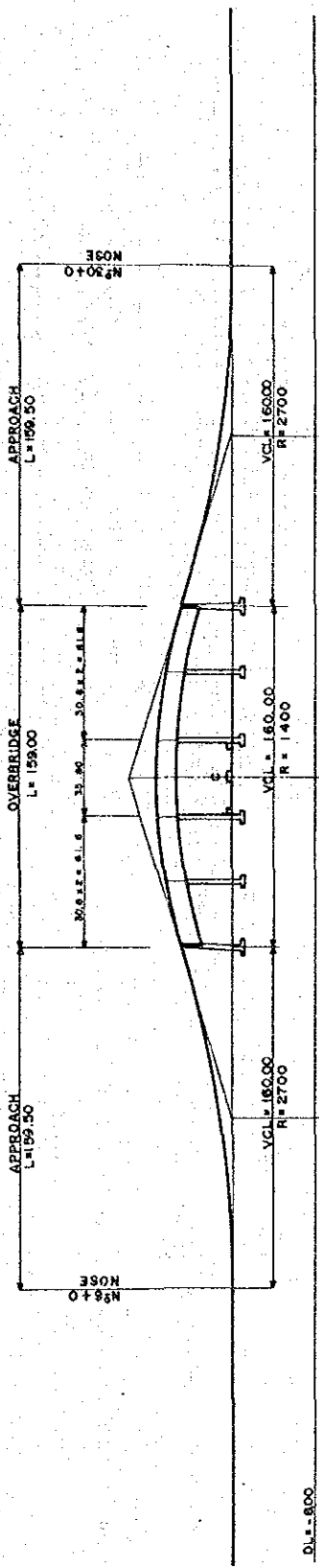
CASE: ALTERNATIVE V

NO.	YEAR	DO NOTHING	ALTERNATIVE	BENEFIT	COST	BENEFIT-COST
1	1985	15100	15100	0	0	0
2	1986	16378	16378	0	1125	-1125
3	1987	17657	17548	109	1187	-1078
4	1988	18935	18717	218	1429	-1211
5	1989	20213	19886	327	1498	-1171
6	1990	21491	21055	436	1570	-1134
7	1991	23807	22224	1583	1647	-64
8	1992	26123	23393	2729	6495	-3766
9	1993	28438	24562	3876	6580	-2704
10	1994	30754	25731	5023	9572	-4549
11	1995	33070	26901	6169	18979	-12810
12	1996	35386	24969	10417	2787	7630
13	1997	37702	26020	11682	2910	8772
14	1998	40017	27067	12951	3039	9912
15	1999	42333	28109	14224	3175	11050
16	2000	44649	29146	15503	3317	12186
17	2001	0	0	0	-43410	43410
TOTAL		956838	393172	85247	21901	63347

NPV= 4980.9
 B/C= 1.32
 IRR= 17.66 (%)

Appendix I-1

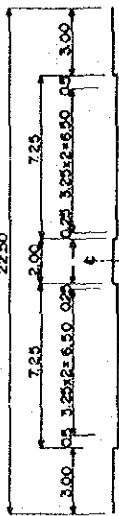
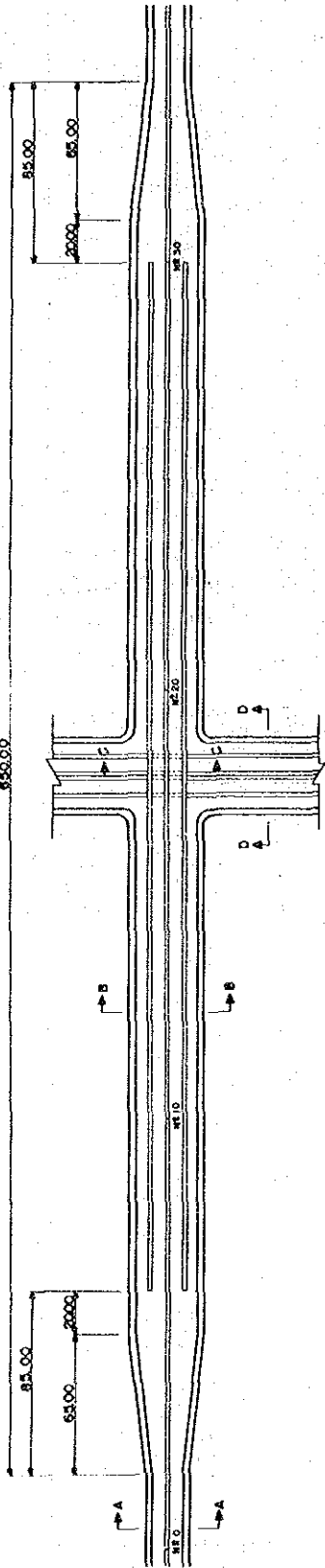
PROFILE SCALE: H=1:2000
V=1:400



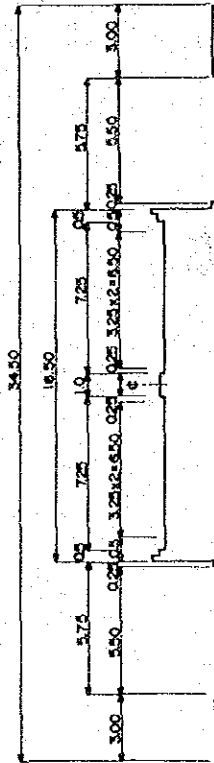
STATION	UNIT DISTANCE	PROPOSED HEIGHT	ACCUMULATE DISTANCE	GRADE
N ⁺ 0+0	0	0	0	0
N ⁺ 1+0	20	20	20	0
N ⁺ 2+0	20	40	40	0
N ⁺ 3+0	20	60	60	0
N ⁺ 4+0	20	80	80	0
N ⁺ 5+0	20	100	100	0
N ⁺ 6+0	20	120	120	0
N ⁺ 7+0	20	140	140	0.075
N ⁺ 8+0	20	160	160	0.030
N ⁺ 9+0	20	180	180	0.075
N ⁺ 10+0	20	200	200	1.20
N ⁺ 11+0	20	220	220	4.075
N ⁺ 12+0	20	240	240	2.70
N ⁺ 13+0	20	260	260	3.875
N ⁺ 14+0	20	280	280	4.005
N ⁺ 15+0	20	300	300	4.20
N ⁺ 16+0	20	320	320	4.475
N ⁺ 17+0	20	340	340	4.75
N ⁺ 18+0	20	360	360	5.00
N ⁺ 19+0	20	380	380	5.25
N ⁺ 20+0	20	400	400	5.55
N ⁺ 21+0	20	420	420	5.85
N ⁺ 22+0	20	440	440	6.15
N ⁺ 23+0	20	460	460	6.45
N ⁺ 24+0	20	480	480	6.75
N ⁺ 25+0	20	500	500	7.05
N ⁺ 26+0	20	520	520	7.35
N ⁺ 27+0	20	540	540	7.65
N ⁺ 28+0	20	560	560	7.95
N ⁺ 29+0	20	580	580	8.25
N ⁺ 30+0	20	600	600	8.55
N ⁺ 31+0	20	620	620	8.85
N ⁺ 32+0	20	640	640	9.15
N ⁺ 33+0	20	660	660	9.45
N ⁺ 34+0	20	680	680	9.75
N ⁺ 35+0	20	700	700	10.05
N ⁺ 36+0	20	720	720	10.35
N ⁺ 37+0	20	740	740	10.65
N ⁺ 38+0	20	760	760	10.95
N ⁺ 39+0	20	780	780	11.25

Fig. I-1-1 Bridge Plan for Overpassing Circumlar (1)

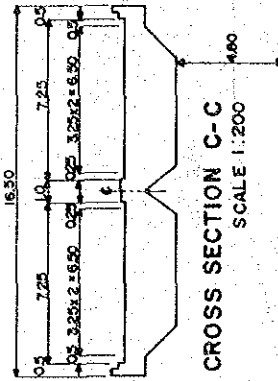
PLAN SCALE 1:2000



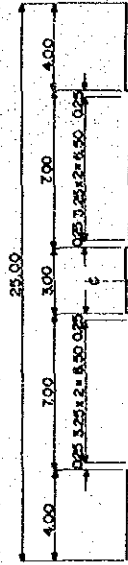
CROSS SECTION A-A
SCALE 1:200



CROSS SECTION B-B
SCALE 1:200

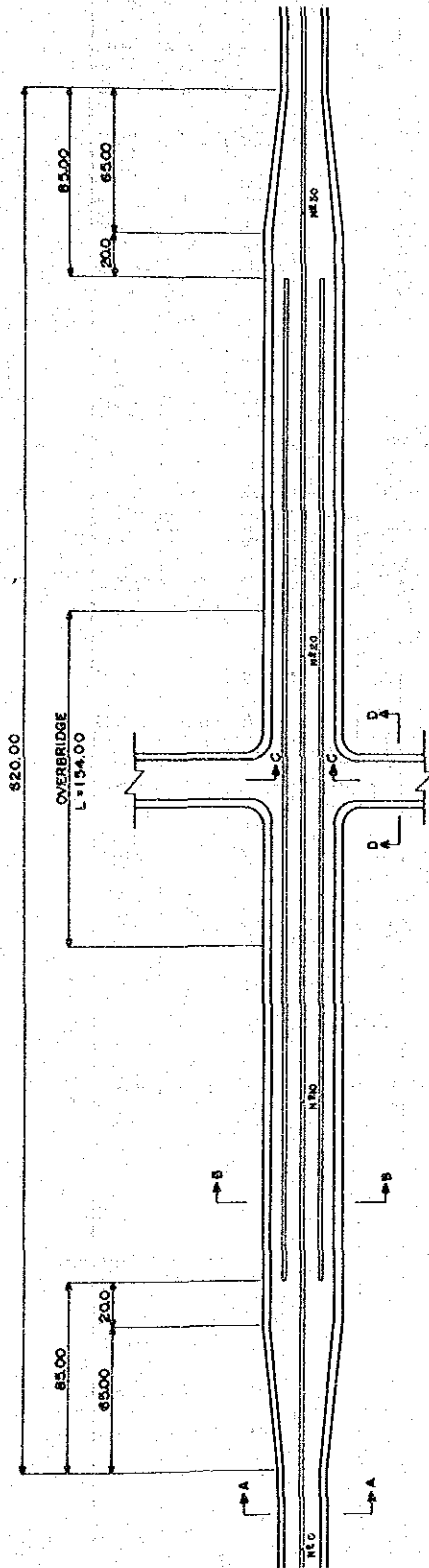


CROSS SECTION C-C
SCALE 1:200

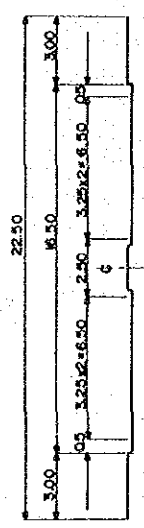


CROSS SECTION D-D
SCALE 1:200

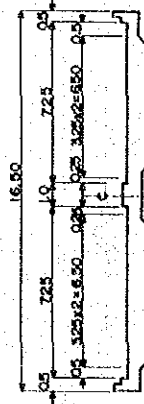
Fig I-1-2 Bridge Plan for Overpassing Circunvalar (2)



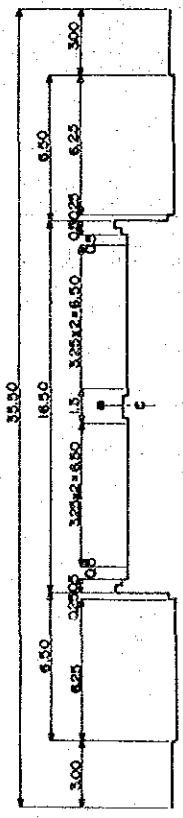
PLAN SCALE 1:2000



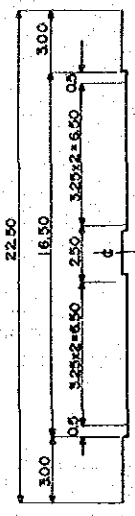
CROSS SECTION A - A
SCALE 1:200



CROSS SECTION C - C
SCALE 1:200



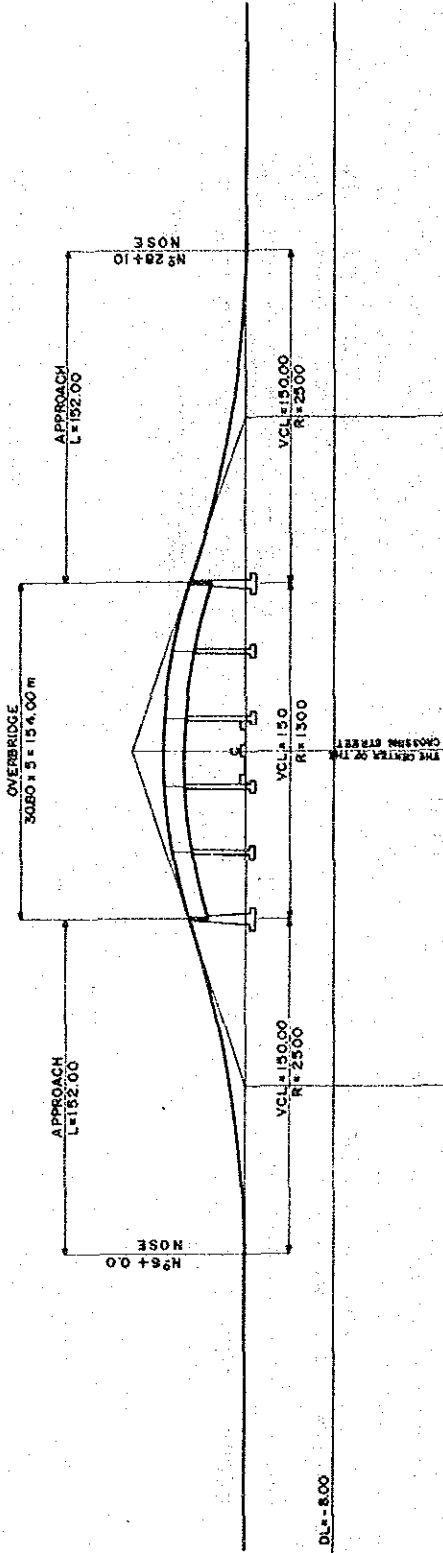
CROSS SECTION B - B
SCALE 1:200



CROSS SECTION D - D
SCALE 1:200

Fig. I-1-3 (1) Typical Overbridge Plan

PROFILE SCALE: H=1:2000
V=1:400



GRADE	Level	Level	Level	Level	Level
PROPOSED HEIGHT	0.00	0.00	0.00	0.00	0.00
ACCUMULATE DISTANCE	0.00	0.00	0.00	0.00	0.00
UNIT DISTANCE	0.00	0.00	0.00	0.00	0.00
STATION	0+00	0+20	0+40	0+60	0+80
	0+100	0+120	0+140	0+160	0+180
	0+200	0+220	0+240	0+260	0+280
	0+300	0+320	0+340	0+360	0+380
	0+400	0+420	0+440	0+460	0+480
	0+500	0+520	0+540	0+560	0+580
	0+600	0+620	0+640	0+660	0+680
	0+700	0+720	0+740	0+760	0+780
	0+800	0+820	0+840	0+860	0+880
	0+900	0+920	0+940	0+960	0+980
	1+000	1+020	1+040	1+060	1+080
	1+100	1+120	1+140	1+160	1+180
	1+200	1+220	1+240	1+260	1+280
	1+300	1+320	1+340	1+360	1+380
	1+400	1+420	1+440	1+460	1+480
	1+500	1+520	1+540	1+560	1+580
	1+600	1+620	1+640	1+660	1+680
	1+700	1+720	1+740	1+760	1+780
	1+800	1+820	1+840	1+860	1+880
	1+900	1+920	1+940	1+960	1+980
	2+000	2+020	2+040	2+060	2+080
	2+100	2+120	2+140	2+160	2+180
	2+200	2+220	2+240	2+260	2+280
	2+300	2+320	2+340	2+360	2+380
	2+400	2+420	2+440	2+460	2+480
	2+500	2+520	2+540	2+560	2+580
	2+600	2+620	2+640	2+660	2+680
	2+700	2+720	2+740	2+760	2+780
	2+800	2+820	2+840	2+860	2+880
	2+900	2+920	2+940	2+960	2+980
	3+000	3+020	3+040	3+060	3+080
	3+100	3+120	3+140	3+160	3+180
	3+200	3+220	3+240	3+260	3+280
	3+300	3+320	3+340	3+360	3+380
	3+400	3+420	3+440	3+460	3+480
	3+500	3+520	3+540	3+560	3+580
	3+600	3+620	3+640	3+660	3+680
	3+700	3+720	3+740	3+760	3+780
	3+800	3+820	3+840	3+860	3+880
	3+900	3+920	3+940	3+960	3+980
	4+000	4+020	4+040	4+060	4+080
	4+100	4+120	4+140	4+160	4+180
	4+200	4+220	4+240	4+260	4+280
	4+300	4+320	4+340	4+360	4+380
	4+400	4+420	4+440	4+460	4+480
	4+500	4+520	4+540	4+560	4+580
	4+600	4+620	4+640	4+660	4+680
	4+700	4+720	4+740	4+760	4+780
	4+800	4+820	4+840	4+860	4+880
	4+900	4+920	4+940	4+960	4+980
	5+000	5+020	5+040	5+060	5+080
	5+100	5+120	5+140	5+160	5+180
	5+200	5+220	5+240	5+260	5+280
	5+300	5+320	5+340	5+360	5+380
	5+400	5+420	5+440	5+460	5+480
	5+500	5+520	5+540	5+560	5+580
	5+600	5+620	5+640	5+660	5+680
	5+700	5+720	5+740	5+760	5+780
	5+800	5+820	5+840	5+860	5+880
	5+900	5+920	5+940	5+960	5+980
	6+000	6+020	6+040	6+060	6+080
	6+100	6+120	6+140	6+160	6+180
	6+200	6+220	6+240	6+260	6+280
	6+300	6+320	6+340	6+360	6+380
	6+400	6+420	6+440	6+460	6+480
	6+500	6+520	6+540	6+560	6+580
	6+600	6+620	6+640	6+660	6+680
	6+700	6+720	6+740	6+760	6+780
	6+800	6+820	6+840	6+860	6+880
	6+900	6+920	6+940	6+960	6+980
	7+000	7+020	7+040	7+060	7+080
	7+100	7+120	7+140	7+160	7+180
	7+200	7+220	7+240	7+260	7+280
	7+300	7+320	7+340	7+360	7+380
	7+400	7+420	7+440	7+460	7+480
	7+500	7+520	7+540	7+560	7+580
	7+600	7+620	7+640	7+660	7+680
	7+700	7+720	7+740	7+760	7+780
	7+800	7+820	7+840	7+860	7+880
	7+900	7+920	7+940	7+960	7+980
	8+000	8+020	8+040	8+060	8+080
	8+100	8+120	8+140	8+160	8+180
	8+200	8+220	8+240	8+260	8+280
	8+300	8+320	8+340	8+360	8+380
	8+400	8+420	8+440	8+460	8+480
	8+500	8+520	8+540	8+560	8+580
	8+600	8+620	8+640	8+660	8+680
	8+700	8+720	8+740	8+760	8+780
	8+800	8+820	8+840	8+860	8+880
	8+900	8+920	8+940	8+960	8+980
	9+000	9+020	9+040	9+060	9+080
	9+100	9+120	9+140	9+160	9+180
	9+200	9+220	9+240	9+260	9+280
	9+300	9+320	9+340	9+360	9+380
	9+400	9+420	9+440	9+460	9+480
	9+500	9+520	9+540	9+560	9+580
	9+600	9+620	9+640	9+660	9+680
	9+700	9+720	9+740	9+760	9+780
	9+800	9+820	9+840	9+860	9+880
	9+900	9+920	9+940	9+960	9+980
	10+000	10+020	10+040	10+060	10+080
	10+100	10+120	10+140	10+160	10+180
	10+200	10+220	10+240	10+260	10+280
	10+300	10+320	10+340	10+360	10+380
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	11+900	11+920	11+940	11+960	11+980
	12+000	12+020	12+040	12+060	12+080
	12+100	12+120	12+140	12+160	12+180
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	12+400	12+420	12+440	12+460	12+480
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	13+000	13+020	13+040	13+060	13+080
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	13+700	13+720	13+740	13+760	13+780
	13+800	13+820	13+840	13+860	13+880
	13+900	13+920	13+940	13+960	13+980
	14+000	14+020	14+040	14+060	14+080
	14+100	14+120	14+140	14+160	14+180
	14+200	14+220	14+240	14+260	14+280
	14+300	14+320	14+340	14+360	14+380
	14+400	14+420	14+440	14+460	14+480
	14+500	14+520	14+540	14+560	14+580
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	14+700	14+720	14+740	14+760	14+780
	14+800	14+820	14+840	14+860	14+880
	14+900	14+920	14+940	14+960	14+980
	15+000	15+020	15+040	15+060	15+080
	15+100	15+120	15+140	15+160	15+180
	15+200	15+220	15+240	15+260	15+280
	15+300	15+320	15+340	15+360	15+380
	15+400	15+420	15+440	15+460	15+480
	15+500	15+520	15+540	15+560	15+580
	15+600	15+620	15+640	15+660	15+680
	15+700	15+720	15+740	15+760	15+780
	15+800	15+820	15+840	15+860	15+880
	15+900	15+920	15+940	15+960	15+980
	16+000	16+020	16+040	16+060	16+080
	16+100	16+120	16+140	16+160	16+180
	16+200	16+220	16+240	16+260	16+280
	16+300	16+320	16+340	16+360	16+380
	16+400	16+420	16+440	16+460	16+480
	16+500	16+520	16+540	16+560	16+580
	16+600	16+620	16+640	16+660	16+680
	16+700	16+720	16+740	16+760	16+780
	16+800	16+820	16+840	16+860	16+880
	16+900	16+920	16+940	16+960	

Appendix I-2 Cost Estimates for Roads and Drainage Projects

Table I-2-1 Repavement Short Term Plan

Road Name	From	To	Financial Direct Cost (1,000 pesos)				Subtotal
			Repavement Cost		Pavement Cost		
			Concrete	Asphalt	Concrete	Asphalt	
Cra. 54-51B	Via 40	Circunvalar	605.70	1,019.40			1,625.10
Cra. 46	Circunvalar	Calle 3	1,600.00				1,600.00
Cra. 45	Calle 30	Calle 72	1,053.30				1,053.30
Cra. 44	Calle 6	Calle 76	18,167.90				18,167.90
Cra. 43	Calle 3	Diag. 96	9,189.10				9,180.10
Cra. 38	Circunvalar	Terminal	1,837.60	57.97			1,895.60
Calle 6	Caño	Cra. 38	36,276.00				36,276.00
Calle 3	Cra. 45	Cra. 41B	437.90				437.90
Calle 74;22;70C	Via 40	Cra. 16	1,750.00		17,696.60		21,456.60
Cra. 14	Calle 30	Calle 64	20,660.10				20,660.10
Calle 76;77	Cra. 43	Via 40	294.60				294.60
Calle 85;84	Cra. 38	Via 40	980.00	40.10		2,459.30	3,479.40
Calle 45	Cra. 22	Via 40	231.40			291.60	523.00
Cra. 30;27; Calle 760	Calle 17	Circunvalar	4,814.80	13,942.60	8,609.10	6,699.30	34,065.80
Via La Playa	Las Flores	Brisas del Mar		2,782.60		8,374.10	11,156.70
Calle 17;18	Cra. 38	Calle 30	5,742.50				5,742.50
Cra. 30 (Soledad)	Calle 18	La Arboleda	1,764.30				1,764.30
SUBTOTAL							169,387.90

Table I-2-2 New Bridge Construction

Location	Direct Cost	Direct cost by 1,000 pesos
		Remarks
Bypass - Caño de la Ahuyama	149,940.00	
Bypass - Caño Arriba	149,940.00	
Bypass - Caño de los Tramosos	147,000.00	
Bypass - Caño de las Compañías (1)	147,000.00	
Bypass - Caño de las Compañías (2)	147,000.00	
Cra. 22 - Arroyo de Rebolo	39,200.00	
Cra. 64 - Circunvalar	65,856.00	Overpass only
Calle 760 - Circunvalar	61,152.00	Overpass only
Calle 45 - Circunvalar	120,000.00	Interchange bridge
Cra. 38 - Circunvalar	120,000.00	Interchange bridge
Subtotal	1,147,088.00	
Cra. 38 - Caño	25,480.00	Improvement bridge
Calle 6 - Caño	33,600.00	Improvement bridge
Subtotal	59,080.00	
Circunvalar - Parque Muvdi	5,610.40	Pedestrian overpass
Circunvalar - Estadio Metropolitano	5,610.40	Pedestrian overpass
Circunvalar - Calle 450	5,610.40	Pedestrian overpass
Circunvalar - El Pueblo	5,610.40	Pedestrian overpass
Circunvalar - Los Olivos	5,610.40	Pedestrian overpass
Subtotal	28,052.00	

Table I-2-3 Road Project Cost

* Cost by Million pesos

			Total Construction Cost	Land Cost	Compensation Cost
1	C01	Bypass I	1,921.2	258.0	0
2	C02	Bypass II	1,525.2	161.1	0
3	C03	Cra. 46	296.8	16.5	0
4	C04	Calle 17	397.5	93.6	0
5	C05	Vía Caracol I	560.6	59.3	0
6	C06	Transversal I	158.8	14.0	0
7	C07	Avenida Las Moras	123.2	10.5	0
8	C08	Transversal II	111.1	2.8	0
9	C09	V. Central Abastos	386.1	23.6	0
10	C10	Calle 450 Ext.	92.1	12.1	0
11	C11	Calle 45 Ext.	1,616.1	17.7	0
12	C12	Carretera Metro	3,739.1	46.7	0
13	C13	Anillo Rural	1,273.6	81.0	0
14	C14	Transversal Rural	569.2	39.2	0
15	I01	Calle 30 I	398.8	165.1	812.7
16	I02	Calle 30 II	301.1	0.0	0
17	I03	Circunvalar I	670.3	0.0	0
18	I04	Circunvalar II	454.9	0.0	0
19	I05	Circunvalar III	660.9	0.0	0
20	I06	Circunvalar IV	1,099.8	0.0	0
21	I07	Vía 40	414.5	0.0	0
22	I08	Cra. 22 I	234.8	44.6	130.0
23	I09	Cra. 22 II	273.4	35.4	123.7
24	I10	Avenida Arenosa I	437.7	70.1	516.6
25	I11	Avenida Arenosa II	169.0	29.5	145.1
26	I12	Vía Caracol II	83.0	24.2	43.7
27	I13	Vía Soledad 2000	237.5	80.0	0
28	I14	Ac. Pte. Pumarejo	128.9	8.0	0
29	I15	Calle 45D I	586.7	69.1	606.8
30	I16	Avenida Arenosa III	177.8	14.7	681.7
31	I17	Calle 45D II	364.8	10.4	129.7
32	I18	Cra. 26 - Calle 76D	306.8	0.0	0
33	I19	Cra. 38	170.2	7.5	12.8
34	I20	Cra. 38 Oc.	972.9	33.8	21.1
35	I21	Cra. 50 - Cra. 54	404.2	79.8	810.2
36	I22	Cra. 54 - Cra. 51B	229.2	0.0	0
37	I23	Cra. 60 - Cra. 64	706.6	25.0	0
38	I24	Carretera Oriental	258.1	0.0	0
39	I25	Cra. 46 Abajo	132.6	13.2	39.1
		TOTAL	22,645.1	1,546.5	4,073.2
					28,264.8

The costs of the projects C05; C06; C07; C08 were increased because of drainage system.

The cost of the project C09 was done for 4 lanes, it is decreased for a 2 lanes.

The land costs were adjusted.

I25: Additional improvement project of Cra. 46 to 6 lanes from Vía 40 to Calle 45.

Table I-2-4 Arroyo Countermeasure Facility

Direct Cost by 1,000 pesos		
	Direct Cost	Remarks
Arroyo Project I	82,551.30	Short term plan
Arroyo Project II	97,820.35	Short term plan
Arroyo Project III	12,389.71	Short term plan
Arroyo Project IV	15,393.98	Short term plan
Subtotal	208,155.30	
Arroyo Project V	64,727.30	Long term plan
Arroyo Project VI	5,603.30	Long term plan
Arroyo Project VII	20,590.40	Long term plan
Subtotal	90,381.00	
Arroyo Project VIII	174,169.70	Recommendable
Arroyo Project IX	78,499.00	Recommendable
Arroyo Project X	27,768.30	Recommendable
Arroyo Project XI	20,071.90	Recommendable
Arroyo Project XII	4,131.50	Recommendable
Subtotal	304,640.40	
Total	603,176.70	

Table I-2-5 Arroyo Facility for Central District

Cost by \$1,000		
	Direct Cost	
Parque Universal Reservoir	501,759.90	
Box Culvert of Calle 47	563,197.70	
Subtotal	1,064,957.60	1,064,957.60
Talleres E.P.M. Reservoir	323,251.10	
Box Culvert of Cra. 25	327,645.00	
Subtotal	650,896.10	650,896.10
Cra. 41 Reservoir	235,714.10	
Box Culvert of Calle 59	729,038.00	
Subtotal	964,752.10	964,752.10
Total Direct Cost		2,680,605.80

Table I-2-6 Improvement Plan of the Collectors Streets in Centro

Cost by \$1,000					
Street Name	From	To	Distance (km)	Direct Cost	Compensation Cost
Cra. 40	Calle 40	Calle 45	0.47	24,877.00	1,334.60
Cra. 45	Calle 30	Calle 54	1.66	71,980.30	9,493.30
Calle 37	Cra. 33	Cra. 50	1.60	82,576.70	35,841.00
Calle 38	Cra. 38	Cra. 50	0.70	53,114.60	8,276.00
Calle 44	Cra. 33	Cra. 50	1.40	88,605.80	42,947.70
Subtotal				\$ 321,154.10	\$ 97,892.60

Table I--2--7 Drainage Facility Plan in Central District

		Cost by \$1,000	
Item	Distance (m)	Direct Cost	
1. Gutter type A	64,110	1,907,041.7	
2. Gutter type B	13,780	763,886.7	
3. Box culvert type A	460	35,926.1	
4. Box culvert type B	940	117,084.5	
5. Channel I	140	3,121.7	
6. Channel II	200	6,996.0	
7. Channel III	140	3,899.3	
8. Channel IV	...	...
9. Channel V	160	3,905.0	
10. Channel VI	686	40,557.3	
11. Box culvert I	585	35,088.3	
12. Box culvert II	40	2,436.0	
13. Box culvert III	170	12,399.3	
14. Box culvert IV	145	10,575.9	
15. Box culvert V	75	5,815.1	
16. Box culvert VI	330	30,621.2	
17. Box culvert VII	125	12,461.0	
18. Box culvert VIII	75	7,821.4	
19. Box culvert IX	120	17,053.6	
20. Box culvert X	125	18,809.1	
21. Box culvert XI	40	6,386.7	
Subtotal		\$ 3,001,308.7	

Note: No. 10 (Channel VI), clarified
 Channel IV does not exist, it was replaced by a Box Culvert

Table I--2--8 The Drainage System in Barranquillita

				Cost by \$1,000
Item	Unit	Quantity	Direct Cost	Remarks
Banking in Barranquillita area	M3	543,696.0	556,146.30	Without the area between Riverside Bypass and Rio Magdalena.
Cutting in Barranquillita area	M3	2,486.4	793.16	For filling R1
Cutting in Loma I (R5)	M3	16,936.0	7,563.62	For filling R3
Filling R1	M3	95,305.0	42,887.25	R1 - 2,486.40
Filling R2	M3	66,852.0	30,083.40	
Filling R3	M3	8,054.0	3,624.30	R3 - R5
Filling R4	M3	10,360.0	4,662.00	
Wall Work	LM	528.0	35,602.60	
Channels	ML	3,162.0	168,025.52	Average section 2.5 x 2
Box Culvert I	ML	676.0	155,404.63	
Box Culvert II	ML	282.0	18,841.75	
Subtotal			1,023,634.53	

Table I-2-9 The Collector Streets Network in Barranquillita

Street Name	From	To	No. of Lanes	Distance (Km)	Direct cost	Cost by \$1,000
						Land cost
Calle 4	New street	Cra. 46	2	0.92	74,546.2	48,438.00
Calle 6	Cra. 38	Cra. 46	4	1.30	123,088.8	99,450.00
Calle 7	New street	Via La Loma	4	1.00	109,701.3	54,400.00
Calle 17*	Cra. 36	Cra. 46	4	1.30	241,240.3	89,505.00
Cra. 43	Calle 4	Calle 30	4	0.90	61,681.1	60,750.00
Cra. 45	Calle 4	Calle 30	2	0.90	146,604.1	34,020.00
Cra. 46*	Bypass	Calle 30	4	1.00	184,066.5	76,500.00
New street	Bypass	Calle 17	2	0.926	81,641.0	38,753.10
Via La Loma	Bypass	Calle 17	2	1.65	97,998.8	66,825.0
Subtotal					695,261.2	407,636.10

* They are not included in the subtotal because are considered in the Road Project Network

Table I-2-10 Street Term Road Improvement Cost

Project	Direct Cost	Total Construction Cost	Land Cost	Compensation Cost	Cost by \$1,000
					Subtotal
Repavement Short Term Plan	169,387.90	271,020.60	...	...	271,020.60
Road and Street Projects (including bridges cost)		22,645,100.00	1,546,500.00	4,073,200.00	28,264,800.00
				Subtotal	28,535,820.60
Arroyo Countermeasure Facility	603,176.70	965,082.70	...	...	965,082.70
Arroyo Facility for Central District	2,680,605.80	4,288,969.30	...	...	4,288,969.30
				Subtotal	5,254,052.00
Improvement Plan of the Collector Streets in Centro	321,154.10	513,846.60	...	97,892.60	611,739.20
Drainage Facility Plan in Central District	3,001,308.70	4,802,093.90	...	...	4,802,093.90
				Subtotal	5,413,833.10
The Collector Street Network in Barranquillita	695,261.20	1,112,417.90	407,636.10	...	1,520,054.00
The Drainage System in Barranquillita	1,023,634.50	1,637,815.20	...	...	1,637,815.20
				Subtotal	3,157,869.20
Total Cost					42,361,574.90

The total construction cost is obtained multiplying the direct cost by 1.6.

Appendix J-1 THE GAP BETWEEN LINKED AND UNLINKED TRIPS OF URBAN BUS USERS

— The Problems of Urban Bus Routes —

1) Major Characteristics of Urban Bus Routes at Present

At present, there are 61 urban bus service routes in the city. These routes are composed into 18 integrated bus routes depending upon their route characteristics and their service areas.

Two of the 18 integrated bus routes are the circular type based on the shape of the route (Integrated Route [I.R.] IV, V). Six of the 18 IRs are the linear type (IR III, IX, XI, XV, XVII, XVIII). The rest of the routes are semi-linear types which means that they have a linear type of route between the center and their service area outside the center but within their service area, they have circular routes.

The functions of the semi-linear routes are similar to the linear type route connecting the center and their service areas directly.

In other words, almost all urban bus routes in the metropolitan area of Barranquilla have a radial type of bus route.

2) The Zone-pairs without Bus Service

This study area is divided into 20 zones for the bus transportation analysis (See Fig. J-1-1).

Over-laying the integrated bus routes with the map of zones mentioned above, about 200 zone-pairs have no direct bus service (See Table J-1-1 and Fig. J-1-2).

According to the O-D matrix of bus passengers in 1983, about 200,000 passengers belong to the above-mentioned zone-pairs. In other words, those passengers will need at least two bus trips to arrive at their destinations.

3) The Gap between Linked and Unlinked Trip of Bus Passengers

Based on the differences of the characteristics of linked and unlinked trips, the problems of the bus routes can be identified (See Fig. J-1-3 and Fig. J-1-4).

Comparing two O-D matrices of linked and unlinked trips of bus users, the following items are identified:

- (1) The difference in the total number of both O-D matrices is about 269,000. This means that about 130,000 users must transfer buses two or three times in one trip.
- (2) 70 zone-pairs among 210 zone-pairs have more number of unlinked passengers than that of linked passengers. In the opposite case the number is 134. About 260,000 bus users

who belonged to this latter case must pay double bus tariff to go their destination (See Table J-1-2).

- (3) The distribution of bus passengers who have no direct bus route connecting their origin and destination is shown in Fig. J-1-5 (In this case, these zone-pairs have more linked trips than unlinked trips.) The characteristic patterns of movement for these passengers are as follows: passengers who must pass through the central area of the city, (as almost all bus routes have that as their destination); and passengers moving between zone-pairs located along the Circunvalar.
- (4) The distribution of zone-pairs which have more unlinked trips than the linked trips is shown in Fig. J-1-6. Almost all of the zone-pairs toward the center of the city have more unlinked trips than linked trips. This phenomenon is a reflection of the urban bus route pattern.

* Note: Definition of "Linked" and "Unlinked" Trip

One person trip using one kind of transportation measure is counted as one trip in both cases of linked and unlinked trips.

One person trip using plural types of transport measures, such as walking at first, then bus and again walking between the origin and destination of the trip, is counted as one trip in the case of a linked trip and is counted as three trips in the case of an unlinked trip.

If a person uses two busrides to go to work, this trip is considered to include two bus trips as an unlinked trip. However, in the case of a linked trip existing on this route, it is considered as only one bus trip.