17.5 OD DISTRIBUTION AND FLOW OF DEMAND

17.5.1 OD Tables Developed

- The types of OD tables showing the distribution and flow of demand developed in JUMSUT are listed in Table 17.56.

Table 17.56
List of OD Tables Developed in JUMSUT

Mode	Time Period	Trip Purpose	Person/ Vehicle	Zoning[5] System
Public	Day	By Purpose (5)[3]	Person	217/64/27
	Day	All Purposes	Person	217/64/27
	Morning[2] Peak Hour	All Purposes	Person	217/74/64/27
	Evening[3]	All Purposes	Person	217/64/27
Private	Day	By Purpose (5)[3]	Person	217/64/27
	Day	All Purposes	Person	217/64/27
	Day	All Purposes	By Type[4] of Vehicle(s) (Person)	217/64/27
	Day	All Purposes	By Type[4] of Vehicle(s) (Vehicle)	217/64/27
	Morning[1] Peak Hour	All Purposes	Person	217/64/27
	Morning[1] Peak Hour	All Purposes	Vehicle	217/64/27
	Evening[2] Peak Hour	All Purposes	Person	21;/64/27
	Evening[2] Peak Hour	All Purposes	Vehicle	217/64/27

Source : 1980 HIS

[1] 7:00 to 8:00 a.m.

[2] 17:00 to 18:00 p.m.

[3] 'to work', 'to school', 'private', 'business' and 'to home'.

[4] car/jeep, taxi and truck/others.

[5] includes the external zones.

17.5.2 Movement Within Metro Manila

1) **Inter-block Movement (Demand across Screenlines):**

- The total number of person trips made within Metro Manila by its residents is 10,193,000 linked trips. This comprises 2,722,000 trips or 26.7 percent made by the private mode and the remaining 7,411,000 or 73.3 percent, by the public mode. These movements can be roughly understood from Figure 17.29, which shows inter-block movement divided by screenlines determined in the Screenline Survey. The largest overall movement is seen between the northwest block and northeast block, followed by those between the northwest block and southwest block. The movement by public mode is significant between the northwest block and northeast block and between the northwest and southwest blocks. For the private mode, relative significance is observed between the east and west blocks.

2) **Inter-Municipality Movement**

- The movement within Metro Manila is further shown among municipalities. These are divided into 24 zones, wherein the City of Manila and Quezon City are subdivided into 4 districts each. Although the above movement is fully presented in section 17.5.4, the chracteristics can be better understood by looking at Figure 17.30 through Figure 17.34. Only the first and second largest inter-municipality movement for each zone are shown. The major findings are as follows:

  a) Figure 17.30 indicates that the 2nd and 4th districts of the City of Manila and Makati are major attracting centers of "to work" trips.
  b) Figure 17.31 indicates that the 3rd, 2nd and 4th districts of the City of Manila attract significantly the "to school" trips made by public mode, while Quezon City II is added for trips by private mode.
  c) Figure 17.32 shows that the 2nd and 4th districts of the City of Manila and Quezon III attract significantly trips made by public mode, while Makati and Quezon II are clearly closed-up for trips by private mode.
  d) Figure 17.33 indicates that "business" trips are mainly attracted to the City of Manila, excluding the 1st district; Makati and Quezon II for the trips by public mode, while Makati and the 4th district of the City of Manila are more highlighted for pirvate mode trips.

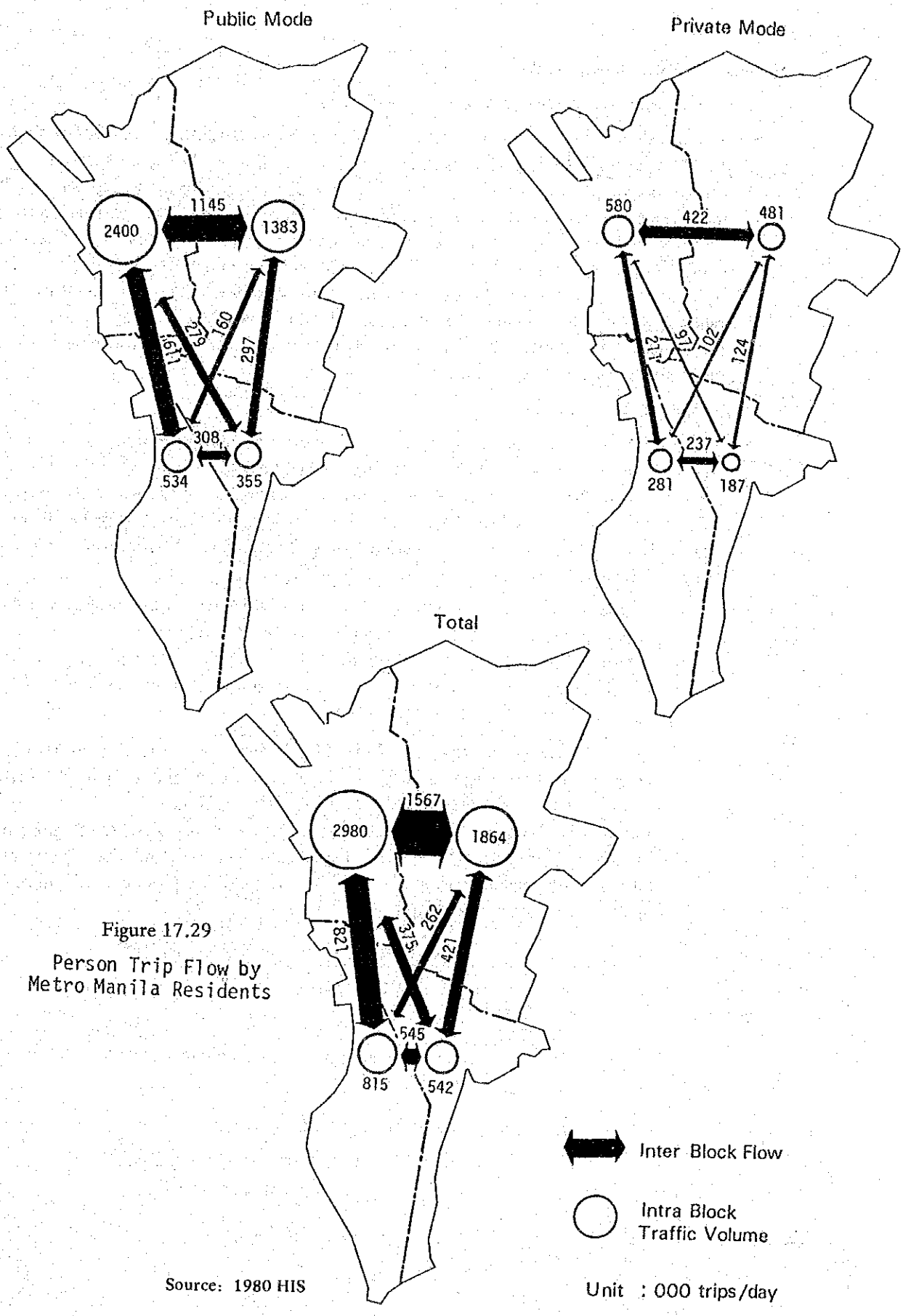


Figure 17.29

Person Trip Flow by Metro Manila Residents

Source: 1980 HIS

Figure 17.30

Major Trip Flow, 'to work'

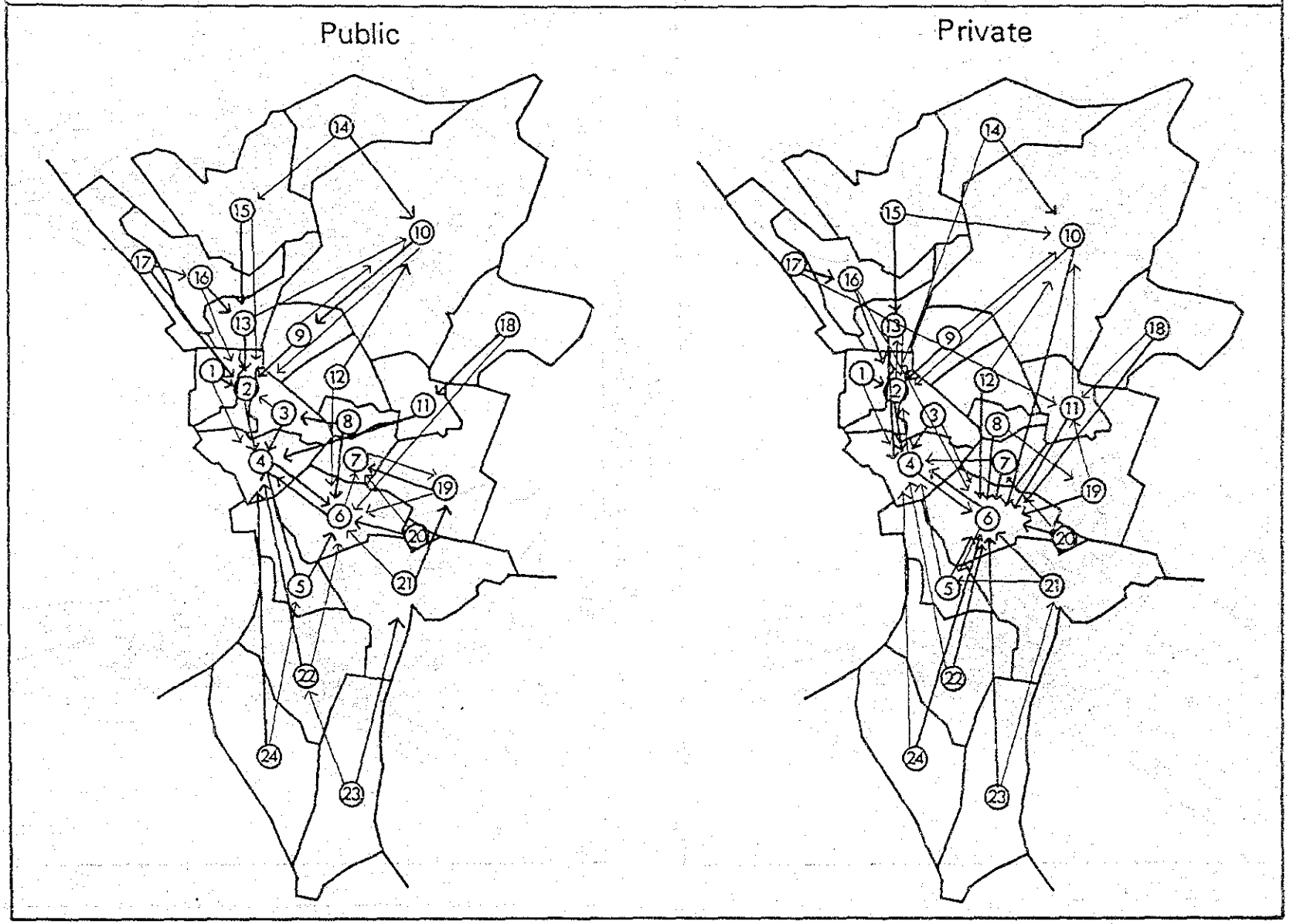


Figure 17.31

Major Trip Flow, 'to school'

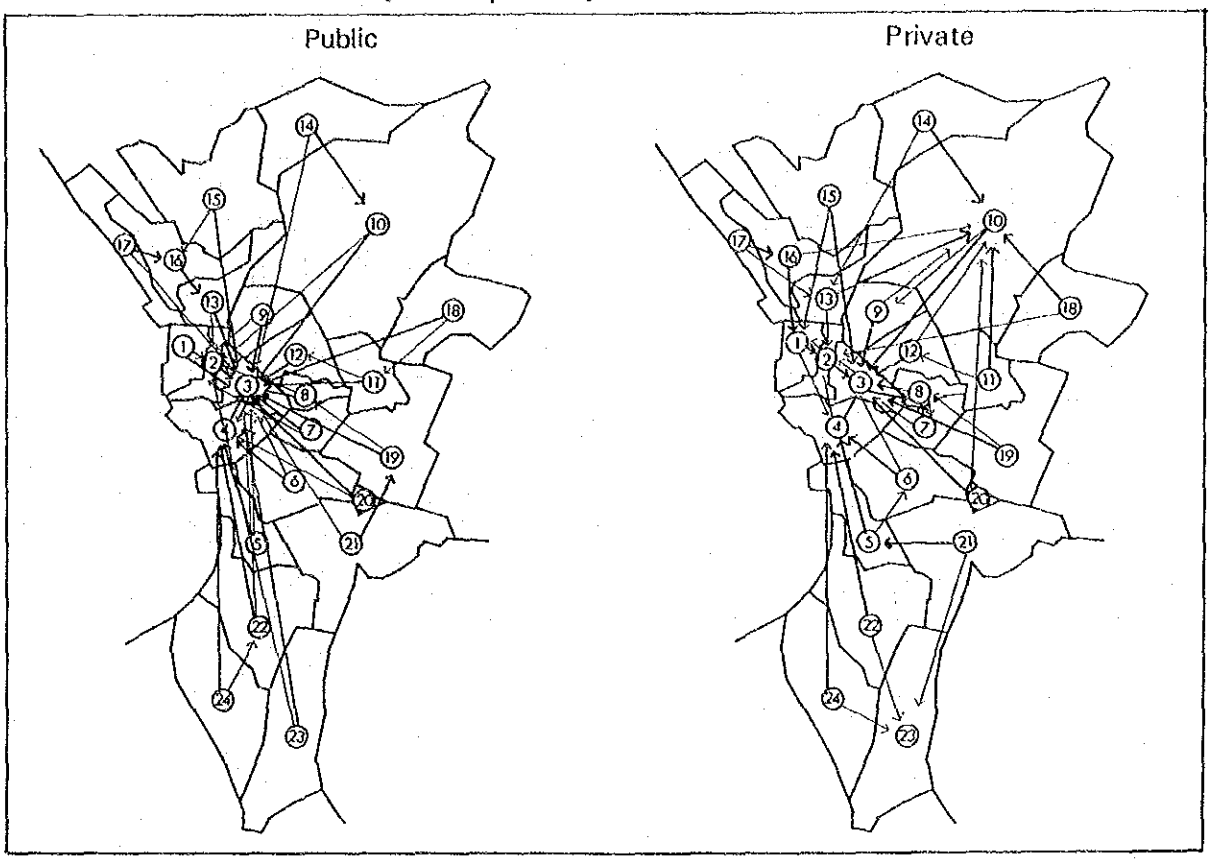


Figure 17.32

Major Trip Flow, 'private'

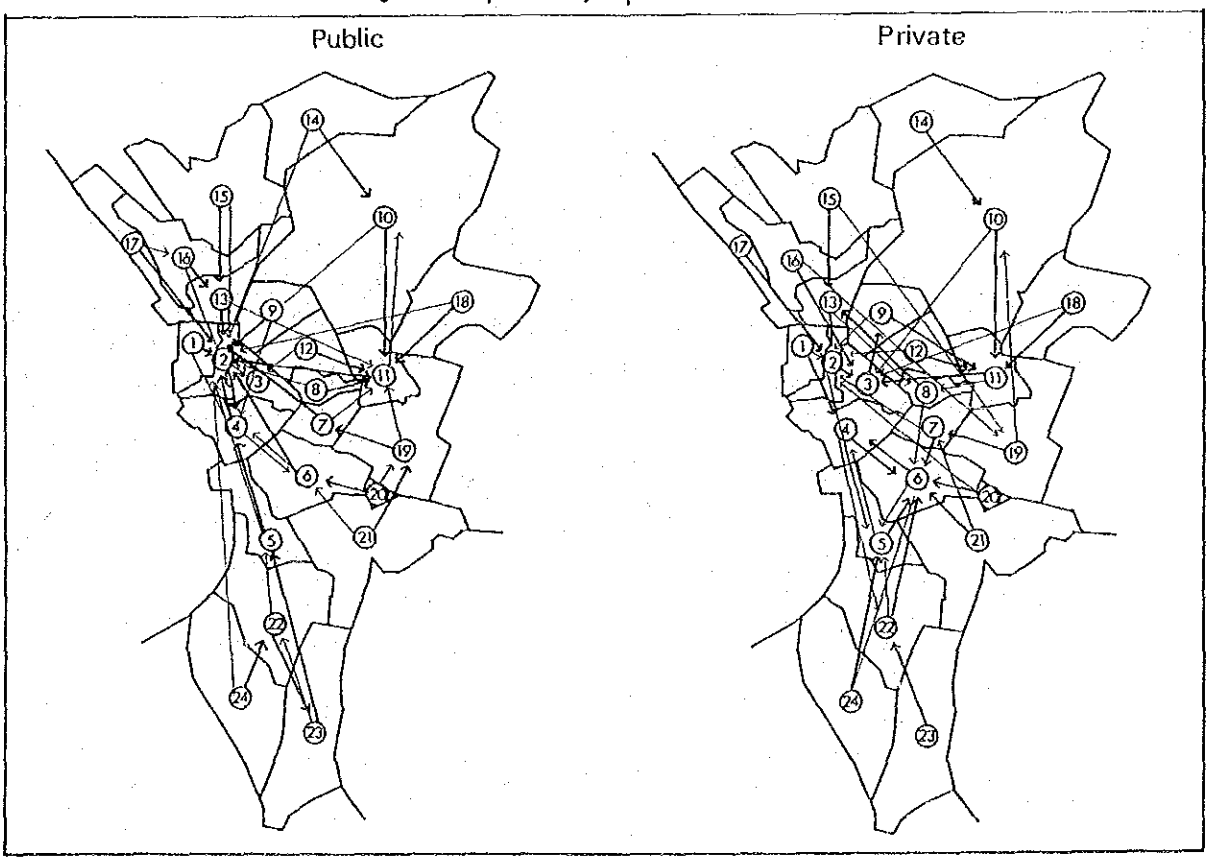


Figure 17.33

Major Trip Flow, 'business'

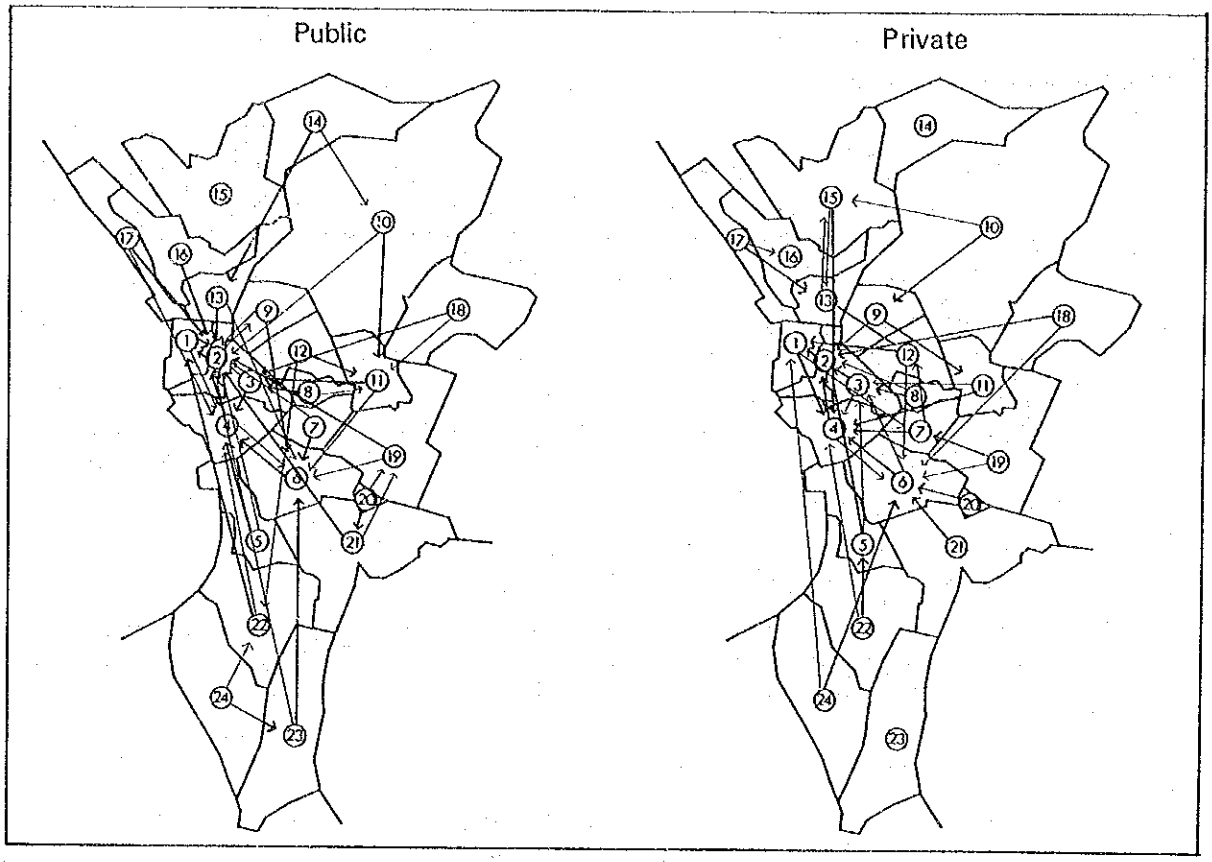
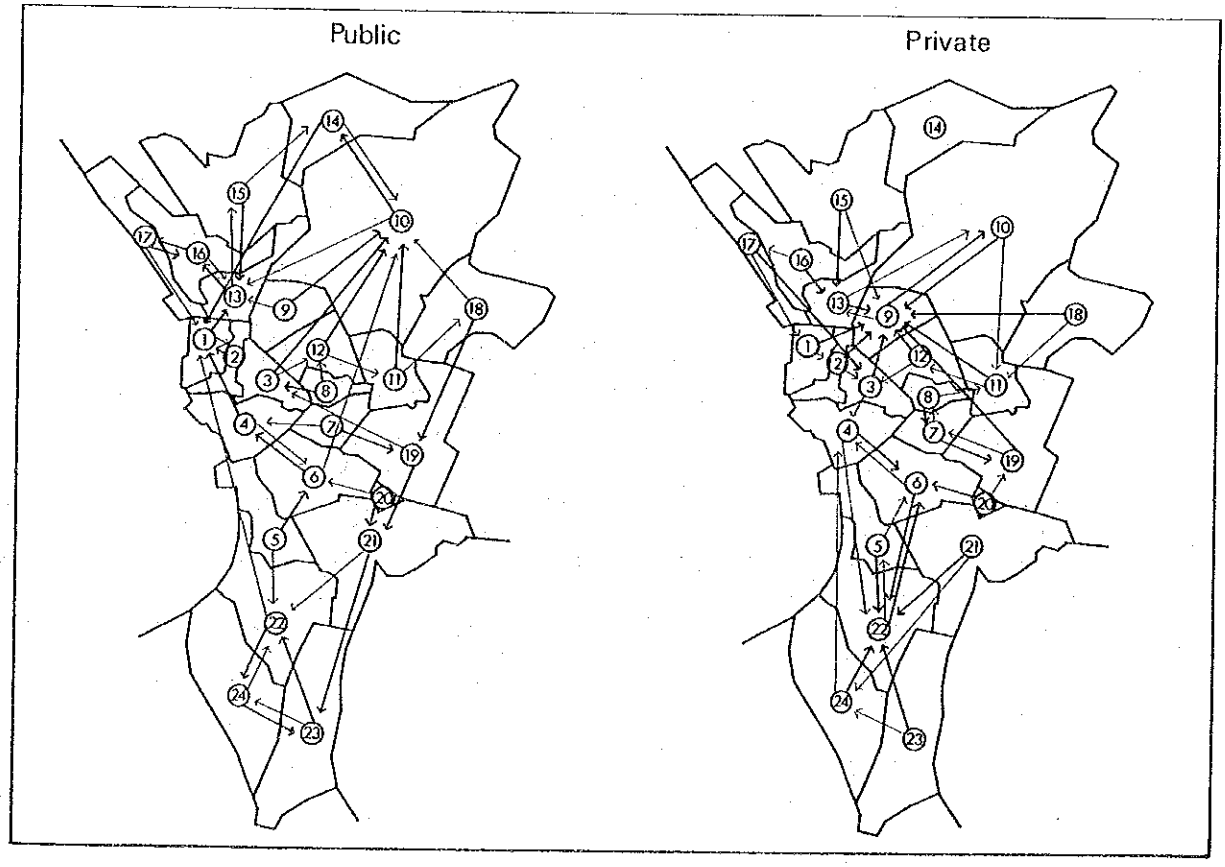


Figure 17.34

Major Trip Flow, 'to home'



17.5.3 Inter-urban Movement

- The results of the Cordonline Survey give a picture on the movements between Metro Manila and its external areas. These movements are classified into two; namely, those made by Metro Manila residents and those made by external residents. The latter can be further brokendown to those between Metro Manila and its external areas and those between the external areas via Metro Manila (through-traffic).
- The overall flow of inter-urban movements by direction is shown in Figure 17.35. The largest flow is seen between Metro Manila and the north and south external areas. Approximately 380,000 trips are made between Metro Manila and the north. Two hundred ninety thousand trips, on the other hand, are made between Metro Manila and the south. One hundred forty thousand trips are made between Metro Manila and the east. Through-traffic is relatively negligible.
- These external trips share approximately 7.5 percent of the total Metro Manila travel demand or 8 percent of the intra-Metro Manila demand.
- The trip purpose composition of external trips is shown in Table 17.57. It is remarkably different from that of the HIS. Incoming trips have over 70 percent of "to work" and "business" purpose trips, while 94 percent of the outgoing trips are "to home" purpose. This implies that Metro Manila provides a great number of employment opportunities and activity centres for residents outside Metro Manila
- Table 17.58 shows the through-traffic demand by trip purpose. Majority of the trips are made by the public mode. Through-trips are mostly "to home", "business", and "to work" purpose trips.

Table 17.57
Travel Demand between Metro Manila and External Areas
by Trip Purpose (Excluding Through-Traffic)

Trip Purpose	Public Mode (No. of Trips)			Private Mode (No. of Trips)			Total (No. of Trips)		
	In	Out	Both	In	Out	Both	In	Out	Both
To Work	76,914	2,838	79,18,377	6,324	24,710	95,291	9,162	79,752	104,453
To School	35,117	1,196	36,313	3,209	111	3,320	38,326	1,307	39,633
Private	39,849	2,241	42,090	20,069	3,533	23,502	59,918	5,674	65,592
Business	149,483	5,236	154,719	24,079	4,013	28,092	173,562	9,249	182,811
To Home	5,868	347,500	353,368	1,840	57,126	58,966	7,708	404,626	412,334
Total	307,231	359,011	666,242	67,574	71,007	138,581	374,805	430,018	804,823

Table 17.57 (cont'd.)

Trip Purpose	Public Mode (%)			Private Mode (%)			Total (%)		
	In	Out	Both	In	Out	Both	In	Out	Both
To Work	25.0	9.8	12.0	32.2	8.9	17.8	25.4	2.1	13.0
To School	11.4	9.3	5.5	4.8	0.2	2.4	10.2	0.3	4.9
Pirvate	13.0	0.6	6.3	29.7	4.8	17.0	16.0	1.3	8.2
Business	48.7	1.5	23.2	35.6	5.7	20.3	46.3	2.2	22.7
To Home	1.9	96.8	53.0	2.7	80.4	42.5	2.1	94.1	51.2
Total	100	100	100	100	100	100	100	100	100

Source: 1980 HIS Analysis Results

Table 17.58
Travel Demand between External Areas via Metro Manila (Through-Traffic) by Trip Purpose

Trip Purpose	Public Mode		Private Mode		Total	
	No. of Trips	%	No. of Trips	%	No. of Trips	%
To Work	3,325	13.2	1,576	17.1	4,901	14.3
To School	777	3.1	211	2.3	938	2.9
Private	2,342	9.3	1,789	19.3	4,131	12.0
Business	6,783	26.9	1,844	19.9	8,597	25.0
To Home	11,949	47.5	3,825	41.4	15,774	45.8
TOTAL	25,146	100.0	9,245	100.0	34,391	100.0

Source: 1980 HIS Analysis Results

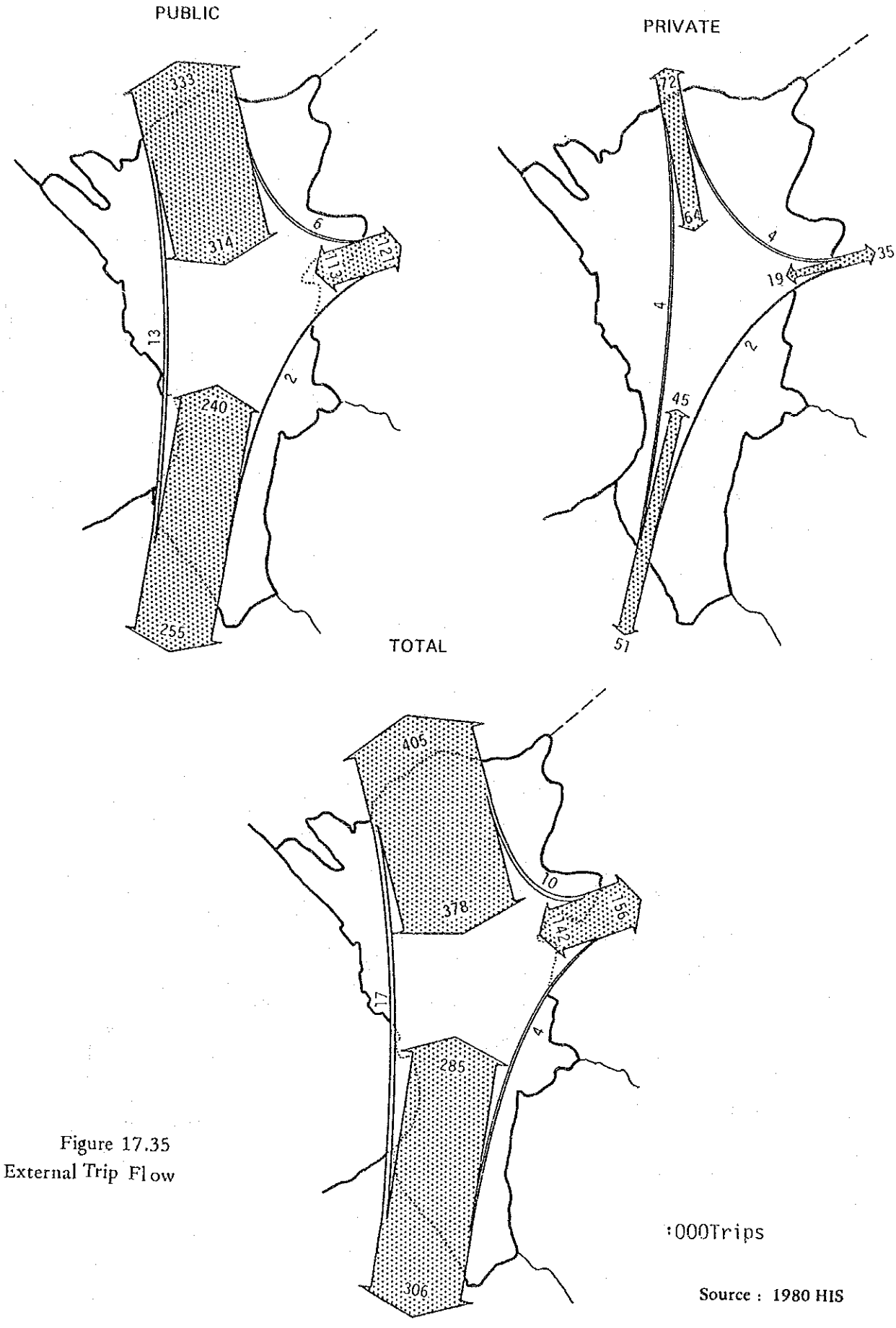


Figure 17.35
External Trip Flow

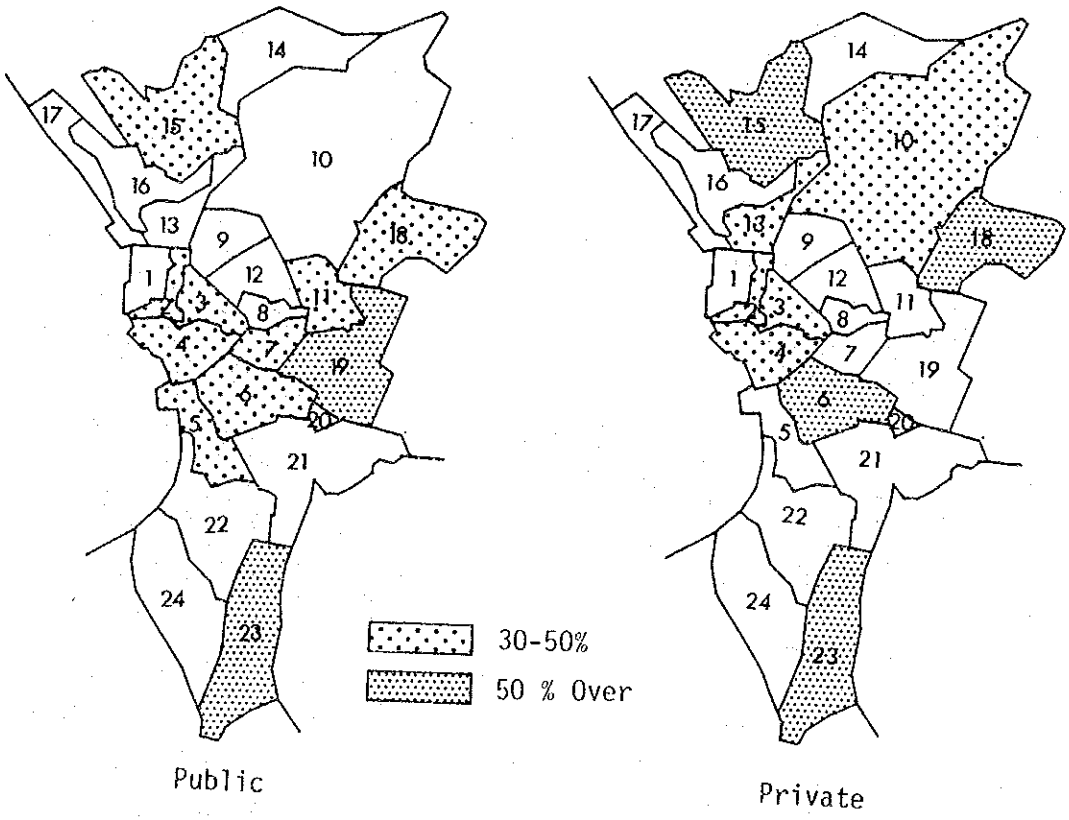
Source : 1980 HIS

17.5.4 Local Movement (Intra-Municipality Movement)

- The analysis was made on the traffic level of intra-zonal movement. The intra-zonal trip ratio, in percentage terms, was defined as the ratio of intra-zonal traffic volume (no. of trips) to total generation and attraction of a zone. The ratio was calculated for each of the 24 municipalities as presented in Figure 17.36 through Figure 17.40.
- Figure 17.36 gives an indication on the overall level of local movement. The level of intra-municipality activities is relatively high for areas where major activity centres exist and at the same time population density is relatively higher within and around EDSA. This is also observed in Valenzuela, Marikina, Pasig, and Muntinlupa, where traffic-attracting facilities exist.
- The level of local movement by trip purpose is more specifically shown as follows:

Figure 17.36

Level of Local Movement
"To Home" Trip



Source: 1980 HIS Analysis Results

Figure 17.37

Level of Local Movement
"To Work" Trip

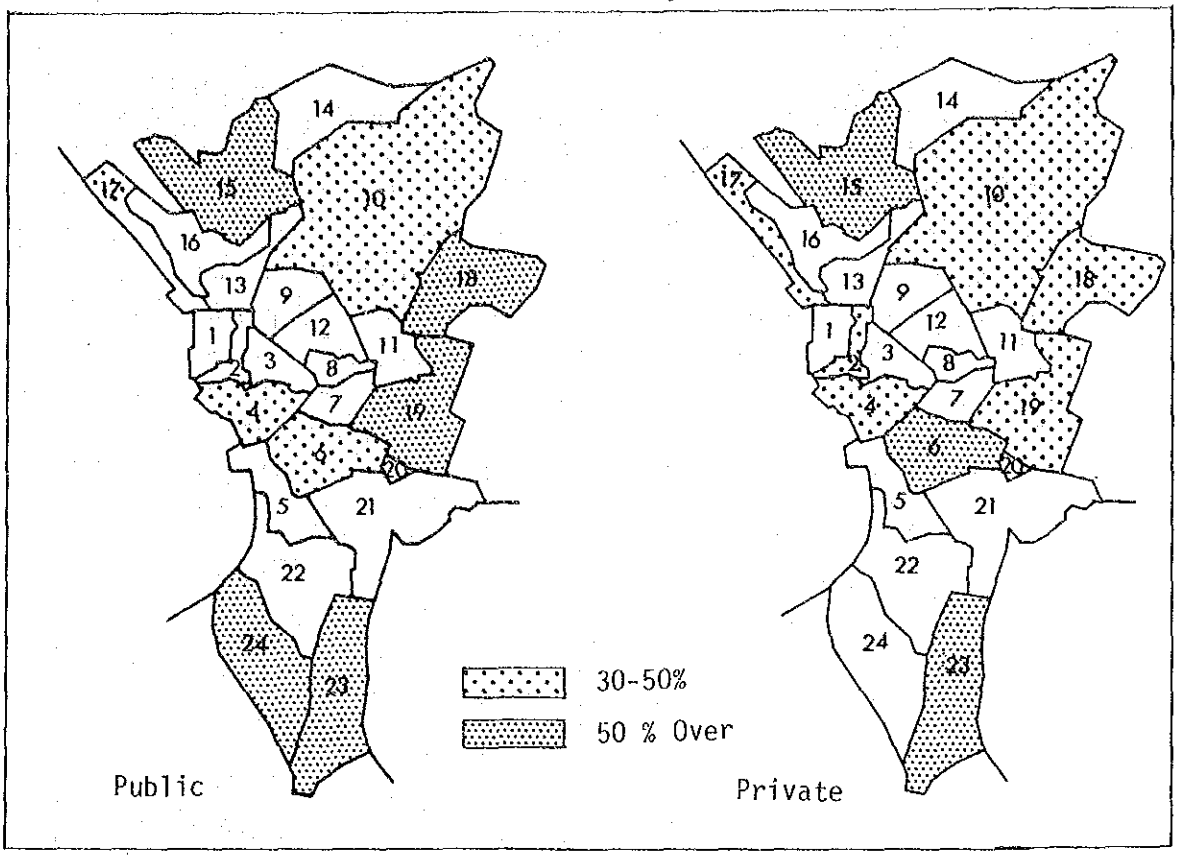


Figure 18.38 Level of Local Movement
"To School" Trip

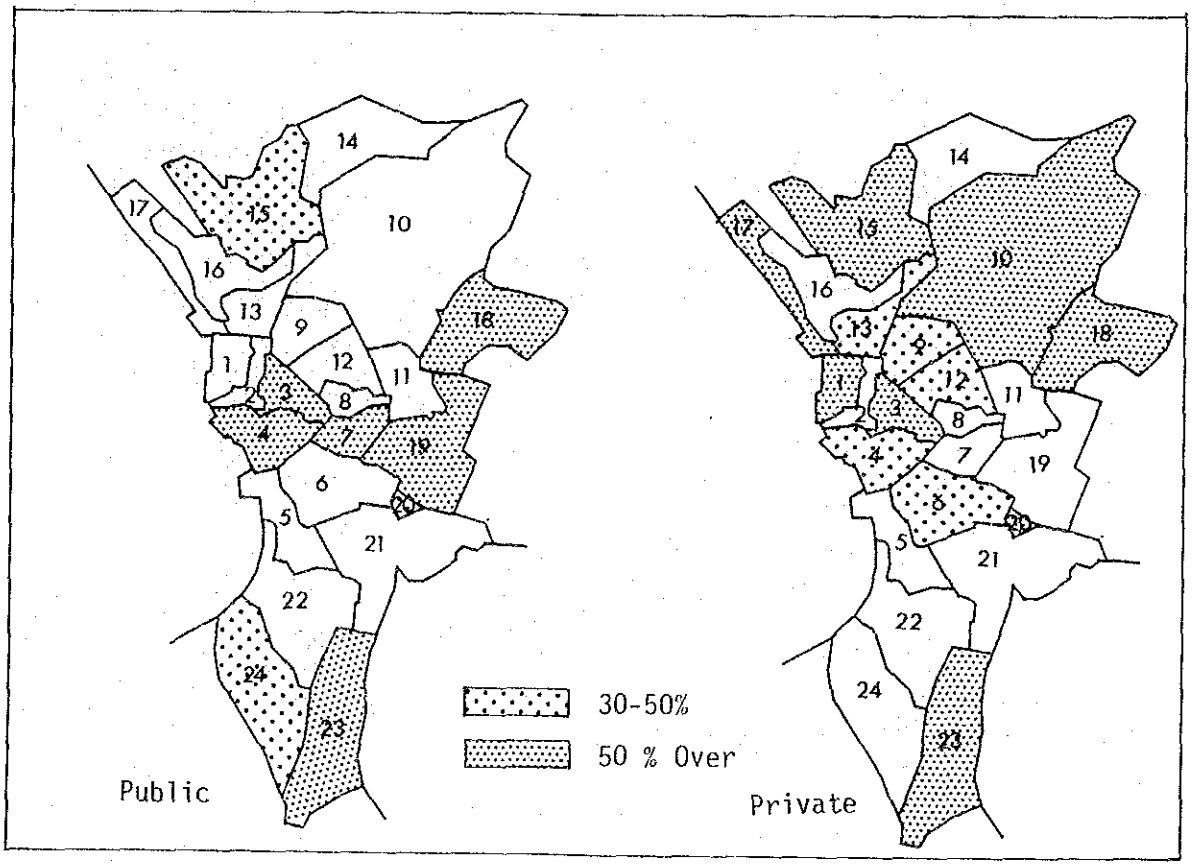


Figure 17.39 Level of Local Movement
"Private" Trip

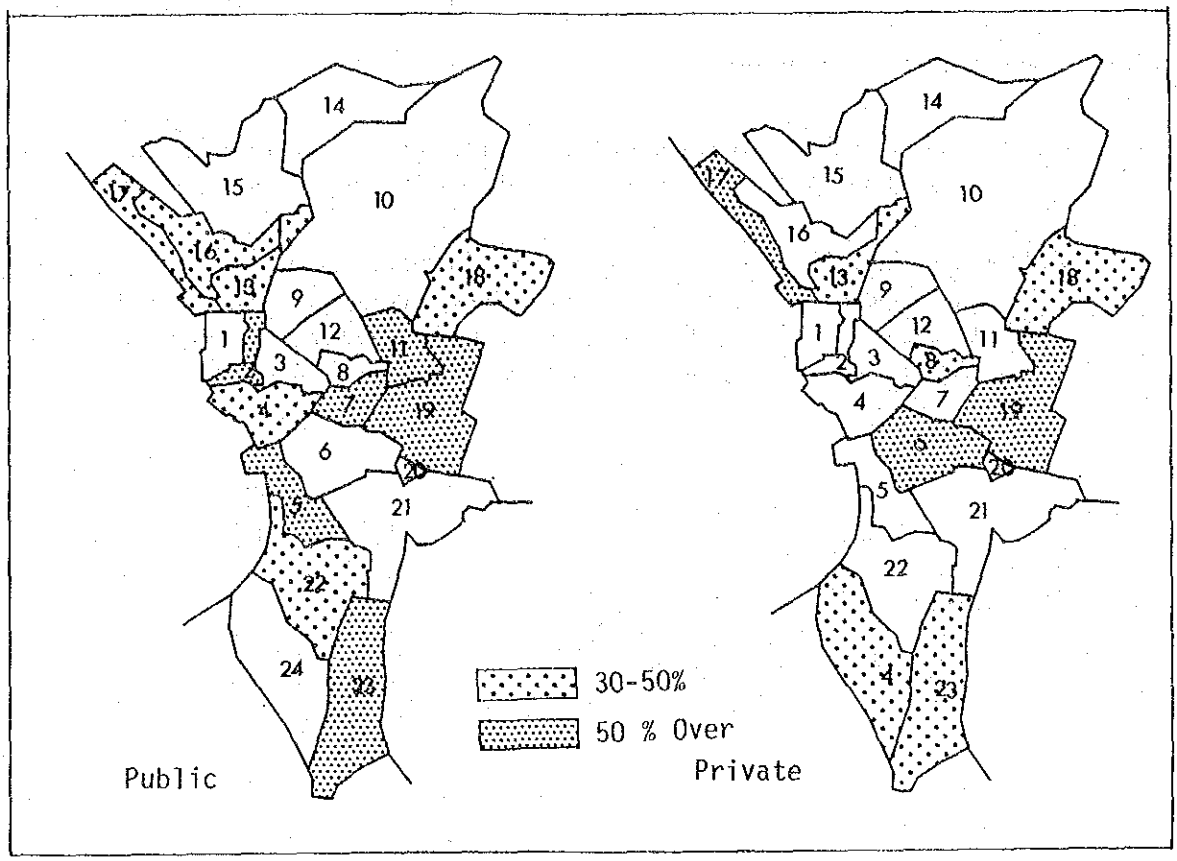
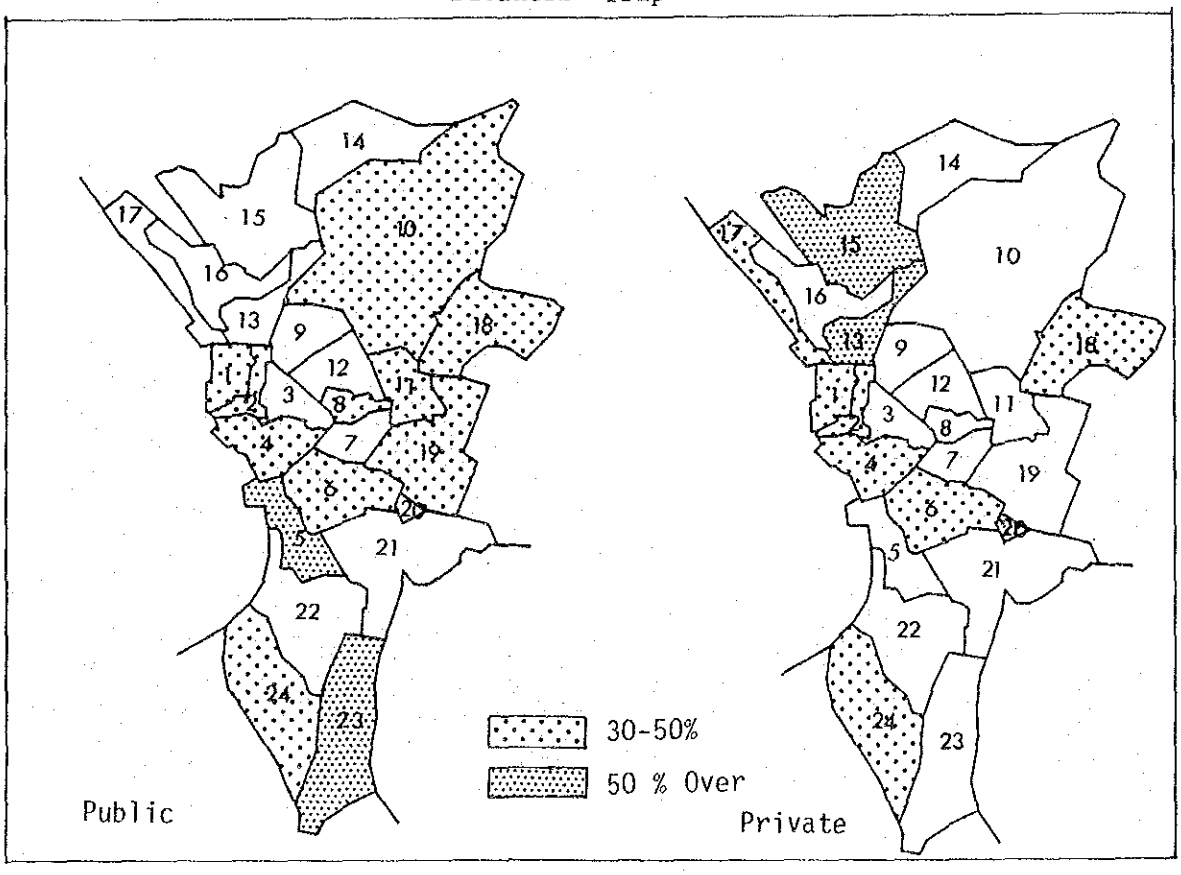


Figure 17.40 Level of Local Movement
"Business" Trip



17.5.5. Overall Demand Distribution

- Distribution of the travel demand which consists of both intra-urban and inter-urban movements is summarized in the form of OD tables as shown in Tables 17.59~68.

- The OD tables were worked out by dividing the 1980 HIS OD tables into 24 zones plus 3 external zones for presentation and discussion purposes. However, since the original HIS OD tables were completed on 202 external zones plus 15 external zones, various OD tables can easily be prepared depending upon the analysis and planning objectives.

Table 17.59
1980 OD Table Mode: Public Purpose Total

ORIGIN \ DESTINATION	1. MANILA 1ST	2. MANILA 2ND	3. MANILA 3RD	4. MANILA 4TH	5. PASAY	6. MAKATI	7. MAND.	8. SAN JUAN DEL MONTE	9. QUEZON I	10. QUEZON II	11. QUEZON III	12. QUEZON IV	13. CALOOCAN SOUTH	14. CALOOCAN NORTH	15. VALENZUELA	16. MALABON	17. NAVOTAS	18. MARIKINA	19. PASIG	20. PATEROS	21. TAGUIG	22. PARAÑAQUE	23. MUNTIN-LUPA	24. LAS PIÑAS	25. EXTERNAL I (BULACAN)	26. EXTERNAL II (RIZAL)	27. EXTERNAL III (CAVITE & LAGUNA)	TOTAL
1. CITY OF MANILA, 1ST	185,881	139,037	49,914	51,127	8,880	13,125	4,340	1,618	7,964	14,106	6,090	7,666	35,280	3,147	2,142	4,190	8,527	2,615	4,658	293	1,157	3,870	1,109	180	3,296	10	2,157	562,379
2. CITY OF MANILA, 2ND	125,910	103,922	83,536	61,833	17,321	22,607	14,443	9,492	38,361	37,654	14,336	18,479	56,877	3,204	7,788	10,329	10,509	6,860	9,141	2,050	2,762	5,983	3,561	3,675	24,244	3,792	11,927	715,526
3. CITY OF MANILA, 3RD	55,612	83,657	208,576	72,389	19,128	26,878	25,082	23,118	45,575	62,010	39,715	53,354	36,692	1,734	9,124	9,699	8,674	14,479	25,595	1,903	6,818	6,959	1,659	2,804	18,410	7,487	8,323	875,675
4. CITY OF MANILA, 4TH	41,560	63,774	65,200	233,245	36,413	57,443	17,704	4,423	15,423	18,417	11,071	9,322	19,379	1,175	5,018	3,967	4,620	2,779	7,350	468	4,397	12,665	6,535	7,959	11,679	2,437	28,019	692,942
5. PASAY	8,909	19,082	22,055	44,094	101,964	21,941	2,842	882	2,718	3,337	1,745	2,233	4,938	0	268	567	1,386	988	1,276	90	6,174	16,347	3,607	5,313	4,085	1,194	10,028	288,043
6. MAKATI	14,567	25,842	27,628	60,084	21,833	134,425	20,163	6,375	8,299	15,184	16,274	12,166	7,965	397	985	1,300	2,136	6,413	10,092	5,356	11,831	8,984	3,778	2,548	6,588	4,248	11,485	446,435
7. MANDALUYONG	3,947	15,774	26,918	17,997	3,181	21,082	114,103	6,083	2,668	5,601	7,359	5,872	3,057	168	640	1,312	786	2,015	25,853	2,765	4,295	1,480	532	609	1,600	9,910	1,088	286,693
8. SAN JUAN DEL MONTE	2,204	10,285	24,900	5,249	2,021	8,309	6,090	42,301	2,022	4,469	11,281	8,426	1,991	0	209	549	242	710	2,869	17	1,332	1,044	1,480	132	34	1,882	694	140,424
9. QUEZON CITY, I	7,672	44,443	45,655	21,342	2,764	9,884	2,919	1,999	91,613	51,850	11,352	18,670	15,084	1,317	814	2,853	1,303	1,193	1,462	875	1,045	2,585	878	169	4,346	206	631	344,924
10. QUEZON CITY, II	11,233	39,459	58,336	23,352	3,365	16,040	5,497	3,536	48,698	190,508	49,877	28,339	26,886	28,844	2,274	4,566	2,559	5,055	6,611	585	1,206	1,560	1,156	185	7,230	1,137	1,162	563,717
11. QUEZON CITY, III	7,034	17,922	42,582	12,085	1,998	18,464	6,149	10,231	11,917	46,287	113,420	35,674	11,056	422	1,312	2,560	1,479	34,727	7,984	736	2,593	587	1,368	542	13,006	6,395	3,630	432,328
12. QUEZON CITY, IV	4,548	18,909	49,358	9,245	1,355	11,099	4,959	7,972	15,788	24,195	34,055	48,093	5,859	0	631	1,192	682	3,258	3,809	340	822	1,446	680	119	3,719	816	1,180	254,209
13. CALOOCAN SOUTH	35,627	66,697	28,133	22,816	3,432	8,031	2,635	1,695	15,650	26,259	10,364	7,473	183,249	4,520	24,234	43,108	11,927	444	2,901	0	679	2,258	2,578	203	23,880	289	1,275	530,527
14. CALOOCAN NORTH	464	3,175	1,305	1,104	0	324	152	0	1,369	29,397	230	0	5,081	15,457	2,363	676	680	0	119	0	0	112	0	0	196	0	0	62,235
15. VALENZUELA	2,248	6,984	7,999	5,807	182	855	596	209	632	2,058	789	631	16,638	2,568	77,743	8,909	306	293	204	0	0	36	69	0	16,256	0	2,931	154,975
16. MALABON	4,688	11,027	10,405	6,086	522	2,064	1,591	532	2,517	6,291	2,335	1,743	37,706	164	11,025	62,594	18,381	345	211	0	303	420	218	270	6,676	113	1,344	189,772
17. NAVOTAS	5,410	14,582	7,173	6,090	1,200	1,476	732	400	1,023	2,770	2,110	678	7,836	0	494	17,137	56,000	0	908	0	108	69	0	0	550	0	57	126,802
18. MARIKINA	547	11,048	14,000	2,892	1,589	4,730	2,651	546	1,360	4,559	28,509	3,992	1,123	0	295	266	0	138,895	6,890	0	310	239	322	0	11,268	5,463	1,491	241,385
19. PASIG	4,623	9,619	22,041	7,474	921	8,963	21,194	3,125	1,231	5,423	6,561	4,340	2,837	114	0	151	894	5,752	194,371	3,351	21,990	813	942	605	3,048	14,532	1,098	346,213
20. PATEROS	105	841	890	304	41	4,580	2,070	118	328	278	225	208	0	0	0	0	0	0	3,956	6,161	5,642	37	0	0	93	129	78	26,084
21. TAGUIG	974	4,003	5,179	3,696	4,135	11,356	3,976	679	702	875	2,127	901	603	0	0	226	168	364	26,212	3,567	40,337	5,421	4,788	310	397	368	3,510	125,124
22. PARAÑAQUE	5,989	8,906	10,545	19,386	17,133	10,221	2,215	1,087	2,902	2,886	1,319	928	2,041	201	52	532	126	388	936	139	8,151	49,677	14,768	10,522	2,026	1,752	25,023	199,852
23. MUNTINLUPA	2,098	3,040	1,671	7,338	3,373	4,085	693	448	975	1,855	1,019	694	1,877	0	59	202	0	588	1,413	0	5,560	10,286	67,920	4,802	1,461	112	11,832	133,401
24. LAS PIÑAS	152	4,469	1,895	6,977	4,101	3,422	415	96	110	206	961	111	91	0	0	151	0	0	489	0	275	10,646	5,621	49,426	422	0	9,839	99,877
25. EXTERNAL I (BULACAN)	2,225	17,981	14,414	10,905	3,228	6,845	2,113	521	5,295	7,571	16,032	4,667	21,567	85	16,223	6,132	548	7,902	1,644	59	631	1,379	1,095	530	15,467	2,628	8,328	176,015
26. EXTERNAL II (RIZAL)	122	2,984	6,841	1,922	884	3,301	6,359	1,251	364	1,122	8,096	939	1,010	0	30	0	92	4,228	10,863	0	0	139	219	0	2,984	3,729	1,089	58,618
27. EXTERNAL III (CAVITE & LAGUNA)	1,520	6,103	6,564	13,928	10,041	6,422	750	161	1,385	1,936	2,550	1,029	1,254	0	6,633	802	247	162	845	73	3,250	21,250	12,154	17,944	5,386	1,435	9,243	133,057
TOTAL	537,169	758,396	842,183	729,257	271,005	437,972	272,433	129,098	326,888	567,106	399,822	276,830	507,976	59,595	170,354	183,970	132,281	240,494	356,742	28,836	131,568	165,842	137,037	108,847	188,323	69,684	157,432	8,187,242

Table 17.60
1980 OD Table Mode: Private Purpose Total

ORIGIN \ DESTINATION	1. MANILA 1ST	2. MANILA 2ND	3. MANILA 3RD	4. MANILA 4TH	5. PASAY	6. MAKATI	7. MAND.	8. SAN JUAN DEL MONTE	9. QUEZON I	10. QUEZON II	11. QUEZON III	12. QUEZON IV	13. CALOOCAN SOUTH	14. CALOOCAN NORTH	15. VALENZUELA	16. MALABON	17. NAVOTAS	18. MARIKINA	19. PASIG	20. PATEROS	21. TAGUIG	22. PARAÑAQUE	23. MUNTIN-LUPA	24. LAS PIÑAS	25. EXTERNAL I (BULACAN)	26. EXTERNAL II (RIZAL)	27. EXTERNAL III (CAVITE & LAGUNA)	TOTAL
1. CITY OF MANILA, 1ST	42,368	17,383	5,815	22,048	2,886	6,186	4,746	681	6,156	1,769	2,897	1,450	3,022	0	556	1,120	2,005	185	495	0	0	1,127	501	255	451	6	355	124,463
2. CITY OF MANILA, 2ND	24,309	29,008	15,684	12,760	6,354	6,164	4,691	3,276	23,464	4,408	4,202	6,082	7,344	1,443	992	2,675	2,331	94	919	1,195	613	4,850	514	2,447	2,659	1,440	1,566	171,484
3. CITY OF MANILA, 3RD	4,437	13,932	67,478	23,711	5,254	11,155	11,684	11,171	26,062	9,082	8,830	18,069	4,282	1,126	1,516	509	264	905	7,979	416	580	6,157	185	1,550	1,526	755	535	239,220
4. CITY OF MANILA, 4TH	11,914	14,856	21,611	62,480	13,919	42,068	6,883	5,302	7,125	4,604	3,808	5,658	8,112	637	345	1,920	1,469	667	1,962	135	2,512	28,340	324	8,159	1,858	1,015	2,224	259,907
5. PASAY	1,628	6,113	7,962	11,166	25,091	15,734	1,488	304	1,698	2,359	1,010	980	2,460	376	0	294	0	97	701	0	3,410	15,896	536	3,890	1,918	610	1,541	107,260
6. MAKATI	5,555	6,273	15,776	35,120	19,212	138,938	10,505	7,235	9,869	5,984	9,441	5,770	2,710	63	87	1,968	1,657	2,540	4,214	3,111	3,853	32,960	1,447	10,172	2,618	2,005	3,473	341,956
7. MANDALUYONG	1,707	5,595	9,137	10,636	1,204	13,256	22,826	8,935	7,927	2,197	5,933	6,113	344	0	228	654	215	233	2,613	781	82	2,696	325	206	610	1,483	257	111,260
8. SAN JUAN DEL MONTE	1,322	3,501	10,511	4,582	631	8,223	12,180	31,433	3,774	2,712	5,305	5,306	4,698	0	1,637	314	[illegible]	837	3,623	0	0	2,846	0	257	70	337	181	104,340
9. QUEZON CITY, I	5,145	17,050	17,752	6,086	2,604	6,085	3,713	2,910	64,596	23,766	17,047	9,114	7,453	0	919	2,098	[illegible]	628	2,526	579	418	990	274	0	1,067	352	239	193,834
10. QUEZON CITY, II	1,822	5,503	19,472	6,896	2,488	10,203	3,715	5,469	22,937	63,660	19,489	9,998	6,980	8,626	1,781	1,293	135	1,345	1,984	402	1,247	5,276	0	1,059	3,951	220	888	206,459
11. QUEZON CITY, III	4,146	1,984	11,624	5,107	639	9,414	4,819	5,966	14,308	18,502	29,734	16,104	2,658	458	64	843	5,645	2,752	4,025	2,115	76	618	126	0	1,885	1,820	764	146,196
12. QUEZON CITY, IV	3,605	7,013	16,924	5,554	552	9,008	2,246	4,847	10,848	11,882	16,321	32,936	1,545	184	1,939	624	227	346	1,362	0	503	2,126	234	0	285	144	297	131,552
13. CALOOCAN SOUTH	2,589	7,072	4,104	3,195	1,622	1,636	276	3,420	6,804	5,581	499	4,874	64,199	2,121	3,510	2,856	211	132	442	0	0	498	0	0	2,903	42	253	98,939
14. CALOOCAN NORTH	0	1,797	1,058	637	399	85	0	0	0	8,619	260	206	1,795	1,198	253	0	0	0	0	0	0	122	0	0	96	0	0	16,525
15. VALENZUELA	1,651	1,736	4,872	1,844	0	299	491	454	3,444	1,273	94	155	7,020	276	28,633	1,598	0	850	2,084	0	0	0	0	0	5,507	116	1,065	63,462
16. MALABON	1,039	2,092	2,235	1,446	708	2,190	722	140	1,408	1,236	435	229	3,429	0	439	7,046	3,211	0	298	0	0	0	71	0	1,387	12	742	31,035
17. NAVOTAS	967	766	722	1,193	0	459	87	0	0	211	559	113	1,569	0	262	3,076	13,520	0	850	0	0	333	0	0	105	0	39	24,931
18. MARIKINA	382	1,259	2,404	1,030	246	4,533	264	282	1,157	2,948	4,823	718	170	0	977	0	0	35,028	924	0	0	97	0	0	1,785	1,297	252	60,576
19. PASIG	288	758	5,082	1,313	1,300	4,768	10,522	1,948	2,764	1,114	1,986	983	495	0	521	155	0	837	22,750	202	0	527	321	278	1,189	3,110	212	63,423
20. PATEROS	0	289	139	34	0	5,177	449	0	139	243	67	0	0	0	0	0	0	0	0	226	1,681	3,456	549	458	36	204	375	16,153
21. TAGUIG	122	98	329	542	1,202	4,774	1,122	0	160	545	24	150	0	0	0	0	0	0	0	4,144	233	0	0	0	0	36	11,046
22. PARAÑAQUE	1,155	7,588	4,273	19,096	15,574	26,800	2,688	2,963	971	3,240	206	1,239	0	73	0	0	140	27	570	0	5,249	27,358	8,595	2,352	1,329	851	3,224	135,535
23. MUNTINLUPA	480	141	854	455	832	2,251	687	0	236	0	91	232	0	0	0	24	0	0	642	0	1,402	15,085	14,207	2,260	463	120	2,318	42,780
24. LAS PIÑAS	268	4,829	2,211	10,524	4,889	10,556	177	113	0	610	0	0	0	0	0	0	0	0	698	0	922	6,521	1,965	37,327	243	0	3,211	85,064
25. EXTERNAL I (BULACAN)	318	3,913	1,292	860	609	1,860	221	344	750	3,172	2,626	586	2,644	72	5,376	1,538	292	1,117	938	40	337	1,129	667	153	5,296	1,588	1,129	39,458
26. EXTERNAL II (RIZAL)	302	1,184	335	666	408	1,299	912	386	569	412	2,229	273	41	0	18	27	33	1,361	2,245	33	22	543	33	22	1,603	2,512	501	17,974
27. EXTERNAL III (CAVITE & LAGUNA)	140	1,484	611	3,213	1,625	4,551	216	277	199	1,349	1,042	218	1,133	0	960	1,431	40	199	530	20	339	2,852	3,439	2,563	2,523	1,309	2,021	34,284
TOTAL	118,383	163,218	250,268	252,194	110,248	347,672	107,730	97,856	217,365	181,478	138,964	128,026	114,103	16,851	51,013	32,063	31,338	50,240	70,470	13,399	23,479	162,403	34,313	73,408	43,438	21,408	27,798	2,879,126

Table 17.61
1980 OD Table Mode: Public Purpose: Work

ORIGIN \ DESTINATION	1. MANILA 1ST	2. MANILA 2ND	3. MANILA 3RD	4. MANILA 4TH	5. PASAY	6. MAKATI	7. MAND.	8. SAN JUAN DEL MONTE	9. QUEZON I	10. QUEZON II	11. QUEZON III	12. QUEZON IV	13. CALOOCAN SOUTH	14. CALOOCAN NORTH	15. VALENZUELA	16. MALABON	17. NAVOTAS	18. MARIKINA	19. PASIG	20. PATEROS	21. TAGUIG	22. PARAÑAQUE	23. MUNTIN-LUPA	24. LAS PIÑAS	25. EXTERNAL I (BULACAN)	26. EXTERNAL II (RIZAL)	27. EXTERNAL III (CAVITE & LAGUNA)	TOTAL
1. CITY OF MANILA, 1ST	27,231	35,690	6,303	22,854	3,649	8,413	2,373	899	3,407	6,512	2,876	3,356	5,486	133	1,645	1,247	1,167	710	3,500	0	1,088	2,762	964	180	0	0	215	142,660
2. CITY OF MANILA, 2ND	3,659	12,361	2,040	10,488	1,045	4,843	961	1,015	1,581	3,175	1,513	948	1,825	0	427	294	157	117	1,953	0	233	284	266	206	0	0	0	49,394
3. CITY OF MANILA, 3RD	2,924	19,678	14,798	23,829	3,709	12,238	4,678	1,868	4,829	8,296	8,910	7,945	1,684	0	834	872	410	1,400	5,216	129	1,548	1,603	722	221	88	20	0	128,449
4. CITY OF MANILA, 4TH	2,132	12,379	4,503	32,570	4,048	17,033	4,764	857	1,777	2,975	2,275	2,014	250	70	820	193	261	220	2,377	0	1,521	1,045	1,333	100	152	129	0	96,348
5. PASAY	317	6,004	2,042	12,928	12,167	8,759	1,624	219	657	1,033	677	667	281	0	0	101	0	74	272	0	1,427	2,555	916	472	0	0	0	53,242
6. MAKATI	400	4,838	1,581	11,394	4,089	33,739	9,727	1,044	745	1,414	3,543	2,360	128	0	218	0	0	269	2,464	74	2,292	1,467	787	259	0	0	88	78,920
7. MANDALUYONG	197	3,993	3,763	4,347	779	11,487	12,282	1,015	867	2,105	1,956	1,568	234	0	294	88	158	234	4,531	105	858	674	450	82	0	258	6	52,931
8. SAN JUAN DEL MONTE	213	2,827	3,696	2,466	197	4,272	1,834	5,276	883	1,864	3,295	2,175	320	0	90	193	0	517	2,167	17	410	425	265	132	0	0	0	33,534
9. QUEZON CITY, I	961	10,962	3,558	8,347	1,436	5,424	1,337	467	12,002	9,809	3,608	4,080	1,654	0	415	510	253	570	1,021	0	590	513	487	0	0	0	299	58,312
10. QUEZON CITY, II	1,667	10,076	6,563	9,884	1,475	9,685	2,487	982	10,559	38,647	9,918	9,891	3,248	261	1,484	660	193	1,652	2,698	0	688	404	835	123	0	129	160	124,349
11. QUEZON CITY, III	51	3,491	2,851	5,218	706	8,531	1,329	1,077	2,749	5,001	11,073	4,216	378	0	282	256	76	1,155	1,188	0	329	125	308	0	176	0	0	50,476
12. QUEZON CITY, IV	284	4,225	3,988	5,324	797	6,439	2,804	421	4,010	7,170	4,768	10,371	734	0	514	89	79	236	2,739	0	152	137	567	0	34	0	0	55,882
13. CALOOCAN SOUTH	5,536	17,767	3,559	10,217	1,730	4,471	2,039	215	3,677	11,453	3,385	3,788	13,754	0	4,456	3,122	711	78	1,903	0	425	599	299	0	145	0	69	93,897
14. CALOOCAN NORTH	174	1,043	92	786	0	93	152	0	566	12,761	78	0	1,753	1,072	2,363	0	0	0	119	0	0	112	0	0	0	0	0	21,264
15. VALENZUELA	53	3,456	1,077	1,382	75	593	336	0	147	492	505	252	5,206	0	17,495	470	0	74	102	0	0	0	0	0	298	0	762	33,275
16. MALABON	1,293	4,894	650	4,724	356	1,389	1,347	174	1,457	4,653	1,173	1,292	9,312	0	2,876	12,898	1,587	0	211	0	217	139	218	48	119	0	198	51,226
17. NAVOTAS	1,323	3,445	592	2,106	629	1,476	574	45	622	1,896	430	311	1,655	0	405	2,232	8,389	0	760	0	108	69	0	0	0	0	0	27,067
18. MARIKINA	299	1,474	1,416	1,321	597	4,325	1,351	183	139	1,402	8,214	1,847	285	0	78	100	0	30,002	1,632	0	86	214	322	0	0	0	0	55,131
19. PASIG	176	1,357	871	3,289	366	4,713	8,311	123	293	1,289	2,649	871	299	0	0	0	107	1,019	41,497	210	853	0	330	170	0	258	0	69,051
20. PATEROS	105	344	224	92	41	1,851	1,305	0	185	215	225	208	0	0	0	0	0	0	1,072	803	564	37	0	0	0	0	0	7,271
21. TAGUIG	89	746	429	902	840	4,469	1,281	530	230	364	723	451	103	0	0	63	0	135	5,606	565	8,347	1,877	557	132	0	0	82	28,521
22. PARAÑAQUE	82	1,250	598	6,591	4,296	6,520	495	56	0	264	63	392	0	0	52	282	0	63	405	0	1,526	7,062	4,155	975	88	0	160	35,375
23. MUNTINLUPA	0	265	52	1,162	570	1,529	72	141	255	252	403	85	358	0	59	0	0	0	400	0	3,004	2,181	12,545	1,031	0	102	306	24,772
24. LAS PIÑAS	0	475	75	2,314	2,150	1,477	274	0	110	0	171	62	91	0	0	123	0	0	288	0	152	1,011	767	10,737	0	0	156	20,433
25. EXTERNAL I (BULACAN)	247	3,066	1,160	3,255	630	2,543	622	0	2,158	1,534	4,137	919	5,437	85	5,939	2,156	72	1,874	481	0	99	373	144	235	1,680	650	593	40,139
26. EXTERNAL II (RIZAL)	30	539	332	544	208	1,097	1,811	0	108	194	1,545	362	194	0	30	0	0	1,260	3,877	0	0	42	97	0	145	842	82	13,339
27. EXTERNAL III (CAVITE & LAGUNA)	75	1,150	338	2,899	3,184	3,066	333	0	230	420	458	621	256	0	0	0	0	0	469	0	2,365	3,261	5,278	3,025	359	158	2,140	30,085
TOTAL	49,567	168,295	67,151	191,283	49,569	170,475	62,506	17,096	54,343	125,189	78,471	60,762	55,425	1,621	40,826	28,549	13,620	41,659	88,948	1,904	28,882	28,971	32,612	18,128	3,284	2,590	5,317	1,484,443

Table 17.62
1980 OD Table Mode: Private Purpose: Work

ORIGIN \ DESTINATION	1. MANILA 1ST	2. MANILA 2ND	3. MANILA 3RD	4. MANILA 4TH	5. PASAY	6. MAKATI	7. MAND.	8. SAN JUAN DEL MONTE	9. QUEZON I	10. QUEZON II	11. QUEZON III	12. QUEZON IV	13. CALOOCAN SOUTH	14. CALOOCAN NORTH	15. VALENZUELA	16. MALABON	17. NAVOTAS	18. MARIKINA	19. PASIG	20. PATEROS	21. TAGUIG	22. PARAÑAQUE	23. MUNTIN-LUPA	24. LAS PIÑAS	25. EXTERNAL I (BULACAN)	26. EXTERNAL II (RIZAL)	27. EXTERNAL III (CAVITE & LAGUNA)	TOTAL
1. CITY OF MANILA, 1ST	6,489	6,427	848	6,009	291	4,233	465	594	617	535	1,087	357	554	0	162	146	325	185	0	0	0	581	501	0	54	0	173	30,634
2. CITY OF MANILA, 2ND	1,116	5,579	492	2,548	611	777	1,268	136	987	384	0	208	1,309	0	321	121	251	0	485	0	98	367	0	0	36	571	0	17,650
3. CITY OF MANILA, 3RD	1,343	2,680	6,381	5,609	1,061	4,905	1,174	310	2,365	1,565	825	3,108	639	0	289	353	264	0	1,295	0	406	353	163	0	28	0	0	35,116
4. CITY OF MANILA, 4TH	568	2,732	1,020	9,394	584	7,294	253	80	173	592	181	565	102	0	0	0	103	0	443	0	411	224	256	222	65	70	36	25,367
5. PASAY	331	2,253	666	4,064	4,926	4,743	359	215	508	1,078	0	427	188	0	0	294	0	97	259	0	341	2,092	470	350	0	36	88	23,785
6. MAKATI	424	1,620	740	6,210	1,854	19,259	721	393	0	63	917	787	239	0	0	109	0	170	765	0	116	825	285	87	82	6	205	35,897
7. MANDALUYONG	227	1,773	2,134	2,806	240	5,167	4,854	259	0	573	333	72	0	0	140	166	0	179	1,551	0	82	355	271	0	30	144	0	21,356
8. SAN JUAN DEL MONTE	0	1,063	1,158	938	89	2,974	1,333	1,776	836	879	935	914	0	0	0	0	0	0	1,392	0	0	0	0	0	0	36	40	14,363
9. QUEZON CITY, I	2,342	8,618	2,037	4,072	581	4,556	848	367	3,487	4,836	3,220	1,819	2,412	0	808	140	0	219	2,016	0	418	638	0	0	0	4	0	43,438
10. QUEZON CITY, II	722	4,722	2,679	3,998	918	5,400	950	408	3,621	13,189	2,397	2,249	754	0	241	0	155	191	678	0	604	0	0	109	323	22	344	44,674
11. QUEZON CITY, III	246	1,145	1,186	1,536	313	4,442	1,065	404	211	3,074	2,664	1,789	0	0	0	0	0	151	813	0	76	42	0	0	383	547	0	20,087
12. QUEZON CITY, IV	121	1,455	2,037	2,266	303	4,011	884	1,078	755	3,174	1,527	3,916	205	0	0	0	227	0	998	0	145	0	234	0	0	28	0	23,364
13. CALOOCAN SOUTH	299	1,855	1,007	3,042	610	1,228	276	87	1,281	1,704	499	620	5,257	0	632	1,038	211	0	0	0	0	0	0	0	412	0	163	20,478
14. CALOOCAN NORTH	0	1,521	635	637	399	85	0	0	0	3,411	260	206	344	599	253	0	0	0	0	0	0	122	0	0	20	0	0	8,492
15. VALENZUELA	325	635	111	753	0	299	136	0	146	919	0	155	1,544	0	7,084	0	0	0	0	0	0	0	0	0	587	0	596	13,290
16. MALABON	470	2,002	248	1,296	0	1,851	427	140	969	873	435	729	661	0	363	2,627	148	0	147	0	0	0	71	0	84	0	0	13,541
17. NAVOTAS	553	509	0	418	0	459	87	0	0	166	559	0	73	0	262	842	1,711	0	0	0	0	70	0	0	6	0	0	5,715
18. MARIKINA	0	265	525	609	0	3,116	264	107	125	499	859	473	170	0	977	0	0	4,465	489	0	0	97	0	0	422	322	0	13,784
19. PASIG	0	239	667	729	98	1,907	874	122	388	255	1,014	0	0	0	521	0	0	0	4,320	74	0	75	202	172	330	384	0	12,311
20. PATEROS	0	221	0	0	0	1,520	449	0	139	198	67	0	0	0	0	0	0	0	0	391	233	0	0	0	0	0	0	3,218
21. TAGUIG	0	87	0	278	574	1,495	0	0	0	297	0	128	0	0	0	0	0	0	0	0	612	283	0	0	0	0	72	3,826
22. PARAÑAQUE	776	1,603	963	4,782	3,616	11,331	359	35	0	1,116	157	698	0	0	0	0	0	0	240	0	1,588	3,848	1,583	265	57	72	224	33,303
23. MUNTINLUPA	0	0	0	123	170	1,532	78	0	186	0	91	0	0	0	0	0	0	0	200	0	363	101	4,425	120	0	24	345	7,758
24. LAS PIÑAS	268	899	884	4,979	1,828	6,467	177	113	0	295	0	0	0	0	0	0	0	0	131	0	922	1,850	302	3,896	0	0	238	23,259
25. EXTERNAL I (BULACAN)	117	953	177	257	118	735	32	64	117	703	655	133	832	22	770	140	26	144	493	0	102	310	40	50	404	185	105	7,884
26. EXTERNAL II (RIZAL)	237	767	75	250	194	553	272	56	295	96	404	144	0	0	18	12	0	282	767	0	0	56	0	22	178	499	18	5,195
27. EXTERNAL III (CAVITE & LAGUNA)	36	550	24	1,492	216	1,034	83	204	61	231	152	150	0	0	0	0	0	0	108	0	97	783	1,128	338	1,340	310	413	8,450
TOTAL	17,001	52,164	26,695	69,095	19,594	101,373	17,628	6,948	17,267	40,705	19,238	19,647	15,283	821	12,841	6,188	3,421	6,083	17,867	465	6,614	13,082	9,929	5,631	4,535	3,260	3,060	516,235

Table 17.63
1980 OD Table Mode: Public Purpose: School

ORIGIN \ DESTINATION	1. MANILA 1ST	2. MANILA 2ND	3. MANILA 3RD	4. MANILA 4TH	5. PASAY	6. MAKATI	7. MAND.	8. SAN JUAN DEL MONTE	9. QUEZON I	10. QUEZON II	11. QUEZON III	12. QUEZON IV	13. CALOOCAN SOUTH	14. CALOOCAN NORTH	15. VALENZUELA	16. MALABON	17. NAVOTAS	18. MARIKINA	19. PASIG	20. PATEROS	21. TAGUIG	22. PARAÑAQUE	23. MUNTIN-LUPA	24. LAS PIÑAS	25. EXTERNAL I (BULACAN)	26. EXTERNAL II (RIZAL)	27. EXTERNAL III (CAVITE & LAGUNA)	TOTAL
1. CITY OF MANILA, 1ST	26,254	31,368	33,060	13,445	566	136	0	0	257	1,027	540	851	2,231	0	371	442	0	0	352	0	0	196	145	0	0	0	0	111,243
2. CITY OF MANILA, 2ND	3,020	20,316	18,322	7,648	257	274	393	571	603	505	272	273	647	0	91	261	0	127	0	0	0	68	0	0	0	0	0	53,648
3. CITY OF MANILA, 3RD	757	21,377	74,060	8,253	761	327	1,146	546	864	1,832	464	2,399	242	0	61	256	0	0	152	0	32	0	0	0	0	0	0	113,529
4. CITY OF MANILA, 4TH	352	15,141	26,006	56,949	1,143	2,972	2,551	75	385	1,146	103	203	285	0	0	150	0	0	60	0	105	0	48	0	0	0	260	107,934
5. PASAY	0	6,209	10,026	15,759	14,933	751	0	0	74	71	0	49	148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48,475
6. MAKATI	0	6,340	13,798	3,177	546	386	29,287	1,040	132	625	595	208	0	0	0	0	0	0	164	661	123	0	206	0	0	0	0	62,068
7. MANDALUYONG	0	2,573	12,920	1,026	75	353	965	5,540	132	388	749	1,247	136	0	0	0	0	0	653	0	132	0	0	0	0	0	0	56,363
8. SAN JUAN DEL MONTE	607	10,359	30,197	5,180	169	127	294	107	17,281	3,220	1,035	4,315	1,312	0	119	88	0	0	0	0	0	49	0	0	0	0	0	26,360
9. QUEZON CITY, I	546	13,951	36,489	5,077	410	235	148	0	5,407	42,218	3,770	6,970	1,881	0	158	94	0	123	0	0	0	0	0	0	0	0	64	74,642
10. QUEZON CITY, II	0	4,747	19,739	1,480	100	298	145	163	169	1,970	13,926	8,525	343	0	166	343	0	169	0	0	0	0	0	0	0	0	0	117,780
11. QUEZON CITY, III	0	8,158	29,513	1,203	0	372	300	1,629	2,085	1,633	4,432	11,549	162	0	59	303	0	82	0	0	36	0	0	0	54	129	6	52,284
12. QUEZON CITY, IV	0	12,069	19,168	6,082	315	251	0	0	2,177	2,824	332	511	24,369	0	0	111	0	84	241	0	0	0	0	0	0	0	0	61,472
13. CALOOCAN SOUTH	6,598	708	1,213	215	0	231	0	0	209	3,347	152	0	393	3,702	0	168	4,259	72	0	0	0	0	0	0	0	0	55	79,250
14. CALOOCAN NORTH	0	1,992	5,540	3,602	107	0	0	0	0	0	0	0	3,058	0	18,052	5,354	0	0	0	0	0	0	0	0	0	0	0	10,290
15. VALENZUELA	0	5,599	8,617	944	66	0	135	0	129	330	57	195	9,276	0	205	11,665	91	0	0	0	0	0	0	0	236	0	1,355	39,298
16. MALABON	940	4,804	8,617	944	66	0	135	0	199	109	0	271	3,022	0	0	7,227	9,245	0	0	0	0	0	0	0	0	0	75	37,529
17. NAVOTAS	1,861	1,727	5,592	1,097	0	0	0	0	219	913	7,478	1,075	0	0	111	166	0	34,476	233	0	0	0	0	0	0	0	57	31,217
18. MARIKINA	0	1,249	9,474	1,399	155	57	177	0	0	301	459	62	72	0	0	0	0	663	36,833	111	0	42	86	0	0	129	0	62,009
19. PASIG	86	3,088	12,625	922	42	280	6,208	0	143	63	0	0	0	0	0	0	0	0	71	1,032	0	0	0	0	0	0	0	2,598
20. PATEROS	0	497	580	212	0	0	0	0	0	107	0	0	0	0	0	0	0	56	145	4,256	2,030	5,198	327	404	0	0	0	24,952
21. TAGUIG	0	1,087	3,153	1,261	1,694	847	1,186	0	0	0	225	63	0	0	0	0	0	0	0	88	0	172	254	7,867	381	0	228	15,190
22. PARAÑAQUE	107	3,871	5,458	9,526	4,309	1,004	180	40	0	107	0	0	85	0	0	0	0	0	0	0	0	2,611	726	9,803	0	0	78	21,638
23. MUNTINLUPA	0	1,301	601	3,399	463	218	0	0	0	0	132	0	86	0	0	0	0	0	0	0	0	21	0	525	40	85	14,561
24. LAS PIÑAS	0	1,427	1,662	4,241	733	95	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	88	187	0	9,067
25. EXTERNAL I (BULACAN)	85	1,758	4,813	1,758	0	91	40	0	0	128	0	49	0	0	0	0	0	0	88	0	172	254	7,867	381	0	228	15,190	
26. EXTERNAL II (RIZAL)	0	736	4,643	269	194	97	1,798	0	0	548	673	85	1,951	0	730	722	36	600	0	0	0	2,611	726	9,803	0	0	78	21,638
27. EXTERNAL III (CAVITE & LAGUNA)	0	557	3,137	4,518	1,188	56	0	161	0	177	0	0	0	0	0	0	0	150	485	0	0	0	0	0	88	187	0	9,067
TOTAL	41,213	183,806	401,872	175,826	31,263	30,106	46,603	9,872	30,497	64,018	35,688	39,232	49,924	3,702	20,291	31,556	9,500	36,619	43,588	3,834	11,726	16,432	12,456	11,235	915	485	2,891	1,345,150

Table 17.64
1980 OD Table Mode: Private Purpose: School

ORIGIN \ DESTINATION	1. MANILA 1ST	2. MANILA 2ND	3. MANILA 3RD	4. MANILA 4TH	5. PASAY	6. MAKATI	7. MAND.	8. SAN JUAN DEL MONTE	9. QUEZON I	10. QUEZON II	11. QUEZON III	12. QUEZON IV	13. CALOOCAN SOUTH	14. CALOOCAN NORTH	15. VALENZUELA	16. MALABON	17. NAVOTAS	18. MARIKINA	19. PASIG	20. PATEROS	21. TAGUIG	22. PARAÑAQUE	23. MUNTIN-LUPA	24. LAS PIÑAS	25. EXTERNAL I (BULACAN)	26. EXTERNAL II (RIZAL)	27. EXTERNAL III (CAVITE & LAGUNA)	TOTAL
1. CITY OF MANILA, 1ST	8,630	3,956	1,851	2,140	0	0	0	0	0	176	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16,753
2. CITY OF MANILA, 2ND	3,764	4,947	5,787	1,217	594	0	0	71	350	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,244
3. CITY OF MANILA, 3RD	0	1,788	13,156	992	0	120	0	1,936	124	460	327	855	0	0	0	89	0	264	140	0	0	0	514	0	0	0	0	20,260
4. CITY OF MANILA, 4TH	0	636	6,941	5,723	0	410	0	0	0	265	0	0	0	0	0	0	0	0	119	0	0	0	0	341	0	0	0	14,435
5. PASAY	0	507	536	1,693	1,183	537	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	210	0	0	0	0	4,666
6. MAKATI	0	804	2,240	7,671	0	11,680	932	94	0	1,664	65	161	0	0	0	0	0	0	0	0	0	1,532	0	0	0	0	0	26,843
7. MANDALUYONG	566	347	2,906	1,265	0	738	5,099	3,670	336	973	424	1,073	0	0	0	0	0	0	712	0	0	0	0	0	0	0	0	18,109
8. SAN JUAN DEL MONTE	98	0	4,085	428	0	335	1,189	2,997	246	863	0	1,150	0	0	344	0	0	0	465	0	0	0	0	0	0	0	0	12,200
9. QUEZON CITY, I	669	941	6,956	86	0	118	140	234	11,622	4,909	302	2,591	639	0	0	0	0	0	0	0	0	0	0	0	36	24	0	29,267
10. QUEZON CITY, II	0	166	4,812	512	0	161	427	206	3,106	17,012	1,254	2,996	1,375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32,027
11. QUEZON CITY, III	0	166	3,387	961	0	548	1,826	935	140	7,444	5,441	3,792	0	0	0	0	0	71	502	0	0	0	0	0	0	0	0	25,213
12. QUEZON CITY, IV	0	329	4,691	259	0	0	120	117	184	1,265	939	7,232	137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15,275
13. CALOOCAN SOUTH	627	1,640	439	0	0	0	0	0	0	1,676	0	125	4,333	0	0	0	0	0	162	0	0	0	0	0	0	0	0	9,002
14. CALOOCAN NORTH	0	276	423	0	0	0	0	0	0	1,532	0	0	1,451	60	0	0	0	0	0	0	0	0	0	0	0	0	0	3,742
15. VALENZUELA	645	515	2,269	0	0	0	0	0	0	0	0	0	0	0	7,444	312	0	0	0	0	0	0	0	0	0	0	416	11,601
16. MALABON	411	0	0	150	0	0	0	0	204	352	0	0	210	0	0	481	0	0	0	0	0	0	0	0	0	0	0	1,808
17. NAVOTAS	0	0	0	0	0	0	0	0	0	0	0	0	73	0	0	605	2,713	0	0	0	0	0	0	0	0	0	0	3,391
18. MARIKINA	0	0	927	89	0	81	0	175	183	1,833	506	245	0	0	0	0	0	7,573	0	0	0	0	0	0	0	0	0	11,612
19. PASIG	0	408	2,012	0	0	185	1,714	310	0	89	178	204	0	0	0	0	0	112	3,198	0	0	0	0	0	0	0	42	8,452
20. PATEROS	0	0	139	0	0	0	0	0	0	45	0	0	0	0	0	0	0	0	0	831	0	0	0	0	0	0	0	1,015
21. TAGUIG	0	0	117	0	514	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78	60	437	0	0	0	0	1,206
22. PARAÑAQUE	0	358	1,295	10,009	1,411	4,529	847	576	344	1,880	0	248	0	0	0	0	0	0	142	0	492	4,247	5,586	0	0	0	0	31,964
23. MUNTINLUPA	0	0	0	0	0	169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,712	0	0	0	0	1,881
24. LAS PIÑAS	0	2,855	702	2,784	472	90	0	0	0	111	0	0	0	0	0	0	0	0	0	0	0	1,347	1,399	3,563	0	0	0	13,323
25. EXTERNAL I (BULACAN)	63	104	217	82	0	5	0	0	42	161	21	14	34	0	28	28	0	77	0	0	0	0	0	0	100	0	0	980
26. EXTERNAL II (RIZAL)	0	10	88	103	0	0	118	48	60	60	135	0	0	0	0	0	0	168	73	0	0	0	0	0	0	321	0	1,214
27. EXTERNAL III (CAVITE & LAGUNA)	0	40	136	798	40	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	250	96	0	0	0	1,436
TOTAL	15,473	20,793	66,112	36,962	4,241	19,726	12,442	11,369	16,941	42,770	9,592	20,688	8,252	60	7,816	1,515	2,713	8,265	5,513	831	570	7,456	9,898	4,000	145	387	416	334,919

Table 17.65
1980 OD Table Mode: Public Purpose: Private + Business

ORIGIN \ DESTINATION	1. MANILA 1ST	2. MANILA 2ND	3. MANILA 3RD	4. MANILA 4TH	5. PASAY	6. MAKATI	7. MAND.	8. SAN JUAN DEL MONTE	9. QUEZON I	10. QUEZON II	11. QUEZON III	12. QUEZON IV	13. CALOOCAN SOUTH	14. CALOOCAN NORTH	15. VALENZUELA	16. MALABON	17. NAVOTAS	18. MARIKINA	19. PASIG	20. PATEROS	21. TAGUIG	22. PARAÑAQUE	23. MUNTIN-LUPA	24. LAS PIÑAS	25. EXTERNAL I (BULACAN)	26. EXTERNAL II (RIZAL)	27. EXTERNAL III (CAVITE & LAGUNA)	TOTAL
1. CITY OF MANILA, 1ST	35,350	62,850	5,776	11,478	4,179	3,533	1,721	555	1,410	3,457	2,383	2,732	4,870	2,721	42	226	1,911	1,432	193	0	0	830	0	0	207	0	820	148,676
2. CITY OF MANILA, 2ND	3,624	25,689	3,872	6,246	1,268	2,728	78	338	2,365	1,412	1,254	301	902	0	16	0	244	164	233	0	0	826	812	53	200	0	168	52,193
3. CITY OF MANILA, 3RD	272	18,471	15,709	8,000	974	1,945	1,421	1,789	1,706	1,399	3,503	2,127	186	0	0	65	0	34	926	0	0	733	0	0	651	21	302	60,224
4. CITY OF MANILA, 4TH	2,157	20,150	6,141	37,579	5,647	8,793	3,372	64	342	1,335	1,831	897	388	0	11	0	237	38	185	0	142	573	0	0	247	0	965	91,699
5. PASAY	0	4,780	3,419	6,330	25,877	1,435	0	0	0	0	139	370	0	0	0	0	0	0	85	0	78	3,389	716	51	291	0	0	47,559
6. MAKATI	2,564	8,210	372	8,942	4,283	19,891	702	0	1,026	601	1,398	911	297	0	20	0	0	431	513	0	569	984	339	0	158	0	264	52,495
7. MANDALUYONG	1,160	4,266	2,285	583	421	2,862	20,516	938	219	382	3,631	975	0	0	0	0	0	0	39	529	265	0	311	0	0	0	139	12	39,978
8. SAN JUAN DEL MONTE	265	2,673	3,025	420	1,468	2,184	405	10,073	197	998	5,550	701	0	0	0	0	0	0	479	0	0	449	994	0	0	0	0	0	29,901
9. QUEZON CITY, I	952	20,203	4,308	4,920	427	3,060	226	0	16,118	3,873	2,611	1,024	905	0	33	0	0	0	0	0	0	2,072	0	0	0	0	0	60,729
10. QUEZON CITY, II	363	11,879	4,330	4,073	645	4,367	619	0	18,411	20,206	28,234	1,770	3,579	0	27	0	0	611	2,033	0	71	834	0	0	232	10	325	102,619
11. QUEZON CITY, III	318	5,924	2,974	1,513	339	3,820	196	0	973	4,268	33,937	3,721	1,006	0	0	0	0	122	0	0	0	340	0	0	88	0	198	59,737
12. QUEZON CITY, IV	0	5,308	6,834	1,041	0	2,145	460	2,741	2,892	1,075	13,844	4,520	0	0	0	0	0	84	0	0	0	1,058	0	0	0	0	0	42,002
13. CALOOCAN SOUTH	6,455	31,038	1,745	5,164	1,072	2,990	0	0	4,336	2,303	5,228	1,342	47,931	0	1,355	3,899	0	0	0	0	0	1,497	1,046	0	184	0	0	117,625
14. CALOOCAN NORTH	0	1,424	0	0	0	0	0	0	494	13,073	0	0	2,930	2,552	0	561	689	0	0	0	0	0	0	0	0	0	0	21,723
15. VALENZUELA	0	952	731	0	0	0	0	0	0	0	0	0	1,493	0	1,628	536	0	0	0	0	0	0	0	0	477	0	408	6,225
16. MALABON	137	948	140	107	0	675	0	0	0	0	0	0	5,158	0	0	7,090	384	0	0	0	0	53	0	0	30	0	810	17,377
17. NAVOTAS	668	9,328	540	1,778	571	0	0	0	336	193	316	0	2,151	0	0	6,036	13,250	0	0	0	0	0	0	0	0	0	0	36,843
18. MARIKINA	0	8,058	2,332	0	1,000	182	963	355	0	570	1,596	0	0	0	57	0	0	17,160	469	0	0	0	0	0	144	214	474	46,052
19. PASIG	297	3,337	3,573	1,037	283	1,896	2,122	0	670	670	11,971	851	838	0	0	0	0	1,944	17,211	0	1,179	505	0	55	0	643	146	38,988
20. PATEROS	0	0	0	0	0	1,915	765	558	0	1,407	2,182	613	0	0	0	0	0	0	2,334	0	856	0	0	0	0	0	0	5,870
21. TAGUIG	0	1,986	336	179	485	4,169	631	0	0	0	0	0	0	0	0	0	0	0	15,444	0	4,247	174	495	0	0	0	0	29,388
22. PARAÑAQUE	214	2,225	1,159	1,157	1,797	309	471	0	338	790	837	0	700	0	0	0	0	0	0	0	487	8,896	3,614	339	152	0	160	23,636
23. MUNTINLUPA	0	820	0	443	1,054	944	0	0	0	0	0	0	507	0	0	0	0	0	0	0	435	77	9,074	0	296	0	608	14,258
24. LAS PIÑAS	0	2,343	0	385	779	1,706	0	0	0	0	790	0	0	0	0	0	0	0	0	0	0	6,354	2,644	6,209	64	0	78	21,552
25. EXTERNAL I (BULACAN)	1,868	12,928	7,918	5,774	2,539	4,061	940	462	3,137	5,196	11,072	3,578	13,580	0	9,357	3,236	422	5,388	1,163	59	473	1,006	871	295	5,232	1,001	3,843	105,339
26. EXTERNAL II (RIZAL)	92	1,709	1,659	1,109	482	2,107	2,653	1,154	224	898	6,115	563	719	0	0	0	92	2,820	6,010	0	0	97	92	0	976	1,077	115	30,763
27. EXTERNAL III (CAVITE & LAGUNA)	231	4,296	3,030	6,339	5,569	3,300	417	0	467	803	2,019	408	526	0	950	0	56	162	376	33	240	16,271	6,342	13,900	2,497	588	2,860	72,161
TOTAL	56,367	271,795	82,757	114,602	61,356	81,008	39,078	19,018	55,661	64,909	14,162	27,505	90,036	5,278	13,496	21,649	17,285	30,429	46,183	338	9,277	47,933	27,239	20,902	12,126	3,693	12,556	1,375,613

Table 17.66
1980 OD Table Mode: Private Purpose: Private + Business

ORIGIN \ DESTINATION	1. MANILA 1ST	2. MANILA 2ND	3. MANILA 3RD	4. MANILA 4TH	5. PASAY	6. MAKATI	7. MAND.	8. SAN JUAN DEL MONTE	9. QUEZON I	10. QUEZON II	11. QUEZON III	12. QUEZON IV	13. CALOOCAN SOUTH	14. CALOOCAN NORTH	15. VALENZUELA	16. MALABON	17. NAVOTAS	18. MARIKINA	19. PASIG	20. PATEROS	21. TAGUIG	22. PARAÑAQUE	23. MUNTIN-LUPA	24. LAS PIÑAS	25. EXTERNAL I (BULACAN)	26. EXTERNAL II (RIZAL)	27. EXTERNAL III (CAVITE & LAGUNA)	TOTAL
1. CITY OF MANILA, 1ST	9,578	4,896	1,147	13,214	2,414	1,126	3,383	0	1,912	480	1,651	759	852	0	114	0	274	0	495	0	0	0	0	0	178	0	0	42,473
2. CITY OF MANILA, 2ND	3,443	10,469	2,561	2,670	1,342	1,147	0	727	2,164	0	2,415	1,250	0	0	118	0	0	0	0	0	0	45	0	0	223	35	0	28,705
3. CITY OF MANILA, 3RD	597	4,803	6,691	4,188	1,718	675	0	2,820	4,265	3,027	1,724	4,073	0	0	235	0	0	0	1,397	0	0	48	22	0	293	0	93	36,669
4. CITY OF MANILA, 4TH	1,809	9,115	367	17,223	3,361	6,942	2,746	2,047	0	53	1,211	704	2,048	0	0	0	0	0	0	0	1,022	4,167	0	0	145	120	5	50,604
5. PASAY	0	2,807	2,241	2,992	6,375	5,831	813	0	0	412	709	0	1,241	0	0	0	0	0	0	0	0	1,062	0	0	372	72	80	24,491
6. MAKATI	1,224	3,438	4,679	11,023	9,937	43,828	2,247	2,983	3,596	699	4,545	410	838	0	0	0	0	1,144	714	0	0	1,730	34	3,859	868	208	255	98,255
7. MANDALUYONG	0	3,282	930	6,292	669	4,846	3,296	1,300	6,858	0	3,036	3,205	0	0	35	0	0	0	1,122	0	0	64	0	0	52	324	0	35,311
8. SAN JUAN DEL MONTE	0	2,351	2,392	2,137	334	3,723	294	10,377	220	120	985	178	4,433	0	1,293	0	0	619	355	0	0	0	0	0	0	0	0	29,811
9. QUEZON CITY, I	566	6,959	2,083	1,565	912	1,310	2,298	0	11,474	5,697	11,897	2,657	896	0	0	442	423	0	0	0	0	0	122	0	276	84	0	49,661
10. QUEZON CITY, II	178	388	5,053	655	302	2,331	0	0	6,674	6,068	6,875	440	0	0	1,283	98	0	0	0	0	0	87	0	20	632	0	190	31,274
11. QUEZON CITY, III	733	673	3,620	1,936	0	302	300	1,922	1,557	1,457	6,042	726	1,259	0	64	0	1,123	0	251	0	0	51	0	0	138	79	24	22,257
12. QUEZON CITY, IV	2,526	5,180	2,270	1,940	0	3,385	0	0	1,559	2,649	8,094	4,293	0	0	1,897	0	0	0	0	0	0	0	0	0	66	14	0	33,943
13. CALOOCAN SOUTH	895	3,085	1,235	0	0	0	0	2,910	0	0	3,141	13,737	0	0	1,883	1,104	0	0	23	0	0	0	0	0	197	3	36	28,249
14. CALOOCAN NORTH	0	0	0	0	0	0	0	0	0	3,676	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0	0	3,712
15. VALENZUELA	0	312	0	1,091	0	0	0	0	0	0	0	0	2,060	0	2,816	0	0	0	510	0	0	0	0	0	1,152	54	0	7,995
16. MALABON	57	45	601	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	151	0	0	0	0	0	148	0	694	2,123
17. NAVOTAS	0	223	0	718	0	0	0	0	0	0	0	0	1,240	0	0	1,606	2,598	0	850	0	0	0	0	0	0	0	15	7,250
18. MARIKINA	0	994	952	332	0	916	0	0	0	242	2,919	0	0	0	0	0	0	4,532	0	0	0	0	0	0	147	27	0	11,061
19. PASIG	0	0	903	0	822	1,638	5,879	0	0	377	0	0	0	0	0	0	0	0	608	5,637	128	0	0	0	127	218	54	16,391
20. PATEROS	0	68	0	34	0	3,476	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	5,463
21. TAGUIG	0	0	0	0	0	3,145	1,122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,091	0	0	0	36	48	5,442
22. PARAÑAQUE	0	5,356	1,314	3,299	8,338	8,055	1,252	2,352	0	0	0	179	0	0	0	0	0	0	0	2,459	2,459	8,038	1,325	0	18	28	325	42,338
23. MUNTINLUPA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,002	961	0	45	28	232	2,268
24. LAS PIÑAS	0	1,075	625	966	1,976	3,156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,663	82	7,903	0	0	250	17,696
25. EXTERNAL I (BULACAN)	738	2,600	899	507	491	1,116	138	280	591	2,269	1,887	361	1,778	26	4,254	1,170	266	889	445	275	235	819	609	103	2,315	698	538	26,062
26. EXTERNAL II (RIZAL)	65	407	172	304	214	707	470	271	214	256	1,554	120	41	0	0	15	33	911	1,106	33	0	487	33	0	750	372	96	9,231
27. EXTERNAL III (CAVITE & LAGUNA)	104	844	451	873	1,369	1,759	133	73	118	198	856	68	363	0	98	60	40	159	422	172	242	1,981	1,936	2,057	329	753	614	16,120
TOTAL	22,583	69,371	41,186	73,949	40,574	99,414	21,418	28,062	41,202	27,680	56,400	22,564	30,786	26	14,166	4,846	4,757	8,862	13,500	2,084	3,358	22,335	5,124	13,942	8,757	3,750	3,559	684,855

Table 17.67
1980 OD Table Mode: Public Purpose: Home

ORIGIN \ DESTINATION	1. MANILA 1ST	2. MANILA 2ND	3. MANILA 3RD	4. MANILA 4TH	5. PASAY	6. MAKATI	7. MAND.	8. SAN JUAN DEL MONTE	9. QUEZON I	10. QUEZON II	11. QUEZON III	12. QUEZON IV	13. CALOOCAN SOUTH	14. CALOOCAN NORTH	15. VALENZUELA	16. MALABON	17. NAVOTAS	18. MARIKINA	19. PASIG	20. PATEROS	21. TAGUIG	22. PARAÑAQUE	23. MUNTIN-LUPA	24. LAS PIÑAS	25. EXTERNAL I (BULACAN)	26. EXTERNAL II (RIZAL)	27. EXTERNAL III (CAVITE & LAGUNA)	TOTAL
1. CITY OF MANILA, 1ST	97,046	9,129	4,775	3,350	486	1,041	246	164	2,890	3,110	291	727	22,693	293	84	2,275	5,449	473	613	293	69	82	0	0	3,089	10	1,122	159,800
2. CITY OF MANILA, 2ND	116,207	50,456	59,302	37,451	14,751	14,762	13,008	7,568	33,812	32,562	11,317	16,957	53,503	3,204	7,254	9,774	10,108	6,452	6,955	2,060	2,529	4,805	2,483	3,416	24,044	3,792	11,759	560,291
3. CITY OF MANILA, 3RD	51,659	24,161	104,010	32,298	13,684	12,368	17,837	18,924	38,176	50,483	26,838	41,083	34,580	1,734	8,229	8,506	8,264	13,045	19,301	1,774	5,238	4,623	937	2,583	17,571	7,446	8,021	573,473
4. CITY OF MANILA, 4TH	36,869	15,604	28,550	106,647	25,375	28,645	6,617	3,427	12,919	12,961	6,862	6,208	18,546	1,105	4,187	3,624	4,122	2,521	4,728	468	2,629	11,942	5,154	7,859	11,280	2,308	26,794	396,961
5. PASAY	8,592	2,089	6,568	9,027	48,987	10,595	1,818	663	1,987	2,233	1,068	1,378	4,139	0	268	466	1,386	914	919	90	4,669	9,349	1,975	4,790	3,774	1,194	10,028	138,767
6. MAKATI	11,593	6,498	14,209	23,394	10,424	60,149	12,169	5,331	6,395	12,544	10,748	8,687	7,540	387	747	1,300	2,136	5,713	6,951	4,621	8,847	6,033	2,446	2,289	6,430	4,248	11,133	252,952
7. MANDALUYONG	2,650	1,175	6,572	9,885	1,435	6,347	52,018	3,090	1,582	2,608	1,815	3,211	2,700	166	346	1,224	628	1,742	20,140	2,395	3,305	496	82	527	1,600	9,513	1,070	138,321
8. SAN JUAN DEL MONTE	1,786	2,212	5,259	1,337	281	1,500	2,886	21,412	810	1,219	1,687	4,305	1,535	0	0	268	242	193	223	0	922	121	221	0	34	1,482	694	50,629
9. QUEZON CITY, I	3,152	2,919	7,592	2,895	735	1,273	1,062	1,416	46,212	34,948	4,098	9,251	11,213	1,317	208	2,249	1,050	500	441	875	455	0	391	169	4,346	206	268	141,241
10. QUEZON CITY, II	8,657	3,544	9,424	4,318	835	1,753	2,243	2,574	14,321	89,437	7,955	9,708	16,178	24,563	597	3,563	2,366	2,623	1,880	585	447	322	321	62	6,998	998	677	218,969
11. QUEZON CITY, III	8,865	3,760	17,018	3,874	853	5,615	4,479	8,991	8,026	35,048	54,484	19,302	9,329	422	969	2,001	1,403	33,368	6,796	736	2,228	122	1,060	542	12,678	6,266	3,396	249,831
12. QUEZON CITY, IV	4,264	1,218	9,023	1,677	558	2,143	1,395	3,181	6,801	14,317	11,011	21,653	4,963	0	117	992	603	2,854	909	340	670	251	113	119	3,685	816	1,180	94,853
13. CALOOCAN SOUTH	17,199	5,733	3,661	1,353	315	319	596	980	5,460	9,679	1,419	1,832	97,194	4,560	18,255	31,828	11,144	366	998	0	254	162	1,233	203	23,551	289	1,151	239,755
14. CALOOCAN NORTH	310	0	0	103	0	0	0	0	0	216	0	0	0	8,131	0	0	0	0	0	0	0	0	0	0	198	0	0	8,958
15. VALENZUELA	2,195	584	651	823	0	262	260	209	485	1,566	284	379	6,381	2,598	40,568	2,549	306	219	102	0	0	36	69	0	15,245	0	406	76,177
16. MALABON	2,518	381	998	311	100	0	109	358	595	1,115	789	256	12,960	164	7,944	30,941	16,319	346	0	0	86	228	0	222	6,527	113	260	83,640
17. NAVOTAS	1,558	82	449	299	0	0	158	0	202	195	84	96	1,007	0	89	1,642	25,116	0	148	0	0	0	0	0	550	0	0	31,675
18. MARIKINA	648	267	778	172	37	166	160	363	332	1,574	846	219	0	0	49	0	0	57,257	2,556	0	224	25	0	0	11,124	5,205	1,017	83,019
19. PASIG	4,264	1,837	4,972	2,226	230	2,074	4,553	2,444	938	2,426	1,271	2,794	2,466	114	0	151	787	2,126	98,830	3,030	19,958	266	526	380	3,048	13,502	952	176,165
20. PATEROS	0	0	86	0	0	814	0	118	0	0	0	0	0	0	0	0	0	0	479	4,326	4,222	0	0	0	93	129	78	10,345
21. TAGUIG	885	184	1,211	1,334	1,116	1,871	878	349	472	512	319	55	500	0	0	163	112	74	906	971	19,545	3,093	3,332	178	397	388	3,428	42,263
22. PARAÑAQUE	5,586	1,560	3,330	2,111	6,731	2,397	1,069	991	2,564	1,725	419	536	1,256	201	0	250	126	325	531	139	3,210	22,623	4,468	8,921	1,788	1,752	24,703	99,312
23. MUNTINLUPA	2,098	654	1,018	2,334	1,286	1,394	621	397	720	1,603	404	609	926	0	0	202	0	588	925	0	1,949	7,774	38,434	3,390	1,165	10	10,693	79,181
24. LAS PIÑAS	152	224	158	37	439	144	56	96	0	80	0	0	0	0	0	28	0	0	201	0	123	670	1,284	22,677	358	0	8,527	36,234
25. EXTERNAL I (BULACAN)	85	229	523	118	59	150	511	59	0	293	150	85	599	0	147	18	18	40	0	0	59	0	59	0	8,030	937	3,807	15,976
26. EXTERNAL II (RIZAL)	0	6	207	0	0	0	97	97	0	0	189	0	0	0	0	0	48	491	0	0	0	0	30	0	1,775	1,623	892	5,449
27. EXTERNAL III (CAVITE & LAGUNA)	1,214	0	59	172	100	0	0	0	688	536	73	0	472	0	5,683	802	191	0	0	59	145	354	112	255	2,530	689	3,615	17,779
TOTAL	390,042	134,500	290,403	247,546	128,817	156,383	124,246	83,112	186,387	312,990	144,501	149,331	312,591	48,999	95,741	104,816	91,876	131,787	176,023	22,762	81,783	72,596	64,730	58,582	171,998	62,916	136,668	3,992,036

Table 17.68
1980 OD Table Mode: Private Purpose: Home

ORIGIN \ DESTINATION	1. MANILA 1ST	2. MANILA 2ND	3. MANILA 3RD	4. MANILA 4TH	5. PASAY	6. MAKATI	7. MAND.	8. SAN JUAN DEL MONTE	9. QUEZON I	10. QUEZON II	11. QUEZON III	12. QUEZON IV	13. CALOOCAN SOUTH	14. CALOOCAN NORTH	15. VALENZUELA	16. MALABON	17. NAVOTAS	18. MARIKINA	19. PASIG	20. PATEROS	21. TAGUIG	22. PARAÑAQUE	23. MUNTIN-LUPA	24. LAS PIÑAS	25. EXTERNAL I (BULACAN)	26. EXTERNAL II (RIZAL)	27. EXTERNAL III (CAVITE & LAGUNA)	TOTAL
1. CITY OF MANILA, 1ST	17,671	2,104	1,968	685	181	827	898	87	3,627	578	159	334	1,616	0	280	974	1,406	0	0	0	0	546	0	255	219	6	182	34,603
2. CITY OF MANILA, 2ND	15,986	8,022	6,844	6,325	3,807	4,240	3,378	2,342	19,963	4,024	1,787	4,624	6,035	1,443	553	2,554	2,080	94	434	1,195	515	4,438	0	2,447	2,356	833	1,566	107,885
3. CITY OF MANILA, 3RD	2,497	4,661	41,250	12,922	2,475	5,455	10,510	6,105	19,308	4,030	5,954	10,033	3,643	1,126	992	67	0	641	5,147	416	174	5,756	0	1,550	1,266	755	442	147,175
4. CITY OF MANILA, 4TH	9,536	2,372	13,283	30,140	9,974	27,422	6,366	3,175	6,952	3,694	2,416	4,389	5,962	637	345	1,920	1,366	667	1,400	135	1,079	23,949	70	7,596	1,648	825	2,183	169,501
5. PASAY	1,297	546	4,519	2,417	12,607	4,623	832	89	1,190	869	301	553	1,031	374	0	0	0	0	442	0	3,069	12,532	66	3,540	1,546	502	1,373	54,318
6. MAKATI	3,907	411	8,117	10,216	7,421	64,171	6,605	3,765	6,273	3,558	3,914	4,412	1,633	63	87	1,859	1,057	1,226	2,715	3,111	3,737	28,873	1,128	6,226	1,668	1,795	3,013	180,961
7. MANDALUYONG	914	194	3,167	273	295	2,505	9,577	3,706	733	651	2,146	1,763	344	0	53	488	215	114	4,228	781	0	2,277	54	206	526	1,015	257	36,484
8. SAN JUAN DEL MONTE	1,224	87	2,876	1,079	208	1,191	9,364	16,263	2,472	850	3,385	3,064	265	0	0	314	0	218	1,411	0	0	2,846	0	257	70	361	141	47,966
9. QUEZON CITY, I	1,568	532	6,676	363	1,111	101	427	2,309	38,013	8,324	1,628	2,047	3,505	0	111	1,516	0	409	510	579	0	352	152	0	755	240	239	71,468
10. QUEZON CITY, II	922	227	6,928	1,731	1,268	2,311	1,738	4,855	9,536	27,391	8,963	4,313	4,851	8,826	257	1,195	0	1,154	1,306	402	643	5,189	0	930	2,936	198	354	98,484
11. QUEZON CITY, III	3,167	0	3,431	674	326	4,122	1,628	2,765	12,400	6,527	15,587	9,797	1,399	453	0	843	4,522	2,530	2,459	2,115	0	525	126	0	1,364	1,194	740	78,639
12. QUEZON CITY, IV	888	49	7,926	1,089	249	1,612	1,242	3,652	8,350	4,794	5,761	17,493	1,203	184	42	624	0	346	364	0	358	2,126	0	0	219	102	297	58,979
13. CALOOCAN SOUTH	868	492	1,423	153	1,012	408	0	423	5,523	2,201	0	988	20,872	2,121	995	714	0	132	0	0	0	498	0	0	2,294	39	54	41,210
14. CALOOCAN NORTH	0	0	0	0	0	0	0	0	0	0	0	0	0	539	0	0	0	0	0	0	0	0	0	0	40	0	0	579
15. VALENZUELA	681	274	2,492	0	0	0	355	454	3,298	354	94	0	3,416	276	11,289	1,286	0	850	1,574	0	0	0	0	0	3,768	62	53	30,576
16. MALABON	121	45	1,386	0	708	339	295	0	235	11	0	0	2,558	0	0	3,587	3,063	0	0	0	0	0	0	0	1,155	12	48	13,563
17. NAVOTAS	414	34	722	57	0	0	0	0	0	45	0	113	183	0	0	23	6,598	0	0	0	0	263	0	0	99	0	24	8,575
18. MARIKINA	382	0	0	0	246	420	0	0	849	374	539	0	0	0	0	0	0	18,458	435	0	0	0	0	0	1,216	948	252	24,119
19. PASIG	288	111	1,500	584	380	1,038	2,115	1,516	2,376	393	794	779	495	0	0	155	0	117	9,595	0	0	452	119	106	732	2,466	158	26,269
20. PATEROS	0	0	0	0	0	181	0	0	0	0	0	0	0	0	0	0	0	0	74	1,059	0	0	0	0	0	0	36	1,350
21. TAGUIG	122	11	212	264	114	134	0	0	160	348	24	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	1,350
22. PARAÑAQUE	393	271	701	1,006	2,209	2,885	230	0	627	244	49	84	0	73	0	0	140	27	188	0	991	2,022	112	458	36	168	355	5,679
23. MUNTINLUPA	480	141	854	332	662	550	609	0	50	0	0	232	0	0	0	24	0	0	442	0	1,039	13,982	7,109	2,140	418	68	1,741	30,873
24. LAS PIÑAS	0	0	0	1,805	613	843	0	0	0	204	0	0	0	0	0	0	0	0	567	0	0	1,651	182	21,965	243	0	2,713	30,786
25. EXTERNAL I (BULACAN)	0	256	0	14	0	0	51	0	0	39	63	78	0	24	324	0	0	7	0	0	0	0	18	0	2,477	705	486	6,542
26. EXTERNAL II (RIZAL)	0	0	0	9	0	39	22	11	0	0	136	9	0	0	0	0	0	0	299	0	22	0	0	0	680	720	287	2,334
27. EXTERNAL III (CAVITE & LAGUNA)	0	50	0	50	0	1,742	0	0	20	920	34	0	770	0	862	1,371	0	40	0	0	0	28	125	72	955	246	994	8,278
TOTAL	63,326	20,890	116,275	72,188	45,866	127,159	56,242	51,477	141,955	70,323	53,734	65,127	59,782	16,144	16,190	19,514	20,447	27,030	33,590	10,019	12,337	119,530	9,367	49,835	30,001	14,011	20,763	1,343,117

Chapter 18.
MODEL ANALYSIS FOR DEMAND FORECASTING

CHAPTER 18 MODEL ANALYSIS FOR DEMAND FORECAST

18.1 INTRODUCTION

- The purpose of this chapter is to describe the methodology and results of the transport demand analysis based on data obtained mainly from Chapter 17. In general, the transport demand model is obtained by analyzing the mechanism of the existing demand and used for forecasting/estimating the future demand.
- The projection of future transport demand has not been undertaken in the sutdy. However, some of the necessary analysis models for projection are provided herein for future application.

18.1.1 Popular Traffic Demand Forecasting Models

- According to the four-step transport demand forecasting model stages, namely: generation, distribution, modal split, and route assignment; the major portion of demand analyses was divided into the following five categories:

1) **Socio-economic indicator forecasting model:** intends to forecast various socio-economic indicators which are the most important input data for traffic demand forecasting models. In general, this involves the following:
   - Population
   - Employment
   - School attendance
   - Production (by industrial sector)
   - Car ownership
   - Floor area (by use)
   - Miscellaneous

   The traffic demand is estimated mostly on the basis of traffic zones which are usually finer than cities/municipalities. Most socio-economic data are based on the latter; except for population, they are seldom provided on the basis of traffic zones. Hence, population is forecasted by zone in the initial stage and then, other data are also forecasted based on their correlationship to population.

2) **Generation/attraction model:** forecasts trip generation/attraction by zone, as well as total traffic demand of the study area. The total demand can be derived as the sum of zonal values. However, since the accuracy of model application depends on the scale zones, the following procedure is usually used:
   a) The total traffic demand is forecasted as a first step and broken down into zonal values based on those separately calculated according to the generation/attraction model.
   b) The model has to be verified beforehand on the basis of the existing situation.

3) **Trip OD-distribution forecast model:** aims to create OD tables based on the estimated trip generation/attraction by zone. This procedure is normally adopted by trip purpose considering the difference in trip distribution pattern. This model is basically divided into the following categories:
   a) Present pattern method: which applies to the existing OD distribution pattern for the future, to be used on the assumption that the interrelationship of each OD pair traffic is almost stable.
   b) OD distribution model method: makes use of distance and other factors by zone pair as explanatory variables in the model.

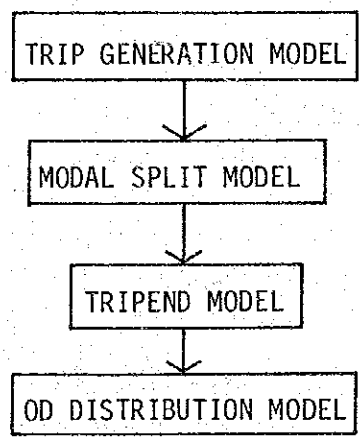
4) **Modal-split forecast model:** forecasts the modal share in number of trips. This is considered to be the most difficult model because a variety of variables including some unquantifiable factors have to be taken into account. In general, this model may be classified into four (4) types:

   a) Total model: determines the modal share, right after processing the total traffic demand.
   b) Trip-end model: determines the modal share between trip generation/attraction and trip OD distribution.
   c) Trip interchange model: determines the modal share after forecasting trip OD distribution.
   d) Path model: determines the modal share as a result of traffic assignment.

5) **Traffic assignment model:** which simulates the traffic flow of vehicles and/or passengers on an approximated transport network. There are some discussions on the method to determine road capacity, volume-speed relationship, etc. This model is classified into two types, namely: a) highway type network assignment and b) public transport route assignment (TRANSTEP).

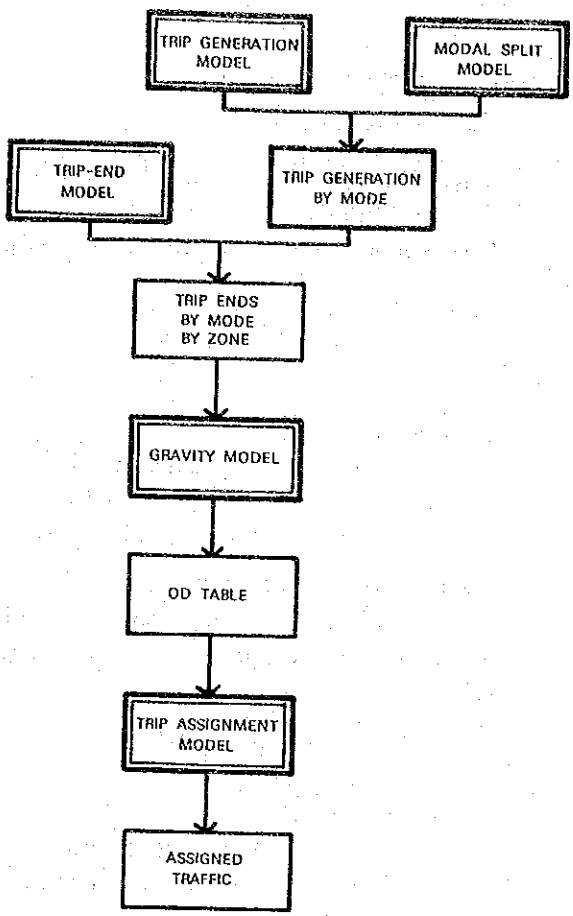
18.1.2 Concept of the Transport Demand Model

- The basic structure of the transport demand model applied in this study consists of the combination of four sub-models as shown below:

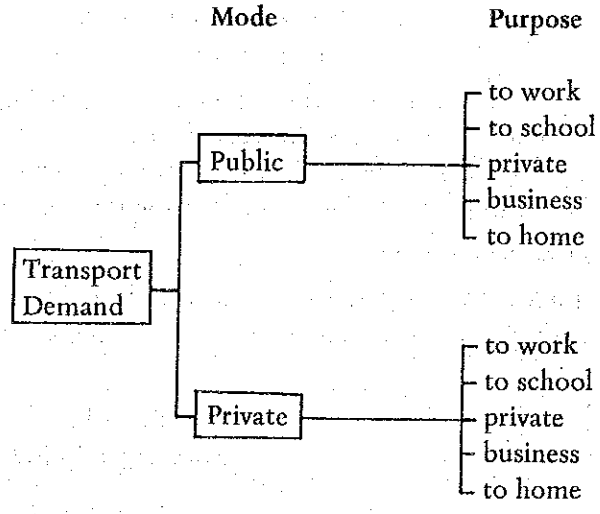


- In contrast to the above, other combinations of these sub-models can be considered by the arrangement of the "Modal Split Model". This application should be chosen depending upon its accuracy to existing conditions. The variations are as follows:
  - Trip Generation → Trip-end → Modal Split → OD Distribution
  - Trip Generation → Trip-end → OD Distribution → Modal Split
- As mentioned in Chapter 17, the modal choice for Metro Manila seems to depend on personal characteristics, such as car ownership and household income level. Accordingly, the Modal Split Model was used right after the Trip Generation Model.
- This transport demand model concept is shown in Figure 18.1.

Figure 18.1
Concept of Transport Demand Model



- For model analysis, all available data were taken from the HIS Analysis results and NCSO statistics as summarized in Chapter 17. The relationship between transport demand and the socio-economic indices were analyzed mainly through the application of the "Direct Least Square Method". Transport demand was classified by transport mode and trip purpose, and analyzed individually into the following categories:



Trips made on foot, motorcycle and train were excluded from this analysis since the transport demand model analysis was oriented to the major urban transport modes on roads.

18.2 TRIP GENERATION MODEL

18.2.1 General

- Since trip generation depends upon the persons' characteristics (such as age, occupation, car-ownership, etc.), it can be explained as "the number of trips generated per person". It is otherwise known as the trip generation rate. This is defined by the following formula:

$$Ri = \frac{Gi}{Pi}$$

wherein,

Ri = Trip generation rate in personal characteristic i
Gi = Trips generated by persons of characteristic i
Pi = Population in characteristic i

- Each person belonging to a particular categorized characteristic has its own trip generation rate. In addition, the population was obtained from other data sources by each category of characteristics. Hence, total generated trips in Metro Manila was calculated by formula below:

$$G = \sum_i Ri \cdot Pi$$

wherein,

G : Total trip generation
Pi : Population in characteristic i

When only the composition rates of personal characteristics are available, the following formula is used:

$$G = \sum_i Ri \cdot Ci \cdot P$$

wherein,

G : Total trip generation
Ci : Composition rate of characteristic i
P : Total population

- The total generated trips estimated by applying this model was used as the control total volume. It comprises the total demand in Metro Manila. Inasmuch as the trip generation by zone was estimated in the latter stage (trip-end model), the sum of these trips should be consistent with the total trips from the trip generation model.

18.2.2 Trip Generation Rate

- Table 18.1 shows the trip generation rate by sex and car-ownership. There are no significant discrepancies between male and female as well as car-owning and noncar-owning.

Table 18.1
Estimated Trip Rate[1/]

Sex		Car Ownership	
Male	2.28	Car-owning	2.33
Female	2.17	Noncar-owning	2.19
Total	2.22	Total	2.22

[1/] includes tricycle and train

- It is desirable that the trip rate should range widely by person characteristics in order to respond sensitively to the change of population characteristics structure in the future. Therefore, the degree of variation was examined. The coefficient of variation indicates that the trip rate by occupation has a larger variation than that by age as indicated in Table 18.2.

Table 18.2
Comparison of Variation, Trip Rate[1/]
by Age and Occupation

	By Age	By Occupation
Average[2/] (1)	2.23	2.30
Standard Deviation (2)	0.145	0.277
Coefficient of Variation (2)/(1) x 100	6.50	12.00

1/includes tricycle and train

2/simple mean

- The trip generation rates by occupation are adequate indices of the trip generation model in Metro Manila. Table 18.3 shows the final revised results of trip generation rate by occupation, excluding walking, motorcycle, train and tricycle modes. The last two factors (train and tricycle modes) are, likewise, excluded from the model factors.

Table 18.3
Trip Generation Rate by Occupation

Occupation	Work	School	Private	Business	Home	All Purpose
Service Workers	0.84	0.02	0.30	0.09	1.00	2.25
Administrative	0.98	0.02	0.22	0.27	1.18	2.67
Sales	0.55	0.01	0.41	0.41	0.83	2.21
Clerical	1.12	0.03	0.08	0.09	1.21	2.53
Factory	1.10	0.01	0.09	0.05	1.12	2.37
Transport	0.94	0.01	0.27	0.21	1.09	2.52
Professional	1.02	0.05	0.14	0.09	1.13	2.43
Student (Elementary	0.01	0.79	0.01	0.00	1.08	1.89
Student (High School & Colleges	0.01	0.79	0.06	0.02	1.21	2.09
Housewife	0.01	0.01	1.09	0.08	0.69	1.88
Jobless	0.01	0.01	0.99	0.28	0.54	1.83
Others	0.55	0.02	0.57	0.12	0.73	1.99
Total	0.39	0.34	0.28	0.09	1.02	2.12

18.3 MODAL SPLIT MODEL

18.3.1 General

- In general, a transport mode is chosen among competitive modes by trip-makers. Their choices are dependent on travel cost, travel time, accessibility (such as walking distance and waiting time) and other convenient factors.
- As mentioned earlier, the concept of the modal split model differs depending upon its arrangement in the process of the demand model. Since the modal choice is not affected very much in the stages of OD distribution and trip assignment due to relatively higher public transport service by bus and jeepneys in Metro Manila, modal choice is examined as a model for the whole area.
- The household income level was selected as an effective factor with a close correlationship to modal split (public vs. private), as well as to car ownership and other factors connected with transportation costs.

18.3.2 Modal Split

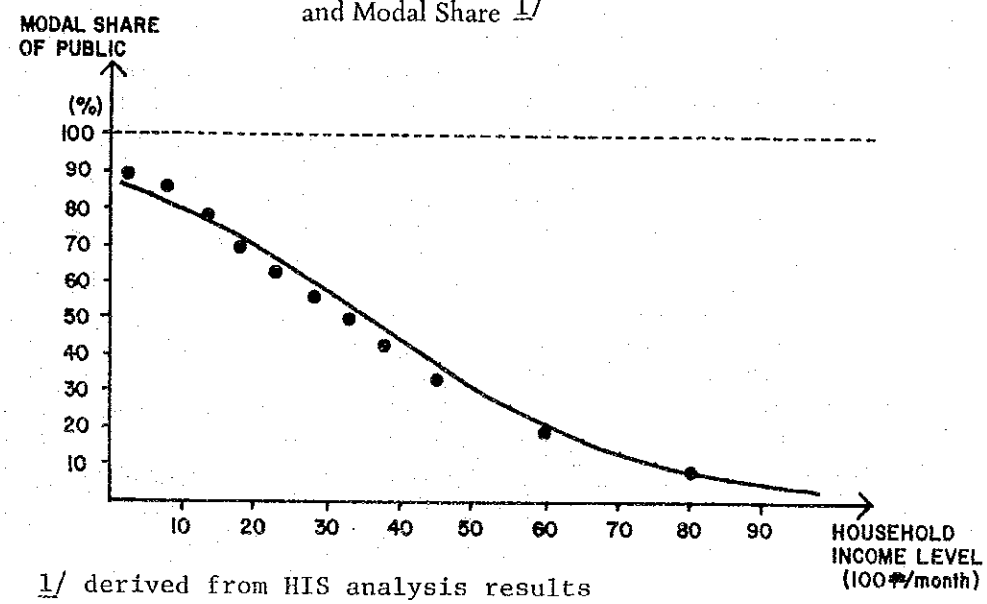
- Figure 18.2 shows the correlation of household income to modal choice which is the public mode share to the total. It shows a clear tendency that as the household income level increases, the share of public mode decreases. This may be explained by the formula of logistic curve as follows:

$$Y = \frac{1}{1 + 0.1496 \cdot e^{0.0532\,x}} \qquad (R = 0.9870)$$

wherein,

Y : Modal share of public in percentage
x : Household income level (₱100/month)
R : Correlation coefficient

Figure 18.2
Correlationship of Income Level
and Modal Share 1/



1/ derived from HIS analysis results

- After the result is derived by the above formula, the modal share can be estimated on the assumption that trip rate does not vary by household income level. The total public modal share is derived as follows:

$$R = \sum_{i} Yi \cdot pi$$

wherein,

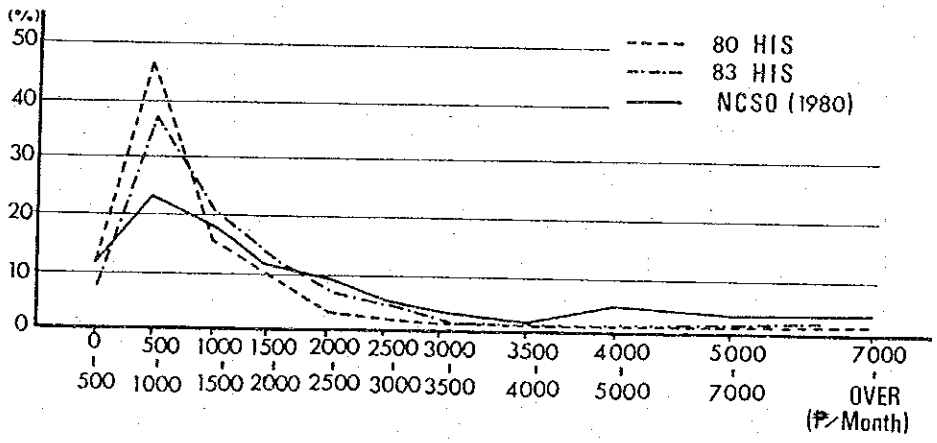
R : Share of public mode

Yi : Share of public mode in income level i

pi : Composition rate of population whose household income level i is $\sum_{i} pi = 1$

- The distribution of household income level in 1980 is shown below.

Figure 18.3
Household Income Level Distribution



- Moreover, the relationship of income level to modal share by trip purpose was analyzed further. This analysis was done by the modal share of trip-ends by 24 zones.
- Figure 18.4 shows a close correlation between modal share and average household income level by zone, while Figure 18.5 illustrates the relationship between modal share and average car-ownership ratio by zone. All figures show approximately the same tendencies; as income level/car-ownership increases, the share of public mode decreases. This is true for all purposes except for "business" purpose.
- Table 18.4 shows the relationship of trip purpose, car-ownership rate and household income, through the use of regression analysis. A comparison of household income level and car-ownership indicates that the latter has a closer correlation to modal choice except for the "business" purpose.

Figure 18.4
Correlation between Household Income Level
and Modal Share by 24 zones

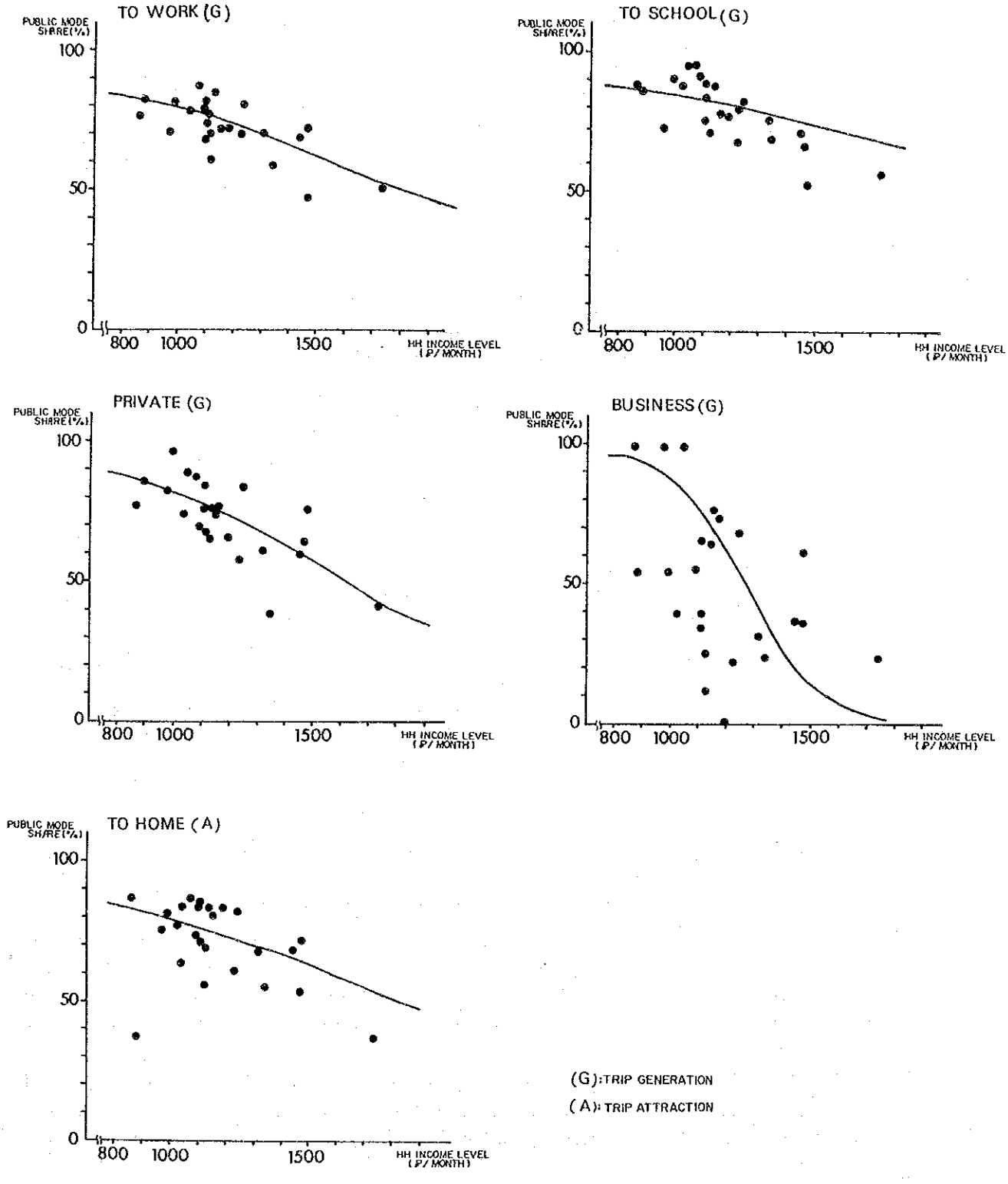


Figure 18.5
Correlation between Car-ownership Ratio and Modal Share by 24 zones

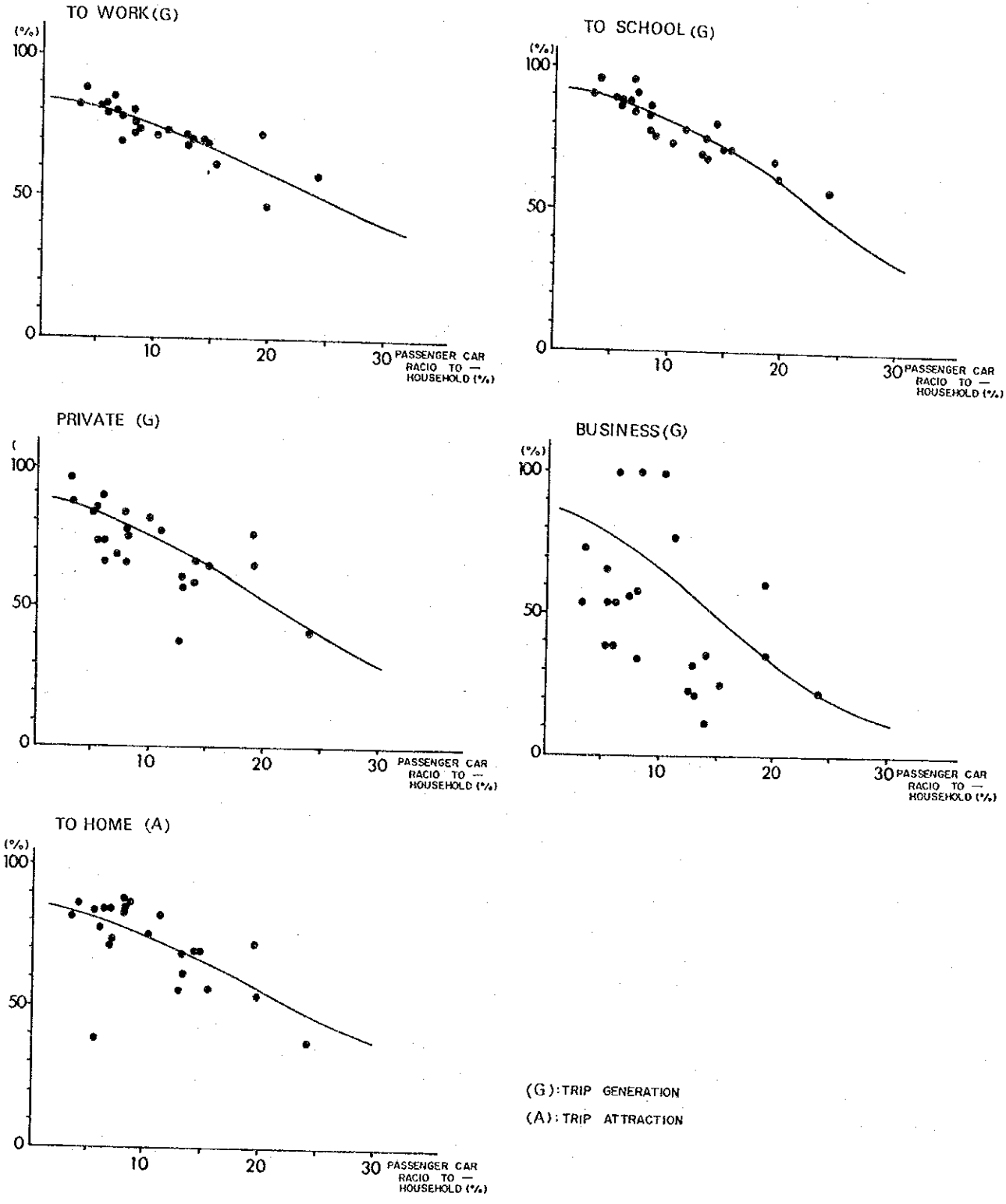


Table 18.4
Modal Split Model

Trip Purpose	Factor x	Parameter a	Parameter m	Correlation Coefficient
To work (G)	Car-Ownership Rate (4-Wheeled Vehicle)	0.0778	0.1333	0.8504
	Car-Ownership Rate (Passenger Car)	0.0785	0.1543	0.8606
	Household Income	0.0016	0.553	0.6418
To school (G)	Car-Ownership Rate (4-Wheeled Vehicle)	0.1142	0.0542	0.8284
	Car-Ownership Rate (Passenger Car)	0.1154	0.0671	0.8399
	Household Income	0.0012	0.0583	0.4942
Private (G)	Car-Ownership Rate (4-Wheeled Vehicle)	0.0855	0.1213	0.5616
	Car-Ownership Rate (Passenger Car)	0.1019	0.1212	0.6713
	Household Income	0.0025	0.0177	0.6242
Business (G)	Car-Ownership Rate (4-Wheeled Vehicle)	0.1027	0.1592	0.1432
	Car-Ownership Rate (Passenger Car)	0.1336	0.1416	0.1870
	Household Income	0.0075	7.725×10^{-5}	0.3863
To home (A)	Car-Ownership Rate (4-Wheeled Vehicle)	0.0797	0.1328	0.5973
	Car-Ownership Rate (Passenger Car)	0.0828	0.1508	0.6223
	Household Income	0.0016	0.1519	0.4598

$$Ti = \frac{1}{1 + ai \cdot e^{mi \cdot xi}}$$

wherein,

Ti : Modal share of public in purpose i

Xi : Factors for purpose i

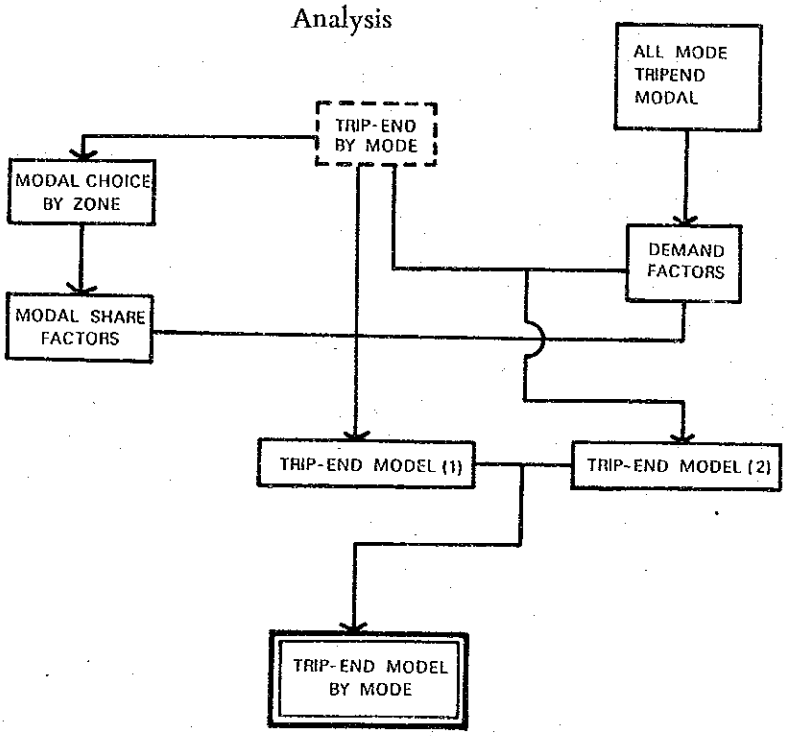
ai,mi : Parameter

18.4 TRIP-END MODEL

18.4.1 General

- Transport demand by zone is presented in terms of trip generation and attraction. Trip generation refers to trips originating from a zone, while trip attraction to trips made towards a zone.
- Since the model heavily relies on trip purpose, it is generally examined by destination: "to work", "to school", "private", "business", and "to home", etc. The trip demand is divided into two categories: home-based and nonhome-based. According to this classification, most of "to work", "to school" and "private" purpose generated trips and "to home" attracted trips belong to home-based, and most of "business" are considered to be nonhome-based. The factors used in the trip-end model also differ by each trip category.
- The analytical procedure of the trip-end model is summarized in the figure below.

Figure 18.6
Conceptual Flow Trip-end Model Analysis



1) In the first stage, the examination on which indicators have close relations to the trip demand by purpose was conducted by analyzing the data of total demand (public mode plus private) by 24 zones.
2) After some effective demand factors were determined, the trip-end model was examined by mode. There were two approaches. One is the same as that of all mode trip-end model analysis and the other is the analysis with respect to the modal share of factors.
3) Although few results were obtained from each method, the most accurate trip-end model by purpose and by mode is considered to be a result of comprehensive judgement.

18.4.2 Socio-economic Indicators as Factors

- Since many verifications on the accuracy of the trip-end model were done, symbols were used to represents the transport demand and socio-economic factors for analysis. The symbols are summarized in Tables 18.5 and 18.6.

Table 18.5
Symbols of Socio-economic Indices

Symbol	Factor
S	Area
PN	Population at night
PD	Population at daytime
H	Household
EN	Employment at night
ED	Employment at daytime
EN3	Tertiary employment at night
ED3	Tertiary employment at daytime
STN	Student at night
STD	Student at daytime
YH	Household income
RCV	Rate of car ownership (all vehicles)
RCP	Rate of car ownership (passenger car)

Table 18.6
Symbols Used for Transport Demand

Symbol	Factor
GW	Generation (To Work)
GS	Generation (To School)
GP	Generation (Private)
GB	Generation (Business)
GH	Generation (To Home)
AW	Attraction (To Work)
AS	Atrraction (To School)
AP	Attraction (Private)
AB	Attraction (Business)
AH	Attraction (To Home)

- For model analysis, thirteen major socio-economic indices were applied. Some indices are illustrated in Figure 18.7 to 18.10 to show a clear-cut and better understanding of the existing feature. These thirteen socio-economic indices are not all independent and some of them have very close affinity with one another. This is shown in the correlation matrix of factors in Table 18.7.

Table 18.7
Correlation Table of Factors

	1 PH	2 H	3 PD	4 EN	5 ED	6 EN3	7 ED3	8 STN	9 STD	10 RCV	11 RCP	12 YH	13 S
1. PN	1.0000	0.9926	0.8740	0.9834	0.6942	0.9747	0.6595	0.9893	0.6965	-0.4192	-0.3245	-0.3270	0.1239
2. H	0.9926	1.0000	0.8580	0.9915	0.6686	0.9793	0.6288	0.9954	0.6843	-0.3783	-0.2795	-0.2670	0.1422
3. PD	0.8740	0.8580	1.0000	0.8693	0.8526	0.8948	0.8563	0.8939	0.8965	-0.3994	-0.2971	-0.2412	0.0294
4. EN	0.9834	0.9915	0.8693	1.0000	0.7221	0.9842	0.6756	0.9905	0.6711	-0.3223	-0.2133	-0.2029	0.1674
5. ED	0.6942	0.6686	0.8526	0.7221	1.0000	0.7343	0.9815	0.6949	0.5793	-0.2563	-0.1460	-0.0812	0.1153
6. EN3	0.9747	0.9793	0.8948	0.9842	0.7343	1.0000	0.7183	0.9837	0.7157	-0.2834	-0.1801	-0.1886	0.0770
7. ED3	0.6595	0.6288	0.8563	0.6756	0.9815	0.7183	1.0000	0.6616	0.6168	-0.2315	-0.1326	-0.0931	0.0045
8. STN	0.9893	0.9954	0.8939	0.9905	0.6949	0.9837	0.6616	1.0000	0.7395	-0.3689	-0.2707	-0.2534	0.1205
9. STD	0.6965	0.6843	0.8965	0.6711	0.5793	0.7157	0.6168	0.7395	1.0000	-0.3918	-0.3204	-0.2544	-0.0956
10. RCV	-0.4192	-0.3783	-0.3994	-0.3223	-0.2563	-0.2834	-0.2315	-0.3689	-0.3918	1.0000	0.9770	0.8031	0.0707
11. RCP	-0.3245	-0.2795	-0.2971	-0.2133	-0.1460	-0.1801	-0.1326	-0.2707	-0.3204	0.9770	1.0000	0.8305	0.0877
12. YH	-0.3270	-0.2670	-0.2412	-0.2029	-0.0812	-0.1886	-0.0931	-0.2534	-0.2544	0.8031	0.8305	1.0000	0.0304
13. S	0.1239	0.1422	0.0294	0.1674	0.1153	0.0770	0.0045	0.1205	-0.0956	0.0707	0.0877	0.0304	1.0000

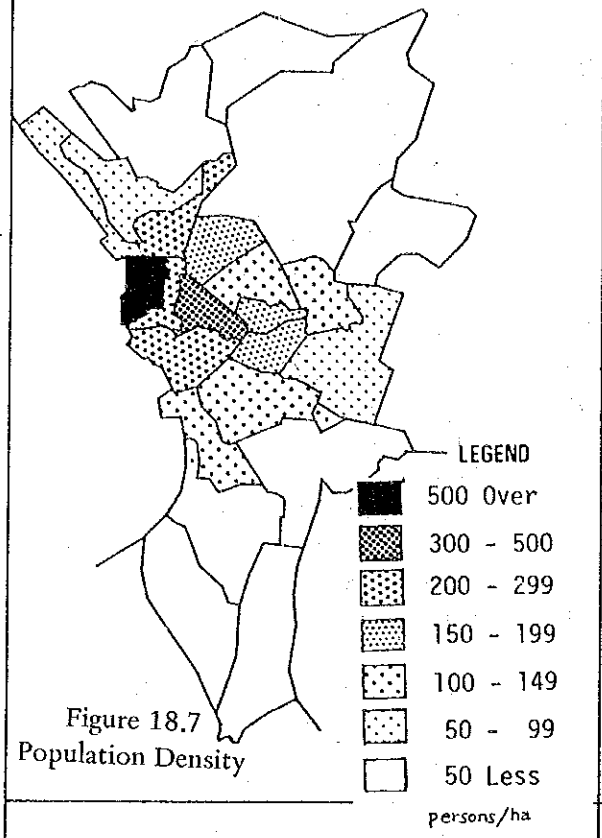


Figure 18.7
Population Density

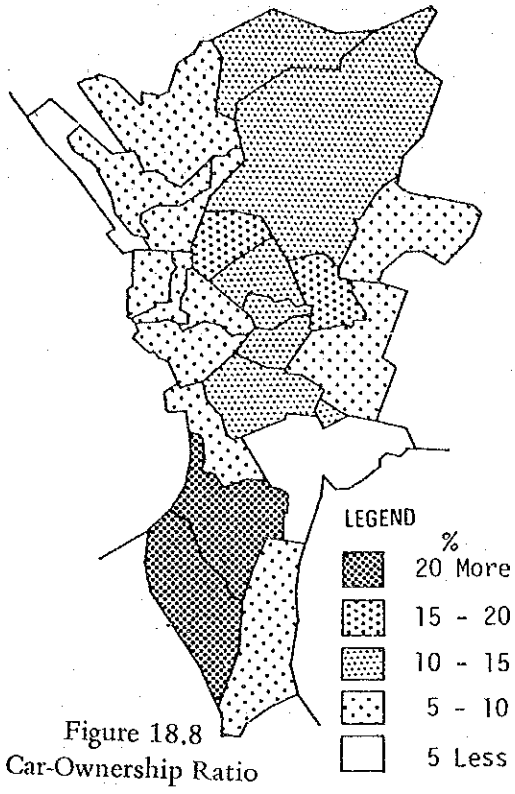


Figure 18.8
Car-Ownership Ratio

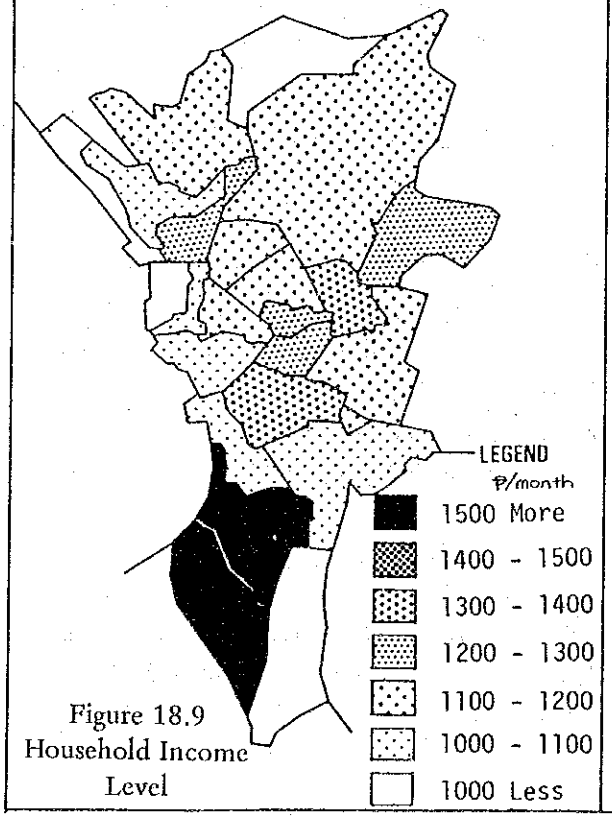


Figure 18.9
Household Income
Level

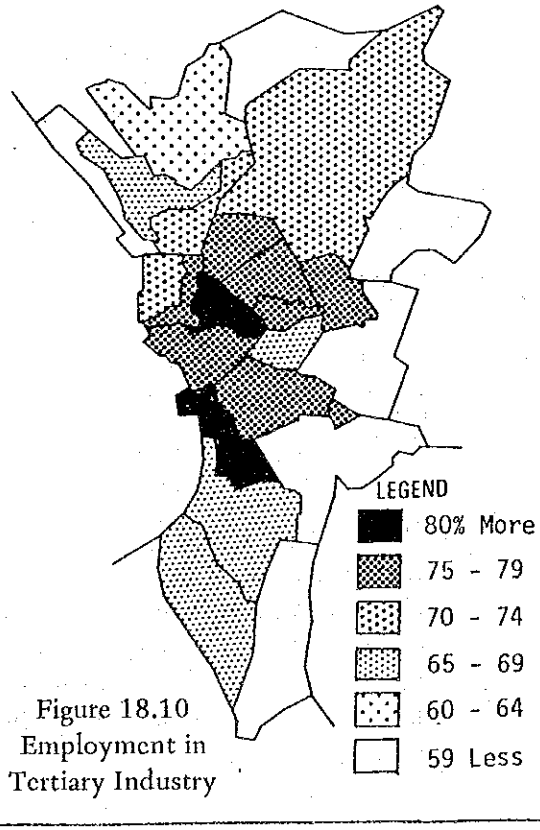


Figure 18.10
Employment in
Tertiary Industry

18.4.3 All Mode Trip-end Model

- In general, several relationships can be considered to be closer between demands by trip purpose and socio-economic data as shown in Table 18.8.

Table 18.8
List of Factors for Transport Demand

Demand			Factor
Generation	To Work	(GW)	Employment at night (EN)
	To School	(GS)	Student at night (STN)
	Private	(GP)	Population at night (PN)
			Household (H)
	Business	(GB)	Employment at night (EN)
			Employment at daytime (ED)
			Tertiary Employment at night (EN3)
			Tertiary Employment at daytime (ED3)
	To Home	(GH)	Population at daytime (PD)
Attraction	To Work	(AW)	Employment at daytime (ED)
	To School	(AS)	Student at daytime (STD)
	Private	(AP)	Population at daytime (PD)
			Tertiary employment at daytime (ED3)
	Business	(AB)	Employment at daytime (ED)
			Tertiary employment at daytime (ED)
	To Home	(AH)	Population at night (PN)

- For "private" and "business" demand, which is different from other purpose demand, two or more factors are considered. The comparison-analysis was tested among these applied factors.

1) "private" purpose trip demand

Generation: Both indices (population at night and household) show almost similar correlation coefficients. Nigh population was selected as the factor to minimize the gap in order to simplify the model structure.

Attraction: Tertiary industry sector employment at daytime was chosen rather than daytime population since the former indicates a higher coefficient than the latter.

2) "business" purpose trip demand

Generation: Four of the indices (employment at night and daytime,and tertiary employment at night and daytime were compared. Both at daytime show a higher correlation than those at night. Although the correlation coefficient is a little higher in the tertiary employment than in total employment, employment at daytime was the factor selected. It is unreasonable that only the tertiary employment influences the business trip demand.

Attraction: As a result of the comparison of employment at daytime and tertiary employment at daytime, the former was selected for almost the same reason as generation.

The results of the tests are tabulated in Table 18.9.

Table 18.9
Correlation Coefficient between Trip Demand and Demand Factor

Demand	Factor	Correlation Coefficient
GW	EN	0.9685
GS	STN	0.9269
GP	PN	0.8864
	H	0.8819
GB	EN	0.5374
	ED	0.7206
	EN3	0.5712
	ED3	0.7391
GH	PD	0.8941
AW	ED	0.9832
AS	STD	0.9658
AP	PD	0.6329
	ED3	0.7613
AB	ED	0.8843
	ED3	0.9318
AH	PN	0.9215

- The results of total demand analysis are summarized in Table 18.10.

These results show comparatively high correlation coefficients in most cases. These are also illustrated in Figures 18.11 and 18.12.

Table 18.10
Total Demand Model

Demand[1/]	Factor[1/]	Constant k	Parameter a	t-value k	t-value a	Correlation Coefficient
GW	EN	-4871.2	1.1617	0.9	17.8	0.9685
GS	STN	2563.4	0.9266	0.4	11.3	0.9268
GP	PN	-2846.8	0.3006	0.4	8.8	0.8864
GB	ED	2595.9	0.2553	0.6	4.8	0.7206
GH	PD	-55273.1	1.2872	1.6	4.1	0.8941
AW	ED	-21895.5	1.4203	4.4	24.7	0.9832
AS	STD	33726.1	1.4423	4.2	17.1	0.9658
AP	ED3	4510.9	1.0400	0.3	5.4	0.7613
AB	ED	3929.1	0.3104	1.3	8.7	0.8843
AH	PN	-181.5	1.0056	0.0	11.2	0.9251

The formula used is: $Y = K + a \cdot X$

wherein,

Y : Demand
X : Factor
a : Parameter
k : Constant

Figure 18.11
Correlation between Socio-economic
Index and Trip Generation by zones (all modes)

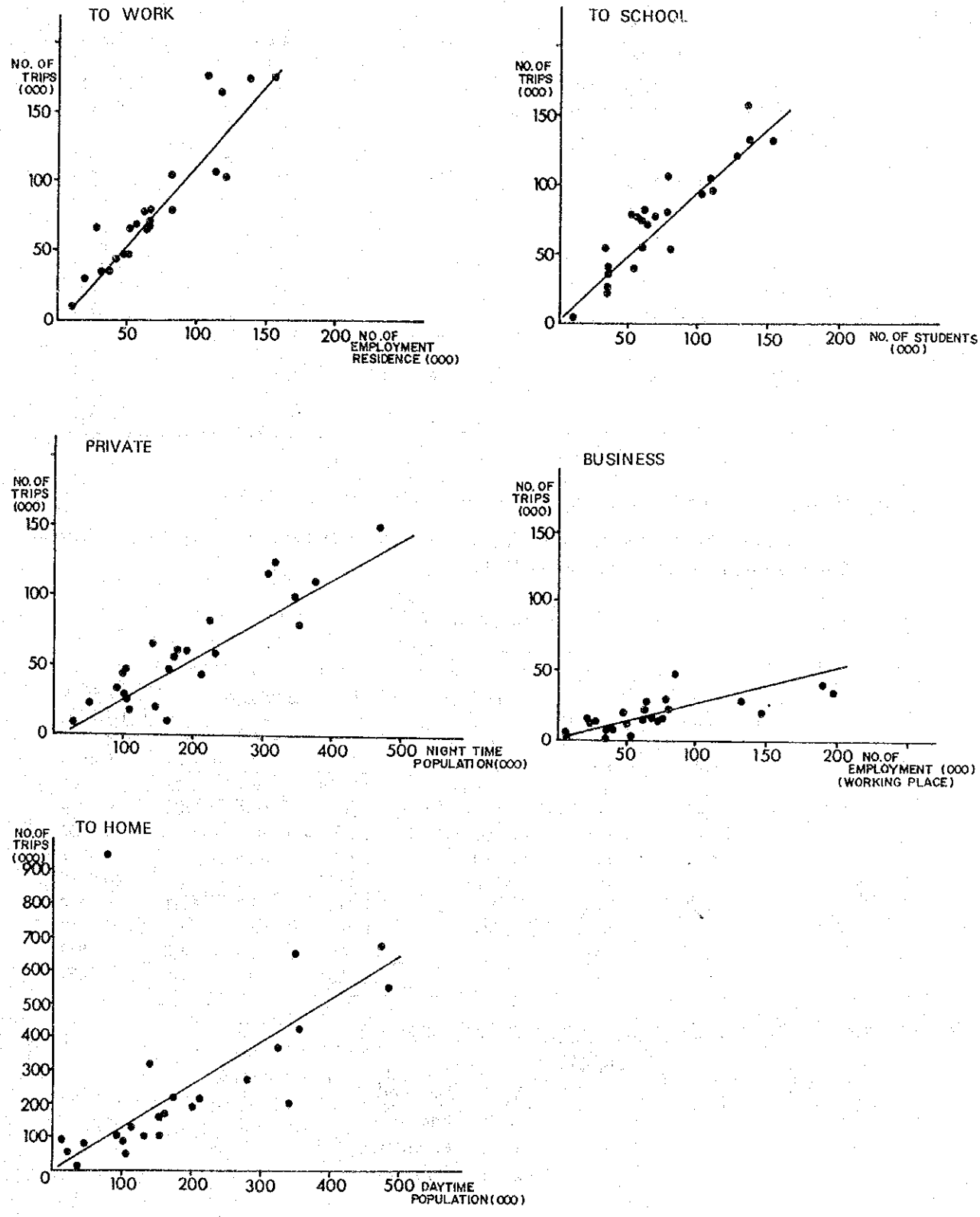
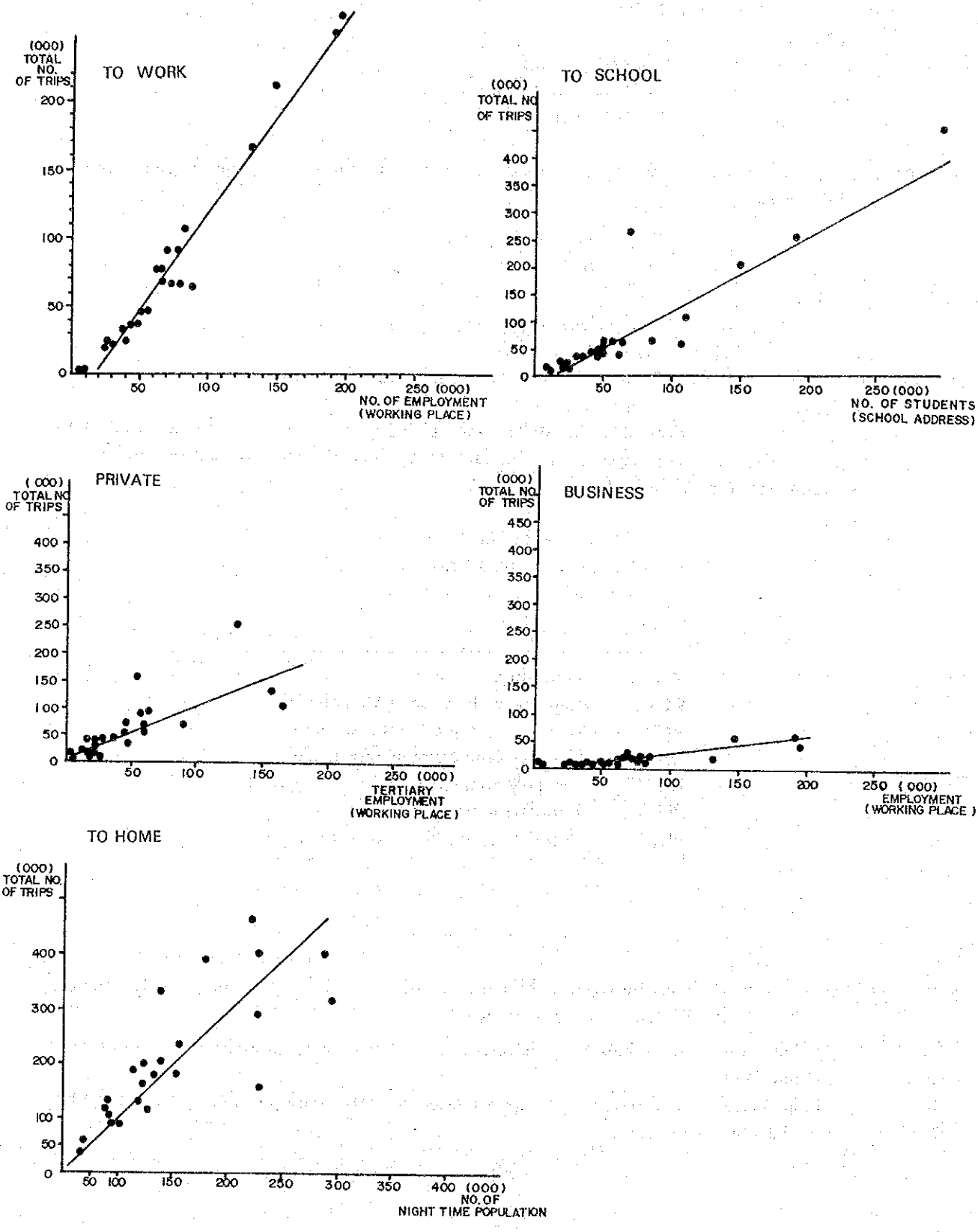


Figure 18.12
Correlation between Socio-economic Index
and Trip Attraction by 24 zones (all modes)



18.4.4 Trip-end Model by Mode (1)

- Trip-end model by mode is defined by the following formula:

$$Ti = D \cdot Ri$$

wherein:

Ti : Trip-end in mode i
D : Total Demand (Public + Private)
Ri : Modal share in mode i

- Since the total demand can be explained by socio-economic indices, the above formula is modified accordingly:

$$Ri = \frac{Ti}{D} = \frac{Ti}{f(x)} \fallingdotseq f\left(\frac{Ti}{X}\right)$$

wherein:

Ri : Modal share in mode i
Ti : Trip-end in mode i
X : Demand factor

- At first, the correlation of R (modal share) or T/X (trip ratio by mode) to some socio-economic indices were analyzed. The factors applied and the correlation coefficients are summarized in Table 18.11.

Table 18.11
Modal Share Factors

Symbol	Factor
YH	Household Income
RCV	Car Ownership Rate (All Vehicle)
RCP	Car Ownership Rate (Passenger Car)
EN3/EN	Tertiary employment rate at night
ED3/ED	Tertiary employment rate at daytime
PN/S	Population density at night
PD/S	Population density at daytime

- Correlation coefficients between public modal share and related socio-economic indices are shown in Table 18.12. The results indicate that:
  1) Modal share of home-based trip is related to car-ownership rate (RCP) and household income (YH).
  2) Modal share of nonhome-based trip is related to tertiary employment rate (ED3/ED); but this correlation is weak.

Table 18.12
Correlation Coefficient between Public Modal Share
and Socio-economic Indices

Generation/ Attraction	Purpose	YH	RCV	RCP	EN3/EN	ED3/ED	PN/S	PD/S
Generation	To Work	-0.6704	-0.8356	-0.8664	-0.2021	–	0.2667	–
	To School	-0.7809	-0.8971	-0.9080	–	–	0.2024	–
	Private	-0.6818	-0.6113	-0.6855	0.3060	–	0.0980	–
	Business	–	–	–	–	-0.1896	–	-0.0398
	To Home	–	–	–	–	-0.1150		0.1359
Attraction	To Work	–	–	–	–	-0.4249		-0.1676
	To School							0.1718
	Private	–	–	–	–	-0.1719		0.0911
	Business	–	–	–	–	0.2898	–	–
	To Home	-0.6439	-0.6400	-0.7099	-0.1552	–	0.0938	0.0177

Note: Refer to Table 18.11 for the meanings of symbols.

- Table 18.13 shows the correlation between trip rate, which is defined as formula Ti/X, and socio-economic index. As in Table 18.12, home-based trip also related to household income (YH) and car-ownership rate (RCP) but this relation appears more clearly in the private mode than in the public mode. On the other hand, the correlation of nonhome-based trip is not clear.

Table 18.13
Correlation Coefficient between Trip Ratio
and Socio-economic Indices

Generation/ Attraction	Trip Ratio[1/]	Mode	YH	RCV	RCP	EN3/EN	ED3/ED	PN/S	PD/S
Generation	GW/EN	Public	-0.4748	-0.3819	-0.3903	0.0816	–	0.3787	–
		Private	0.5410	0.8179	0.8314	0.2373	–	0.1749	–
	GS/STN	Public	-0.0286	-0.0880	-0.0261	–	–	0.1553	–
		Private	0.7271	0.8277	0.8704	–	–	0.1508	–
	GP/PN	Public	-0.0548	0.0301	0.0146	0.3057	–	0.2409	–
		Private	0.6780	0.6497	0.7188	0.4067	–	0.0124	–
	GB/PD	Public	–	–	–	–	-0.0583	–	-0.1532
		Private	–	–	–	–	0.2433		0.0764
	GH/PD	Public	–	–	–	-	0.4526	–	0.5951
		Private	–	–	–	–	0.4248	–	0.1686
Attraction	AW/ED	Public	–	–	–	–	0.2127	–	0.4064
		Private	–	–	–	–	0.4954	–	0.4194
	AS/STD	Public							0.6954
		Private							0.0169
	SP/PD	Public	–	–	–	–	0.3900	–	0.3632
		Private	–	–	–	–	0.4136	–	0.0928
	AB/PD	Public	–	–	–	–	0.3516	–	0.5832
		Private	–	–	–	–	0.5888	–	0.3902
	AH/PN	Public	-0.1715	-0.1295	-0.1644	0.0882	–	0.2912	–
		Private	0.7323	0.7812	0.8338	0.1286	–	0.2044	–

Note: Refer to Tables 18.5 and 18.6 for the meanings of symbols.

- Briefly, in nonhome-based trips, the variation of transport demand is expressed by the demand factor. Therefore, the variation of modal share is small compared with that of demand value as calculated by the regression model. The multi-regression technique was used for trip-end model analysis of home-based trips. The following formula was tested:

$$T = k \cdot X1^{a} \cdot X2^{b}$$

wherein:

T	:	Trip-end by mode and by purpose
X1	:	Demand Factor
X2	:	Factor of modal choice
a,b	:	Parameters
k	:	Constant

Judging from the sign of the parameters, multi-correlation coefficient and t-value[1/], the home-based trip model shows better results in the private mode than in the public mode. Car-ownership rate (passenger car) is more appropriate for the model choice factor rather than household income and car-ownership rate (all vehicles).

[1/] "t-value" shows the reliability of the variable parameter. When the multi-regression technique is applied, parameters have to be checked to determine whether they are significant or not. If t-value is too small, the parameter should be omitted from the model. For example, when t-value is 2.0, this parameter is significant at a confidence level of 95%.

- Table 18.14 shows the results of the home-based trip-end model. However the sign for parameter "b" in the public mode of "to school" and "private" should be negative. The formula used is given as follows:

$$Y = k \cdot X1^{a} \cdot X2^{b}$$

wherein:

Y	:	Generation or Attraction
X1	:	Demand Factor
X2	:	Car Ownership rate (Passenger Car)
a,b	:	Parameters
k	:	Constant

Table 18.14
Multi-regression Model
(Home-based trips)

Mode	G/A	Purpose	Demand Factor[1/]	Constant k	Parameter a	Parameter b	t-value k	t-value a	t-value b	Multi-Correlation Coefficient
Public	Generation	To Work	EN	0.6041	1.0469	-0.1211	0.6	15.4	1.5	0.9626
		To School	STN	0.0257	1.2993	0.0103	3.5	14.7	0.1	0.9585
		Private	PN	0.0822	1.0637	0.0082	1.0	5.5	0.0	0.7871
	Attraction	To Home	PN	1.5569	0.9701	-0.2164	0.2	5.4	1.0	0.7976
Private	Generation	To Work	EN	0.0452	1.0267	0.6769	3.2	12.6	7.1	0.9504
		To School	STN	0.0004	1.2973	1.2204	3.9	7.7	6.0	0.8952
		Private	PN	0.00006	1.3448	1.2542	3.7	6.6	5.2	0.8601
	Attraction	To Home	PN	0.0006	1.2491	1.3199	3.5	7.6	6.8	0.8984

[1/] Refer to Table 18.5 for the meanings of symbols.

18.4.5 Trip-end Model by Mode (2)

- In Section 18.4.4, the relation between total demand and socio-economic index was analyzed and adequate indices have been determined. On the basis of these results, the correlation by mode was also tested independently.
- In this section, different formulas will be examined. They are linear regression and log-linear regression equations. The results of the test are summarized in Tables 18.15 to 18.18. Refer to Tables 18.5 and 18.6 for meanings of symbols used. Meanwhile, correlationships by mode and trip purpose are illustrated in Figures 18.13 to 18.16. Major observations are pointed out below:
  1) In both regression formulas, the correlation coefficient of the public mode is higher than that of the private mode.
  2) In the log-linear regression model, the coefficient of nonhome-based trips is higher than that of home-based trips.
  3) "Private" and "Business" trips generally show low coefficients when the above formulas are used.

Table 18.15
Correlation between Transport Demand
and Socio-economic Index (Public)

Demand (Y)	Factor (X)	Constant k	Parameter a	t-value k	t-value a	Correlation Coefficient
GW	EN	-8089.4	0.9233	1.7	16.1	0.9617
GS	STN	-2298.3	0.8005	0.5	15.4	0.9585
GP	PN	-5199.0	0.2297	0.8	8.1	0.8692
GB	ED	3625.3	0.0657	2.7	1.7	0.5296
GH	PD	-41088.1	0.9616	1.4	7.8	0.8615
AW	ED	-11858.1	0.9911	2.8	20.0	0.9746
AS	STD	-32710.9	1.2329	4.2	15.1	0.9567
AP	ED3	3940.2	0.7240	0.3	4.1	0.6647
AB	ED	-1793.6	0.1426	1.1	7.4	0.8491
AH	PN	-16668.1	0.8238	1.0	11.5	0.9286

Formula: $Y = k + a \cdot X$

Table 18.16
Correlation between Transport Demand
and Socio-economic Index (Private)

Demand (Y)	Factor (X)	Constant k	Parameter a	t-value k	t-value a	Correlation Coefficient
GW	EN	3218.2	0.2384	0.9	5.3	0.7565
GS	STN	4861.7	0.1260	1.3	2.7	0.5028
GP	PN	2352.1	0.0709	0.4	2.9	0.5366
GB	ED	2189.9	0.1070	1.0	4.4	0.6944
GH	PD	-1168.3	0.3256	1.1	7.2	0.8442
AW	ED	-10037.6	0.4292	3.6	13.2	0.9446
AS	STD	-1015.2	0.2094	0.5	9.0	0.8912
AP	ED3	570.674	0.3160	0.2	5.8	0.7850
AB	ED	-2135.6	0.1678	1.0	7.1	0.8415
AH	PN	16596.6	0.1818	1.1	2.7	0.5080

Formula: $Y = k + a \cdot X$

Table 18.17
Correlation between Transport Demand
and Socio-economic Index (Public)

Demand (Y)	Factor (X)	Constant k	Parameter a	t-value k	t-value a	Correlation Coefficient
GW	EN	0.3915	1.0621	1.2	15.3	0.9581
GS	STN	0.0268	1.2976	3.9	15.4	0.9585
GP	PN	0.0855	1.0619	1.1	5.8	0.7871
GB	ED	1.7823	0.6923	0.1	0.7	0.1549
GH	PD	0.0053	1.3948	4.2	13.3	0.9457
AW	ED	0.0116	1.3743	8.1	27.2	0.9861
AS	STD	0.0090	1.3775	6.0	19.1	0.9724
AP	ED3	0.0292	1.2879	1.7	6.7	0.8252
AB	ED	2.56×10^{-21}	5.0021	6.0	6.9	0.8345
AH	PN	0.5548	1.0163	0.3	5.8	0.7858

Formula: $Y = k \cdot X^a$

Table 18.18
Correlation between Transport Demand
and Socio-economic Index (Private)

Demand (Y)	Factor (X)	Constant k	Parameter a	t-value k	t-value a	Correlation Coefficient
GW	EN	0.5100	0.9421	0.4	6.4	0.8120
GS	STN	0.0555	1.0940	1.0	4.0	0.6618
GP	PN	0.0247	1.0773	1.0	3.6	0.6228
GB	ED	1.26×10^{-23}	3.3535	1.9	2.4	0.4604
GH	PD	0.00008	1.6457	3.6	7.6	0.8551
AW	ED	0.0018	1.4409	9.0	22.3	0.9795
AS	STD	0.0005	1.5093	2.6	5.6	0.7766
AP	ED3	1.46×10^{-11}	3.1741	3.5	4.7	0.7186
AB	ED	5.40×10^{-11}	2.9084	2.9	3.9	0.6522
AH	PN	0.3202	0.9676	0.3	3.4	0.5996

Formula: $Y = k \cdot X^a$

18.4.6 Conclusion

- It may be concluded that the model which consists of the demand factor and modal factor can only be applied for home-based trips, with the exception of "to school" and "private" trips. Other trip linear-typed models or log-linear models are more applicable.
- The trip-end model formulas and their respective correlation coefficients by mode and purpose are summarized in Table 18.19.

N-12

Table 18.19
Summary of Trip-end Model

Mode	Generation/ Atrraction	Prupose	Formula[1/]	Correlation Coefficient
Public	Generation	To Work	$GW=0.6041 \cdot EN^{1.0469} \cdot RCP^{-.1211}$	0.9626
		To School	$GS=0.0268 \cdot STN^{1.2976}$	0.9585
		Private	$GP=0.0855 \cdot PN^{1.0619}$	0.7871
		Business	$GB=3625.3+0.0657 \cdot ED$	0.5296
		To Home	$GH=0.0053 \cdot PD^{1.3948}$	0.9457
	Attraction	To Work	$AW=0.0116 \cdot ED^{1.3743}$	0.9861
		To School	$AS=0.0090 \cdot STD^{1.3775}$	0.9724
		Private	$AP=0.0292 \cdot ED3^{1.2879}$	0.8252
		Business	$AB=-1793.6 + 0.7240 \cdot ED$	0.8491
		To Home	$AH=1.5569 \cdot PN^{0.9701} \cdot RCP^{-0.2164}$	0.7976
Private	Generation	To Work	$GW=0.0452 \cdot EN^{1.0267} \cdot RCP^{0.6769}$	0.9504
		To School	$GS=0.0004 \cdot STN^{1.2973} \cdot RCP^{1.2204}$	0.8952
		Private	$GP=0.00006 \cdot PN^{1.3448} \cdot RCP^{1.2542}$	0.8601
		Business	$GB=2189.9+0.1070 \cdot ED$	0.6944
		To Home	$GH=0.00008 \cdot PD^{1.6457}$	0.8551
	Attraction	To Work	$GH=0.0018 \cdot ED^{1.4409}$	0.9795
		To School	$AS=0.0005 \cdot STD^{1.5093}$	0.7766
		Private	$AP=570.674+0.3160 \cdot ED3$	0.7850
		Business	$AB=-2135.6+0.1678 \cdot ED$	0.8415
		To Home	$AH=0.0006 \cdot PN^{1.2491} \cdot RCP^{1.3199}$	0.8984

[1/] Refer to Tables 18.5 and 18.6 for meanings of symbols.

Figure 18.13
Correlation between Socio-economic Index
and Trip Generation by 24 zones (Public Mode)

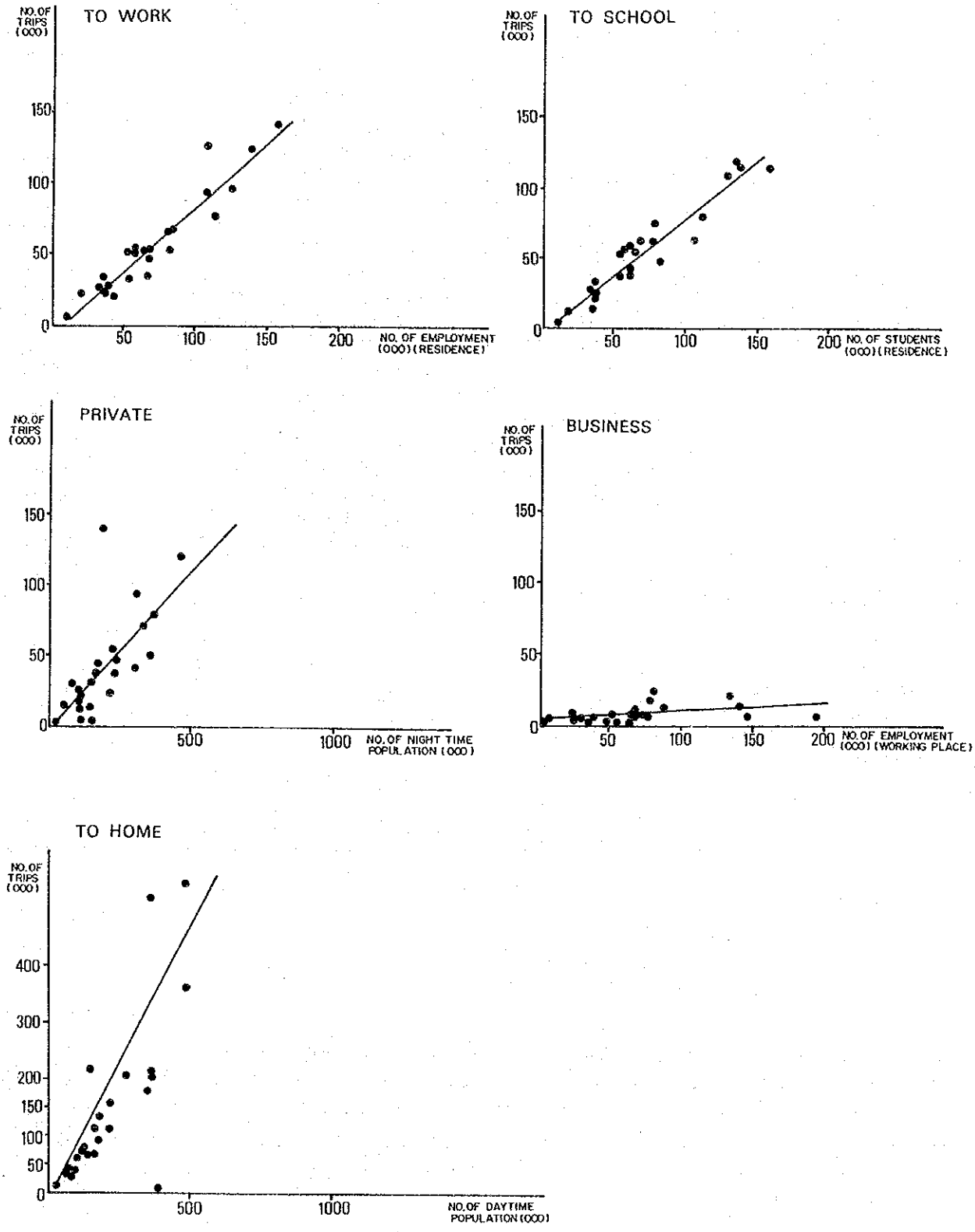


Figure 18.14
Correlation between Socio-economic Index
and Trip Attraction by 24 zones (Public Mode)

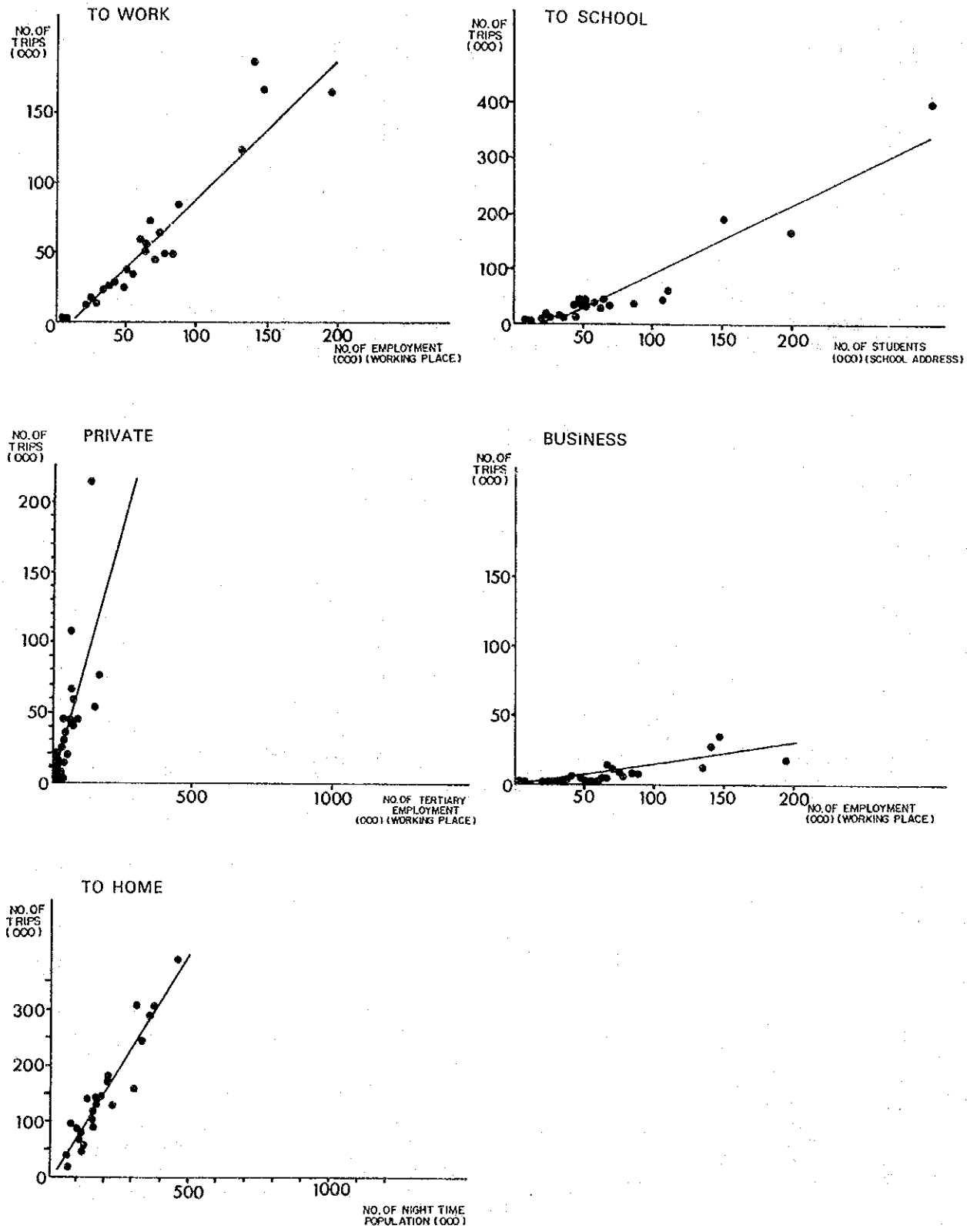


Figure 18.15
Correlation between Socio-economic Index
and Trip Generation by 24 zones (Private Mode)

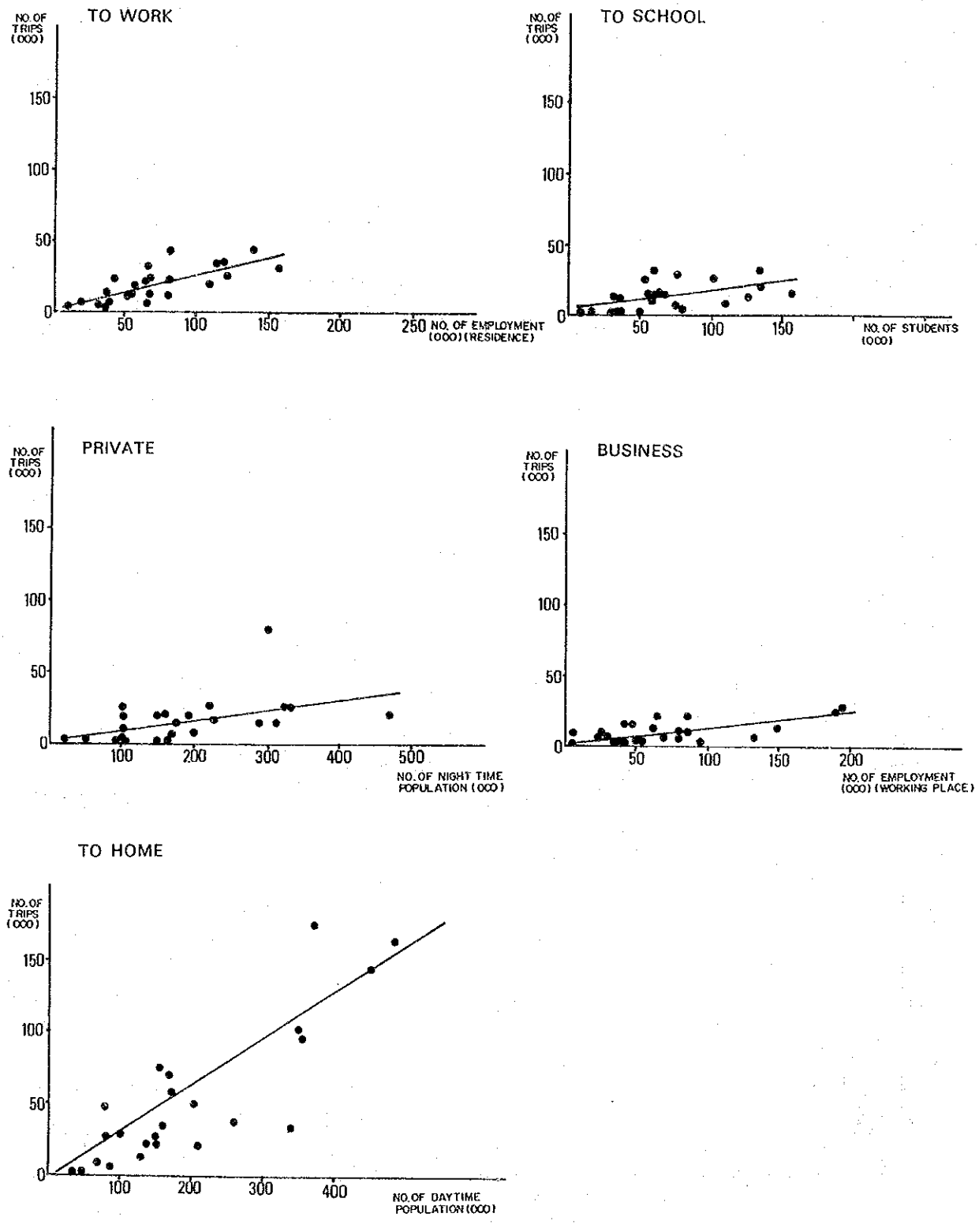
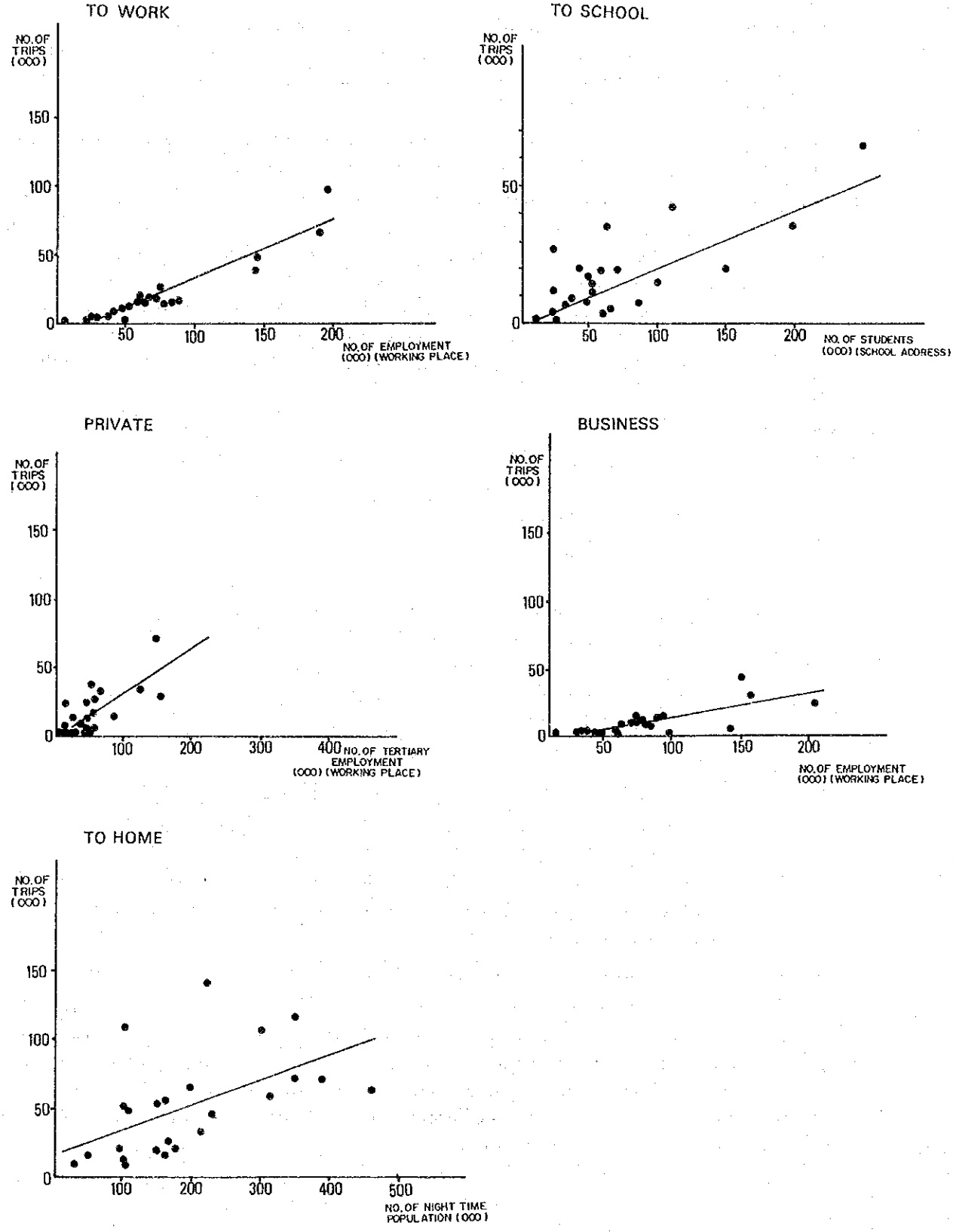


Figure 18.16
Correlation between Socio-economic Index
and Trip Attraction by 24 zones (Private Mode)



18.5 OD DISTRIBUTION MODEL

18.5.1 General

- This model was tested after application of the trip-end model. Accordingly, the trip demand per zone is given in terms of trip generation and attraction. The model estimates the OD trip distribution and trip volume by OD pair, based on generated and attracted trips by zone.
- Some applicable OD distribution models for urban transport analysis and planning are the "Gravity Model", "Opportunity Model", "Entropy Model", and so on.
- The gravity model which is commonly used nowadays consists of three variables, namely: 1) trip generation, 2) trip attraction, and 3) inter-zone distance (travel time). The concept of this model is that trip distribution is directly proportional to trip generation and attraction in their zones, but inversely proportional to the distance between their zones. In this section, the existing OD trip distributions in 24 and 202 zone systems were examined from the viewpoint of the accuracy of the gravity model. Moreover, since the results of the gravity model application was insufficient, further analysis was undertaken with the intra-zone trip model.

18.5.2 Gravity Model

- The following formula was used for the test:

$$Tij = k \cdot \frac{(Gi \cdot Aj)^a}{dij^b}$$

Wherein:
- Tij : OD pair trip demand, zone i to j
- Gi : Trip generation in zone i
- Aj : Trip generation in zone j
- Dij : Distance between zones i to j
- a, b : Parameters
- k : Constant

- Calibration was done with the following two cases, based on the present OD tables:
  1) **24-zone OD Table** : Since it is difficult to determine the intra-zone distance, intra-zone OD pairs are excluded.
  2) **202-zone OD Table** : In this OD table, the intra-zone OD trips are not large in comparison with other OD pair volumes. Therefore, all OD pairs, except those with zero, are the objectives for analysis.
- The results of the analysis are given in Tables 18.20 to 18.23 are summarized as follows:
  1) 24 zones : The level of accuracy of correlation coefficients in each case are not sufficient, except for "to work" and "all purpose" trips by public mode. The parameter "b", which represents the impedance of distance, is smallest for "business" purpose trips. This indicates that the business activity is less affected by distance.
  2) 202-zones : The correlation coefficients are even smaller than those in the 24-zone case, both in public and private modes.

Table 18.20
Gravity Model by 24 Zones (Public Mode)

Trip Purpose	Constant k	Parameter a	Parameter b	Multi-Correlation Coefficient
to work	5.0375×10^{-5}	0.8903	1.1003	0.892
to school	7.0001×10^{-5}	0.8393	0.9638	0.721
private	0.0015	0.7072	0.8126	0.604
business	2.6111	0.3362	0.1853	0.485
to home	6.2371×10^{-6}	0.9430	1.2073	0.798
all purpose	9.4357×10^{-6}	0.9233	1.3763	0.924

Table 18.21
Gravity Model by 24 Zones (Private Mode)

Trip Purpose	Constant k	Parameter a	Parameter b	Multi-Correlation Coefficient
to work	0.0032	0.6243	0.5059	0.631
to school	1.6126	0.3418	0.6264	0.281
private	0.1000	0.5047	0.8540	0.533
business	68.6279	0.1742	0.2446	0.433
to home	0.0010	0.6827	0.8549	0.613
all purpose	0.0003	0.8386	1.0956	0.689

Table 18.22
Gravity Model by 202 Zones (Public Mode)

Trip Purpose	Constant k	Parameter a	Parameter b	Multi-Correlation Coefficient
to work	0.6960	0.3027	0.3200	0.478
to school	0.5331	0.3330	0.3708	0.473
private	4.3564	0.2497	0.3006	0.412
business	87.8112	0.1249	0.0601	0.406
to home	0.4779	0.3300	0.5080	0.478
all purpose	0.5108	0.3279	0.6803	0.557

Table 18.23
Gravity Model by 202 Zones (Private Mode)

Trip Purpose	Constant k	Parameter a	Parameter b	Multi-Correlation Coefficient
to work	17.0942	0.1545	0.2076	0.334
to school	11.0869	0.2025	0.2214	0.381
private	7.6743	0.2481	0.1952	0.375
business	192.2104	0.1066	0.1031	0.436
to home	3.3608	0.2609	0.3894	0.399
all purpose	4.6309	0.2352	0.4510	0.429

18.5.3 Intra-Zonal Trip Model

- When the intra-zonal trip model has a certain amount of trips against other OD pair trips, it is desirable to examine the intra-zonal trips separately from other OD distribution trips.
- This model was examined in terms of "intra-zonal trip ratio" or the "intra-zonal trip" itself. For example, the following formula was applied:

$$Tii = k \cdot (G \cdot Ai)^a \cdot Si^b$$

Wherein:

Tii : Intra-zonal trip in zone i
Gi : Trip generation in zone i
Ai : Trip attraction in zone i
Si : Area of zone i
a,b : Parameters
k : Constant

- The results are given in Tables 18.24 and 18.25.

Table 18.24
Intra-zonal Trip Model by 24 zones (Public Mode)

Trip Purpose	Constant k	Parameter a	Parameter b	Multi-Correlation Coefficient
To Work	0.1022	0.4548	0.2653	0.9086
To School	0.1805	0.4553	0.2417	0.9640
Private	4.0967×10^{-15}	1.3937	1.7863	0.8596
Business	0.0005	0.5773	0.3573	0.7108
To Home	0.9580	0.4141	0.1420	0.8930

Table 18.25
Intra-zonal Trip Model by 24 zones (Private Mode)

Trip Purpose	Constant k	Parameter a	Parameter b	Multi-Correlation Coefficient
To Work	0.2268	0.4377	0.1776	0.9130
To School[1/]	6.6098×10^{-5}	0.5633	—	0.7815
Private	6.4288×10^{-8}	0.7283	1.3419	0.7380
Business[1/]	0.0011	0.3074	—	0.6205
To Home	0.4516	0.4530	0.0950	0.8570

[1/] Because of insufficient results, the following formula was applied: $\frac{Tii}{Si} = K \cdot (Gi \cdot Ai)$

18.5.4 Conclusion

On the basis of the above findings, it may be concluded that the application of the OD model indicates the following:

1) For the 24-zone level, the combination of the intra-zonal trip and gravity models are applicable.
2) For the 202-zone level, the gravity model may be applied even if the level of accuracy is insufficient.

3) Therefore, in both cases, adjustment methods are necessary after the OD distribution pattern by gravity model and intra-zonal trip model are estimated.

18.6 SUMMARY OF THE WHOLE TRANSPORT DEMAND MODEL

18.6.1 JUMSUT Model

- The JUMSUT transport demand model basically consists of four sub-models, namely: generation, modal split, trip-end and OD distribution models.
- When the model is totally applied, two additional adjustment stages are necessary in order to retain consistency among the sub-models. They are:

  1) **Trip-end Adjustment:** The total trip-end by purpose is estimated by the trip generation model, while the total trip-end by mode is calculated from the modal share product estimated in the modal split model. These are represented as shaded boxes in in Figure 18.17. On the other hand, the total trip-end by purpose and mode, symbolized by the character G or A in the figure, is estimated using the trip-end model. On the basis of these results, the "Fratar Method" should be applied for consistency.

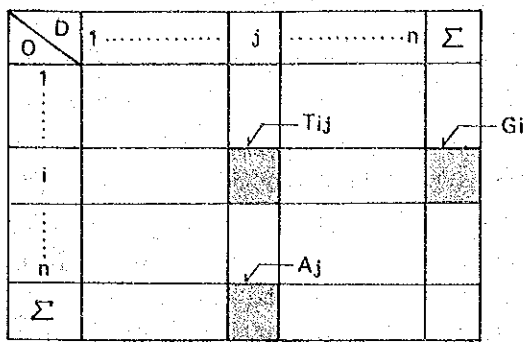
Figure 18.17
Total Trip-end Table

	To Work	To School	Private	Business	To Home	TOTAL
PUBLIC	G	G	G	$\frac{G+A}{2}$	A	
PRIVATE	G	G	G	$\frac{G+A}{2}$	A	
TOTAL						

  2) **OD Trip Adjustment:** OD pair trips are estimated by using the gravity model, whiile trip generation and trip attraction are calculated from the OD table. These trip-ends should coincide with those trip-ends estimated at the previous stage of trip-end adjustment. Hence, OD pair trips should also be adjusted using the "Fratar Method" as illustrated in Figure 18.18.

- The total framework of the model application is presented in Figure 18.19, while the structure of the demand model is illustrated in Figure 18.20.

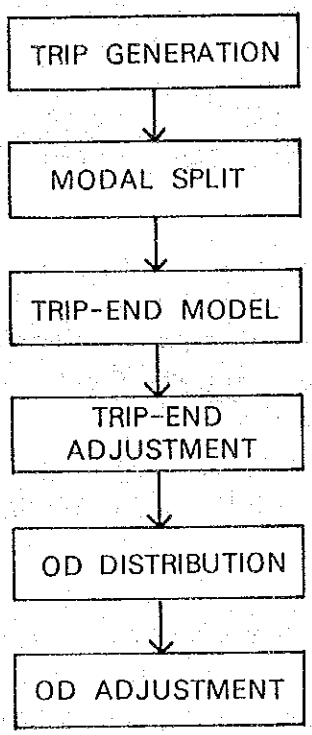
Figure 18.18
OD Pair Trips and Trip Generation/Attraction



$$G_i = \sum_j T_{ij} \quad : \text{Generation}$$

$$A_j = \sum_i T_{ij} \quad : \text{Attraction}$$

Figure 18.19
General Framework of Model Application



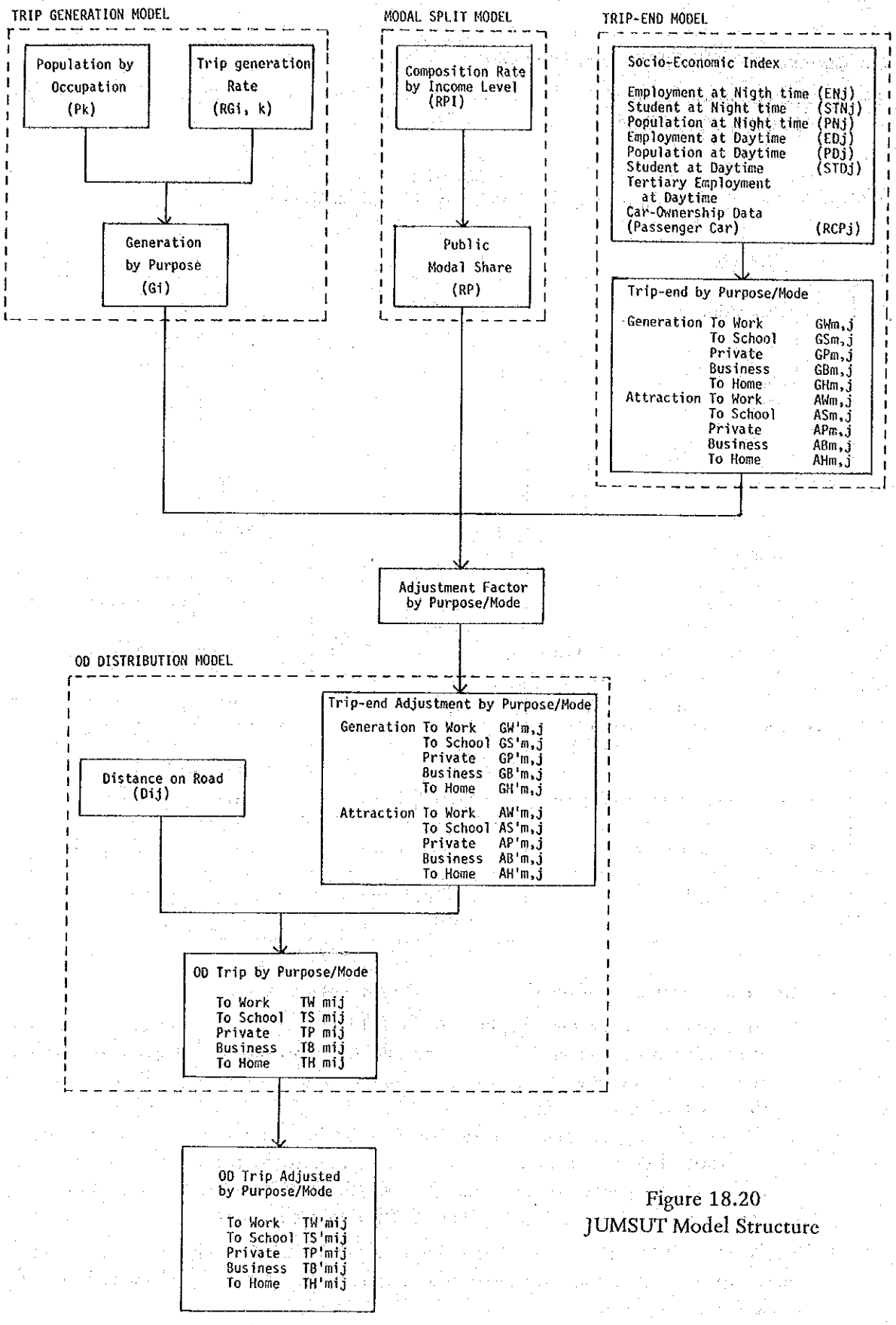


Figure 18.20
JUMSUT Model Structure

18.6.2 Comparison of JUMSUT Model and MMETRO Model

- A comparison of the JUMSUT model with the MMETRO model developed in 1977 by the MMETROPLAN Study is illustrated in Table 18.26.

Table 18.26
Comparison of JUMSUT Model and MMetro Model

JUMSUT	ITEM	MMETRO
Generation → Modal Split → Trip-end → OD distribution	Model Structure	Household Categorization → Trip-end → OD distribution → Modal Split
• by purpose (To Work, To School, Private Business, To Home)	Trip Category	• Home-based and nonhome-based
• Per person by occupation	Generation Rate	• Per household by type
• Income or Car Ownership rate	Modal Split Factor	• Generalized cost
• By purpose and by mode	Trip-end model	• All modes by category
• Gravity Model	OD distribution Model	• Entropy model

- The major differences of the two models are summarized as follows:
  1) **Arrangement of the modal split:** In the JUMSUT model, the modal share is estimated after generation model; also, trip-end and trip distribution are estimated by mode. However, in the MMETRO model, the modal split is arranged at the final stage after the OD distribution model.
  2) **Object of trip generation:** In the JUMSUT model, person by occupation is used. In the MMETRO model, household by type as well as the trip generation are estimated by zone. In JUMSUT, trip generation is estimated for the whole Metro Manila; this value is used as a control total which adjust trip-ends by zone.
- The MMETRO Model consists of four kinds of sub-models, namely: household categorization, trip-end estimation, trip distribution, and modal split. The characteristics of this model are given as follows:

- Modal split is arranged in the last stage
- Trip generation is estimated by type of household
- Trip purpose is categorized into home-based work, home-based education, all other home-based and nonhome-based.

The MMETRO sub-models are described as follows:

1) **Household Categorization:** Households are categorized by the number of members employed and by the number of household members as shown below:

Table 18.27
Household Type

Household Type	No. of Members Employed	Household Members
I	0-3	1-3
II	0-1	4-5
III	2-5	4-5
IV	0-1	6 –
V	2-3	6 –
VI	4 –	6 –

Households are also categorized by car-ownership. "Poisson Distribution" is applied for the distribution of households by number of household members; "Binomial Distribution" is applied in the distribution of employed residents. On this assumption, the number of households by type is estimated by zone.

2) **Trip-end Model:** consists of trip generation and trip attraction models. The equation for the trip generation model is shown as follows:

$$G(p,h,c) = TR(p,h,c) \cdot H(h,c)$$

wherein:

G (p,h,c)	:	Generation trip-end
TR (p,h,c)	:	Trip rate
H (h,c)	:	Number of household
P	:	Trip purpose
h	:	Type of household
c	:	Car ownership

For the trip attraction model, the equation used is:

$$A(p) = R1(p) \cdot PE + R2(p) \cdot SE + RE(p) \cdot TE + R4(p) \cdot EA + R5(p) \cdot H$$

wherein:

A (p)	:	Attraction trip-end
PE	:	Primary employment
SE	:	Secondary employment
TE	:	Tertiary employment
EA	:	Educational attendance
H	:	Household

Ri (p) : Trip rate by parameter index i
P : Trip purpose

Trip rate is shown in the table below. The value zero means that this variable has no relation to trip-end attraction.

Table 18.28
Trip Rate

Trip Purpose	PE	SE	TE	E	H
Home-based Work	0.90	1.07	0.82	0.02	0.00
Home-based Education	0.00	0.00	0.00	1.28	0.00
All other Home-Based	0.00	0.00	0.33	0.17	0.15
In the course of work	0.02	0.13	0.28	0.00	0.11

3) **Trip Distribution Model:** Entrophy maximization method (i.e., to estimate the most probable OD table under some assumptions) by A. G. Wilson is applied for trip distribution. The basic formula is:

$$Tij = ri \cdot sj \cdot Gi \cdot Aj \cdot \exp(-BCij)$$

wherein:

Tij : The number of trips (i j)
Gi : Generation trip -end (zone i)
Aj : Attraction trip-end (zone j)
Cij : Generalized cost of travel (i j)
ri, sj, B : Constant

The symbols, ri, sj and B, are estimated using the entropy method under the following conditions:

$$\sum Tij = Gi$$
$$\sum Tij = Aj$$
$$\sum Tij \cdot Cij = C$$

4) **Modal Split Model:** The concept of this formula which is shown below is the same as that of trip distribution model.

$$\frac{Tip}{T2ij} = \frac{\exp(-BCij)}{\exp(-B(C2ij + Sij))}$$

wherein:

Tij : Trips by car occupants (i→j)
T2ij : Trip by public transport passenger (i→j)
Cij : Generalized cost on the road (i→j)
C2ij : Generalized cost by public transport (i→j)
Sij : Modal Handicap cost (i→j)
B : Parameter

APPENDICES

LIST OF APPENDICES

CHAPTER 16

Appendix 16.1(1)

Population Expansion Factor by Municipality

Municipality	No. of Samples	Population		Expansion Factor	
		MMUTIP	JUMSUT	MMUTIP	JUMSUT
Manila	27,511	1,347,763	1,341,078	49.0	48.7
Pasay	4,852	238,767	232,767	49.2	48.0
Makati	6,411	310,256	306,501	48.4	47.8
Mandaluyong	3,591	169,793	166,849	47.3	46.5
San Juan	2,662	107,338	105,247	40.3	39.5
Quezon	22,170	959,346	948,247	40.3	42.8
Caloocan	8,605	385,838	373,283	44.8	43.4
Valenzuela	3,385	160.940	166,828	47.5	49.3
Malabon	3,573	154,157	152,786	43.1	42.6
Navotas	2,295	101,532	98,565	44.2	42.9
Marikina	3,529	168,832	168,552	47.8	47.8
Pasig	5,172	213,317	214,027	41.2	41.4
Pateros	647	32,124	31,718	46.1	45.5
Taguig	2,428	87,056	104,551	40.0	43.1
Parañaque	3,826	177,827	171,424	46.5	44.8
Muntinlupa	2,199	103,729	107,641	47.2	48.9
Las Piñas	2,151	107,561	106,892	50.0	49.7
TOTAL	105,057	4,836,177	4,796,401	46.0	45.7

Appendix 16.1(2)
Population Expansion Factor by Age, Sex
(Metro Manila)

Age Group	MALE					FEMALE				
	No. of Sample	Population (Estimated) MMUTTP	Population (Estimated) JUMSUT	Average Expansion Factor MMUTTP	Average Expansion Factor JUMSUT	No. of Sample	Population (Estimated) MMUTTP	Population (Estimated) JUMSUT	Average Expansion Factor MMUTTP	Average Expansion Factor JUMSUT
7-9	4,813	226,028	210,146	47.0	43.7	4,626	214,275	180,392	46.3	39.0
10-14	7,631	240,002	318,612	44.6	41.8	7,538	343,970	294,797	45.6	39.1
15-19	7,424	337,351	321,243	45.4	43.3	8,677	429,850	295,636	49.5	45.6
20-24	6,461	338,374	340,784	52.4	52.7	7,843	397,011	418,641	50.6	53.4
25-29	5,845	284,236	287,093	48.6	49.1	7,355	291,052	337,233	39.6	45.9
30-34	4,552	188,767	215,424	41.5	47.3	4,866	188,944	241,533	38.8	43.6
35-39	3,355	165,362	139,863	49.3	41.7	3,738	167,489	159,452	44.4	42.7
40-49	4,957	229,379	202,502	46.3	40.9	5,481	224,211	242,661	40.9	44.3
50-59	2,771	130,215	115,057	47.0	41.5	3,071	133,754	149,993	43.6	48.8
60-69	1,485	72,443	62,057	48.8	41.8	1,449	75,912	89,684	52.4	61.9
70-	514	24,315	28,346	47.3	55.1	507	28,265	40,352	55.7	79.6
U. N.	33	1,675	1,618	50.8	49.0	29	1,348	1,349	46.5	46.5
TOTAL	49,841	2,338,147	2,242,765	46.9	45.0	55,180	2,496,081	2,551,723	45.2	46.2

Appendix 16.1(3)
Household Expansion Factor by Municipality

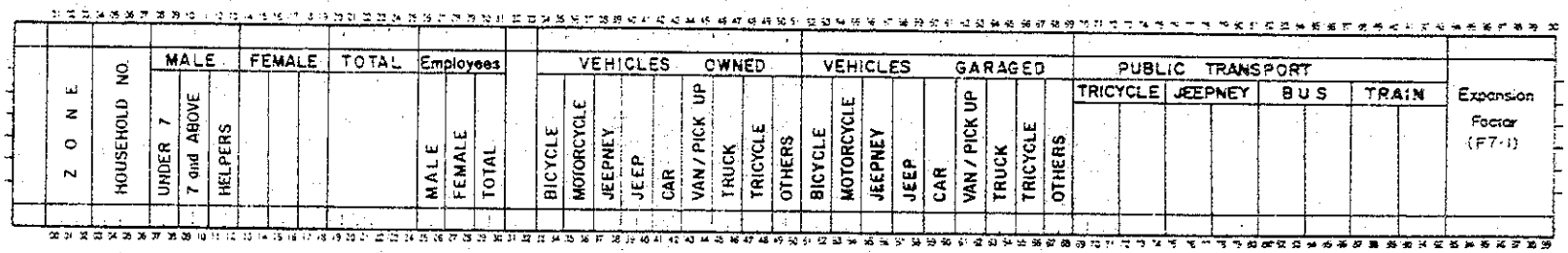
Municipality	Sample	No. of Household (Estimated)	Expansion Factor
Manila	6,471	300,342	46.5
Pasay	1,202	55,193	45.9
Makati	1,521	68,873	45.3
Mandaluyong	859	38,856	45.2
San Juan	594	22,953	38.6
Quezon	4,949	218,446	44.1
Caloocan	2,051	89,324	43.6
Valenzuela	888	39,916	45.0
Malabon	780	36,321	46.6
Navotas	514	23,208	45.2
Marikina	879	38,882	44.2
Pasig	1,104	50,240	45.5
Pateros	153	7,270	47.5
Taguig	570	25,127	44.1
Parañaque	836	27,501	44.9
Muntinlupa	552	24,392	44.2
Las Piñas	546	24,863	45.5
TOTAL	24,469	1,102,207	45.0

Appendix 16.2

Layout of 1980 HIS Master Files

A: Household File

FILE NAME : HHIF
CODE : EBCDIC
REC.SIZE : 100 CH.
BLK.FACTOR : 100 Rec/Blk.
NO. OF REC. : 24,469



B: Household Member File

FILE NAME : HHMIF2
CODE : EBCDIC
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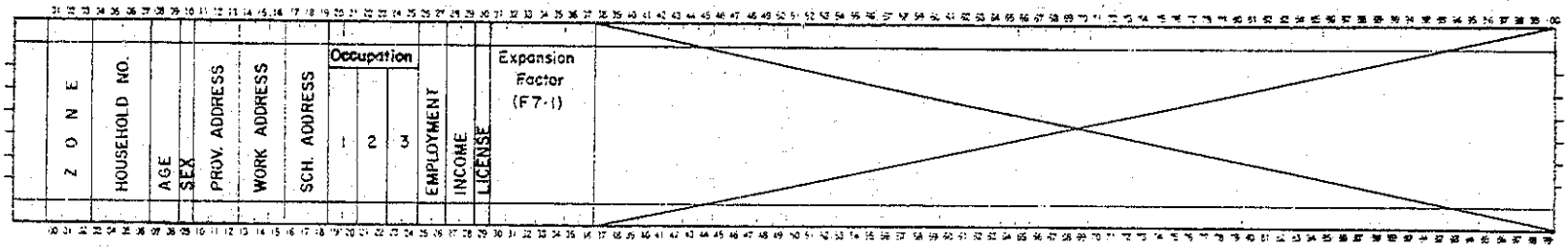
BLK.FACTOR : 100 Rec/Blk.
NO. OF REC. : 105,057



C: Trip File

FILE NAME : TRIPIF2
CODE : EBCDIC
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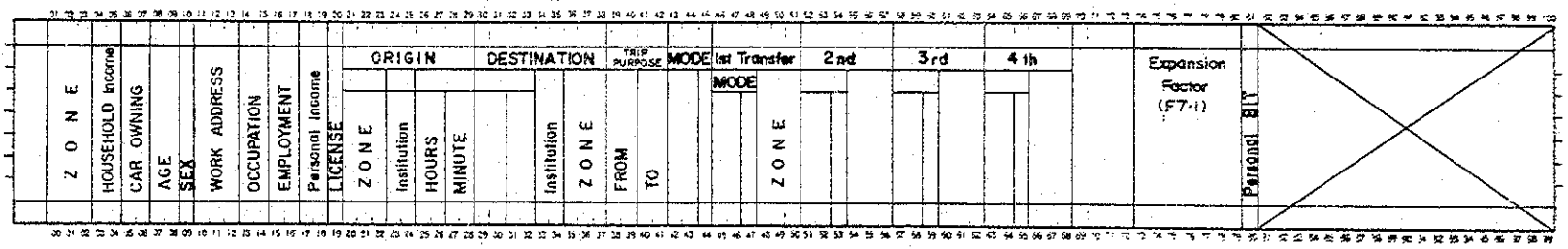
NO. OF REC. : 182,008



Appendix 16.3

Interview Questionnaire SET for 1983
Supplemental HIS

1. Letter for Barangay Captains
2. Example of Sampling List
3. Letter for Households
4. Instructions for Answering Questionnaire Forms
5. Illustration on How to Fill Up the Trip Information Form
6. Form 1 - Household Information
7. Form 2 - Household Member Information
8. Form 3 - Trip Information

Appendix 16.3(1)

Letter for Barangay Captains

Republic of the Philippines
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
PHILCOMCEN Building, Ortigas Ave., Pasig, Metro Manila
OFFICE of the MINISTER

17 December 1982

_____

_____

_____

_____

Dear _____ :

We wish to inform you that the Ministry of Transportation and Communications (MOTC) will be conducting a Home Interview Survey in joint effort with the Jica-Almec Consultants Group.

Interviewers will be assigned to interview sample households selected by random sampling from your respective barangays. This is for purposes of updating the previously acquired data on the travelling characteristics and requirements per area for the whole Metro Manila.

As the Barangay Captain of Barangay _____, we wish to secure your cooperation and permission for our interviewers to go about visiting the attached sample households.

Please indicate your approval and support by signing in the space provided below.

Thank you.

Very truly yours,

JOSE P. DANS, JR.
Minister

CONFORME:

_____

82L-MIN-1769

Appendix 16.3(2)

Example of a Sampling List

Zone No : 364

Barangay : Loyola Heights

H.H.No.	NAME	ADDRESS	TOTAL H.H. Member
0001	Samaniego,Gil	Escaler St.	5
0002	Carbon, Evelyn	Katipunan	1
0003	Gundolfo,Bibonia	B.Gonzales	5
0004	Montoya,Joe	B. Gonzales	2
0005	Baluyot,Rey Sr.	C. Salvador	6
0006	Bonafra,Leopoldo	C. Salvador	9
0007	Gelado,Eduardo	F. De la Rosa	4
0008	Alejandro,Leo	E. Abada	6
0009	Guzman,Jeanette	E. Abada	2
0010	Avangel,Marilou	E. Banda	4

Republic of the Philippines
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
PHILCOMCEN Building, Ortigas Ave., Pasig, Metro Manila
OFFICE of the MINISTER

20 January 1983

Dear Householder:

The forms you are being requested to complete are part of a comprehensive Public Transport Study covering the 17 cities and municipalites of Metro Manila. The purpose of the Home Interview Survey (HIS) is to obtain detailed information on the travel requirements of the inhabitants of Metro Manila to determine both current and future needs. This study is being conducted for the purpose of supplementing the former HIS done in 1980, with the cooperation of the Japanese Government.

As you have been chosen as a sample household by random sampling, please complete the questionnaire forms attached herewith. Otherwise, please permit the surveyors to interview your household members and yourself. All questions asked will only be in relation to your travelling habits and requirements. Your cooperation is essential if the study is to be successful. If you have any problems in completing the forms, please request the assistance of the interviewer.

This information will be treated in strict confidence by this Ministry and will be used only for purposes of the transportation study. Your cooperation in this program will be most appreciated.

Very truly yours,

JOSE P. DANS, JR.
Minister

:csap

83L-MIN-070

Appendix 16.3(4)

Instructions for Answering Questionnaire Forms

INSTRUCTIONS FOR ANSWERING QUESTIONNAIRE FORMS

Please answer all the questions one by one according to its numbering.

Print the information in the space provided, or put a check mark in the appropriate box.

If you have doubts in answering any point in the questionnaire, please consult the interviewer.

Form 1. Household Information

1. Only the "head" of the household should complete Form 1. The head of the household is the Father, Mother or the household member who is responsible for the economic well being of the household.

Form 2. Household Members Information

1. Form 2 should be completed for every member of the household who is aged 7 years or older, one sheet per person.

2. In Question 6, "service workers" include firefighters, policemen, guards, housekeepers, maids, waiters, bartenders, building caretaker and cleaners, barbers, hairdressers, beauticians, launderers, sportsmen, photographers, and undertakers.

3. In Question 7, "commerce" include wholesale trade, retail trade, banks and financial institutions, insurance and real estate.

Form 3. Trip Information

1. Form 3 should be completed for every member of the household who is aged 7 years or older.

2. Provide the required information about ALL THE TRIPS, both home-based and non-homebased, during the survey date indicated in Form 3. The survey date covers 24-hours (one day) beginning at 3:00 a.m. and ending at 3:00 a.m. of the following day. For example, if the survey date is Jan. 28 (Friday), the information requested relates to the period from 3:00 a.m. Friday to 3:00 3:00 a.m. Saturday.

3. Start with the first trip (TRIP NO. 1) and proceed sequentially to the next trip. Give all informations on each trip.

4. If more than 6 trips were made on the sruvey date, record the information of TRIP 7, TRIP 8, TRIP 9, etc., on another sheet and number the trips accordingly.

THIS PORTION IS FOR OFFICE USE ONLY

HIS Zone No. ☐☐☐

Traffic Zone No. ☐☐☐

Household No. ☐☐☐☐

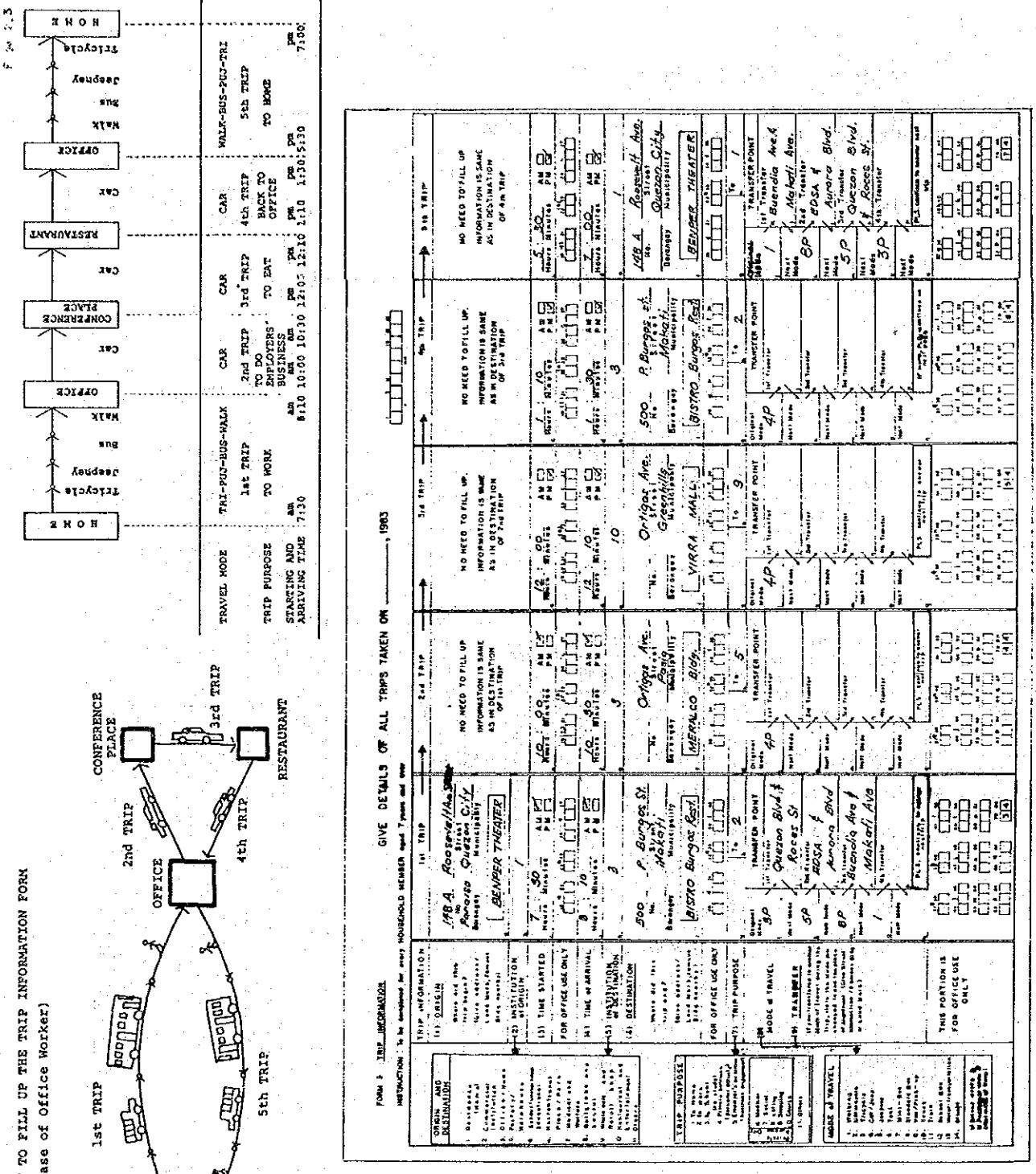
No. H.H. Members' Sheets ☐☐

Supervisors' Check

	Date	Name
For Interviewers		
For Editors		
For Coders		

Appendix 16.3(5)

Illustration on How to Fill Up the Trip Information Form



Appendix 16.3(6)

Household Information
(Form 1)

FORM 1 HOUSEHOLD INFORMATION

INSTRUCTION: To be completed by HEAD of HOUSEHOLD

(1) NAME _____ Family Name _____ First Name _____ M.I.

(2) ADDRESS OF HOUSEHOLD _____ No. _____ Street _____ Barangay (a)

_____ City/Municipality (b)

(3) HOW MANY PEOPLE RESIDE IN YOUR HOUSEHOLD

		UNDER 7 YRS. OLD	7 YRS. AND ABOVE	HOUSEHOLD HELPERS
1	MALE			
2	FEMALE			
3	TOTAL			

(4) WHAT IS THE TOTAL MONTHLY HOUSEHOLD INCOME (Check One)

1	BELOW ₱ 500	☐
2	501 to 1000	☐
3	1001 to 1500	☐
4	1501 to 2000	☐
5	2001 to 2500	☐
6	2501 to 3000	☐
7	3001 to 3500	☐
8	3501 to 4000	☐
9	4001 to 5000	☐
10	5001 to 7000	☐
11	OVER ₱ 7000	☐

(5) HOW MANY VEHICLES ARE OWNED BY HOUSEHOLD MEMBERS

	TYPE	NO. OF UNITS
1	BICYCLE	
2	MOTORCYCLE	
3	JEEPNEY	
4	JEEP	
5	CAR	
6	VAN/PICK-UP	
7	TRUCK	
8	TRICYCLE	
9	OTHER SPECIFY	
10	NONE (check)	☐

(6) HOW MANY VEHICLES WERE GARAGED AT OR NEAR YOUR HOUSE BY HOUSEHOLD MEMBERS

	TYPE	NO. OF UNITS
1	BICYCLE	
2	MOTORCYCLE	
3	JEEPNEY	
4	JEEP	
5	CAR	
6	VAN/PICK-UP	
7	TRUCK	
8	TRICYCLE	
9	OTHER SPECIFY	
10	NONE (check)	☐

THIS PORTION IS *FOR OFFICE USE* ONLY

Z [1 3]

HH [11 14]

(3)

1 [19 24]

2 [25 30]

3 [31 36]

(4) [37 38]

(5) (6)

1 [39 40] [57 58]

2 [41 42] [59 60]

3 [43 44] [61 62]

4 [45 46] [63 64]

5 [47 48] [65 66]

6 [49 50] [67 68]

7 [51 52] [69 70]

8 [53 54] [71 72]

9 [55 56] [73 74]

[79 80] 1 4

Appendix 16.3(7)

Household Member Information
(Form 2)

FORM 2 HOUSEHOLD MEMBER INFORMATION

INSTRUCTION: To be completed for every HOUSEHOLD MEMBER aged 7 years and over

THIS PORTION IS FOR OFFICE USE ONLY

(1) NAME _____ (Family Name) _____ (First Name) _____ (M.I)

(2) AGE _____ (3) SEX (Pls. Check) 1.MALE ☐ 2.FEMALE ☐

(4) WORK ADDRESS _____ (No.) _____ (Street) _____ (Barangay (a))

_____ (City / Municipality (b))

(5) SCHOOL ADDRESS _____ (No.) _____ (Street) _____ (Barangay (a))

_____ (City / Municipality (b))

(6) OCCUPATION (Please Check)

01	☐ SERVICE WORKER
02	☐ ADMINISTRATIVE & EXEC.WORKER
03	☐ SALES WORKER
04	☐ CLERICAL WORKER
05	☐ FACTORY WORKER CRAFTSMAN
06	☐ TRANSPORT WORKER
07	☐ PROFESSIONAL WORKER
08	☐ STUDENT/ELEM SCHOOL
09	☐ STUDENT / HIGH SCH. & UNIV.
10	☐ HOUSEWIFE
11	☐ JOBLESS
12	☐ OTHER, SPECIFY

(7) EMPLOYMENT SECTOR (Please Check)

01	☐ SERVICE INDUSTRY
02	☐ SCHOOL
03	☐ UNIVERSITY
04	☐ GOVERNMENT
05	☐ AGRICULTURAL MINING
06	☐ MANUFACTURING
07	☐ PUBLIC UTILITY COMPANY
08	☐ CONSTRUCTION
09	☐ TRANSPORTATION COMMUNICATIONS
10	☐ HOME BASED
11	☐ COMMERCE
12	☐ OTHER, SPECIFY

(8) MONTHLY INCOME (Please Check)

01	☐ Below ₱ 300
02	☐ 301 to 500
03	☐ 501 to 700
04	☐ 701 to 900
05	☐ 901 to 1000
06	☐ 1001 to 1500
07	☐ 1501 to 2000
08	☐ 2001 to 2500
09	☐ 2501 to 3000
10	☐ 3001 to 4000
11	☐ 4001 to 5000
12	☐ ABOVE 5000

(9) STATE TYPE OF DRIVER'S LICENSE HELD.

☐ 1. STUDENT ☐ 2. NON - PROF. ☐ 3. PROFESSIONAL ☐ 4. NONE

(10) Please list all the places you visited on survey day.

1) _____ 6) _____

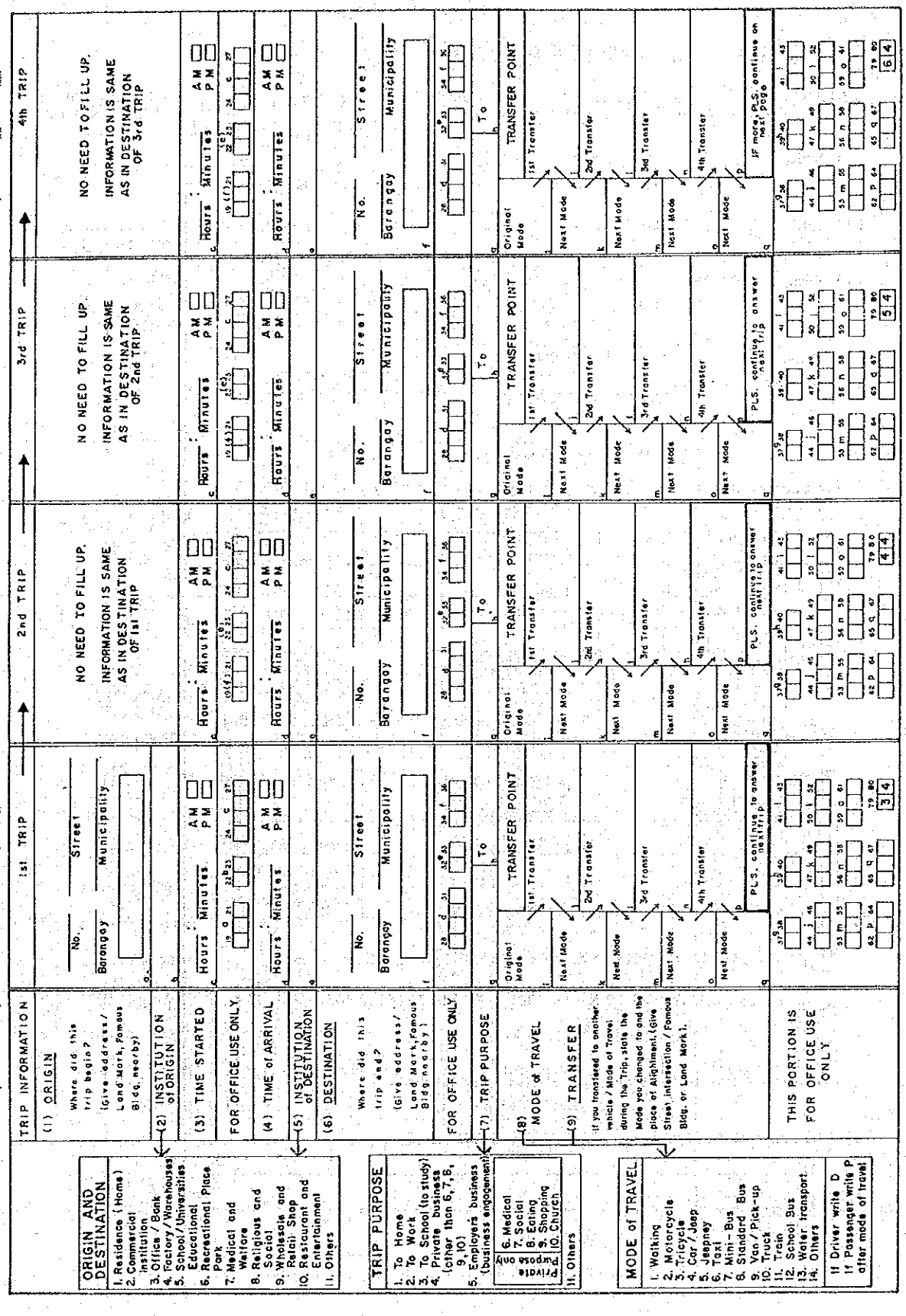
2) _____ 7) _____

3) _____ 8) _____

4) _____ 9) _____

5) _____ 10) _____

Trip Information
(Form 3)

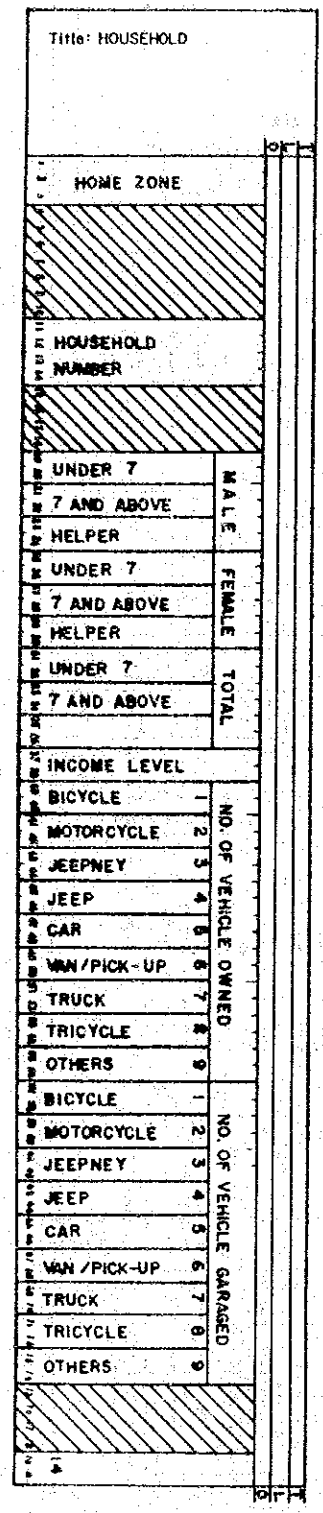


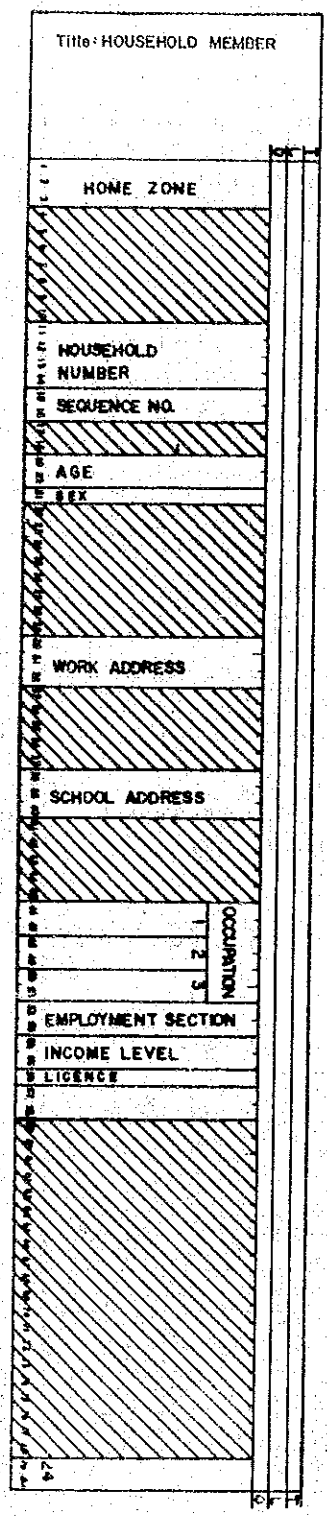
Appendix 16.3 (8)(cont'd.)

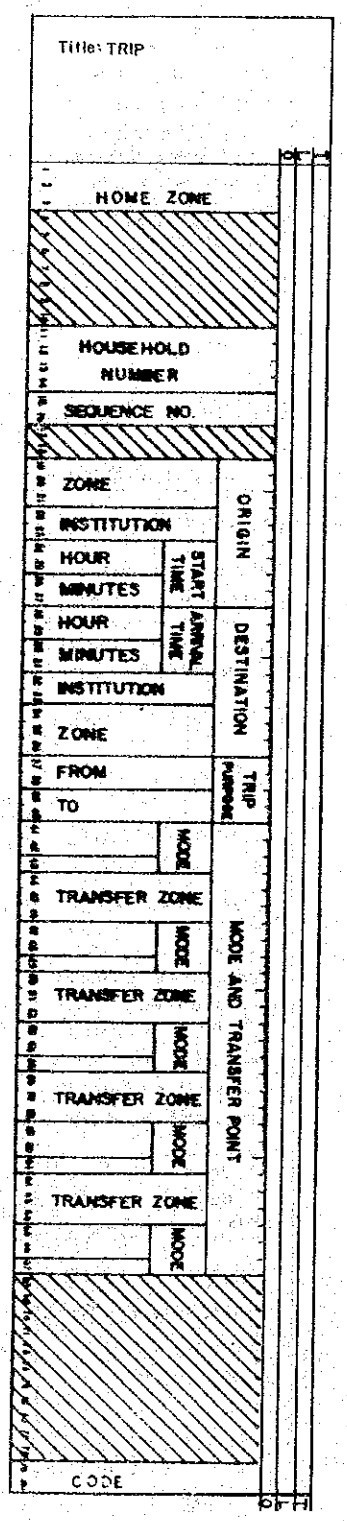
TRIP INFORMATION	5th TRIP →	6th TRIP
(1) ORIGIN Where did this trip begin ? (Give Address / Land Mark, Famous Bldg. nearby)	NO NEED TO FILL UP INFORMATION IS SAME AS IN DESTINATION OF 4th TRIP	NO NEED TO FILL UP. INFORMATION IS SAME AS IN DESTINATION OF 5th TRIP
(2) INSTITUTION OF ORIGIN		
(3) TIME STARTED	c Hours : Minutes AM ☐ PM ☐	c Hours : Minutes AM ☐ PM ☐
FOR OFFICE USE ONLY	19 (f) 21 · 22 (e) 23 · 24 c 27	19 (f) 21 · 22 (e) 23 · 24 c 27
(4) TIME of ARRIVAL	d Hours : Minutes AM ☐ PM ☐	d Hours : Minutes AM ☐ PM ☐
(5) INSTITUTION of DESTINATION	e	e
(6) DESTINATION Where did this trip end ? (Give the Address Land Mark, Famous Bldg. nearby)	No. Street Barangay Municipality f	No. Street Barangay Municipality f
FOR OFFICE USE ONLY	28 d 31 · 32 e 33 · 34 f 36	28 d 31 · 32 e 33 · 34 f 36
(7) TRIP PURPOSE	g To h	g To h
(8) MODE of TRAVEL (9) TRANSFER If you transfered to another vehicle / mode during the Trip, state the Mode you changed to and the Place of Alightment. (Give street Intersection / Famous Bldg. or Land Mark). If Driver write D If Passenger write P after mode of travel	Original Mode i TRANSFER POINT 1st Transfer j Next Mode k 2nd Transfer l Next Mode m 3rd Transfer n Next Mode o 4th Transfer p Next Mode q PLS. continue to answer next trip	Original Mode i TRANSFER POINT 1st Tranfer j Next Mode k 2nd Transfer l Next Mode m 3rd Transfer n Next Mode o 4th Transfer p Next Mode q Thank you.
THIS PORTION IS FOR OFFICE USE ONLY	37 g 38 · 39 h 40 · 41 i 43 44 j 46 · 47 k 49 · 50 l 52 53 m 55 · 56 n 58 · 59 o 61 62 p 64 · 65 q 67 · 79 80 [7][4]	37 g 38 · 39 h 40 · 41 i 43 44 j 46 · 47 k 49 · 50 l 52 53 m 55 · 56 n 58 · 59 o 61 62 p 64 · 65 q 67 · 79 80 [8][4]

Appendix 16.4

Formats of Records Entered to Punch Cards
of 1983 Supplemental HIS







Appendix 16.5(1)

List of Data Check (Household) for '83 HIS

Column	Item	Specified Code No./Character
1-3	Home Address	Internal zone code
4-10		Space
11-14	Household Number	Numeric
15-18		Space
19-20	No. Of Household Male under 7	Numeric 1
21-22	7 or above	Numeric 2
23-24	Helper	Numeric 3
25-26	Female under 7	Numeric 4
27-28	7 or above	Numeric 5
29-30	Helper	Numeric 6
31-32	Total under 7	Numeric 7 = 1 + 4
33-34	7 or above	Numeric 8 = 2 + 5
35-36	Helper	Numeric 9 = 3 + 6
37-38	Income Level	Numeric, 1 ∽ 11 and 99
39-56	No. of Vehicle Owned	Numeric
57-74	No. of Vehicle Garaged	Numeric
75-78		Space
79-80	Code	14

Appendix 16.5(2)

List of Data Check (Household Members)

Column	Item	Specified Code Number/Character	Remarks
1-3	Home Address	Internal Zone Code	
4-10		Space	
11-14	Household Number	Numeric	The same as that in household information
15-16	Sequence Number	From 1 to No. of Household member(8+9)	
17-18			
19-20	Age	Greater than 7	
21	Sex	1, 2 or 9	
22-29		Space	
30-32	Work Address	HIS zone or 999	
33-37		Space	
38-40	School Address	HIS zone or 999	
41-45		Space	
46-47	Occupation 1	1 ∽ 12, 99	
48-49	Occupation 2	1 ∽ 12, 99, space	
50-51	Occupation 3	1 ∽ 12, 99, space	
52-53	Employment Sector	1 ∽ 12, 99, space	
54-55	Income Level	0 ∽ 12, 99	
56	License	1 ∽ 4, 9	
57-58	No. of trips	Numeric	
59-78		Space	
79-80	Code	24	

Appendix 16.5(3)

List of Data Check (Trip Information)

Column	Item	Specified Code Number/Character	Remarks
1-3	Home Address	Internal Zone Code	
4-10		Space	
11-14	Household Number	Numeric	The same as that in household information
15-16	Sequence Number	Numeric	
17-18		Space	
19-21	Origin Zone	HIS zone, 999	
22-23	Institution	1∽11, 99	
24-25	Start Time Hour	0∽23, 99	
26-27	Minute	0∽59, 99	
28-29	Destination Arrival Time Hour	0∽23, 99	
30-31	Minute	0∽59, 99	
32-33	Institution	1∽11, 99	
34-36	Zone	HIS zone, 999	
37-38	Trip Purpose From	1∽11, 99	
39-40	To	1∽11, 99	
41-42	Mode or Transfer Point Mode	1∽14, 99	
43	Driver or Passenger	D, P, Space or 9	
44-46	Transfer Zone	HIS zone, 999	
47-48	Mode	1∽14, 99	
49	Driver or Passenger	D, P, Space or 9	
50-52	Transfer Zone	HIS Zone, 999	
53-54	Mode	1∽14, 99	
55	Driver or Passenger	Space or 9	
56-58	Transfer Zone	HIS zone, 999	
59-60	Mode	1∽14, 99	
61	Driver or Passenger	D, P, Space or 9	
62-64	Transfer Zone	HIS zone, 999	
65-66	Mode	1∽14, 99	
67	Driver or Passenger	D,P, Space or 9	
68-78		Space	
79-80	Code	34, 44, 54, 64, 74, 84, 94	

Appendix 16.6

Household Expansion Rates for 1983 Supplemental HIS

Zone No.	No. of Household	No. of Samples		Expansion Rate
		Proposed	Collected	
1	109,868	290	292	376.3
2	29,289	110	80	366.1
3	8,184	40	30	272.8
4	62,914	170	212	296.8
5	14,368	40	40	359.2
6	1,733	40	12	144.4
7	15,167	60	40	379.2
8	14,754	50	50	295.1
9	44,847	120	120	373.7
10	75,757	200	200	378.8
11	13,603	30	30	453.4
12	23,210	80	80	290.1
13	36,353	110	90	403.9
14	39,953	110	113	353.6
15	29,984	90	160	187.4
16	20,986	60	65	322.9
17	15,066	40	45	334.8
18	28,651	90	80	358.1
19	35,881	100	101	355.3
20	22,138	70	76	291.3
21	47,852	130	132	362.5
22	17,888	50	50	357.8
23	23,517	90	112	210.0
24	38,881	120	152	255.8
25	38,919	120	126	308.9
26	50,288	150	155	324.4
27	20,882	70	70	298.3
28	21,448	150	80	268.1
29	26,729	90	70	381.8
30	33,331	80	80	416.6
31	21,905	60	60	365.1
32	25,145	80	90	279.4
33	7,269	20	20	363.5
34	37,517	110	150	250.1
35	24,877	70	80	311.0
36	24,409	60	60	406.8
37	-	-	-	-
TOTAL	1,103,563	3,300	3,403	324.3