3.3.2 SURVEY SCHEDULES

The field surveys were conducted as follows:

1) First Survey conducted in 1987

The field survey was carried out for 3 days from 27th to 29th October. The 16-hour survey (0600 to 2200) was executed in 2 shifts. A total of 720 man-hours were spent on this survey.

The bus services surveyed on each survey date and allocation of surveyors per shift are shown in Table 3.4.

2) Second Survey conducted in 1988

The field survey was conducted for four days from 8 April to 13 April (excluding Saturday and Sunday), for 16 hour (0600 hours to 2200 hours).For the field surveys, twenty-four (24) surveyors, of which twelve (12) are assigned in morning shift (8 hours) and others in evening shift are required for both traffic count and interview surveys. A total of 768 man-hours were spent on this survey. The schedule and allocation of surveyors are shown in Table 3.5 and 3.6.

Editing and Coding works for the survey was carried out for one week, from 9 April to 15 April. Four (4) Editors/Coders were assigned for this work in the office.
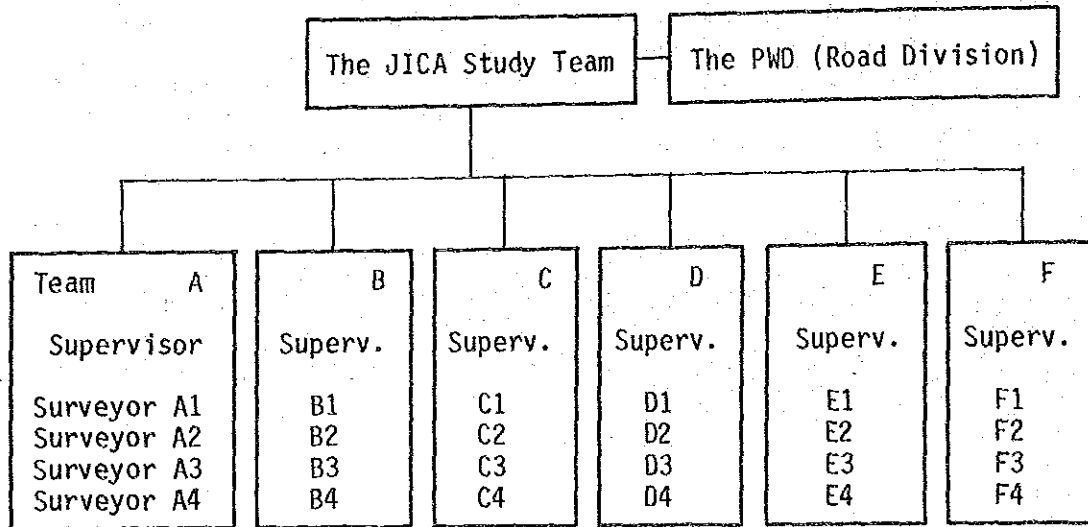
The survey data were entered into micro-computer by two operators for 5 days.

3.3.3 SURVEY ORGANIZATION

The PWD/JICA Study Team administratively and technically responsible, respectively, for the execution of the Surveys. Figure 3.5 shows the organization established for execution of the first survey.

The plan required thirty (30) surveyors, which were grouped into six teams. A team comprised of four surveyors and one supervisor. A survey manual (see Appendix 3.A) was prepared, which was used during the orientation of the surveyors and supervisors.

Figure 3.5
Survey Organization

```
        ┌──────────────────────┬──────────────────────┐
        │  The JICA Study Team  ├─  The PWD (Road Division) │
        └──────────────────────┴──────────────────────┘
```

Team A	B	C	D	E	F
Supervisor	Superv.	Superv.	Superv.	Superv.	Superv.
Surveyor A1	B1	C1	D1	E1	F1
Surveyor A2	B2	C2	D2	E2	F2
Surveyor A3	B3	C3	D3	E3	F3
Surveyor A4	B4	C4	D4	E4	F4

The surveyors for this survey were mainly recruited from the students of the National University of Singapore. About one-fourth of them conducted both the 1987 and 1988 surveys.

Table 3.4
Allocation of Surveyor by Bus Service (1987)

Survey Date	Bus Service No.	Berth No.	Type of Berth	No. of Surveyors Per Shift		
				Traffic Count	Interview Survey	Total
1st day 27th Oct.	130	1- 3	End-on	1	1	
	165	4- 6	End-on	1		
	74	7- 9	End-on	1	1	
	24			1		
	25	32	Sawtooth	1	1	
	269			1		
	159			1		
	266	33	Sawtooth	1	1	
	267			1	1	
SUB-TOTAL				9	6	15
2nd day 28th Oct.	138	10-12	End-on	1	1	
	168	13-16	End-on	1		
	166	17-19	End-on	1	1	
	169			1	1	
	265	34	Sawtooth	1	2	
	135			1		
	136	35	Sawtooth	1	1	
	262			1	1	
SUB-TOTAL				8	7	15
3rd day 29th Oct	133	20-23	End-on	1		
	134	24-26	End-on	1	1	
	162	27-29		1	1	
	132	36	Sawtooth	1	1	
	261			1	2	
	Alighting	30	Sawtooth	4	0	
	Alighting	31	Sawtooth	1	0	
SUB-TOTAL				10	5	15
TOTAL				27	18	45

Table 3.5
Allocation of Surveyors by Bus Service (1988)

(a) Bus Traffic Survey

Date/Day	Bus Service No.	Bus Berth No.	No. of Surveyors Assigned Per Shift	Type of Counting Work
1st day 8th Apr. (Friday)	130	1- 3	1	Boarding & Alighting Pass
	165	4- 6	1	--- ditto ---
	74	7- 9	1	--- ditto ---
	138	10-12	1	--- ditto ---
	24	32	1	Boarding Pass Only
	25	32	1	--- ditto ---
	269	32	1	--- ditto ---
	Total		7	
2nd day 11th Apr.	168 (incl. Aircon 168)	13-16	1	Boarding & Alighting Pass
	166	17-19	1	--- ditto ---
	159	33	1	Boarding Pass Only
	266	33	1	--- ditto ---
	267	33	1	--- ditto ---
	169	34	1	--- ditto ---
	265	34	1	--- ditto ---
	Total		7	
3rd day 12th Apr. (Tuesday)	133	20-23	1	Boarding & Alighting Pass
	134	24-26	1	--- ditto ---
	162	27-29	1	--- ditto ---
	135	35	1	Boarding Pass Only
	136	35	1	--- ditto ---
	262	35	1	--- ditto ---
	132	36	1	--- ditto ---
	261	36	1	--- ditto ---
	Total		8	
4th day 13th Apr. (Wednesday)	Alighting	30 & appendices 31	6	Alighting Pass Only
	Waiting Time Survey		6	Waiting Time at Bus Stop/Interchange
	Total		12	

Table 3.6
Allocation of Surveyors by Bus Service (1988)

b) Bus Passenger Interview Survey

Date/Day	Bus Service No.	Bus Berth No.	No. pof Surveyors Assigned Per Shift	
1st day 8th Apr. (Friday)	130	1- 3	)	
	165	4- 6	)	1
	74	7- 9	)	
	138	10-12	)	2
	24	32	)	
	25	32	)	2
	269	32	)	
	Total			5
2nd day (incl. Aircon 168)	168	13-16	)	
	166	17-19	)	1
	159	33	)	
	266	33	)	2
	267	33	)	
	169	34	)	2
	265	34	)	
	Total			5
3rd day 12th Apr. (Tuesday)	133	20-23	)	
	134	24-26	)	2
	162	27-29	)	
	135	35	)	
	136	35	)	2
	262	35	)	
	132	36	)	2
	261	36	)	
	Total			6

3.3.4 SURVEY EQUIPMENT

The following materials/equipment were prepared for the survey:

		Quantity (1988)	(1987)
1)	Bus Survey Manual	24	30
2)	Survey Sheets		
	Bus/Passenger Traffic Count Sheets	250	250
	Bus Passenger Interview Survey Sheets	600	1,000
	Bus Waiting Time Survey Sheets	150	—
3)	Clipboards	15	18
4)	Counting Machines	15	18

3.3.5 PUBLICITY

Each surveyor had an ID card issued by PWD. SBS also cooperated to conduct this survey.

3.4 SURVEY FIELDWORK

3.4.1 FIELD WORK IMPLEMENTATION

Generally the survey was successfully executed according to plan, although there was a slight confusion on the first day. However, all the surveyors became accustomed with the survey thereafter. Nobody was absent throughout the survey days.

3.4.2 SURVEY PROBLEMS

No serious problems took place during the survey except for the following:

1) First Survey (1987)

   a) A 10-minute time blank, during which no survey was executed during shift change, due to handling over of equipment from the preceeding shift members to the next shift members. This might have been overcomed by more efficient preparatory work.

   b) The counting of bus passengers boarding bus service 24 was delayed almost 3.5 hours as well as those of bus service numbers 25 and 269 for about 50 minutes on the morning of 27 October 1987, because the surveyors were late. A follow-up survey was carried out in order to cover the missing data of these three bus services on 13 November 1987.

90

c) On the first day, some interviewers did not ask correctly for the places/addresses of the interviewees' origin and destination, i.e., they asked only for the name of the road instead of the block number. This problem was resolved, however, on subsequent days after clear instructions have been given to the surveyors.

2) Second Survey (1988)

a) Bus Waiting Time Survey for one bus stop was canceled in the morning shift due to shortage of surveyors.

b) A wrong bus stop was surveyed for Bus Waiting Time Survey for service number 269 for one hour. However, this mistake was not a serious problem for this survey. Sufficient data was collected for the remaining survey hours.

3.5   EDITING AND CODING

3.5.1   DUTIES/RESPONSIBILITIES OF EDITORS/CODERS

The primary duties/responsibilities of editors and coders are enumerated in Appendix 3.C and briefly summarized as follows:

1) To ensure high quality surveyed data and to facilitate the data entry procedure.

2) To correct wrong information within the limits of logical estimation.

3) To put code number for origin and destination of bus passengers travel.

4) To eliminate invalid samples after editing/coding.

3.5.2   EDITING WORK

Editing and coding tasks were simultaneously carried out after collecting the survey forms.

As the main purpose of editing is to ensure high quality data for processing and to facilitate the data entry works, all records of the survey forms were checked and unclear records were rechecked with red pen. Aside from the above work, the following corrections were made in the editing procedure.

1) Records of the surveyed time were changed from 12 hours system to 24 hours.

2) Records of private buses in the 1988 survey were deleted from the survey forms because the first survey did not count private buses.

91

3.5.3 CODING WORK

Coding works have been made for bus passengers interview survey form. To determine the origin and destination of the bus passenger's travel, the name of place was converted into zone code numbers.

6. DATA ENTRY

The survey data were entered into the micro-computer after editing and coding. The key to the data entry procedure was to simulate the record section of the survey form on the display screen, as shown in Figure 3.6 and 3.7. This procedure facilitated the data entry works.

Data checking and correction were also made after the data entry work by the computer.

Figure 3.6

Display Screen for Bus/Passenger Traffic Count Survey Sheet

Set Up   Modify   Option   Exit 02:14:45 pm
                                                    Date   99
                              1 Single   Weather   Surveyor
              Bus Berth No. 999   2 Double   Remarks (1-3) 9

No.	Bus Service No.	Type of Bus	Arrival Bus		Departure Bus	
			Time	Alight	Time	Board
1	999	9	9999	999	9999	999
2	999	9	9999	999	9999	999
3	999	9	9999	999	9999	999
4	999	9	9999	999	9999	999
5	999	9	9999	999	9999	999
6	999	9	9999	999	9999	999
7	999	9	9999	999	9999	999
8	999	9	9999	999	9999	999
9	999	9	9999	999	9999	999
10	999	9	9999	999	9999	999

MODIFY SCREEN <D>   D: BUSCOUNT.SCR   Pg 01 Row 19 Col 18   Num
     Enter text. Drag field or box under cursor with . F10 for menu
        Field: BUSCOUNT->BN010   Type: Numeric Width: 3 Decimal 0

Set Up   Modify   Options   Exit 02:14:52 pm
                1 Single
                2 Double

No.	Bus Service No.	Type of Bus	Arrival Bus		Departure Bus	
			Time	Alight	Time	Board
11	999	9	9999	999	9999	999
12	999	9	9999	999	9999	999
13	999	9	9999	999	9999	999
14	999	9	9999	999	9999	999
15	999	9	9999	999	9999	999
16	999	9	9999	999	9999	999
17	999	9	9999	999	9999	999
18	999	9	9999	999	9999	999
19	999	9	9999	999	9999	999
20	999	9	9999	999	9999	999

MODIFY SCREEN <D>   D: BUSCOUNT.SCR   Pg 02 Row 15 Col 18   Num
     Enter text. Draf field or box under cursor with . F10 for menu
             Screen field definition blackboard

Figure 3.7

Display Screen for Bus Passengers Interview
Survey Sheet

```
Set Up        Modify              Option            Exit  05:23:54 pm
           Bus Passengers Interview Survey at Interchange
        Sheet No. 999/999    Date: Apr. 99   Weather:  Surveyor:
```

		1	2	3	4	5
Interview	Berth No.	99	99	99	99	99
Made	Time	9999	9999	9999	9999	9999
	Bus No.	999	999	999	999	9
	Sex	9	9	9	9	9
Interviewee	Age	99	99	99	99	99
	Resident	9	9	9	9	9
	Occupation	99	99	99	99	99
Origin		9999-99	9999-99	9999-99	9999-99	9999-99
Destination		9999-99	9999-99	9999-99	9999-99	9999-99
Trip Purpose		9	9	9	9	9
Before Bus Mode		99	99	99	99	99
Bus No.		999	999	999	999	999
Walk min.		99	99	99	99	99
After Bus Mode		99	99	99	99	99
Car Ownership		9	9	9	9	9

```
MODIFY SCREEN   <D>   D:BUSPASEN.SCR      Pg 01 Row 00 Col 00    Num
   Enter text.  Drag field or box under cursor with  .  F10 for menu.
               Screen field definition blackboard
```

3.7   ANALYSIS OF SURVEY

The following analysis is based on the data of the 1988 Survey. For the major items, the data are compared with those of the 1987 Survey.

3.7.1   BUS TRAFFIC

A total of 3,289 departing buses and 3,272 arriving buses were counted during the survey period. Table 3.7 shows the composition of arriving/departing buses by type of service. Among the departing buses, 2,178 or 66.2% of the total were for trunk services and 1.111 or 33.8% were for feeder services.

The total number of departing buses was decreased compared with the same data obtained from the 1987 survey.

Table 3.8 shows the number of the arriving and departing buses by service. As compared with the previous data, departing buses of services No. 74 (Clementi) increased, while those of Service No. 168 (Orchard Rd) decreased.

Table 3.7

Number of Arriving/Departing Buses by Type of Service

Type of Bus Service	Number of Arriving Buses	Number of Departing Bus	Total
Trunk Service	2.182 (66.7)	2.178 (66.2) §2.275† (65.3)	4.360 (66.5)
Feeder Service	1.090 (33.3)	1.111 (33.8) §1,210† (34.7)	2.201 (33.5)
Total	3.272 (100)	3.289 (100) §3,485† (100)	6.561 (100)

[ ]   Bus traffic surveyed in 1987

Table 3.8

Number of Arriving/Departing Buses by Service

Bus Service Number		Number of Buses Arrived	Number of Buses Departed	Total	Number of Buses Departed (Surveyed in 1987)
Trunk Servce	22	168	168	336	- 1)
	24	148	146	294	173
	25	191	193	384	213
	74	264	264	528	139
	130	96	96	192	83
	132	81	86	167	106
	133	140	140	280	150
	134	125	125	250	139
	135	86	97	183	97
	136	105	100	205	133
	138	-	-	-	- 2)
	159	130	137	267	173
	162	108	109	217	119
	165	151	151	302	153
	166	95	105	200	115
	168	121	121	242	220 3)
	169	173	140	313	176
Sub-Total		2,182	2,178	4,360	2,275
	261	262	268	530	279
	262	111	111	222	129
	265	178	185	363	207
	266	187	185	372	205
	267	168	166	334	170
	269	184	196	380	220
Sub-Total		1,090	1,111	2,201	1,210
Total		3,272	3,289	6,561	3,485

1)   Service Number 22 is a new service

2)   Service Number 138 was abolished because of the MRT

3)   Air-conditioning bus service of Service Number 168 was abolished because of the MRT

3.7.2 NUMBER OF BOARDING AND ALIGHTING PASSENGERS

A total of 83,544 passengers boarded and 71,230 passengers alighted at Ang Mo Kio Bus Interchange from 0600 hours to 2200 hours, as shown in Table 3.9. The total number of boarding and alighting passengers decreased compared with those in 1987. The number of boarding and alighting passengers for trunk services decreased due to the running of MRT, while the passengers boarding and alighting for feeder services increased.

Table 3.9

Number of Boarding/Alighting Passengers

Type of Bus Service	1988 Survey			1987 Survey		
	Boarding Passengers	Alighting Passengers	Total	Boarding Passengers	Alighting Passengers	Total
Trunk Service	43,652 (52.3)	37,760 (53.0)	81,412 (52.6)	47,447 (56.4)	39,742 (54.6)	87,189 (55.6)
Feeder Service	39,892 (47.7)	33,470 (47.0)	73,362 (47.4)	36,665 (43.6)	33,059 (45.4)	69,724 (44.4)
Total	83,544 (100)	71,230 (100)	154,774 (100)	84,112 (100)	72,801 (100)	156,913 (100)

3.7.3 Passengers by Service

The number of boarding passengers has slightly increased for all feeder bus services compared with the survey data in 1987 before the running of MRT as shown in Table 3.10 Service number 261 carried the largest number of passengers (17,437) to/from the industrial Park 1.

As for services outside the New Town, service number 25 plying to/from Bedok still carried the largest number of passengers. Service number 169 plying to/from Woodlands also has the second largest number of passengers. The boarding and alighting passengers of these services increased.

The number of passengers for service number 168 plying to/from Orchard Road, 159 (Toa Payoh), 132 (Bukit Merah) and 134 (New Bridge Road) has considerably decreased in 1988 because of the commencement of MRT. After the Service Number 138 was abolished, some passengers of this service may have shifted to Service Number 130.

Table 3.10

Number of Passengers by Service

Bus Service Number	Destination	1988 Survey		1987 Survey	
		Boarding Passengers	Alighting Passengers	Boarding Passengers	Alighting Passengers
22	Tampines	1,597	1,800	-	-
24	Changi Airport PTB	4,437	2,897	4,543	3,199
25	Bedok	8,274	6,843	6,897	6,066
74	Clementi	2,175	2,291	2,214	2,109
130	Shenton Way	2,420	1,718	2,069	1,381
132	Bukit Merah	827	1,548	1,291	1,635
133	Marina Center	2,403	2,007	2,618	1,958
134	New Bridge Road	2,429	2,032	3,512	2,547
135	Marine Parade	2,761	2,211	2,361	2,177
136	Upper Serangoon Rd.	1,604	1,302	1,917	1,306
138	Robinson Road	-	-	2,224	1,575
159	Toa Payoh	1,981	2,606	3,131	4,080
162	Sims Avenue	844	982	739	1,118
165	Jurong	2,597	2,065	2,822	1,724
166	Labrador	1,351	1,611	850	1,472
168	Orchard Road	1,533	1,272	5,062	3,252
169	Woodlands	6,419	4,575	5,197	4,203
Trunk Services		43,652	37,760	47,447	39,742
261	AMK Ind. Park 1	9,996	7,441	8,957	8,283
262	AMK Avenue 2	2,604	2,388	2,363	2,755
265	AMK Avenue 10	6,764	6,704	6,222	6,764
266	AMK Avenue 4/5	7,817	6,743	7,912	5,906
267	AMK Ind. Park 2	6,455	5,937	5,357	5,300
269	AMK Street 61	6,256	4,257	5,854	4,051
Feeder Services		39,892	33,470	36,665	33,059
Total		83,544	71,230	84,112	72,801

3.7.4 PEAK AND OFF-PEAK PASSENGERS

In Ang Mo Kio bus interchange, peak period of boarding and alighting passengers occurs from 0630 hour to 0830 hours in the morning and from 1700 hours to 1930 hours in the evening. However, the evening peak period of passengers is lower than morning peak.

In Singapore, 0630 hour to 0830 hours and 1645 hours to 1845 hours are usually defined as the mrning peak hours and the evening peak hours respectively. Table 3.11 shows the number of boarding/alighting passengers in these peak periods. It shows that the share of passengers during the morning peak period (2 hours) is 20.5% of daily (16 hours) passengers and the share during the evening peak period is 18.4%.

The same table shows that 23.9% of boarding passengers for trunk services made their trips during the morning peak period, while 17.2% of them for feeder services. On the other hand, the share of the boarding passengers in the evening peak period is 15.6% for trunk services and 22.5% for feeder services.

Figure 3.8 shows the distribution of departure bus traffic by 15 minutes time period. Figure 3.9 shows the number of boarding and alighting passengers by time period and Figures 3.10 and 3.11 also shows the boarding and alighting passengers for trunk and feeder services by time period respectively.

Table 3.11

Bus Passenger Traffice During Peak and Off-Peak Hours

	Trunk Services			Feeder Service			Total		
	Boarding	Alighting	Total	Boarding	Alighting	Total	Boarding	Alighting	Total
Morning Peak	10430	6398	16828	6854	8087	14941	17281	14495	31769
Evening Peak	6795	7029	13824	8960	5729	14689	15755	12758	28513
Afternoon Off-peak	4398	4622	9020	4798	3558	8356	9196	8180	17376
Others	22029	19711	41740	19280	16096	35376	41309	35807	77116
All Day	43652	37760	81412	39892	33470	73362	83544	71230	154774
Morning Peak	23.9	16.9	20.7	17.2	24.2	20.4	20.7	20.3	20.5
Evening Peak	15.6	18.6	17.0	22.5	17.1	20.0	18.9	17.9	18.4
Afternoon Off-peak	10.1	12.2	11.1	12.0	10.6	11.4	11.0	11.5	11.2
Others	50.5	52.2	51.3	48.3	48.1	48.2	49.4	50.3	49.8
All Day	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Morning Peak	62.0	38.0	100.0	45.9	54.1	100.0	54.4	45.6	100.0
Evening Peak	49.2	50.8	100.0	61.0	39.0	100.0	55.3	44.7	100.0
Afternoon Off-peak	48.8	51.2	100.0	57.4	42.6	100.0	52.9	47.1	100.0
Others	52.8	47.2	100.0	54.5	45.5	100.0	53.6	46.4	100.0
All Day	53.6	46.4	100.0	54.4	45.6	100.0	54.0	46.0	100.0

Note: Morning Peak   :   0630 - 0830 Hours
        Evening Peak   :   1645 - 1845 Hours
                       :   1730 - 1930 Hours
        Afternoon Peak :   1430 - 1630 hours

Figure 3.8

Number of Departure Buses
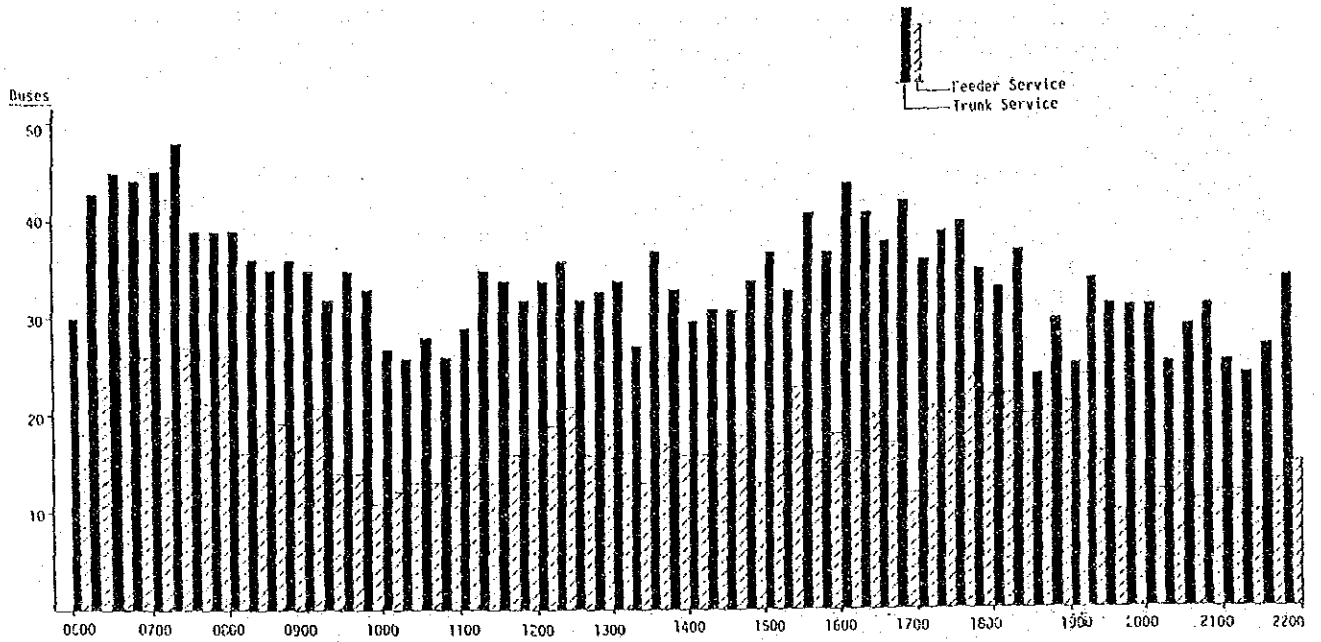
Figure 3.9

Boarding and Alighting Passengers by Time Period
(Total)
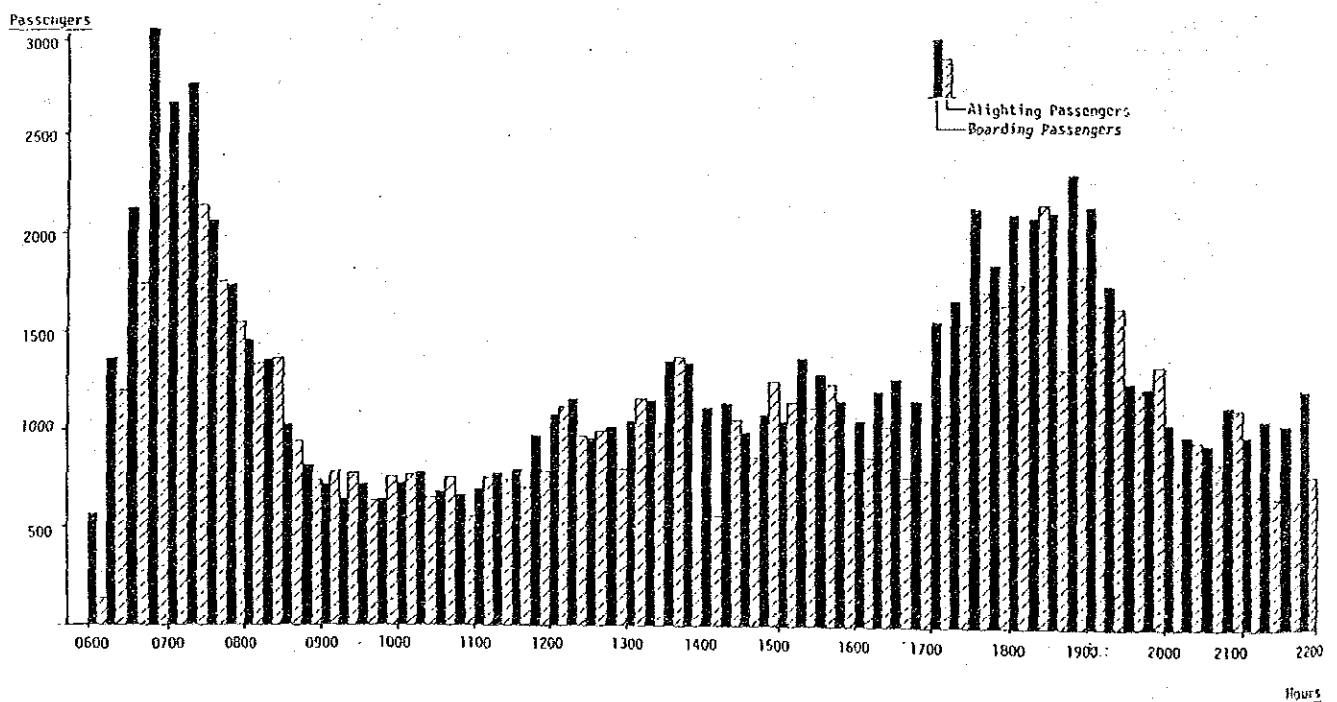
Figure 3.10

Number of Boarding and Alighting Passengers by time period
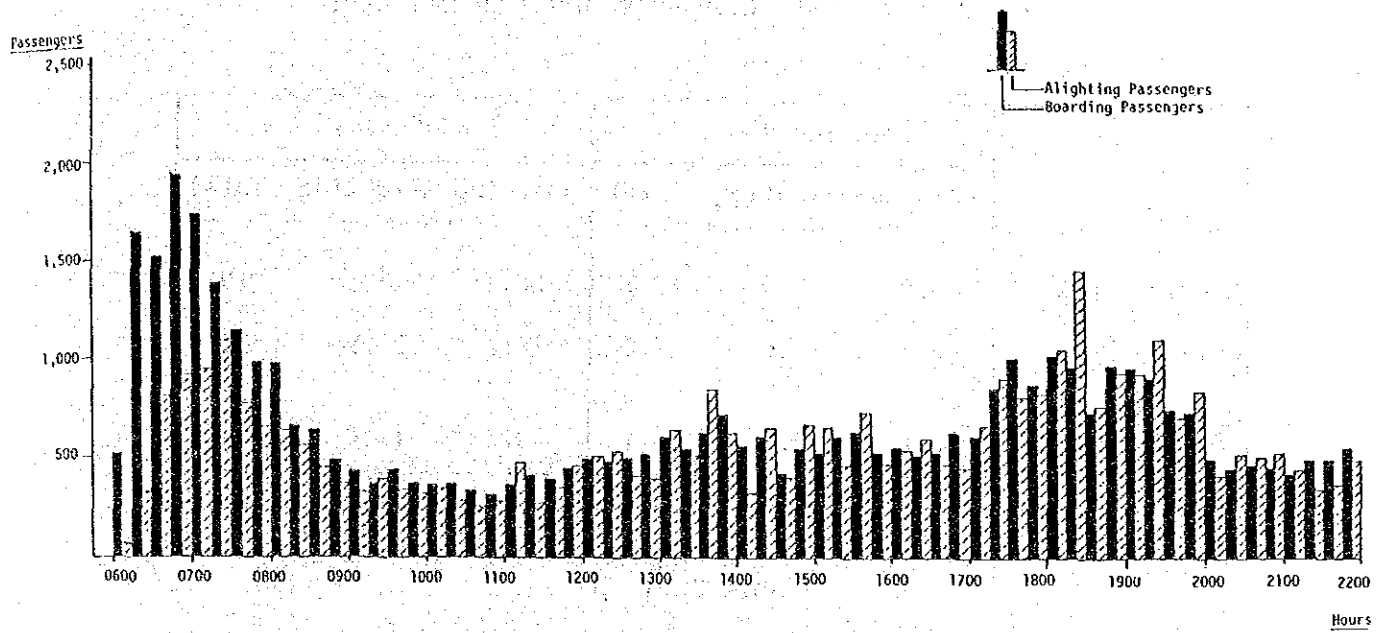### (Trunk Bus Services)

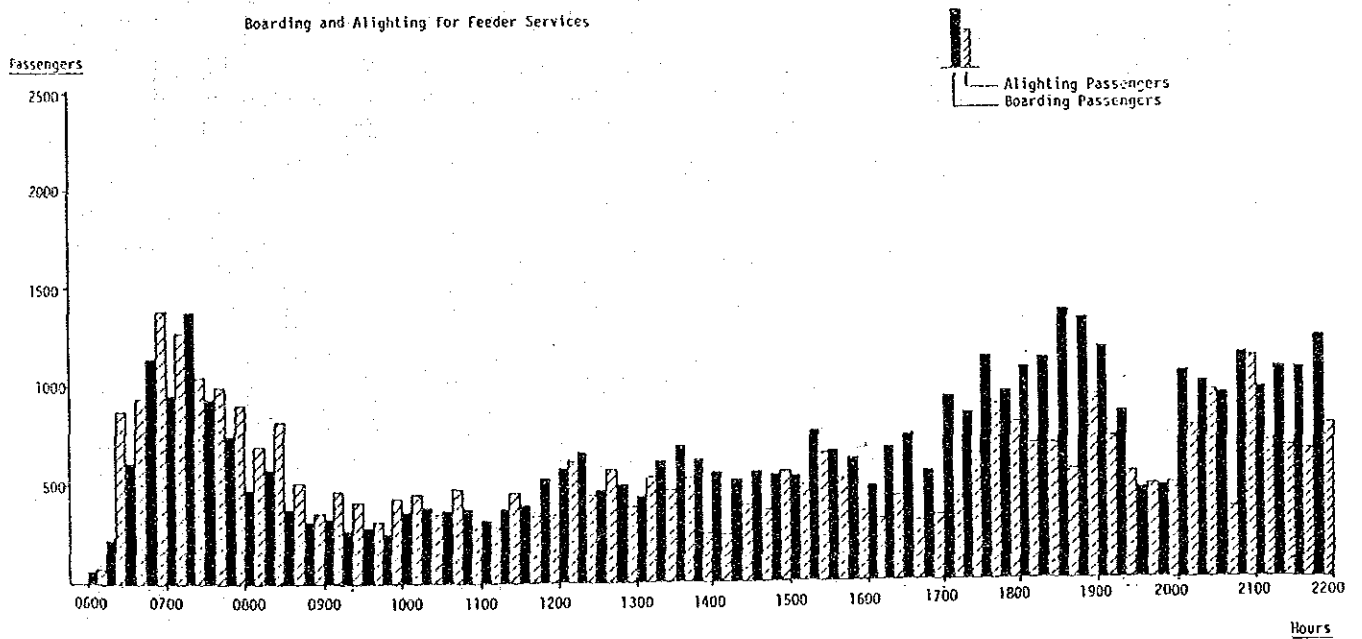## Figure 3.11

Boarding and Alighting for Feeder Services

Table 3.12

Share of Peak Hour Passengers for Trunk Services

	1988 Survey			1987 Survey		
	Boarding	Alighting	Total	Boarding	Alighting	Total
Morning Peak	23.9	16.9	20.7	25.7	12.6	19.8
Evening Peak	15.6	18.6	17.0	14.7	21.9	18.0
Afternoon Off-Peak	10.1	12.2	11.1	9.6	10.4	9.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 3.13

Share of Peak Hour Passengers for Feeder Services

	1988 Survey			1987 Survey		
	Boarding	Alighting	Total	Boarding	Alighting	Total
Morning Peak	17.2	24.2	20.4	14.3	22.5	18.2
Evening Peak	22.5	17.1	20.0	22.8	16.0	19.5
Afternoon Off-Peak	12.0	10.6	11.4	12.5	9.7	11.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

3.7.5 PROFILE OF BUS PASSENGERS

The following data were obtained from the sample passengers interviewed at Ang Mo Kio Bus Interchange from 8 to 13 April 1988 (exclude Saturday and Sunday). These data are compared with the previous data surveyed on October 1987.

1) Age and Sex

Table 3.14 shows the distribution of passengers by age and sex. The distribution ratios of age groups are similar to those surveyed in 1987.

Table 3.14

Distribution of Passengers by Age Group and Sex

| Age Group | Number of Persons | | | |
	Male	Female	Unknown	Total
0 - 7	2	4	-	6
8 - 16	243	243	-	486
17 - 25	620	561	-	1,181
26 - 55	550	350	-	900
56 & above	24	11	-	35
Unknown	2	3	8	13
Total	1,441	1,172	8	2,621

| Age Group | Percentage (%) | | | | 1987 Survey |
	Male	Female	Unknown	Total	Total (%)
0 - 7	0.1	0.3	-	0.2	0.2
8 - 16	16.9	20.7	-	18.5	19.8
17 - 25	43.0	47.9	-	45.1	38.7
26 - 55	38.2	29.9	-	34.3	33.0
56 & above	1.7	0.9	-	1.3	1.4
Unknown	0.1	0.3	100.0	0.5	6.8
Total	100.0	100.0	100.0	100.0	100.0

2) Occupation

The majority of bus passenger interviewed in this survey were employed. It has 50.3 per cent of the total. The component ratios of passengers by occupation are not so different from those of the previous survey data.

Table 3.15

Distribution of Passengers by Occupation

Occupation	Number of Person			
	Male	Female	Unknown	Total
Employed	735	579	4	1,318
Students	468	402	1	871
Others	230	189	1	420
Unknown	8	2	2	12
Total	1.441	1.172	8	2,621

Occupation	Percentage (%)				Survey in 1987
	Male	Female	Unknown	Total	Total
Employed	51.0	49.4	50.0	50.3	47.1
Students	32.5	34.3	12.5	33.2	32.5
Others	16.0	16.1	12.4	16.0	18.6
Unknown	0.5	0.2	25.0	0.5	1.8
Total	100.0	100.0	100.0	100.0	100.0

Table 3.16

Distribution of Passengers by Occupation (Detailed)

Occupation	Number of Person			
	Male	Female	Unknown	Total
Professional/ Technical Workers	271	96	-	367
Administrative/ Managerial Workers	72	63	-	135
Clerical Workers	48	156	1	205
Sales Workers	54	60	-	114
Service Workers	89	66	1	156
Agricultural Worker and Fisherman	3	-	-	3
Production/Transport Workers	141	123	1	265
Workers not Classifiable	57	15	1	73
Sub-Total	735	579	4	1,318
Primary Students	24	22	-	46
Secondary Students	226	221	1	448
Pre-Uni Students	67	92	-	159
Vocational Ins. Students	62	18	-	80
Tertiary Students	89	19	-	138
Sub-Total	468	402	1	871
Housewife	4	105	-	109
Others	226	84	1	311
Unknown	8	2	2	12
Total	1,441	1,172	8	2,621

Table 3.16 (Cont.)

Occupation	Percentage (%)			Total	1987 Survey Total
	Male	Female	Unknown		
Professional/ Technical Workers	18.8	8.2	-	14.0	10.3
Administrative/ Managerial Workers	5.0	5.4	-	5.2	4.6
Clerical Workers	3.3	13.3	12.5	7.8	9.3
Sales Workers	3.7	5.1	-	4.3	4.0
Service Workers	6.2	5.6	12.5	6.0	6.5
Agricultural Worker and Fisherman	0.2	-	-	0.1	0.1
Production/Transport Workers	9.8	10.5	12.5	10.1	10.4
Workers not Classifiable	4.0	1.3	12.5	1.8	3.5
Sub-Total	51.0	49.4	50.0	50.3	48.6
Primary Students	1.7	1.9	-	1.8	2.4
Secondary Students	15.7	18.9	12.5	17.1	18.8
Pre-Uni Students	4.6	7.8	-	6.1	2.4
Vocational Ins. Students	4.3	1.5	-	3.1	2.1
Tertiary Students	6.2	4.2	-	5.3	4.6
Sub-Total	32.5	34.3	12.5	33.2	30.3
Housewife	0.3	9.0	-	4.2	4.9
Others	15.7	7.2	12.5	11.9	13.7
Unknown	0.6	0.2	25.0	0.5	1.5
Total	100.0	100.0	100.0	100.0	100.0

3.7.6 TRIP PURPOSE

Information on trip purpose of passengers was tabulated by time period and divided into two categories that is residents and non-residents.

The major trip purpose in morning peak was travelling "to work" and "two school" for both residents and non-residents. However, the component ratios are different from those in 1987 survey.

Table 3.17 -

Trip Purpose

| | | Trip Purpose | |
		To Work	To School	Part Work	Prsnal Busnes	Private	To Home	Not Known	Total
Residents	Morning Peak	133	89	2	9	2	25	2	262
	Evening Peak	7	2	2	7	14	94	–	126
	Off Peak	217	114	9	127	118	432	9	1026
	subtotal	357	205	13	143	134	551	11	1414
Non Residents	Morning Peak	58	56	1	6	2	6	3	132
	Evening Peak	12	3	2	17	23	148	2	207
	Off Peak	134	34	19	93	95	465	20	860
	subtotal	204	93	22	116	120	619	25	1199
Not Known	Morning Peak	1	1	–	–	–	–	1	3
	Evening Peak	–	–	–	–	–	–	–	–
	Off Peak	1	–	1	–	–	–	3	5
	subtotal	2	1	1	–	–	–	4	8
Total	Morning Peak	192	146	3	15	4	31	6	397
	Evening Peak	19	5	4	24	37	242	2	333
	Off Peak	352	148	29	220	213	897	32	1891
	subtotal	563	299	36	259	254	1170	40	2621

(%)

| | | Trip Purpose | |
		To Work	To School	Part Work	Prsnal Busnes	Private	To Home	Not Known	Total
Residents	Morning Peak	50.8	34.0	0.8	3.4	0.8	9.5	0.8	100.0
	Evening Peak	5.6	1.6	1.6	5.6	11.1	74.6	–	100.0
	Off Peak	21.2	11.1	0.9	12.4	11.5	42.1	0.9	100.0
	subtotal	25.2	14.5	0.9	10.1	9.5	39.0	0.8	100.0
Non Residents	Morning Peak	43.9	42.4	0.8	4.5	1.5	4.5	2.3	100.0
	Evening Peak	5.8	1.4	1.0	8.2	11.1	71.5	1.0	100.0
	Off Peak	15.6	4.0	2.2	10.8	11.0	54.1	2.3	100.0
	subtotal	17.0	7.8	1.8	9.7	10.0	51.6	2.1	100.0
Not Known	Morning Peak	33.3	33.3	–	–	–	–	33.3	100.0
	Evening Peak	–	–	–	–	–	–	–	–
	Off Peak	20.0	–	20.0	–	–	–	60.0	100.0
	subtotal	25.0	12.5	12.5	–	–	–	50.0	100.0
Total	Morning Peak	48.4	36.8	0.8	3.8	1.0	7.8	1.5	100.0
	Evening Peak	5.7	1.5	1.2	7.2	11.1	72.7	0.6	100.0
	Off Peak	18.6	7.8	1.5	11.6	11.3	47.4	1.7	100.0
	subtotal	21.5	11.4	1.4	9.9	9.7	44.6	1.5	100.0

1987 Survey (%)

| | | Trip Purpose | |
		To Work	To School	Part Work	Prsnal Busnes	Private	To Home	Not Known	Total
Residents	Morning Peak	68.4	17.8	0.2	3.5	3.0	6.3	0.9	100.0
	Evening Peak	3.3	1.3	0.4	7.6	15.2	71.7	0.5	100.0
	Off Peak	15.7	6.5	1.3	12.2	17.2	46.7	0.5	100.0
	subtotal	21.8	7.4	1.0	10.2	14.8	44.2	0.6	100.0
Non residents	Morning Peak	70.7	14.1	–	4.0	–	8.1	3.0	100.0
	Evening Peak	1.0	1.0	–	5.9	16.7	75.5	–	100.0
	Off Peak	14.4	6.5	1.1	14.4	20.3	42.0	1.3	100.0
	subtotal	20.2	6.8	0.8	11.8	17.0	42.0	1.4	100.0
Not known	Morning Peak	–	–	–	–	–	–	100.0	100.0
	Evening Peak	–	–	–	–	–	–	100.0	100.0
	Off Peak	4.5	–	–	–	–	4.5	90.9	100.0
	subtotal	3.2	–	–	–	–	3.2	93.5	100.0
Total	Morning Peak	68.6	17.3	0.1	3.6	2.5	6.5	1.3	100.0
	Evening Peak	2.9	1.2	0.3	7.3	15.3	71.5	1.7	100.0
	Off Peak	15.4	6.4	1.2	12.5	17.6	45.6	1.3	100.0
	subtotal	21.4	7.3	0.9	10.4	15.0	43.6	1.3	100.0

3.7.7 CAR OWNERSHIP OF BUS PASSENGERS

Among the bus passengers interviewed at Ang Mo Kio Bus Interchange, 29.3 percent of passengers came from car-owning households. The proportion of household car-owning is quite different from that surveyed in 1987.

There must be some confusion of household car-owning with personal car-owning in 1987 survey.

Table 3.18

Car-ownership of Household

Occupation	Car Ownership			
	Yes	No	Not Known	Total
Prof./Technical Worker	94	268	5	367
Adm./Managerial Worker	36	99	-	135
Clerical Worker	70	133	2	205
Sales Worker	39	75	-	114
Service Worker	42	113	1	156
Agri. Worker and Fisherman	-	3	-	3
Production, transport Worker	48	214	3	265
Workers Not Classifiable	15	55	3	73
Primary Student	10	36	-	46
Secondary Student	154	287	7	448
Pre-Uni Student	53	102	4	159
Vocational Ins. Student	26	54	-	80
Tertiary Student	51	86	1	138
Housewife	30	78	1	109
Others	98	209	4	311
Not Known	1	6	5	12
Total	767	1818	36	2621

Occupation	Car Ownership (%)				1987 Survey
	Yes	No	Not Known	Total	Car Owner
Prof./Technical Worker	25.6	73.0	1.4	100.0	15.4
Adm./Managerial Worker	26.7	73.3	-	100.0	18.3
Clerical Worker	34.1	64.9	1.0	100.0	10.9
Sales Worker	34.2	65.8	-	100.0	7.7
Service Worker	26.9	72.4	0.6	100.0	6.2
Agri. Worker and Fisherman	-	100.0	-	100.0	-
Production, transport Worker	18.1	80.8	1.1	100.0	4.5
Workers Not Classifiable	20.5	75.3	4.1	100.0	6.6
Primary Student	21.7	78.3	-	100.0	6.7
Secondary Student	34.4	64.1	1.6	100.0	5.1
Pre-Uni Student	33.3	64.2	2.5	100.0	13.6
Vocational Ins. Student	32.5	67.5	-	100.0	5.7
Tertiary Student	37.0	62.3	0.7	100.0	7.7
Housewife	27.5	71.6	0.9	100.0	17.0
Others	31.5	67.2	1.3	100.0	8.4
Not Known	8.3	50.0	41.7	100.0	3.7
Total	29.3	69.4	1.4	100.0	8.9

3.7.8 TRANSFER PASSENGERS

Table 3.19 shows the distribution of passenger by their previous and next mode of travel. Among the passengers for trunk bus passenges, 36.8% of them used feeder buses and 28.5% used trunk buses for their previous mode of travel, while 17.7% of them walked to the bus interchange. The proportion of passengers transfering from MRT to trunk buses was 10.5 percent.

As for passengers using feeder bus services, 43.7% of them used trunk buses and 19.7% used feeder buses as their previous mode of travel. The proportion of passengers transfering from MRT to feeder buses was 19.0%.

Table 3.20 shows the distribution of transfer mode surveyed in 1988 and 1987. It shows that the passengers transfering from MRT to buses were mainly converted from buses.

Table 3.19

Previous and next Mode of Travel for Bus Passengers

Number of Persons (%)

Mode	Passengers for Trunk Services		Passenger for Feeder Services	
	Previous Mode	Next Mode	Previous Mode	Next Mode
Walk	318 (17.7)	1,433 (79.8)	114 (13.8)	752 (91.0)
Bicycle	4 (0.2)	- (-)	- (-)	- (-)
Motorcycle	1 (0.1)	1 (0.1)	3 (0.4)	- (-)
Car	31 (1.7)	1 (0.1)	6 (0.7)	- (-)
Car-pool Pass.	- (-)	1 (-)	- (-)	- (-)
Taxi	12 (0.7)	- (-)	3 (0.4)	- (-)
Van/pick-up/ Others	10 (0.6)	2 (0.1)	1 (0.1)	- (-)
MRT	189 (10.5)	1 (0.1)	157 (19.0)	- (-)
Feeder Bus	661 (36.8)	153 (8.5)	163 (19.7)	30 (3.6)
Trunk Bus	511 (28.5)	112 (6.2)	361 (43.7)	11 (1.3)
Scheme B/CSS	3 (0.2)	2 (0.1)	1 (0.1)	- (-)
School/Company Bus	9 (0.5)	2 (0.1)	1 (0.1)	- (-)
Others	2 (0.1)	1 (0.1)	- (-)	3 (0.4)
Unknown	44 (2.5)	86 (4.8)	16 (1.9)	20 (3.6)
Total	1,795 (100.0)	1,795 (100.0)	826 (100.00	826 (100.00)

Table 3.20

Comparison of Transfer Mode

| Mode | Previous Mode (%) | | | |
| | Passengers for Trunk Services | | Passenger for Feeder Services | |
	1988	1987	1988	1987
Walk	17.7	17.8	13.8	14.9
Feeder Bus	36.8	78.9	19.7	82.4
Trunk Bus	28.5	-	43.7	-
MRT	10.5	-	19.0	-
Others	4.0	2.3	1.9	1.2
Unknown	2.5	1.0	1.9	1.5
Total	100.0	100.0	100.0	100.0

| Mode | Next Mode (%) | | | |
| | Passengers for Trunk Services | | Passenger for Feeder Services | |
	1988	1987	1988	1987
Walk	79.8	72.6	91.0	90.1
Feeder Bus	8.5		3.6	
Trunk Bus	6.2	23.4	1.3	8.1
MRT	0.1	-	-	-
Others	0.6	0.7	0.5	0.2
Unknown	4.8	3.3	3.6	1.6
Total	100.0	100.0	100.0	100.0

3.7.9 EXPANSION OF INTERVIEW SURVEY DATA

Since the bus passenger interview survey was conducted on a sampling basis, the data need to be expanded to reflect the total bus passengers of ang Mo Kio bus interchange, especially for examining the OD patters of bus passengers.

The sample data were expanded into boarding passengers bases by service and by time period. Table 3.21 shows the expansion factor and Table 3.22 shows the distribution of expanded samples by service and time period.

Table 3.21

Expansion of Factor for the Interview Survey

Bus Service Number	Time Period			
	Morning Peak	Evening Peak	Afternoon Peak	Others
22	10.9	6.2	4.0	7.1
24	80.3	72.8	35.8	29.5
25	43.6	67.8	28.7	38.4
74	31.9	12.2	6.3	10.6
130	52.0	25.5	21.6	23.3
132	23.5	4.7	8.5	10.3
133	98.7	44.6	29.8	38.2
134	135.5	27.4	42.4	27.5
135	30.6	38.1	21.4	24.7
136	9.2	13.4	10.0	8.8
159	26.5	29.7	23.6	17.4
162	60.5	34.2	19.8	11.4
165	91.7	23.6	36.1	29.0
166	21.6	8.5	11.8	21.6
168	53.7	10.6	12.2	13.0
169	65.3	50.0	33.9	27.6
261	95.3	218.1	73.0	69.9
262	11.9	46.5	20.8	17.3
265	16.3	86.6	36.6	27.9
266	20.0	46.7	46.7	40.9
267	158.9	64.5	64.5	40.7
269	42.8	49.0	49.0	53.9

Table 3.22

Distribution of Sample at Ang Mo Kio Bus IC

		600 -59	700 -59	800 -59	900 -59	1000 -59	1100 -59	1200 -59	1300 -59	1400 -59	1500 -59	1600 -59	1700 -59	1800 -59	1900 -59	2000 -59	2100 -59	Total
Trunk Lines	22	171	165	107	72	57	58	79	72	72	77	96	106	127	137	101	100	1597
	21	308	985	329	354	118	236	236	177	160	323	167	292	350	148	206	148	4437
	25	513	566	574	385	347	500	577	308	415	544	509	884	821	422	419	460	8274
	71	313	352	192	110	110	110	88	77	74	65	91	147	96	100	100	120	2175
	130	93	312	353	117	140	70	163	140	92	196	89	181	100	187	93	94	2420
	132	137	163	10	31	31	31	42	41	39	43	37	35	13	52	62	30	827
	133	213	396	273	114	115	114	153	77	138	119	38	180	215	77	76	115	2403
	131	191	107	299	110	140	112	84	83	139	137	109	138	82	135	108	135	2429
	135	228	372	205	200	100	225	0	200	161	107	169	191	216	123	120	144	2761
	136	100	157	83	90	99	91	99	90	85	90	104	149	131	76	85	85	1604
	159	96	159	133	105	140	35	245	175	107	118	93	180	135	87	105	68	1981
	162	33	182	31	23	35	34	35	31	52	59	68	68	35	35	45	22	844
	165	396	460	182	145	145	116	58	116	202	36	143	144	141	58	174	174	2597
	166	110	180	96	132	132	110	110	84	45	36	61	31	26	63	81	126	1351
	168	106	270	239	52	65	66	65	65	89	74	74	66	80	39	130	53	1533
	169	195	655	503	280	252	252	308	280	400	374	480	651	382	432	213	132	6419
subtotal		3517	5610	3602	2350	2026	2150	2342	2019	2260	2388	2331	3446	2983	2171	2151	2306	43652
Feeder Lines	261	494	669	571	70	560	490	420	630	572	584	506	716	1309	935	840	628	9996
	262	124	108	61	122	140	123	105	192	116	126	270	384	232	192	85	204	2587
	265	210	245	294	308	336	336	336	364	446	478	392	631	869	826	280	413	6764
	266	321	541	489	110	328	328	410	205	422	513	532	629	1166	669	366	185	7817
	267	759	1431	999	246	205	205	246	205	301	257	187	313	385	276	240	200	6155
	269	277	593	319	270	270	321	378	432	353	294	358	158	569	672	318	371	6256
subtotal		2190	3587	2736	1126	1839	1806	1895	2028	2210	2252	2245	3131	4530	3570	2129	2301	39875
Total		5707	9197	6338	3776	3865	3956	4237	4047	4470	4640	4576	6577	7513	5711	4280	4607	83527

3.7.10 ORIGIN AND DESTINATION OF BUS PASSENGERS TRAVEL

1) Zoning

To determine the origin and destination of (OD) of the interviewee's travel, the places of OD were coded 89 zones for the whole country and 15 sub-zones for Ang Mo Kio New Towns based on the postal district. Furthermore, these zones were integrated into 60 zones including 15 sub-zones for Ang Mo Kio New Towns for the purpose of analysis. Table 3.23 shows the list of these zones. Figures 3.12 and 3.13 shows the zoning map of these zones.

Table 3.23

List of Zones and Sub-Zones of Bus Survey

Zone No.	Name of Zone	Zone No.	Name of Zone
24	Ang Mo Kio 1 (Ind Park 3)	16	Marine Parade
2	Ang Mo Kio 2 (Street 61)	17	Clementi
3	Ang Mo Kio 3 (Sports Complex)	18	Pandan
4	Ang Mo Kio 4 (Street 13/21)	19	Jurong East
5	Ang Mo Kio 5 (St. 21/Mayflower	20	Jalan Ahamad Ibrahim
6	Ang Mo Kio 6 (Town Center)	21	Jurong West
7	Ang Mo Kio 7 (Street 51-53)	22	Jurong Industry
8	Ang Mo Kio 8 (Street 54)	23	Bishan
9	Ang Mo Kio 9 (Ind Park 2)	25	Seletar
10	Ang Mo Kio 10 (Street 22/23)	26	Serangoon
11	Ang Mo Kio 11 (Street 31/32)	27	Hougang
12	Ang Mo Kio 12 (Street 41-43)	28	Old Airport
13	Ang Mo Kio 13 (Street 44)	29	Bedok
14	Ang Mo Kio 14 (Ind Park 1)	30	Padang Terbakar
15	Ang Mo Kio 15 Others	31	Changi Airport
1	CBD	32	Tampines
2	North Bridge Road	33	Pasir Ris
3	Orchard Road	34	Punggol
4	Istana Negara	35	Jalan Kayu
5	Keppel Harbour	36	Yishun,
6	Bukit Merah	37	Simpang
7	Queenstown	38	Sembawang
8	Pasir Panjang	39	Woodlands
9	Bukit Timah East	40	Mandai
10	Bukit Timah West	41	Choa Chu Kang
11	Jalan Besar	42	Bukit Panjang
12	Toa Payoh	43	Princess Elizabeth
13	Katong	44	Bukit Batok
14	Macpherson	45	Lim Chu Kang
15	Geylang	46	Nature Reserve

Figure 3.12

Zone Map of Bus Survey (1988)

☐ CBD Aria-Land 2

113
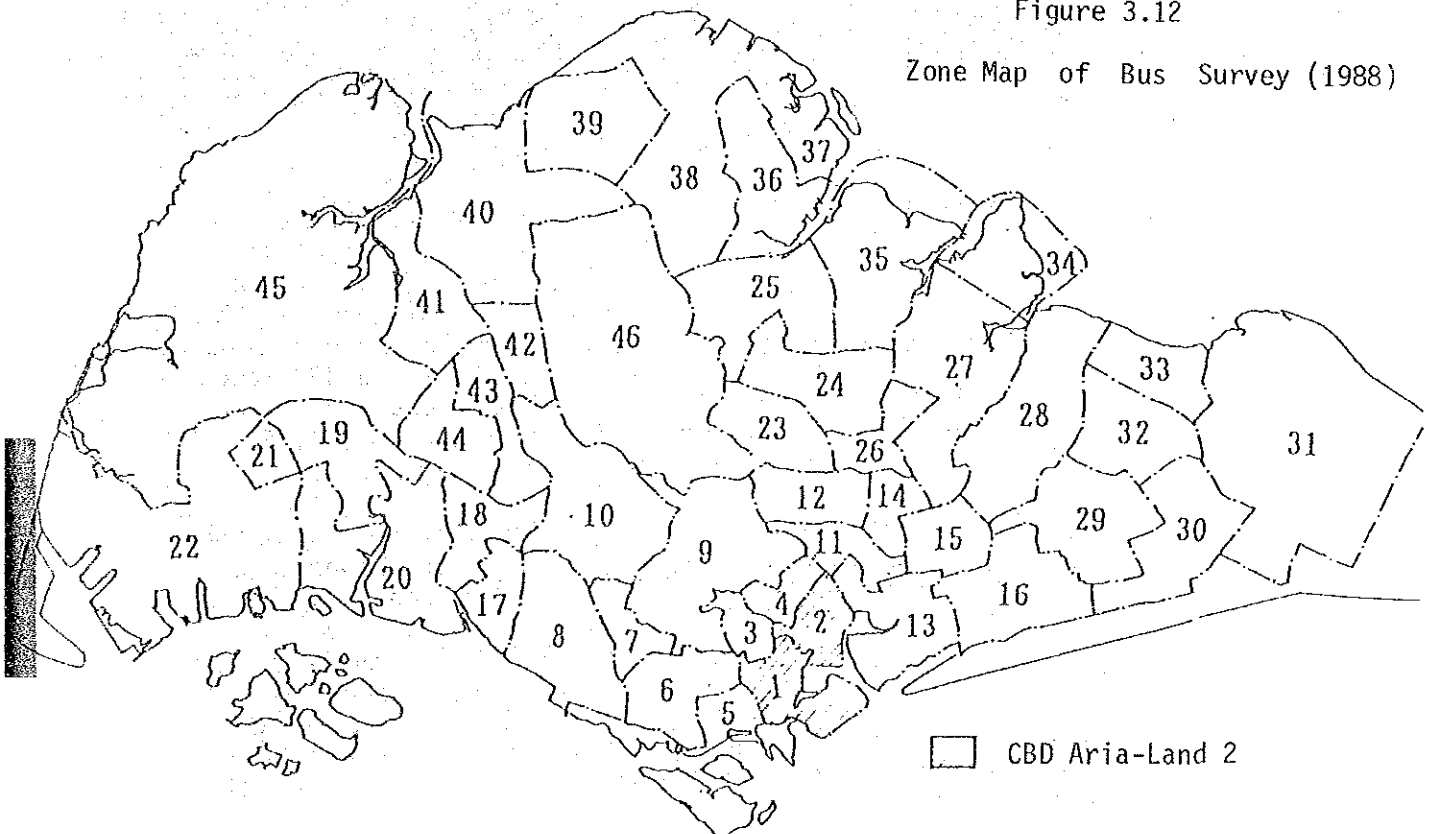
Figure 3.13

Sub-Zone Map of Ang Mo Kio New Town (15 Sub-Zones)
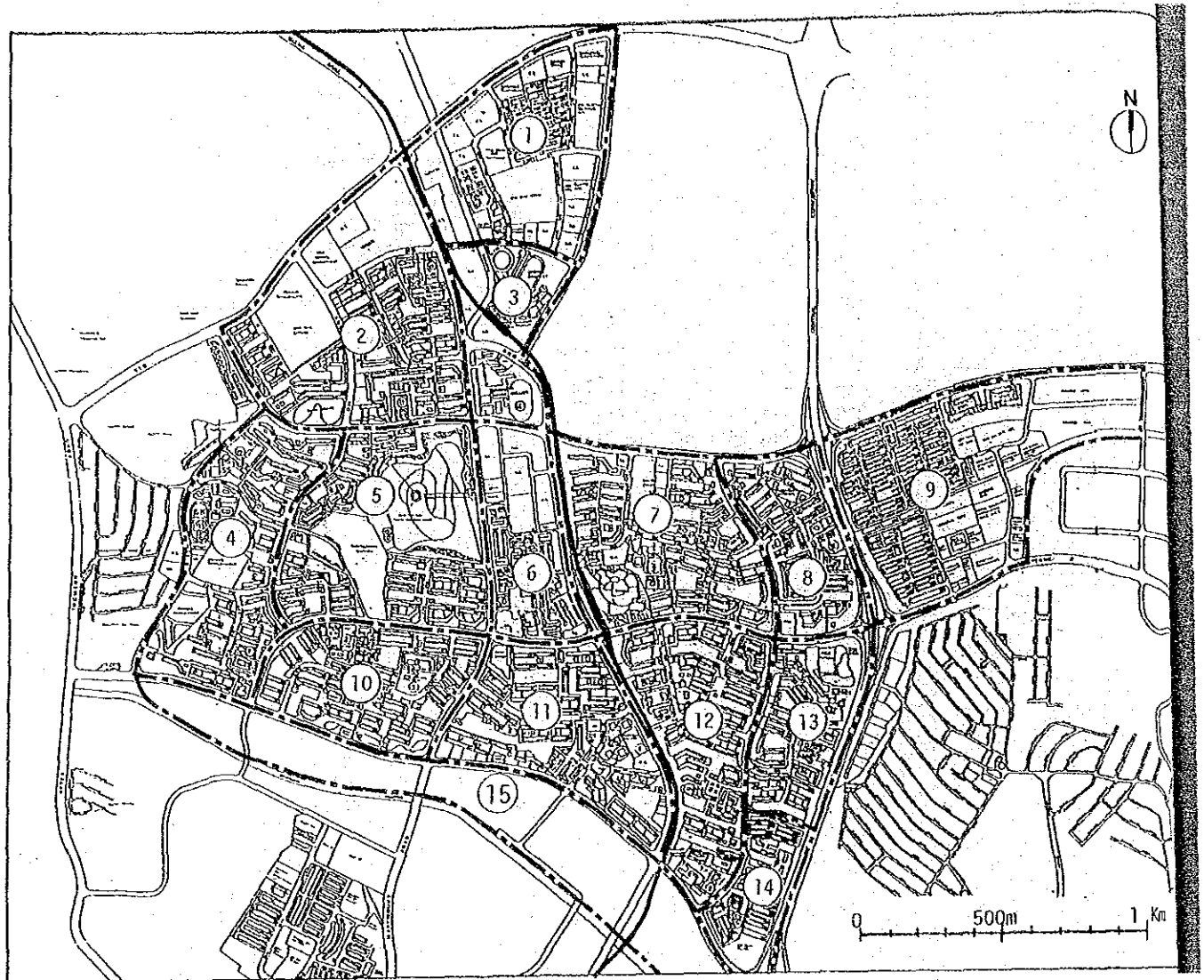
2) Trip Distribution at Ang Mo Kio New Town

Table 3.24 shows the number of trips travelled within, to/from and outside of Ang Mo Kio New Town. Among these trips related with Ang Mo Kio New Town, 22.8% of them finish their travel within the New Town, while the remaining 77.2% traveled between the New Town and outside of the New Town. Besides these trips, abaout 16,000 trips completed their trips between outside areas of the New Town. These trips would use the bus interchange only for a relay point of their travel. (See Figure 7.7)

As for the trips starting from Ang Mo Kio new town, the major destinations were East Coast (17.9%) Serangoon/Hougan (16.7%) and Bedok/Changi (10.2%) area as shown in Table 3.25. On the other hand, most of trips ending in Ang Mo Kio New Town originated from the CBD (12.3%), Orchard Rd. (10.4%), East Coast (9.9%) and Serangoon/Hougang (14.4%) area. The same shows that the proportions of passengers to/from the CBD and Orchard Road areas were reduced compared with those in 1987 survey. Figure 3.15 shows the area map for this analysis.

Table 3.24

Distribution of Bus Passengers Trips

Trips Traveling	1988 Survey No. of Trips	%		1987 Survey No. of Trips	%	
Within Ang Mo Kio	15,341	22.8	18.4	15,154	21.5	18.0
From Ang Mo Kio	25,891	38.4	31.0	32,619	46.3	38.7
To Ang Mo Kio	26,198	38.9	31.4	22,615	32.1	26.8
Sub-Total	67,430	100.0	80.7	70,388	100.0	83.5
Outside Ang Mo Kio	16,114		19.3	13,877		16.5
Total	83,544		100.0	84,265		100.0

Figure 3.14
Distribution of Trips at Ang Mo Kio New Town
(1988)
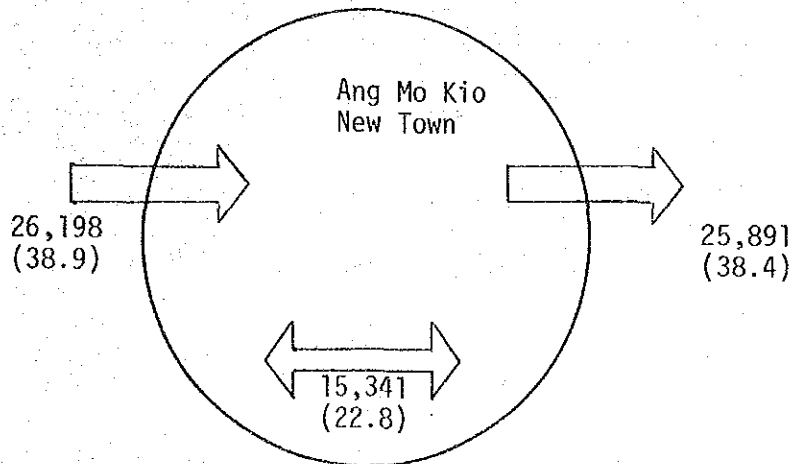
Total Number of Trips related with Ang Mo Kio New Town: 67,430 trips
(100%)

Table 3.25

Trip Distribution of Bus Passengers

No. of Trips (%)

Area	1988 Survey			1987 Survey		
	From Ang Mo Kio	To Ang Mo Kio	Total	From Ang Mo Kio	To Ang Mo Kio	Total
1 CBD	1,429 (5.5)	3,218 (12.3)	4,647 (8.9)	3,979 (12.2)	3,462 (15.3)	7,441 (13.5)
2 ORCHARD ROAD	426 (1.6)	2,716 (10.4)	3,142 (6.0)	3,223 (9.9)	2,078 (9.2)	5,301 (9.6)
3 ISTANA NEGARA	337 (1.3)	992 (3.8)	1,329 (2.6)	97 (0.3)	265 (1.2)	362 (0.7)
4 BUKIT MERAH/ QUEESTOWN	1,658 (6.4)	2,197 (8.4)	3,855 (7.4)	2,102 (6.4)	1,233 (5.5)	3,335 (6.0)
5 BUKIT TIMAH ROAD	1,272 (4.9)	1,611 (6.1)	2,883 (5.5)	819 (2.5)	939 (4.2)	1,758 (3.2)
6 EAST COAST	4,638 (17.9)	2,593 (9.9)	7,231 (13.9)	4,350 (13.3)	2,454 (10.9)	6,804 (12.3)
7 TOA PAYOH	1,874 (7.2)	1,969 (7.5)	3,843 (7.4)	2,170 (6.7)	2,105 (9.3)	4,275 (7.7)
8 CLEMENTI/ JURONG TOWN	1,402 (5.4)	1,380 (5.3)	2,782 (5.3)	1,836 (5.6)	1,373 (6.1)	3,209 (5.8)
9 JURONG INDUSTRIAL	23 (0.1)	21 (0.1)	44 (0.1)	– (–)	– (–)	– (–)
10 BISHAN	2,103 (8.1)	1,593 (6.1)	3,696 (7.1)	2,161 (6.6)	1,099 (4.9)	3,260 (5.9)
11 BEDOK/CHANGI	2,631 (10.2)	1,151 (4.4)	3,782 (7.3)	2,372 (7.3)	1,364 (6.0)	3,736 (6.8)
12 SERANGOON/HOUGANG	4,318 (16.7)	3,768 (14.4)	8,086 (15.5)	5,756 (17.6)	2,843 (12.6)	8,599 (15.6)
13 YISHUN/SEMBAWANG	2,041 (7.9)	1,969 (7.5)	4,010 (7.7)	1,915 (5.9)	2,121 (9.4)	4,036 (7.3)
14 WOODLANDS/ LIM CHU KANG	1,739 (6.7)	1,020 (3.9)	2,759 (5.3)	1,839 (5.6)	1,279 (5.7)	3,118 (5.6)
Total	25,891 (100.0)	26,198 (100.0)	52,089 (100.0)	32,619 (100.0)	22,615 (100.0)	55,234 (100.0)

Figure 3.15

Area Map for Bus Passenger OD Table
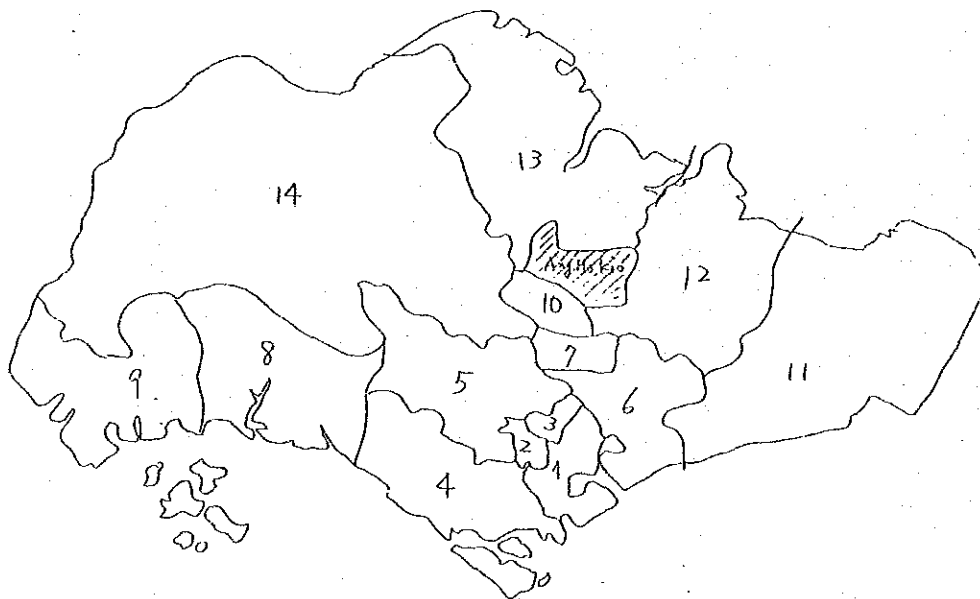
3.8   IMPACT OF MRT

Table 3.26 shows the changes on bus operation and bus passengers for trunk bus services to/from Ang Mo Kio bus interchange between the period before running of MRT and after running of MRT. It shows that in 1988, after the opening of MRT, a total of 114 buses were reduced compared with those in 1987 before MRT opening. The number of passengers on these trunk bus services was also reduced from 87,200 to 81,400 passengers. The passengers for Service 134 (New Bridge Road), Service 168 (Orchard Road) and Service 132 (Bukit Merah) were significantly reduced due to the running of MRT. Service 138 (Anson Road) was abolished after MRT.

Table 3.26

Change on Bus Operation and Passenger
(Trunk Bus Services To/From AMK Interchange)

	Service	Competition with MRT	No. of Bus Trips 1987	1988	No. of Bus Passenger 1978	1988
22	Tampines	X	-	202 (+202)	-	3,397 (+3,397)
24	1) Changi Air-port PTB	X	386	364 (- 22)	7,742	7,334 (- 408)
25	Bedok	X	457	463 (+ 6)	12,903	15,117 (+2,154)
74	Clementi		274	257 (- 17)	4,323	4,466 (+ 143)
130	Shentonway	0	207	207 (same)	3,450	4,138 (+ 688)
132	Bukit Merah		221	214 (- 7)	2,926	2,375 (- 551)
133	Marina Center	0	299	304 (+ 5)	4,576	4,410 (- 166)
134	New Bridge Rd.	0	271	271 (same)	6,059	4,461 (-1,598)
135	Marine Parade	X	192	226 (+ 34)	4,538	4,972 (+ 434)
136	1) Upper Serangoon Rd.	X	244	244 (same)	3,223	2,906 (- 317)
138	1) Anson Road	0	146	- (-146)	3,799	- (-3,799)
159	1) Toa Payoh	0	368	328 (- 40)	7,211	4,587 (-2,624)
162	1) Sims Avenue	X	224	224 (same)	1,857	1,826 (- 31)
165	Jurong	X	282	262 (- 20)	4,546	4,662 (+ 116)
166	Labrador	0	216	197 (- 19)	2,322	2,962 (+ 640)
168	1) Orchard	0	382	2) 292 (- 90)	8,314	2,805 (-5,509)
169	Woodlands	X	354	354 (same)	9,400	10,994 (1,594)
Total			4,523	4,409 (-114)	87,189	81,412 (-5,837)

1) Loop Route: No. of Trip = Schedule Trips x 2
2) Including Aircon 168

Table 3.27

Changes in Bus Passengers on Services Competing with MRT
Trunk Bus Service to/from AMK Interchange

Area		Service	No. of Bus Trips	Boarding & Alighting Bus Passengers	
Clementi	74	Clementi	-17	+143	33%
CBD	130	Shentonway	--	+ 688	19.9
	133	Marina Center	+5	- 166	- 3.6
	134	New Bridge Road	--	-1,598	-26.4
	135	Arson Road	-146	-3,799	-100.0
			-141	-4,875	-27.3
Bukit Merah	132	Bukit Merah	- 7	- 551	-18.8
	166	Labrador	- 19	+ 640	27.6
			- 26	+ 89	1.7
Orchard	168	Orchard	- 90	-5,509	-66.3
Toa Payoh	159	Poa Payoh	- 40	-2,624	-36.4
Total			-314	-12,776	-29.7%

4.1   HIS IN 1987

4.1.1 INTRODUCTION

1) Purpose of Survey

In 1980-81, a comprehensive Household Interview Survey was
conducted by the Provisional Mass Rapid Transit Authority
to prepare a sound data base for public transport planning
particularly for MRT and bus studies. Approximately 19,000
households out of 500,000 households or 2.2 million
population were covered by the survey. With the high
sampling rate of nearly 4%, the survey provided extensive
data/information on he characteristics of households,
household members and their trips in relation with their
socio-economic features. Nonetheless, it was decided that
a limited HIS should be conducted for a selected new town;
namely Ang Mo Kio, which is considered one of the
completed/matured and typical new towns, in such a manner
that the limited HIS would supplement the transport demand
information of new towns by the 1980/81 data.

The purpose of the survey are more specifically as follows:

a) To obtain up-to-date information on traffic features of
    a selected new town.

b) To obtain more precise data on the relationship between
    trunk and feeder transport of the selected new town
    residents.

c) To obtain information on the assessment by the
    residents on existing feeder transport system and
    services of the selected new towns.

d) To obtain information on the assessment by the
    residents on present environmental conditions of the
    selected new towns.

e) To assess the changes in transport activities and
    perception in living and feeder transport environment
    of a new town due to the completion of MRT by
    conducting the same survey before and after the opening
    of MRT.

2) Survey Area

Among the existing HDB New Towns, Ang Mo Kio New Town was
selected as a survey area. Ang Mo Kio New Town is one of
the larger new towns in Singapore and has a population of
about 200,000. It has a bus interchange, two MRT stations
and is serviced by an expressway. With regard to land,
use, three small industrial areas are located together with
the residential area. Figure 4.1 shows the location of the
survey are with major transport systems indicated.

Figure 4.1

Location of Survey Area

LEGEND

▨ Survey Area
--○-- MRT
--⊖-- Expressway
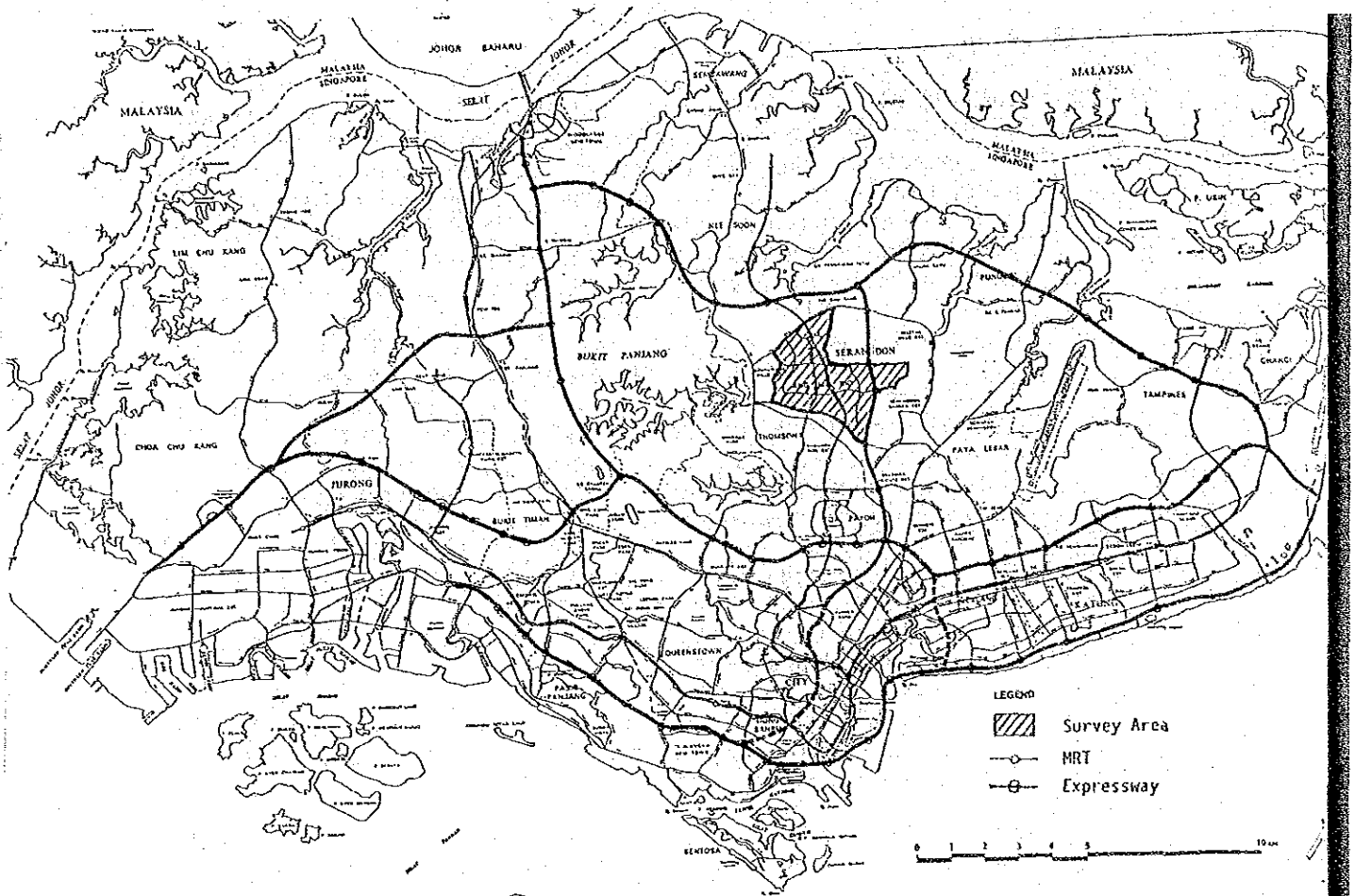
3) Outline of Survey

The survey comprises the following activities which are also shown in Figure 4.2.

a) Preparatory Work

- Prepare survey plan
- Finalize and print questionnaire forms
- Prepare survey manuals
- Prepare sample list
- Recruit surveyors
- Train surveyors
- Publicity
- Prepare survey equipment/materials

b) Field Interview Survey

- Distribution of forms
- Checking/Collection of forms

c) Checking/Editing/Coding of collected forms and data entry

d) Data Processing

- Data check
- Prepare relevant programs
- Complete sample master
- Data processing

Figure 4.2
Outline of Survey Steps/Implementing Process

Work Items	Week						
	1	2	3	4	5	6	7
1. Preparatory Work							
1) Prepare Survey Plan	▭						
2) Finalize Questionnaire Forms	▭						
3) Print Questionnaire Forms		▭					
4) Prepare Survey Manuals		▭					
5) Prepare Sample List			▭				
6) Recruit Surveyors			▭				
7) Train Surveyors			▭				
8) Prepare Survey Equipment Including ID			▭				
2. Field Interview Survey							
1) Distribution of Forms				▭			
2) Checking/Collection of Forms				▭			
3. Checking/Editing/Coding of Samples and Data Entry						▭	
4. Data Processing							
1) Data Check						▭	
2) Complete Sample Master							
3) Prepare Relevant Programs							
4) Data Processing							

4.1.2 DESIGN OF SURVEY

1) Survey Form

The basic data expected to be obtained from this survey include the following:

a) Socio-economic characteristics of the new town residents

b) Present features on transport activities of the new town residents

c) Service level of feeder bus services as perceived by the new town residents

d) Assessment of living/environmental conditions by the residents

Intensive discussions were held among the study team and PWD officials on the design and layout of the forms which are shown in Appendix 4.A.

The survey forms are composed of the following:

a) Household Information

b) Household Member Information

c) Trip Information

d) Assessment of Feeder Bus Services

e) Assessment of Living/Environmental Condition

In addition to the above five forms, a "Visiting Sheet" was designed for the management of the survey. It also contained a part of household information to be filled by surveyors.

2) Size of Survey

The size and coverage of the survey was determined on availability of time and resources. However, the survey was designed as much as possible in such a way that the statistical accuracy be maintained under such limitations. It was intended to cover approximately 1,000 households and their members residing in Ang Mo Kio new town.

3) Sampling

a) Sampling Method

After the survey area was divided into six sub-areas a two-step sampling method was adopted. The first step selects blocks, while the second step, dwelling units.

b) Selection of Sample Blocks

Ninety blocks out of 359 blocks located in the Ang Mo Kio New Town were selected according to the following method; the survey area was divided into six survey zones as shown in Figure 4.3. Then a screen with a 250 meter is considered roughly the average distance between the feeder bus stop. This method is similar to random sampling. The sample blocks in each survey zone are listed in Table 4.1 and shown in Figure 4.4

Table 4.1
Survey Zones and Sample Blocks in
Ang Mo Kio New Town

Survey Zone1/	Block No.
A (15)	153,155,163,603,607,612,622,627,629,634,639,643, 644,646,649
B (14)	101,104,105,110,112,117,172,176,177,182,246,250, 255,255,258
C (12)	121,124,133,201,206,211,214,218,224,226,229,235
D (18)	304,308,312,313,316,320,324,329,330,333,334,343, 347,704,710,722,728
E (15)	503,507,510,520,524,538,540,546,551,557,558,565, 576,581,585
F (16)	401,406,411,415,417,424,426,434,439,444,451,454, 459,463,469,476

1/ Figures in parenthesis are total number of sample blocks of each Zone.

c) Selection of Sample Units

One thousand fifty sample households were selected as random from the 90 blocks. Using a table, the number of storeys to be surveyed were determined at random.

123

First and the necessary numbers of units were selected from the selected storeys by giving the addresses with a regular interval. The allocated number of sample households by zone is shown in Table 4.2.

Table 4.2
No. of Sample Units by Survey Zone

Survey Zone	No. of Units
A	210
B	175
C	140
D	175
E	175
F	175
TOTAL	1,050

d) Sample Rate

The total number of dwelling units in the survey area is reported to be 49,480, while the number of sample units is 1,050. This gives a planned sample rate of approximately 2.1%. Statistically, this sample rate yield a considerably sufficient dependability for data analysis of the New Town area. Given 14 zones for transport analysis and 6 kinds of transport mode for the estimated population size of 200,000 and the assumed average number of trips per head of 2.0, the Origin-Destination (O-D) matrix by transport mode could be analyzed with a rate of relative error of 19.3% attaining a 95% dependability. Given 6 categories of trip purposes additionally, the O-D matrix by transport mode and by trip purpose could be computed and analyzed using the following equation:

$$F = t \sqrt{\frac{1}{N-1} \frac{1-r}{r} \frac{1-P}{P}}$$

where F : relative error rate;
      r : sample rate;
      N : population; and
      P : reciprocal number of categories
          broken down for analysis
      t : 1.96 for a 95% dependability

4) Survey Manual

Prior to the commencement of the field interview, a survey manual was prepared for the training and reference of interviewers.

The survey manual describes the following:

a) Outline of the survey including objective, survey procedures, tasks to be undertaken during the field survey, explanation of questionnaire forms and survey zones.

b) Explanation on survey materials and specific tasks to be undertaken at Ang Mo Kio site office.

c) Distribution and collection of questionnaire forms.

d) Special instruction on Form 3, trip information sheet.

Survey Manual is attached as Appendix 4.B.

Figure 4.3
Survey Zones in Ang Mo Kio New Town
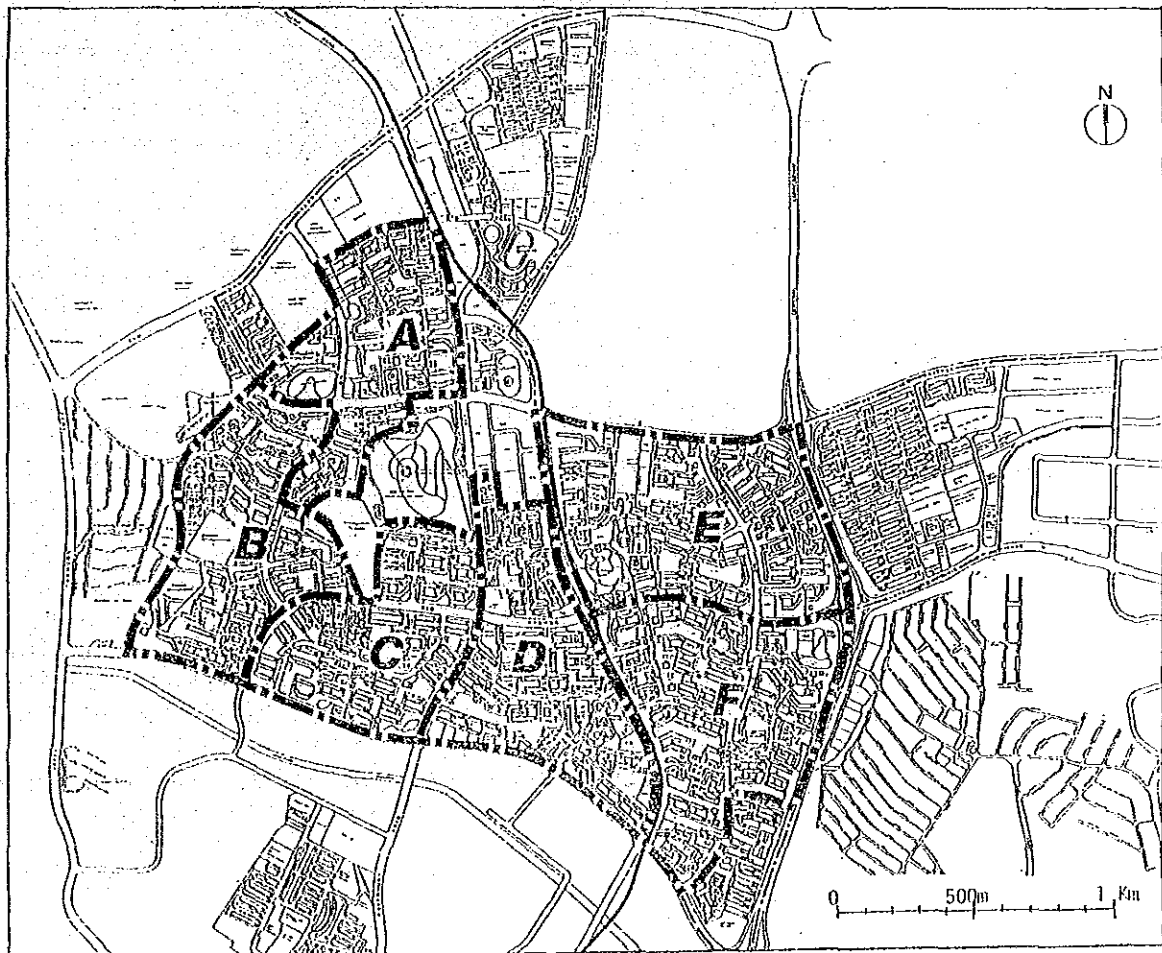
Figure 4.4

Location of Sample Blocks in Ang Mo Kio New Town
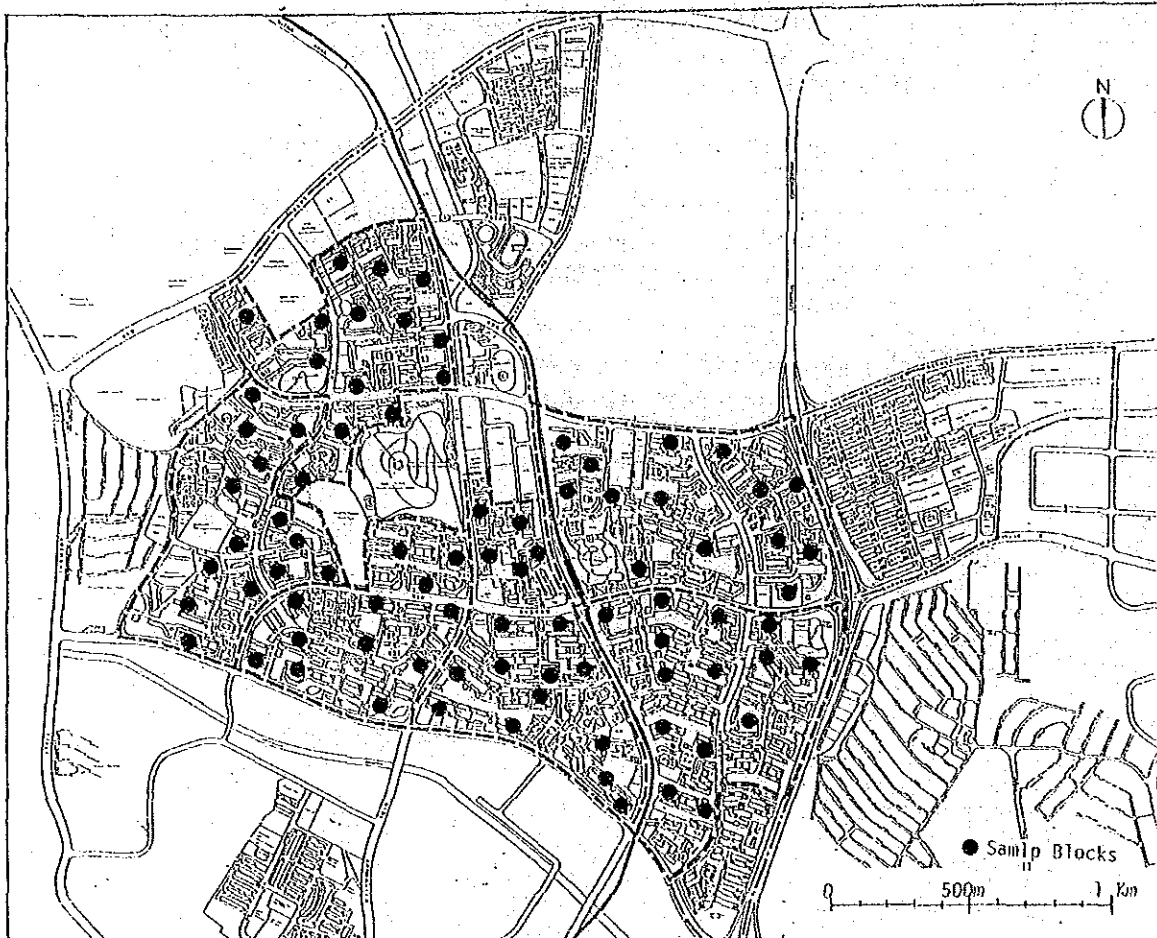
4.1.3 SURVEY IMPLEMENTATION

1) Survey Organization

The survey was undertaken by the JICA Study Team with
consultation and support of PWD. Under the supervision of
the Study Team, six interview teams comprising four
surveyors and a supervisors were organized. Each team
covered a survey zone. In addition to the field interview
teams, a team for editing/coding of the forms was
organized. The survey organization is shown in Figure 4.5.

Figure 4.5
HIS Survey Organization

```
┌─────────────────────┐         ┌──────────────────┐
│  JICA Study Team     ├─────────┤    The PWD       │
└──────────┬──────────┘         └──────────────────┘
```

| Field Inter- A view Team Supervisor Surveyor A1 Surveyor A2 Surveyor A3 Surveyor A4 | B Superv. B1 B2 B3 B4 | C Superv. C1 C2 C3 C4 | D Superv. D1 D2 D3 D4 | E Superv. E1 E2 E3 E4 | F Superv. F1 F2 F3 F4 | Editing/ Coding Team Superv. Editor/Coder 1 Editor/Coder 2 Editor/Coder 3 Editor/Coder 4 |
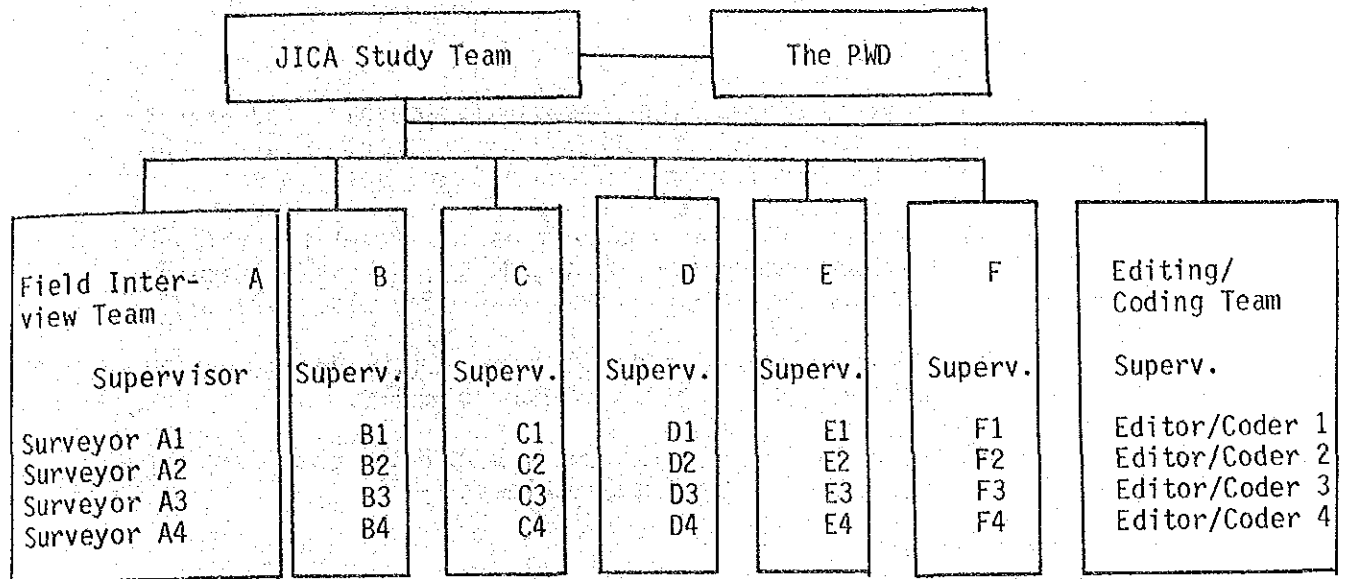
2) Recruitment and Training of Surveyor

Surveyors were recruited with the assistance of the Student Liaison Office (SLO) of the National University of Singapore (NUS). Thirty-seven (37) applicants indicated their interests in taking part in the Surveys. They were from a wide range of academic areas (under graduate): engineering; science; art; building management; business administration and so on. Subsequently, thirty (30) surveyors including six (6) supervisors were recruited. Supervisors were selected in accordance with the SLO's recommendation and surveyors' suggestions.

For the training of surveyors/supervisors a number of meetings were held. The first meeting was held at the conference room of the NUS on 16 October 1987 to facilitate students' interest and explain the outline of the surveys. The second meeting was held at the function room of the NUS on 26 October 1987 to give an outline instruction of how to carry out the HIS Survey and to organize survey teams with specific assignments. Six (6) groups consisting four (4) surveyors headed by one supervisor were organized. The third meeting was held at the conference room of PWD on 30 October 1987, prior to the commencement of the HIS to have all the surveyors fully understood the questionnaires and and implement the procedures. Attention was also placed on that all surveyors could answer properly the questions which are anticipated to be asked by members of households: (1) for what purpose? (2) why are we selected? (3) how the answers will be treated?

The manual shown in Appendix 4.C was prepared to facilitate the training of the surveyors.

3) Conduct of Field Surveys

   1) Publicity

   In order to conduct the interviews smoothly, and expect the better understanding and cooperation of the residents, the following measures were undertaken:

   a) Request for the cooperation of residents through residents committee of Ang Mo Kio New Town, Members of Parliament for the new town were also informed.

   b) Press statement made in "The Strait Times" on 27 October 1987 as shown in Appendix 4.C.

   c) 200 sheets of posters placed on the wall of entrance hall of sample blocks.

   2) Site Office

   A site office was prepared during the field survey period to monitor the survey progress and coordinate with surveyors quickly whenever further instructions are required.

   3) Progress of the Field Surveys

   The field survey commenced on 31 October and ended on 7 November. During the first three days, survey forms were distributed to each sample household which were collected during the rest of the period. 8 November was reserved for extra collection.

   Control of the activities in the field was the primary responsibility of supervisors who are expected to collected the forms from the surveyors, preliminarily check them on the spot before submission to the Study Team Office. Problems on field were supposed to be tackled by the supervisors in the first place.

   4) Summary of Problems Encountered

   The following problems/difficulties during the conduct of the HIS were reported by the supervisors:

   a) Communication difficulties: Survey forms written in English were not always suitable for people to understand the questionnaire. A Mandarin version questionnaire was suggested to help the people to understand better.

   b) Unwillingness to open the door: Some people were quite wary of strangers, and were not always willing to open the door for the surveyors.

c) Difficulties in getting people's cooperation because of:

  i)   insufficient Public Relation (PR) prior to the survey;
  ii) a sort of fear to being officially involved;
  iii) a sort of fear to answering the questions on privacy
  iv) voluminous questions that required people to spend lengthy time to answer

Regarding (c), some households refused to answer the question about the same of child's school because of a fear of kidnap.

d) Difficulties in getting a contact: As there were a lot of vacant units/the units where nobody was staying during daytime even on Saturday and Sunday, it was difficult for the surveyors to get contacts with the sample households.

e) Differences in co-operative attitude between:

  i)   educated and uneducated people,
  ii) race, and
  iii) types of dwelling units

The educated people were reported to be more cooperative, the Chinese households were comparatively uncooperative, and household living in the point block building and at the large floor units were less cooperative.

f) Time-consuming and less productive work: Surveyors had to spend a long time (15-20 minutes to explain about the survey and to convince and ask for the household's cooperation. Ironically the surveyors who gave a more detailed explanation would get less cooperation.

In order to relieve or lessen the above problems/difficulties encountered by the surveyors, a number of countermeasures were undertaken as follows:

a) Regarding the communication difficulties, surveyors made efforts to translate the contents of the questionnaire as muc as possible. It has been realized that this problem must be solved for the next survey.

b) The unwillingness to "open-the-door" and lack of opperation are interrelated. The PWD prepared a poster announcing the survey on each information board attached with each block on November 5, 1987. This prompt action was effective in facilitating people's cooperation. It was reported that people's attitudes drastically changed after the announcement and this made the surveyors' work much easier.

129

c) In order to increase the number of responses, the Survey office allowed the surveyors to choose the sample households at the assigned site at their discretion. However, the chosen blocks were strictly followed or sampled. This made the surveyors' behavior more flexible, although the principle of random sampling might have been slightly affected.

d) It was found that the surveyors were likely to visit households of the same ethnic group, for example surveyors of Indian origin, preferred visiting the Indian households. Although there was possibility that this might have affected the proportional sampling, the Office did not stop this, because this contributed to solving the communication problems on the other hand.

e) The surveyors were always thinking about an efficient way to perform their obligations. Some groups attempted to make direct interviews with the sample household members instead of leaving the survey froms and collecting them later, because they found that most of the households gave no answers on the left forms. The shifted their working hours from daytime to night time, 6:00 p.m. through 10:00 p.m. so as to ensure contacts with the household members. However, since it took 30 to 40 minutes to get the answer from one household, the number of households they could visit was limited. The Survey Office encouraged the surveyors continue this for as long as the surveyors preferred it, because a more assured collection was expected.

Based on what were learned through this survey, it is suggested to take into account the following points:

a) A proper publicity should be considered. Residents must be given notices about the survey in advance. The notices must come in several languages so that the various racial groups may fully understand.

b) The survey forms must be prepared in several languages to accomodate the non-English speaking people.

c) It is preferred to prepared survey forms which are short and easy to understand.

4) Collection of Samples

Results of the field survey are briefly summarized as follows:

a) Number of household intended to be
interviewed : 1,000

b) Number of households whose data on
trip made by members were collected : 731

130

c) Number of households unable to be
interviewed due to rejection or
cannot be contacted : 283

d) Performance ratio, (b)/(a) : 73.1%

e) Sample ratio, (b)/49,500 : 1.48%

Surveyors' performance were considerably different by group as follows:

a) the largest number of households
that a surveyor visited during
the one week survey period : 60

b) average number of households
that one surveyor visited during
the one week survey period : 33

c) the smallest number of households
that one surveyor visited during
the one week survey period : 18

Accordingly the average number of households that one surveyor could visit a day is computed to be about 5, while the average number households from the member of which the trip data could be collected (number of sample collected) accounted for about 3.5 per surveyor per day. However, not all surveyors necessarily worked whole day during the one week survey period. Judging from the performance of those who worked everyday, it can be said that a surveyor can interview and collect on a daily basis the forms with trip information of only five households.

4.1.4 DATA PROCESSING

1) Editing of the Collected Forms

Checking and editing of the forms were made as follows:

a) The forms were initially checked by surveyors themselves upon collection. Supplemental interviews were made when necessary.

b) Supervisors checked the forms and returned them to surveyors when and where the gaps need to be filled or corrected.

c) Supervisors checked the forms against the records of visiting sheets.

d) Finally the editors checked and edited the forms in the Office.

Appendix 4.D shows the editing and coding manual prepared to guide the editors/coders in their tasks.

131

2) Zoning and Coding

For the purpose of analyzing trip data, zoning was made for the relevant area. Ang Mo Kio new town was sub-divided into 14 zones while the rest of the country was done according to the postal district. Zoming map is shown in Figure 4.6. Origins and destinationas were then coded on the forms.

3) Data Entry

Data was entered directly from the forms into the four personal computers.

4) Expansion of Data

Since the survey was done on a sampling basis, they need to be expanded to reflect the total population of Ang Mo Kio new town. Although the data has not been expanded yet, the following analysis was made to determine the proper expansion factor:

a) Comparison of Sample Data with 1980 Census

Tables 4.3 and 4..4 give comparative figures of household size and population compositon by ethnic group between 1980 census and 1987 HIS of SUTIS. The response from the survey seems all right except for the low percentage of samples from Chinese, which is likely attributed to higher refusal met in the survey.

Table 4.3
Comparison of Household Size

Area	1980 Census	1987 SUTIS HIS
Ang Mo Kio Division1/	4.67	-
HDB flat only	4.66	4.6

1/ The area include adjoinign area of Ang Mo Kio New Town. HDB flats, however, account for 93% of the total number of houses in the division

132

Figure 4.6

Zoning Map
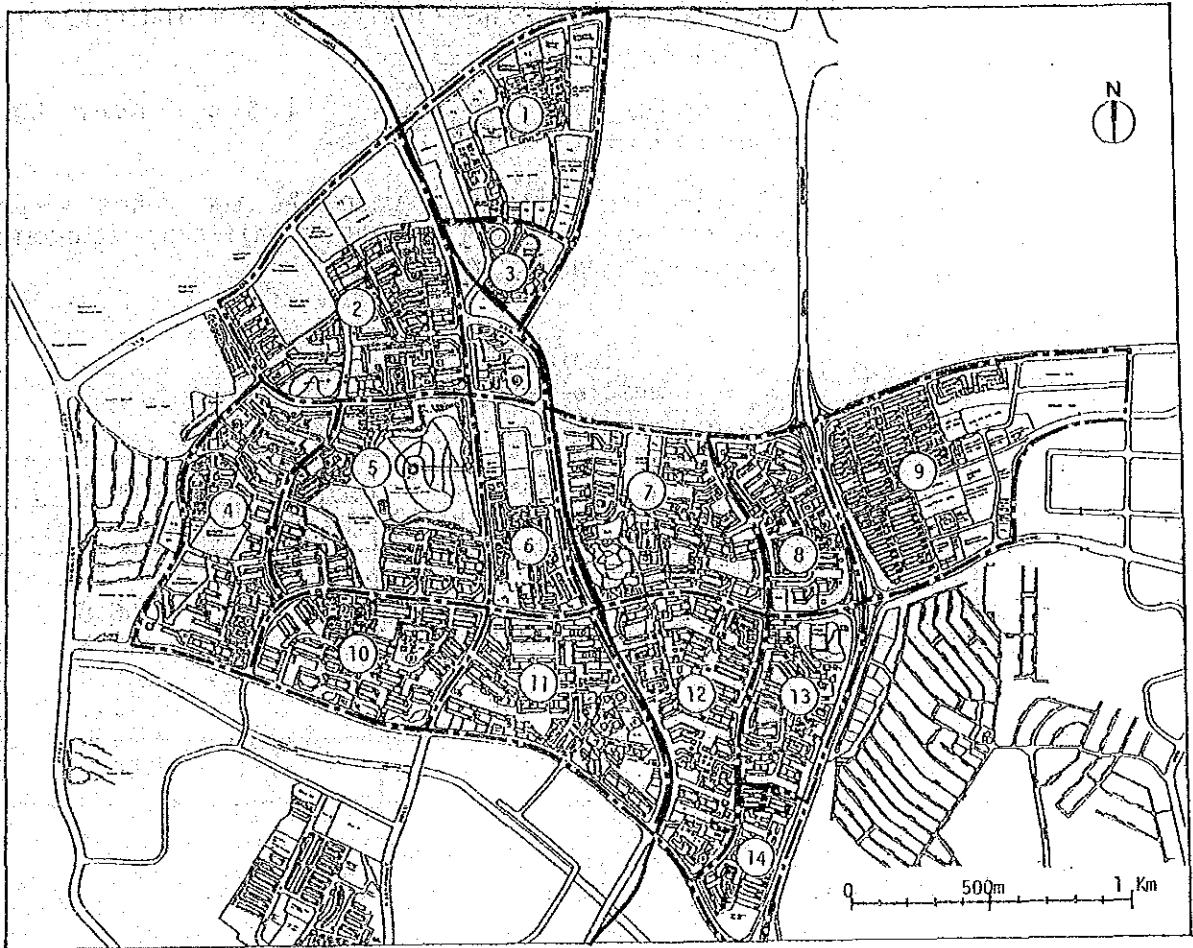
Table 4.4
Distribution of Ethnic Group

Ethnic Group	Singapore (1985/86)	1987 SUTIS HIS2/
Chinese	76.4%	69.7%
Malay	24.9	17.4
Indians	6.4	11.1
Others	2.3	1.83/
Total	100.0	100.0

2/   % distribution of household
3/   "not known" is excluded

b) Comparison of Sample Data with 1980 HIS

Vehicle ownership and household income distribution of Ang Mo Kio residents surveyed by 1987 HIS are shown in comparison with those derived from 1980 HIS by Table 4.5 and Table 4.6, respectively. This indicate the following:

1) It seems the 1987 HIS failed to cover the households with higher income.

2) Distribution pattern between the two years seems too similar in spite of the significant economic growth made during the period.

Table 4.5
Vehicle Ownership

Ownership Type	1980 HIS (Singapore): %	2987 HIS (Ang Mo Kio)	
		No. of HH	%
No vehicle	60.4	415 1/	56.8
Motorcycle only	11.5	86	11.8
One Car	23.8	222 2/	30.4
Multi-Car	4.4	8	1.1
Total	100	731	100

1/ Including Bicycle only
2/ Including va, truck, etc.

Table 4.6
Household Income Distribution

Household Income : S$/month	1980 HIS (Singapore): %	1987 HIS (Ang Mo Kio)	
		No. of HH	%
Below 1,000	40.9	279	48.6
1,000 - 1,999	33.4	295	40.9
2,000 - 2,999	13.0	104	14.4
3,000 - 3,999	7.6	30	4.2
4,000 - 4,999	2.6	6	0.8
5,000 - 5,999	1.3	3	0.4
above 6,000	1.2	5	0.7
Total	100	722	100

c) Determination of Expansion Factor

Although further analysis is needed to determine the expansion factor of the samples, it can be preliminarily stated that:

1) if it is proven that the transport activites are different by ethnic group, the expansion of the samples need to take this into account

2) critical factor is considered to be car ownership which affects the transport activites of the residents. However, car ownership data are not available for Ang Mo Kio new town separately.

Accordingly, the most practical method is to expand the samples by considering the type of dwelling units, which relates closely to the income level, therefore, further to car ownership level.

4.1.5 TABULATION AND ANALYSIS

This section presents the results of the HIS conducted in 1987 after expansion of data. The results are mostly presented in tabular form to facilitate the further analysis of the survey.

1) Household Charateristics

Data on the household characteristics were tabulated as shown in Table 4.7 through 4.12. Table 4.7 shows the distribution of household size. The medium size household (3-4 and 5-6 members) shows higher proportion in comparison to 1980/81 HIS. The distribution of ethnic groups is shown in Table 4.8. Chinese (70.8%) is the biggest ethnic group. However, the proportion of chinese group is smaller than that of the national census. On the other hand, Indian indicates the bigger proportion (12.8%). Table 4.9 to Table 4.11 shows the characteristics of dwelling units. Approximately 62% of residents in the new town resides in a two-bed room unit. Eighty nine percent of residents owned their dwelling units and more than 70% of residents reside in their units longer than 6 years.

Table 4.12 shows the distribution of household income. About 78% of residents in the new town belong to the household income level of below S$2,000/month.

Table 4.7

Household Size

		Less than 2	3-4	5-6	7-8	9-10	11 and more	Not known	Total	Ave. HH Size
1987 SUTIS HIS	No. of HH (%)	3152 (6.4)	22517 (45.5)	18034 (36.4)	4094 (9.5)	485 (1.0)	69 (0.1)	532 (1.1)	49483 (100.0)	4.6
1980/81 HIS	(%)	(13.8)	(34.3)	(31.5)	(13.3)	(5.0)	(2.2)	(-)	(100.0)	4.9

1/ Source: CTS Phase A. Report for 1980/81 HIS

Table 4.8

Etnic Group Composition

		Chinese	Malay	Indian	Mixed	Others	Not Known	Total
1987 SUTIS HIS	No. of HH (%)	34026 (70.8)	7239 (15.0)	6164 (12.8)	534 (1.1)	133 (0.3)	1377 (-)	49483 (100)1/
1985/85 Singapore	(%)	(76.4)	(14.9)	(6.4)	(2.3)			(100)

Source: Yearbook of Statistics 1985/86
1/ % excluded not known

Table 4.9

Number of Bedrooms

	One	Two	Three	Four	Five	Six and more	Not Known	Total
No. of HH (%	4059 (8.2)	30783 (62.2)	12585 (25.2)	2056 (4.3)	- -	- -	- -	49483 (100.0)

Table 10

Ownership of Residence

	Owned	Owned	Known	Total
No. of HH (%)	44037 (89.0)	5082 (10.3)	364 (0.7)	49483 (100.0)

Table 4.11

Residing Years

	Within 3 years	4 to 5 years	6 to 10 years	11 to 15 years	Longer than 16 years	Not Known	Total
No. of HH (%)	9376 (18.9)	4339 (8.8)	31830 (64.3)	3095 (6.3)	127 (0.3)	716 (1.4)	49483 (100.0)

Table 4.12

Household Income Distribution

Household Income Range (S$/month)	No. of Household	(%)	1982/83 Households Expenditure Survey (%)
1 Below 500	4155	(8.4)	4.8
2 500 - 999	15966	(32.3)	26.3
3 1000 - 1499	13508	(27.3)	21.6
4 1500 - 1999	5003	(10.1)	14.8
5 2000 - 2499	4759	(9.6)	15.7
6 2500 - 2999	2143	(4.3)	
7 3000 - 3499	936	(1.9)	7.0
8 3500 - 3999	1150	(2.3)	
9 4000 - 4999	718	(1.5)	3.8
10 5000 - 5999	156	(0.3)	6.8
11 6000 and over	276	(0.6)	
12 Not known	713	(1.4)	
Total	49483	(100.0)	100.0
Average HH Income (S$/month)	1400		2029

2) Vehicle Ownership

Data on vehicle ownership are tabulated as shown in Table 4.13 and the relationship between vehicle ownership and household income is shown in Table 4.14. Although the overall distribution seems reasonable, the ownership of higher income household is not covered sufficiently. This is partly due to the lack of samples for that segment of the households.

Table 4.15 shows the relationship between vehicle ownership and the size of dwelling units.

Table 4.14

Vehicle Ownership

	Non Vehicle	Bicycle only	M.cycle only	Single Car	Multi Car	Others	Total
1987 SUTIS No. of HH HIS (%)	26869 (54.3)	1575 (3.2)	6412 (13.0)	14028 (28.3)	520 (1.1)	79 (0.2)	49483 (100.0)
1980/81 HIS (%)	(60.4)		(11.5)	(23.8)	(4.4)	-	(100.0)

Source: CTS Phase A, Report on HIS, Main Sample Tabulation
for 1980/81 HIS

3) Households Members Characteristics

Table 4.16 to Table 4.18 present the total number of household members charateristics. The total number of household members was estimated as 211.823 persons based on the data of household size expanded from sample households.

The distribution of sex and age groups are shown in Table 4.16. The age group with the highest percentage of household members is 17-25 years category (22.7%),followed by 26-35 years category (22.2%) and then 7-16 years category (7-16).

Table 4.17 shows the distribution of occupation. It shows that 37.6% of the total household members were workers and 30.6% were students.

Among the household members, 37.7% of them owned driving licences as shown in Table 4.18

Table 4.16

Sex and Age

Age Group	Male Number	(%)	Female Number	(%)	Total Number	(%)
4-6	2807	(2.6)	2239	(2.1)	5046	(2.4)
7-16	22132	(20.9)	21993	(20.8)	44125	(20.8)
17-25	22361	(21.1)	25706	(24.3)	48067	(22.7)
26-35	21578	(20.3)	25369	(24.0)	46947	(22.2)
36-45	16719	(15.8)	14149	(13.4)	30868	(14.6)
46-55	10625	(10.0)	8223	(7.8)	18848	(8.9)
56 and over	8402	(7.9)	6368	(6.0)	14770	(7.0)
Not Known	1533	(1.4)	1619	(1.5)	3152	(1.5)
Total	106157	(100.0)	105666	(100.0)	211823	(100.0)
	50.1		49.9		100.0	

Table 4.17

Occupation

Occupation	Number	(%)
Professional/Technical Workers	15791	(7.5)
Administrative/Managerial Workers	5738	(2.7)
Clerical Workers	13603	(6.4)
Sales Workers	5582	(2.6)
Service Workers	9526	(4.5)
Agriculture Workers	1435	(0.7)
Production/Transport/Manual Workers	22570	(10.7)
Workers Not Classifiable	5372	(2.5)
Workers Subtotal	79683	(37.6)
Primary Students	23732	(11.2)
Secondary Students	28564	(13.5)
Pre-University Students	5519	(2.6)
Vocational Ins. Students	3095	(1.5)
Tertiary Students	3790	(1.8)
Students Subtotal	64700	(30.6)
Housewife	32932	(15.5)
Others	29621	(14.0)
Not Known	4887	(2.3)
Total	211823	(100.0)

Table 4.18

Driving Licence Owned

	Owner									Non Owner	Total
	Type of Driving Licence										
	1	2B	2A	2	3	4A	4	5	Total		
No. of Persons	5417	3011	10840	47633	1764	7896	3200	-	79761	132062	211823
(%)	(6.8)	(3.8)	(13.6)	(59.7)	(2.2)	(9.9)	(4.0)	(-)	(100.0) (37.7)	(62.3)	(100.0)

4) Trip Charateristics

1) Overall Travel Demand

The total number of person trips made by the residents of Ang Mo Kio new town is estimated to be 330,600 as shown in Table 4.19, trips per day in terms of linked trips, including walk only trips. The movement within new town accounts for 43.6% of the total trips, while that between the new town and outside area is 56.4%.

Table 4.19

Overall Travel Demand of Ang Mo Kio Residents

		Motorized Trips		Walked Only Trips		Total	
		No.	%	No.	%	No.	%
Intra New Town	No.	66.076	26.7	78.140	93.9	144.216	43.6
	(%)	(45.8)	-	(54.2)	-	(100.0)	-
Inter New Town	No.	181.314	73.3	5.064	6.1	186.378	56.4
	(%)	(97.3)	-	(2.7)	-	(100.0)	-
Total	No.	247.390	100.0	83.204	100.0	330.514	100.0
	(%)	(74.8)	-	(25.2)	-	(100.0)	-

2) Modal Split Between Public and Private Mode

Table 4.20 shows the overall modal split between public and private mode: Approximately 73% of trips ae made by private mode.

Table 4.20

Modal Split Between Public and Private Mode

		Public Mode		Private Mode		Motorized Trips Total	
		No.	%	No.	%	No.	%
Intra New Town	No.	53.079	29.3	12.997	19.7	66.076	26.7
	(%)	(80.3)		(19.7)		(100.0)	-
Inter New Town	No.	128.198	70.7	53.116	80.3	181.314	73.3
	(%)	(70.7)		(29.3)		(100.0)	-
Total	No.	181.277	100.0	66.113	100.0	247.390	100.0
	(%)	(73.3)		(26.7)		(100.0)	-

3) Trip Purpose

Table 4.21 shows the distribution of trips by trip purpose. "To work" is the dominant purpose for inter new town trips, while "to school for intra new town trips.

<div align="center">Table 4.21</div>

<div align="center">Trip Purpose</div>

Purpose	Intra New Town			Inter New Town			Total		
	Public	Private	Total	Public	Private	Total	Public	Private	Total
To Work	8.615 (16.2)	3.506 (27.0)	12.121 (18.3)	36.667 (28.6)	18.797 (35.4)	55.464 (30.6)	45.282 (25.0)	22.303 (33.2)	67.585 (27.3)
To School	12.247 (23.1)	1.199 (9.2)	13.446 (20.3)	17.073 (13.3)	1.304 (2.5)	18.377 (10.1)	29.320 (16.2)	2.503 (3.8)	31,823 (12.9)
To Home	23.929 (45.1)	6.169 (47.5)	30.098 (45.5)	58.835 (45.9)	24.505 (46.1)	83.340 (46.0)	82.764 (45.7)	30.674 (46.4)	113.438 (45.9)
Others	8.288 (15.6)	2.124 (16.3)	10.412 (15.8)	15.623 (12.2)	8.510 (16.0)	24.133 (13.3)	23.911 (13.2)	10.634 (16.1)	34.545 (14.0)
Total	53.079 (100.0)	12.998 (100.0)	66.077 (100.0)	128.198 (100.0)	53.116 (100.0)	181.314 (100.0)	181.277 (100.0)	66.114 (100.0)	247.391 (100.0)

4) Number of Transfer

Table 4.22 shows that the largest number of transfer is produced between buses. The average number of transfers for bus users is 2.9 for a transfer bus passenger.

<div align="center">Table 4.22</div>
<div align="center">No. of Transfers by Mode</div>

From	To	1st Transfer	2nd Transfer	3rd Transfer	Total
Walk	Bus	608	2	4	614
	Car-pool	0	0	0	0
	Car	79	0	0	79
	Others	59	2	0	61
	Subtotal	746	4	4	754
Bicycle	Bus	0	1	0	1
	Car-pool	0	0	0	0
	Car	2	0	0	2
	Others	0	2	0	2
	Subtotal	2	3	0	5
Motorcycle	Bus	0	0	0	0
	Car-pool	0	0	0	0
	Car	0	0	0	0
	Others	0	7	0	7
	Subtotal	0	7	0	7
Car	Bus	3	0	0	3
	Car-pool	0	0	0	0
	Walk	8	49	0	57
	Others	0	0	0	0
	Subtotal	11	49	0	60
Car-pool	Bus	0	0	0	0
	Car-pool	0	0	0	0
	Walk	0	0	0	0
	Others	0	0	0	0
	Subtotal	0	0	0	0
Bus	Bus	258	202	5	465
	Car-pool	0	0	0	0
	Car	0	2	0	2
	Walk	122	291	103	516
	Others	1	2	2	5
	Subtotal	381	497	110	988
Others	Bus	0	0	0	0
	Car-pool	0	0	0	0
	Car	0	0	0	0
	Walk	1	1	0	2
	Others	0	0	C	0
	Subtotal	1	1	0	2
Total		1141	561	114	1816

3) Travel Time

Figure 4.7 shows the distribution of travel time by trip purpose and travel mode. It shows that the trips are made by two major travel time groups. The one completing their travel within new town (21-30 minutes) and the other travelling to/from outside areas (51-60 minutes).

Figure 4.7

Distribution of Travel Time
by Trip Purpose and Mode
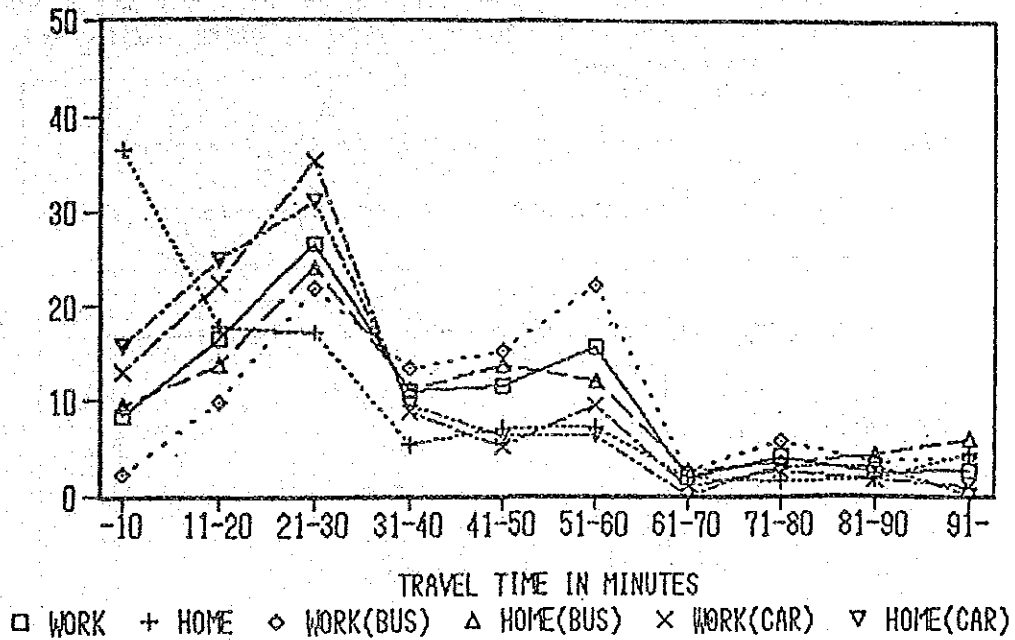
Source : 1987 SUTIS HIS

5) Assessment of Feeder Bus Services

In this survey, the residents using feeder bus services were asked to give an assessment of the feeder bus services. The assessment were conducted for the frequency and purpose of utilizing feeder bus services and the condition of bus stops, bus interchange and bus operation. The assessment is as follows:

1) Frequency and Purpose

Among the respondets, about 20% of them were regular users of feeder bus sevices. Sixty two percent of users utilize feeder bus services 1-3 times per week. For the purpose of "To/From Work", 68% of users took feeder bus more than 6 times per week as shown in Table 4.23.

Table 4.24 shows the number of persons who used feeder bus services for a week and the number of their trips. Average number of trips per person per week is 3.8 times. However, for the purpose of "to/from work", feeder buses were used 7.4 times per week.

Table 4.23

Dependence to Feeder Bus Service

%

Trip Purpose	Frequency per Week (Time)					User Total	Non User
	1-3	4-5	6-8	9-10	11-		
To/From Work	15.1	16.7	32.2	10.6	25.4	100.0 (27.3)	(72.7)
To/From School	16.8	37.1	24.6	7.8	13.7	100.0 (17.8)	(82.2)
Part of Work	58.8	17.8	23.4	-	-	100.0 (1.0)	(99.0)
Personal Business	79.6	12.3	3.7	-	4.4	100.0 (14.4	(85.6)
Shopping	85.9	10.8	3.0	0.3	-	100.0 (37.6)	(62.4)
Recreation	87.6	8.7	2.6	1.1	-	100.0 (12.6)	(87.4)
Social	83.8	13.8	1.8	0.6	-	100.0 (26.2)	(73.8)
Total	61.7	16.0	11.6	3.4	7.3	100.0 (19.6)	(80.4)

Table 4.24

Frequency of Utilizing Feeder Bus Services
by Trip Purpose

Trip Purpose	Feeder Bus User		Trips		Average No. of Trips Per Person
	No. of Persons	(%)	No. of Trips	(%)	
To/From Work	33925	(20.0)	250616	(39.3)	7.4
To/From School	22071	(13.0)	137337	(21.5)	6.2
Part of Work	1285	(0.8)	4271	(0.7)	3.3
Personal Business	17845	(10.5)	45682	(7.2)	2.6
Shopping	46646	(27.4)	97599	(15.3)	2.1
Recreation	15664	(9.2)	34076	(5.3)	2.2
Social	32496	(19.1)	67881	(10.6)	2.1
Total	169932	(100.0)	637462	(100.0)	3.8

142

(2) Condition of Access to the Nearest Bus Stops

Table 4.25 shows the distribution of walking time from home to the nearest bus stops. The average walking time was 4.9 minutes and 79% of feeder bus users walk within the 5 minutes range.

Table 4.26 shows the assessment for the condition of walking path to the nearest bus stops. The facilities and condition of walking path to bus stops are generally well provided in the new town.

Figure 4.8 also shows the assessment for the condition of walking path to the nearest bus stops with four criteria: Very Bad, Bad, Acceptable, Good.

Table 4.25

Walking Time to Nearest Bus Stops

	Below 3 mins.	3-5 mins.	5-8 mins.	8-10 mins.	Above 10 mins.	Not Known	Total	Average Walking Time
No. of Persons	40673	56964	7312	10488	1576	7078	124091	4.9 mins.
(%)	(32.8)	(45.9)	(5.9)	(8.5)	(1.3)	(5.7)	(100.0)	

Table 4.26

Condition of Walking Path to Nearest Bus Stops

	Pavement		Street Light		Stairs		Shade Light	
%	Paved	90.6	Installed	87.5	Exist	77.2	Exist	74.2
	Unpaved	3.1	Not Installed	6.3	None	16.5	None	19.4
	Not Known	6.3	Not Known	6.2	Not Known	6.3	Not Known	6.4
	Total	100.0	Total	100.0	Total	100.0	Total	100.0

3) Waiting Condition at Bus Stops

Table 4.27 shows the waiting time at bus stops. Average waiting time at bus stops was 7.3 minutes and 58% of respondents were waiting less than 5 minutes in peak periods. In off-peak periods, the average waiting time was 10.3 minutes.

Table 4.28 shows the condition of waiting facilities at bus stops. Shelters and seats are well provided at bus stops.

The assessment of waiting condition at bus stops is presented in Figure 4.9.

Figure 4.8

Assessment of Condition of Path
to Nearest Bus Stop

1)Walking
Time
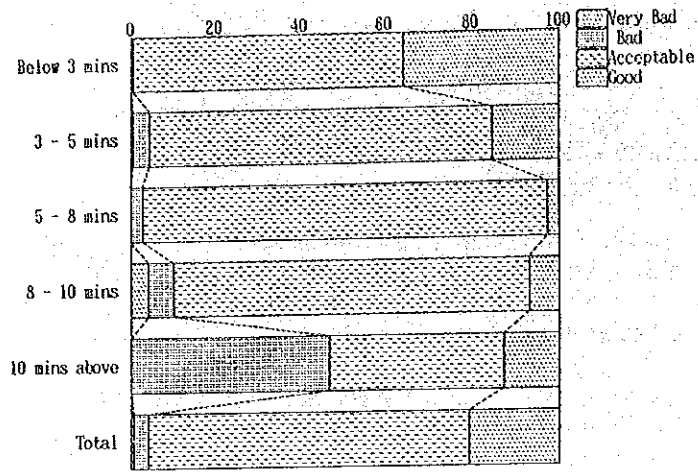
2) Pavement
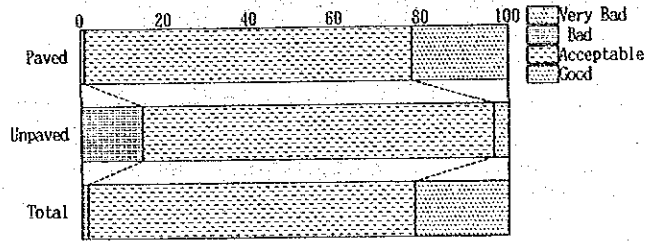
3)Street
Light
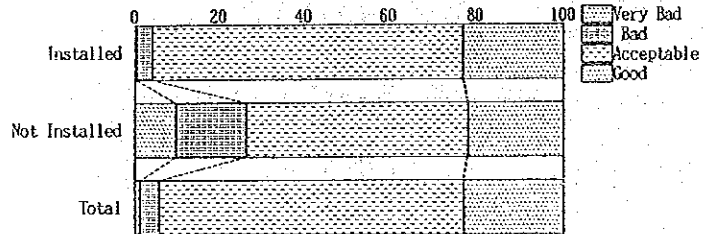
4) Stairs
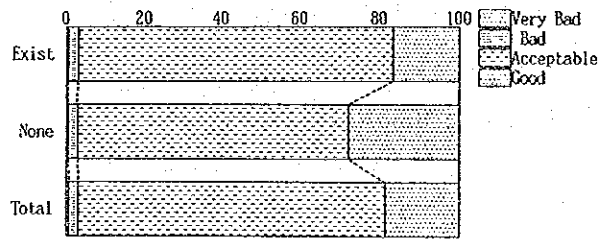
5) Shade
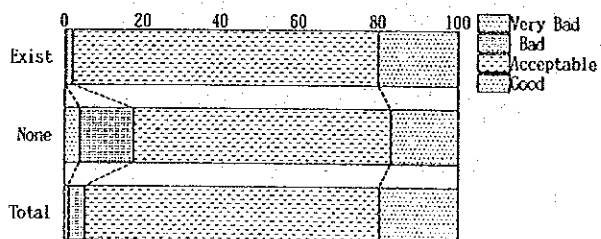
Table 4.27

Waiting Time at Bus Stops

		Below 5 mins.	5-10 mins.	10-15 mins.	15-20 mins.	20 mins. Above	Not Known	Total	Average Waiting Time
Peak Period	No. of Persons (%)	71883 (57.9)	27305 (22.0)	13101 (10.6)	2635 (2.1)	520 (0.4)	8647 (7.0)	124091 (100.0)	7.3 mins.
Off-peak Period	No. of Persons	26256 (21.2)	55840 (45.0)	26884 (21.7)	3673 (3.0)	2597 (2.1)	8841 (7.1)	124091 (100.0)	10.3 MINs.

Table 4.28

Facilities at Bus Stops

	Shelter		Seat		Bus Service Information	
%	Exist	92.1	Available	86.8	Available	31.7
	None	1.0	None	6.0	None	60.9
	Not Known	6.9	Not Known	7.2	Not Known	7.4
	Total	100.0	Total	100.0	Total	100.0

Figure 4.9

Assessment of Waiting Condition at Bus Stops

1) Waiting Time

   Peak
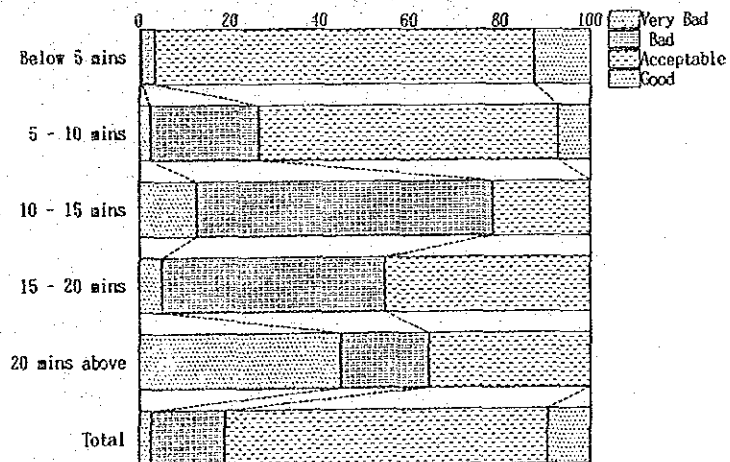
Off-peak
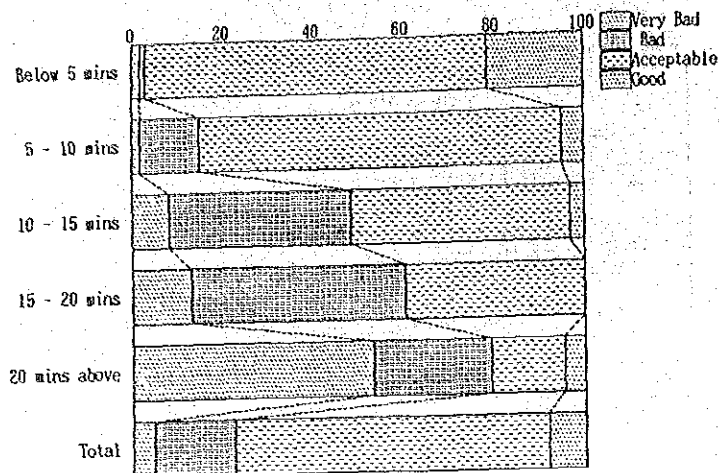
2) Shelter
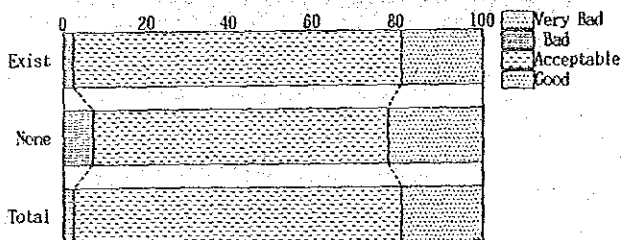
3) Seat
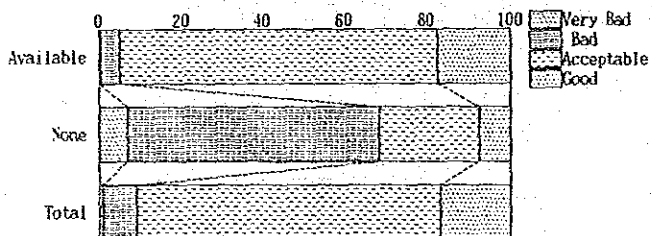
4) Bus
   Infor-
   mation
   Service

146
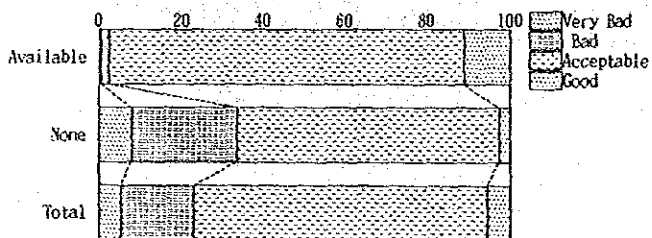
(4) Waiting Condition at Bus Interchange

Table 4.29 shows the waiting time for feeder or trunk buses at bus interchange in peak and off-peak periods. The average waiting time in the peak periods was 6.4 minutes for feeder bus and 8.0 minutes for trunk buses. In the off-peak periods, the average waiting time was 9.4 minutes for feeder buses and 11.5 minutes for trunk buses. The assessment of waiting condition at bus interchange is presented in Figure 4.10.

Table 4.29

Waiting Time at Bus Interchange

			Below 5 mins.	5-10 mins.	10-15 mins.	15-20 mins.	20 mins. Above	Not Known	Total	Average Waiting Time
Peak Periods	Feeder Bus	No. of Persons	79649	26972	6091	1426	186	9767	124091	6.4 mins.
		(%)	(64.2)	(21.7)	(4.9)	(1.1)	(0.1)	(7.9)	(100.0)	
	Trunk Bus	No. of Persons	42902	57016	10157	1959	180	11877	124091	8.0 mins.
		(%)	(34.6)	(45.9)	(8.2)	(1.6)	(0.1)	(9.6)	(100.0)	
Off-peak Periods	Feeder Bus	No. of Persons	24311	70083	16800	3106	434	9357	124091	9.4 mins.
		(%)	(19.6)	(56.5)	(13.5)	(2.5)	(0.3)	(7.5)	(100.0)	
	Trunk Bus	No. of Persons	14008	57520	30346	9456	943	11818	124091	11.5 mins.
		(%)	(11.3)	(46.4)	(24.5)	(7.6)	(0.8)	(9.5)	(100.0)	

5) Assessment of Bus Operation
Figure 4.11 and Figure 4.12 present the assessment of feeder bus operation and trunk bus operation, respectively.

Figure 4.10

Assessment of Waiting Condition
at Bus Interchange

1) Waiting time

Peak
Feeder
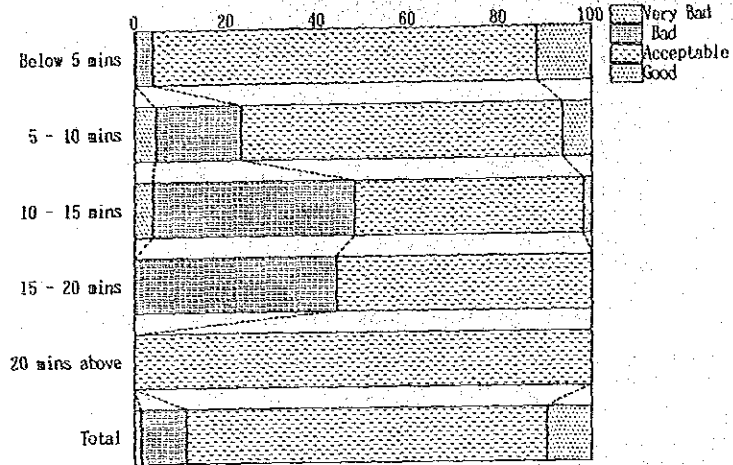
Peak
Trunk
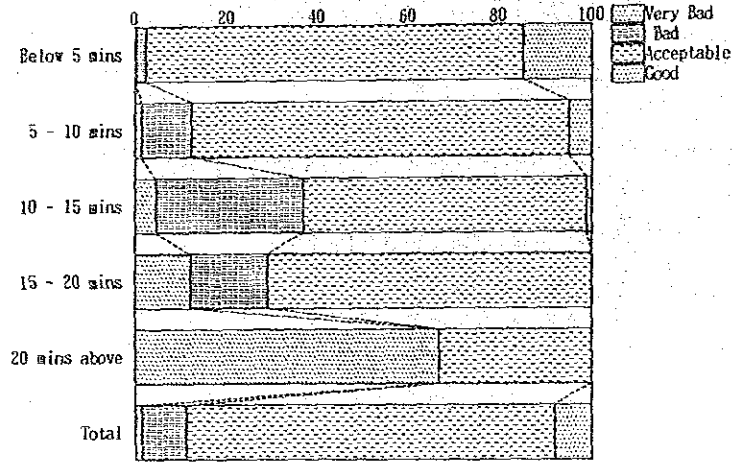
Off-peak
Feeder
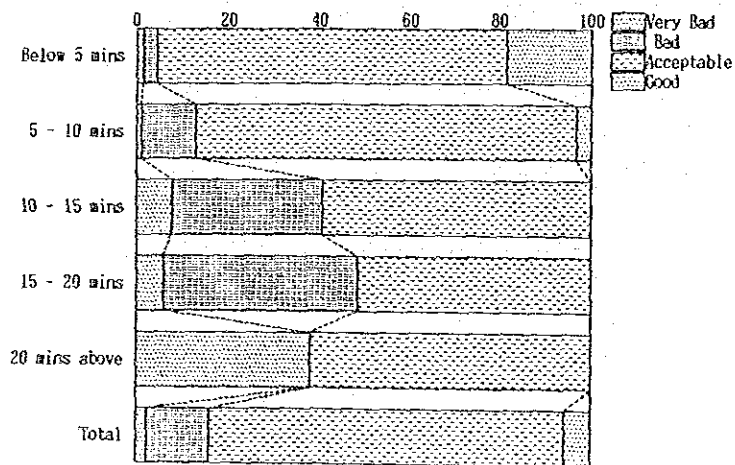
Off-peak

Trunk
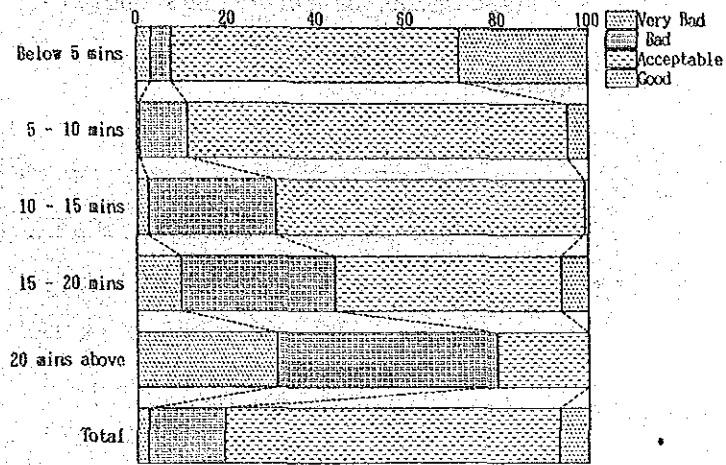
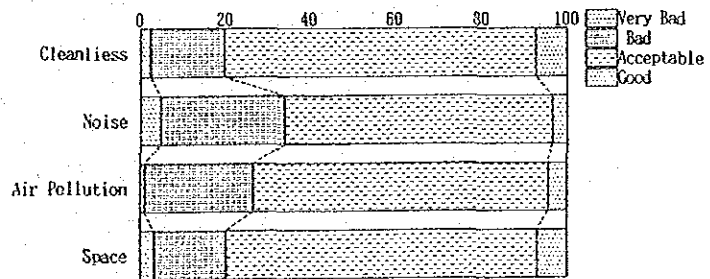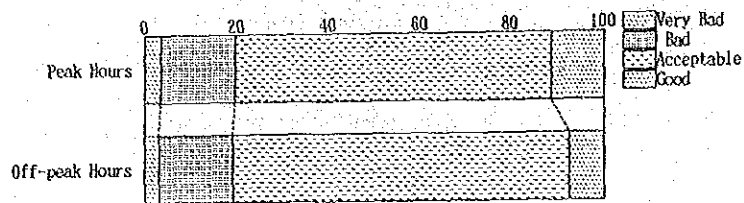2) Transfer Condition

3) Enviroment

149
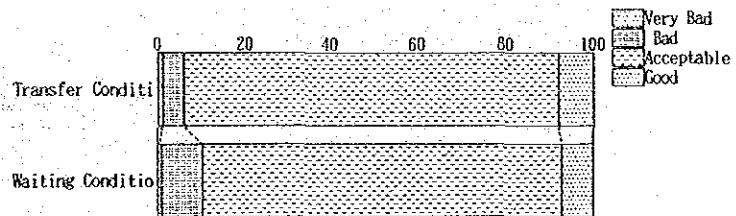
Figure 4.11

Assessment of Feeder Bus Operation

1) Service Frequency
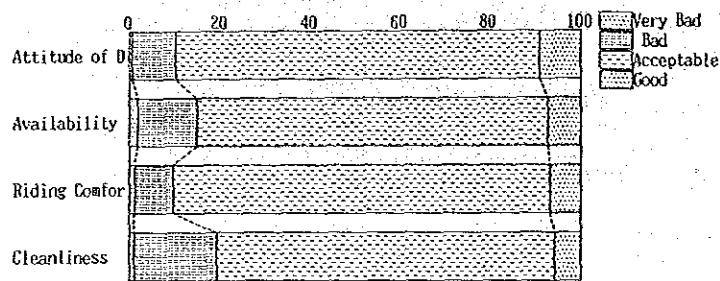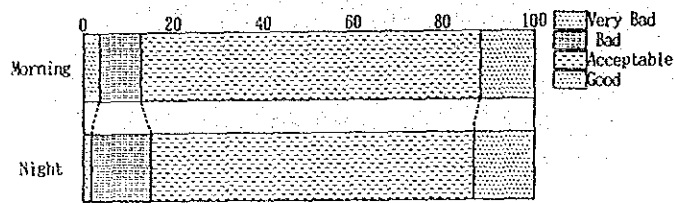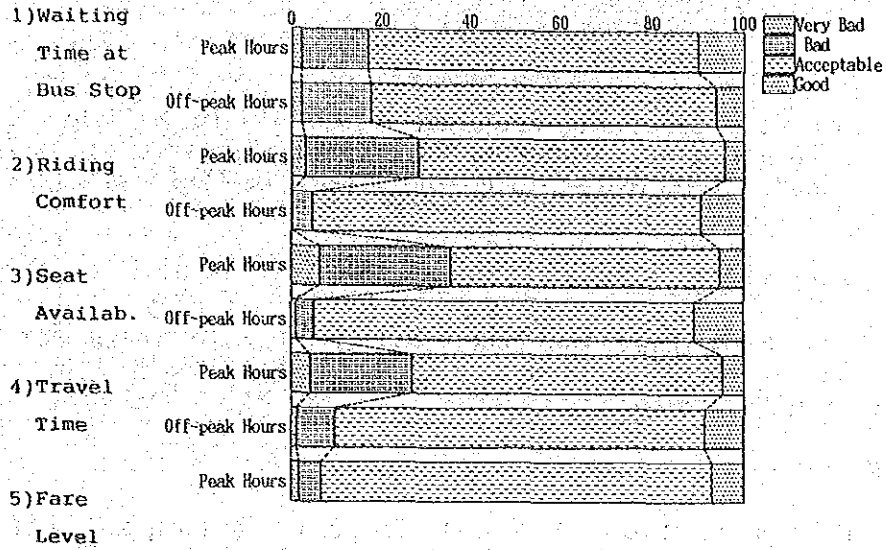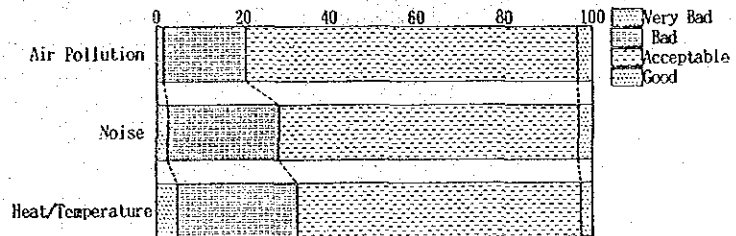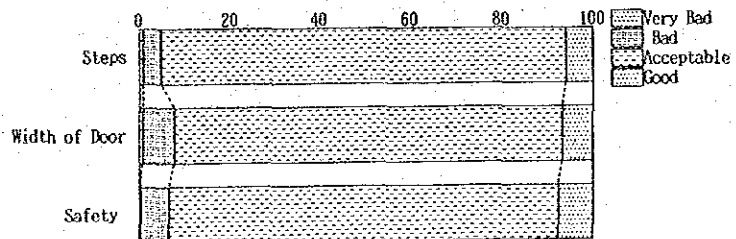

2) Operation

Figure 4.12

Assessment of Trunk Bus Service

7) Discomfort in Bus

8) Step/Door

6) Assessment of Living/Environmental Condition

In this survey, the residents of the new town were asked to give an assessment of living and environmental condition of the new town. The assessment indicated the condition and accessibilities to the daily activities, environment of the new town and use of bicycles.

The results of assessment are as follows:

1) Frequency of Activities

Table 4.30 shows the frequency of activities made by residents of the new town. the major daily activity is to go to "work or school". This folows to go to "market in the town". The other activities are not made so often.

2) Access Time

Table 4.31 shows the accessibility time to these activities. Most residents could access to the activities in the new town within 15 minutes.

3) Main Mode of Transport

Table 4.32 shows the main mode of transport for these activities. For the activities in the new town, "on foot" and by bus are the major modes of transport.

Table 4.30

Frequency of Acitivities

Activitities Going to	Frequency					
	Every Day	3-4 times /week	1-2 times /week	Occationally	Never	Total
Work/School	127,590	7,283	1,299	2,353	32,129	170,657
CBD for Shopping	1,814	3,034	15,173	92,645	48,734	161,400
Cinema in New Town	366	988	10,972	74,600	60,883	147,809
Town Center	5,863	13,188	37,870	94,849	17,550	169,320
Clinic in New Town	522	168	2,889	89,788	58,289	151,656
Market in New Town	12,112	16,306	25,534	35,871	63,089	152,912
Church Outside	978	1,268	13,504	31,405	98,700	145,855
Church in New Town	1,354	2,422	14,317	25,394	95,141	138.628
Total	150,599	44,657	121,558	446,905	474,515	1,238,234

Work/School	74.8	4.3	0.8	1.4	18.8	100.0
CBD for Shopping	1.1	1.9	9.4	57.4	30.2	100.0
Cinema in New Town	0.2	0.7	7.4	50.5	41.2	100.0
Town Center	3.5	7.8	22.4	56.0	10.4	100.0
Clinic in New Town	0.3	0.1	1.9	59.2	38.4	100.0
Market in New Town	7.9	10.7	16.7	23.5	41.3	100.0
Church Outside	0.7	0.9	9.3	21.5	67.7	100.0
Church in New Town	1.0	1.7	10.3	18.3	68.6	100.0
Total	12.2	3.6	9.8	36.1	38.3	100.0

Table 4.30

Frequency of Activities

Activities Going to	Every Day	3-4 times /week	1-2 times /week	Occasionally	Never	Total
Work/School	84.7	16.3	1.1	0.5	6.8	13.8
CBD for Shopping	1.2	6.8	12.5	20.7	10.3	13.0
Cinema in New Town	0.2	2.2	9.0	16.7	12.8	11.9
Town Center	3.9	29.5	31.2	21.2	3.7	13.7
Clinic in New Town	0.3	0.4	2.4	20.1	12.3	12.2
Market in New Town	8.0	36.5	21.0	8.0	13.3	12.3
Church Outside	0.6	2.8	11.1	7.0	20.8	11.8
Church in New Town	0.9	5.4	11.8	5.7	20.1	11.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 4.31

Access Time to Activities

Activities Going to	1-3	3-5	6-10	11-15	16-20	21-30	31-40	41-50	51-60	61-	Total
Work/School	897	4,779	16,365	17,145	14,741	28,984	10,376	19,738	17,220	6,119	136,661
CBD for Shopping	0	1,598	2,043	3,230	9,138	29,806	26,512	24,071	11,832	1,775	110,005
Cinema in New Town	627	8,813	38,566	28,469	6,429	7,260	983	1,230	515	103	92,994
Town Center	596	15,718	69,761	46,791	9,000	4,864	1,054	1,004	108	0	148,896
Clinic in New Town	1,190	18,542	44,835	18,273	7,642	3,566	250	352	0	0	94,650
Market in New Town	988	24,749	43,951	12,350	3,831	1,655	371	307	311	0	88,513
Church Outside	358	1,627	3,145	3,595	5,273	16,068	3,085	8,423	4,137	1,093	46,804
Church in New Town	154	2,963	18,104	15,577	3,774	2,431	521	314	885	94	44,817
Total	4,810	78,789	236,770	145,430	59,828	94,634	43,448	55,439	35,008	9,184	763,340

%

Activities Going to	1-3	3-5	6-10	11-15	16-20	21-30	31-40	41-50	51-60	61-	Total
Work/School	0.7	3.5	12.0	12.5	10.8	21.2	7.8	14.4	12.6	4.5	100.0
CBD for Shopping	-	1.5	1.8	2.9	8.3	27.1	24.1	21.9	10.8	1.6	100.0
Cinema in New Town	0.7	9.5	41.5	30.6	6.9	7.8	1.1	1.3	0.6	0.1	100.0
Town Center	0.4	10.6	46.9	31.4	6.0	3.3	0.7	0.7	0.1	-	100.0
Clinic in New Town	1.3	19.6	47.4	19.3	8.1	3.8	0.3	0.4	-	-	100.0
Market in New Town	1.1	28.0	49.7	14.0	4.3	1.9	0.4	0.3	0.4	-	100.0
Church Outside	0.8	3.5	6.7	7.7	11.3	34.3	6.6	18.0	8.8	2.3	100.0
Church in New Town	0.3	6.6	40.4	34.8	8.4	5.4	1.2	0.7	2.0	0.2	100.0
Total	0.6	10.3	31.0	19.1	7.8	12.4	5.7	7.3	4.6	1.2	100.0

Table 4.32

Main Modes of Transport

Activity Going to	Mode of Transport			Others	Total
	Onfoot	Bus	Car		
Work/School	20,640	79,095	14,979	19,894	134,608
CBD for Shopping	1,122	83,954	15,576	8,138	108,970
Cinema in New Town	20,424	55,582	9,596	5,649	91,251
Town Center	42,344	85,571	12,843	5,791	146,549
Clinic in New Town	47,746	36,063	7,046	2,924	93,779
Market in New Town	62,834	17,893	3,917	1,584	86,228
Church Outside	1,934	30,868	9,308	3,366	45,476
Church in New Town	15,502	20,600	3,993	2,887	42,982
Total	212,546	409,626	77,438	50,233	749,843

%

	Onfoot	Bus	Car	Others	Total
Work/School	15.3	58.8	11.1	14.8	100.0
CBD fo Shopping	1.0	77.0	14.5	7.5	100.0
Cinema in New Town	22.4	60.9	10.5	6.2	100.0
Town Center	28.9	58.4	8.8	4.0	100.0
Clinic in New Town	50.9	38.5	7.5	3.1	100.0
Market in New Town	73.0	20.8	4.5	1.8	100.0
Church Outside	4.3	67.9	20.5	7.4	100.0
Church in New Town	36.1	47.9	9.3	6.7	100.0
Total	28.3	54.6	10.3	6.7	100.0

Table 4.33

Use of Bicycle in New Town

Item		%
Use of Bicycle	Yes	12.1
	No	87.9
Purpose of Usage	To/From Work Place	6.3
	On Official Business	2.9
	Marketing/Shopping	8.0
	Play/Leisure	76.8
	Others	6.0
Reason of Not Using Bicycle	No Necessity	72.0
	Hot Weather	3.3
	Dangerous	12.4
	Others	12.3
Needs for Development /Improvement of Streets Exclusively for Bicycle	Yes Strongly	14.9
	Yes	34.0
	No Need	51.1

Figure 4.13

Satisfied for Accessibility to Activities
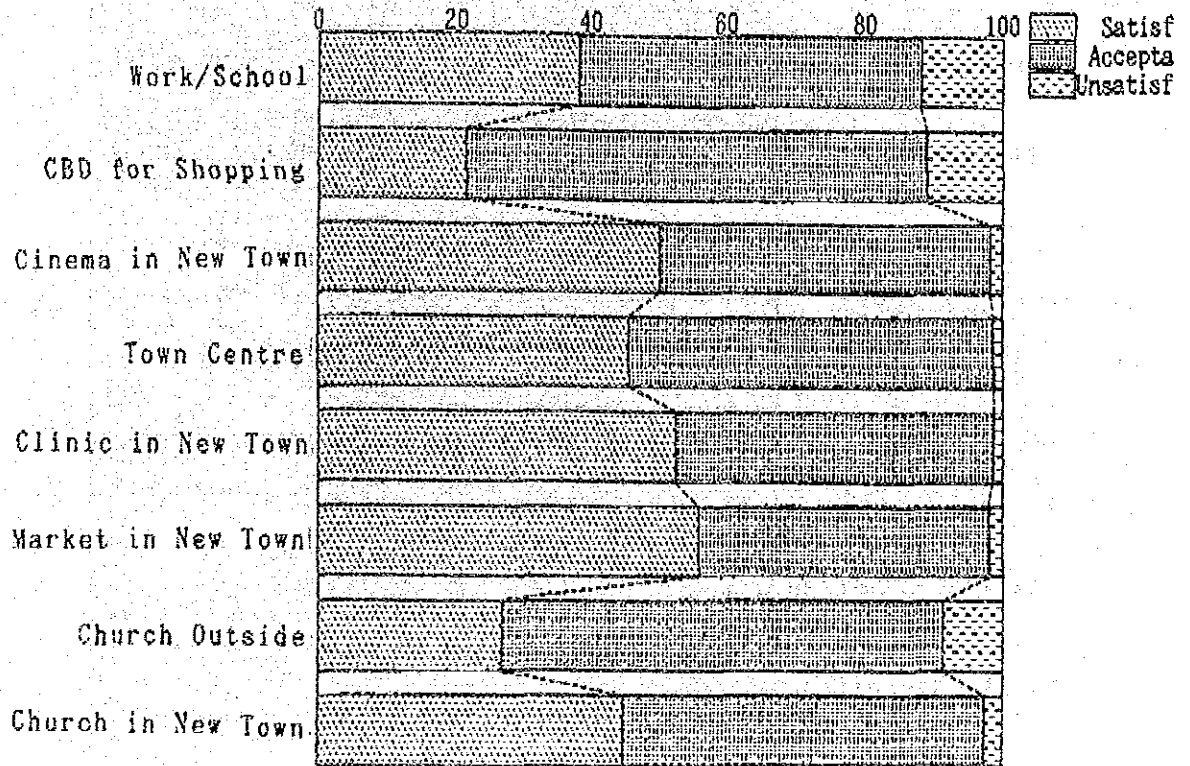
Figure 4.14

Assessment of Environmental of New Town

	Good
	Acceptable
	Bad
	Very Bad
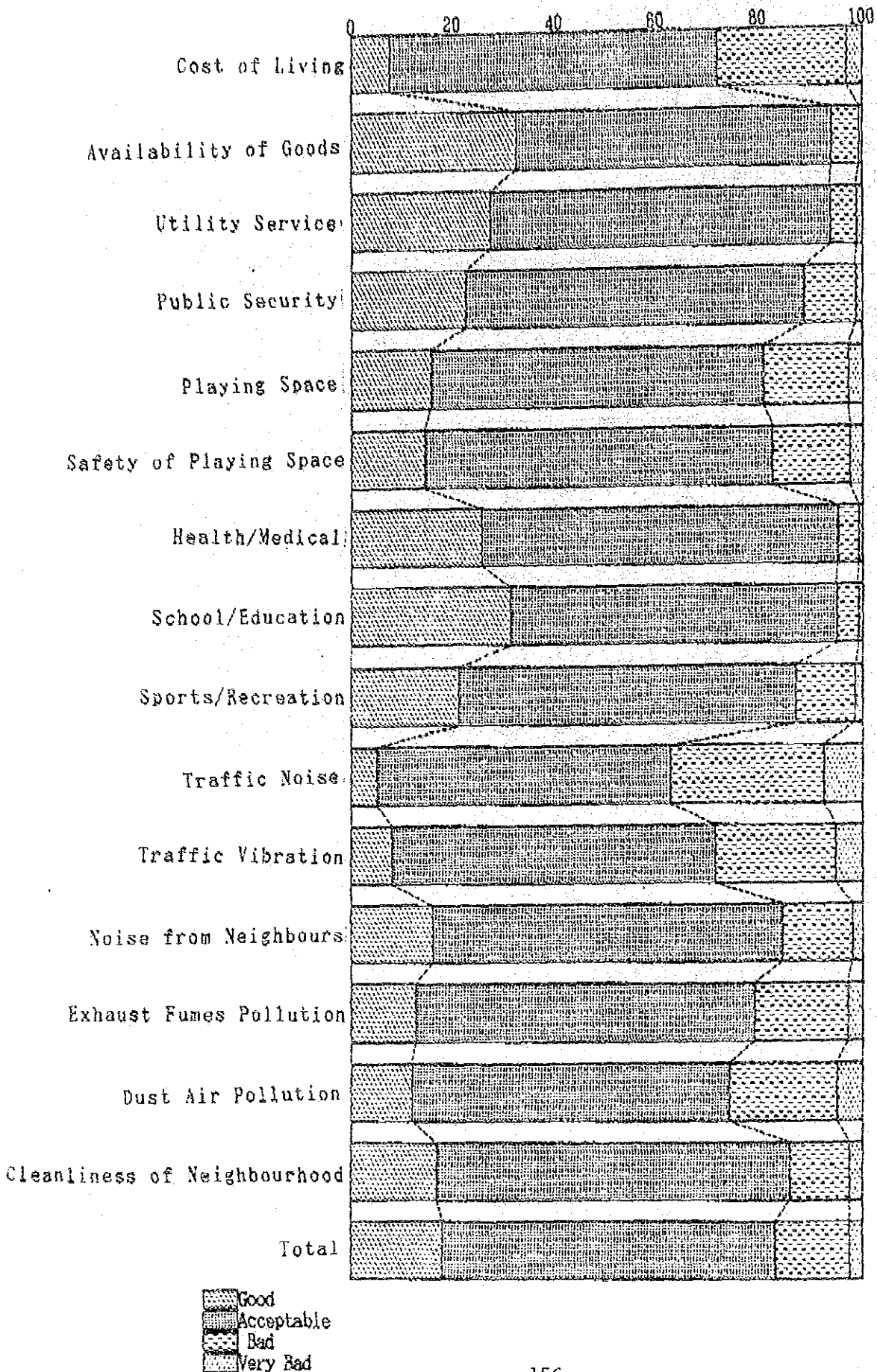
4.2   HIS in 1988

4.2.1   Objectives

The primary objective of the Limited Home Interview Survey (HIS) is to obtain information on the present travel demand characteristics in the study area.   In October/November 1987, the first Limited HIS was conducted in Ang Mo Kio New Town where future feeder transport systems may be introduced.   The aims of the previous survey were more specifically as follows:

1)   To obtain up-to-date information on traffic features of the Ang Mo Kio New Town.

2)   To obtain precise data on the relationship of usage between trunk and feeder transport.

3)   To obtain information on the assessment of the existing feeder transport system and services by the residents of the new town.

4)   To obtain information on the assessment of present enviromental condition in the new town.

5)   To assess the changes in transport activities due to the commencement of the MRT by conducting the same survey before and after the opening of the MRT.

The result of the survey are presented in the Technical Paper No. 1 "Supplemental Transport Surveys : Limited Home Interview Survey for Ang Mo Kio New Town in 1987" (Chapter4).

In order to check and assess the changes in transport activities after the commencement of the MRT, the second Limited Home Interview Survey (HIS) was planned to be conducted.   The second HIS was basically conducted in the same method and for the same sample households surveyed in the previous HIS. However, the survey questionnaires were simplified compared with the previous survey.   For example, the questionnaires on the assessment of feeder transport services and environmental condition were excluded from this survey forms.

The sample size of households were slightly increased in the second survey for the reason that the previous samples did not cover the whole types of residence.   The additional sample households were mainly selected from 5-room flats and private housing estates.

4.2.2 Survey Methodology

1) Information Needed

In the previous HIS conducted October/November 1987, the transport behaviours of residents in Ang Mo kio New Town were surveyed in their various aspects including the assessment of feeder transport and environment of the new town. As sufficient information on the overall aspect of feeder transport in the new town has been obtained from the previous survey, these surveys were extracted from the new survey. The new survey focused on obtaining trip information which may be changed due to the commencement of the MRT.

The following information was considered to be necessary for the purpose of study.

1) Information on Household

This is required for each household:

— Ownership of residence
— Years Residing
— Household Income
— Vehicle ownership
— Usage of Vehicle
— Spending on Vehicle
— Factors restricted from car ownership
— Value of environment

2) Information on Household Members

The following information was required for each household member aged four years and older:

— Relationship to the head of household
— Sex and age
— Occupation
— Work or school address
— Monthly Income
— Use of MRT
— Transport Mode before opening MRT
— Reason for using MRT
— Assessment of MRT
— Walking distance

3) Trip Information

The following information was required for each trip made by household member four years and older:

- Origin and destination of trip
- Starting and finishing time of trip
- Trip purpose
- Mode of travel
- Place of Transfer
- Waiting Time
- Waiting Time for Bus/MRT Passengers
- Expenses for the Trip

4) Administrative Information

The following information was required for survey administration or for controlling the data during the processing:

For each household

- Block and Room number of Sample
- Name of Family and telephone number
- Sequential Number for survey forms
- Visiting Record
- Household Address
- Number of household members (Male/Female, under 4 years/4 years & above)
- Ethnic Group
- Type of Residence
- Number of Rooms
- Car ownership
- Name of Surveyors/Supervisor

For each household member

- Sequential Number (same as household Seq. No.)
- Household Members Number

2) Field Survey Design

(1) Design of Survey Forms

Based on the information required for planning purposes, a set of survey forms was prepared by the study team with the assistance of PWD staff as presented in Appendix 4.B.

The survey forms were basically the same as those used in as previous survey. The survey forms were composed of the folllowing:

a) Form 1 Household Information

This form should be completed by the head of the household. The detailed questions on car ownership and the assessment of the value of environment were added in this survey.

b) Form 2. Household Member Information

This form should be completed by every household member of the household aged 4 years and above. The questions on the usage and assessment of MRT and on the walking distance to/from the MRT stations were added in this survey.

c) Form 3. Trip Information

This form should be also completed by every member of the household. All their trips made during the survey date should be recorded. The same questionnaire was designed as the previous survey.

d) Visiting Sheet

This sheet was used for the administrative purpose of the survey. It contained a part of household information to be recorded by surveyors including the the address, number of household members, ethnic group and type of residence. Besides the above information, the type of household/car ownership was recorded by surveyors. (This is not included in the visiting sheet).

2) Survey Schedule

The survey was planned to be conducted for 7 weeks including preparatory works, field interview survey, editing and coding works data entry into micro computer. The scheduled activities of the survey are shown in Figure 4.15

3) Survey Area and Survey Zone

Almost the same areas as in 1987 for Ang Mo Kio New Town was selected for 1988 survey. Some private housing estates within Ang Mo Kio New Town area were included. The survey area was divided into six (6) Survey Zones as illustrated in Figure 4.16. A survey team is responsible for the survey activities in each zone.

Figure 4.15   Implementation Schedule of 1988 Limited HIS for
Ang Mo Kio New Town

WORK ITEMS	Week							
	1	2	3	4	5	6	7	8
1. Preparatory Works								
1) Prepare Survey Plan	▬							
2) Design Survey Forms		▬						
3) Print Survey Forms			▬					
4) Prepare Survey Manual		▬						
5) Prepare Sample List		▬						
6) Recruit Surveyors		▬						
7) Prepare Survey Equipment			▬					
8) Publicity of Survey			▬					
2. Field Interview Survey								
1) Distribution of Survey Forms and Interviews				▬				
2) Collection of Survey Forms and Checking				▬				
3. Editing and Coding Works								
a) Editing				▬				
b) Coding					▬			
4. Data Processing								
1) Data Entry						▬		
2) Data Check							▬	
3) Complete Sample Master								▬
4) Complete Expanded Sample Master								▬

Figure 4.16

Survey Areas of 1988 Limited HIS
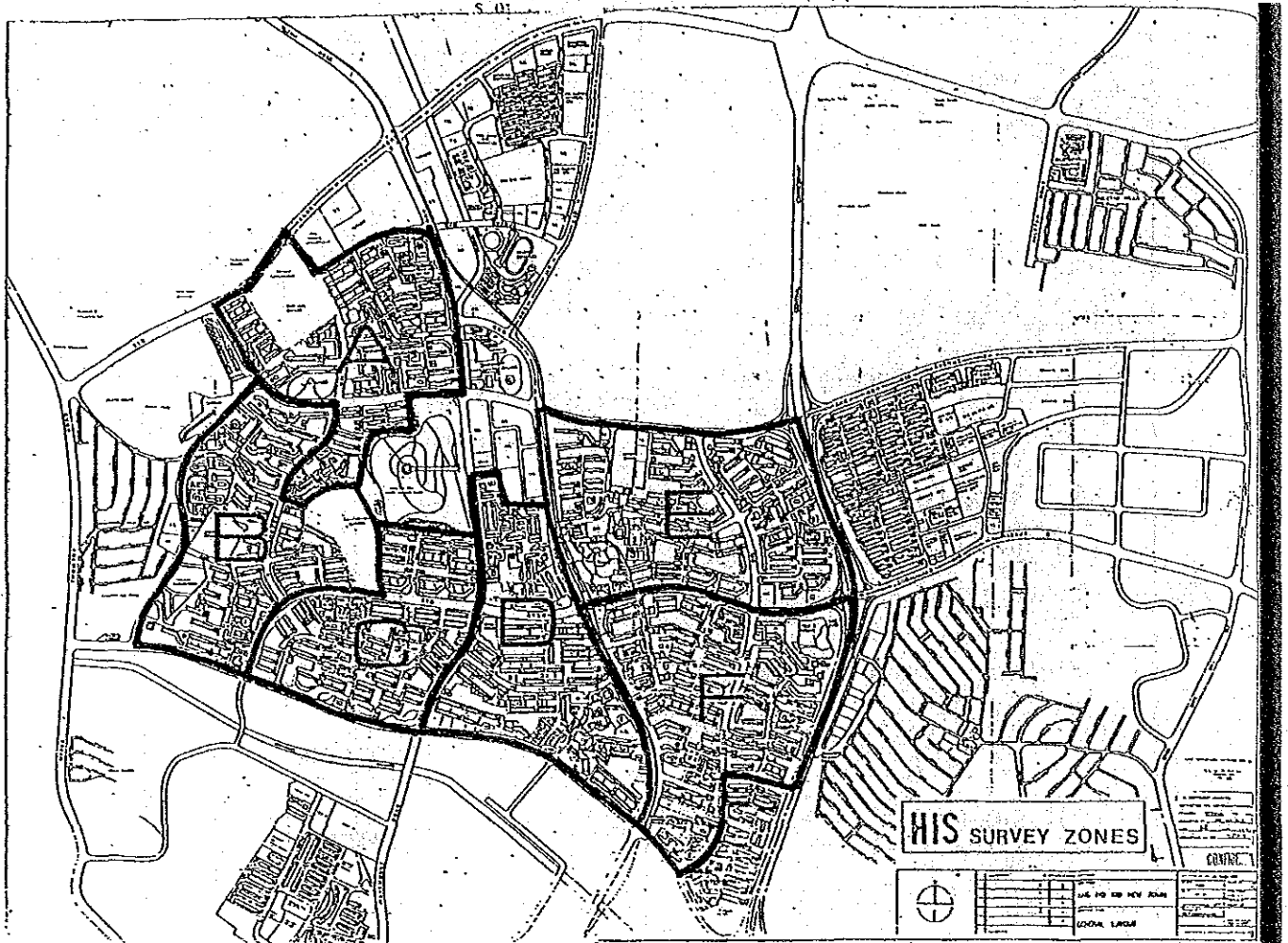
4) Sampling of Households

The same households surveyed in 1987 were selected as
sample households for this survey. The sample households
surveyed in the previous survey were 731 households, out of
which 723 household addresses were identified. As the
volume of these samples was not enough for our survey
implementation, about 400 additional samples were selected
in the same random sampling method used for the previous
survey. In addition, 13 sample households were selected
from private housing estates located within the Ang Mo Kio
new town area. The list of the sample blocks are shown in
Appendix 4.F and their locations in Figure 4.17.