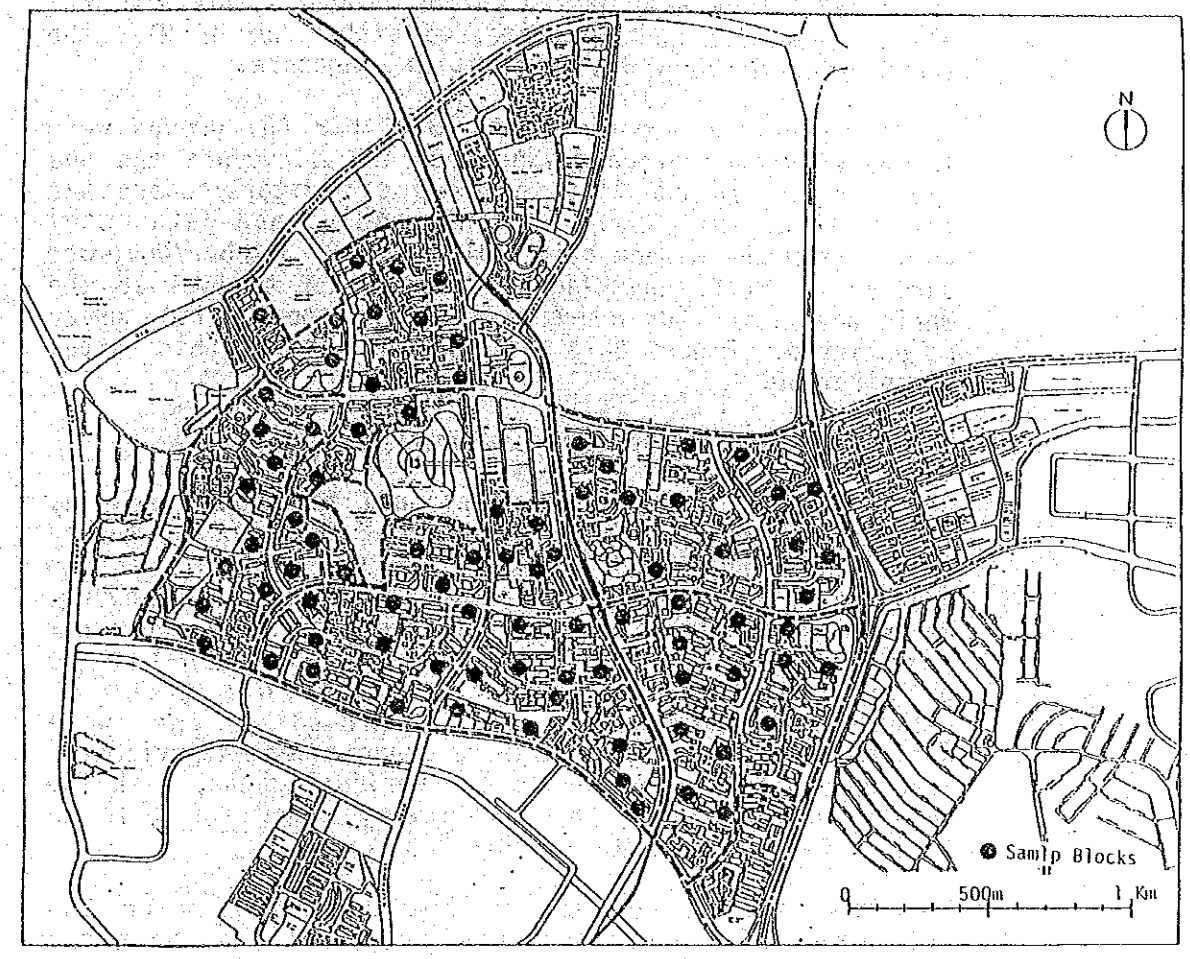
Figure 4.17
Location of Sample Blocks for 1988 HIS



4.2.3 Survey Implementation

1) Organization of Survey Team

The field survey was carried out by students interviewers; all of them were undergraduates of either NUS or NTI, the two premier tertiary institutions in Singapore.

Under supervision of the study team, six (6) groups were formed with each group having four (4) surveyors and one supervisor. In addition, a group of editors/coders was formed to carry out the editing, coding and data entry work. From the wisdom gained in the last October/November survey, a chief supervisor was appointed to oversee the whole activities to ensure that a more coordinated survey is achieved. Figure 4.18 shows the outline of this survey organization.

2) Recruitment and Orientation of Surveyors

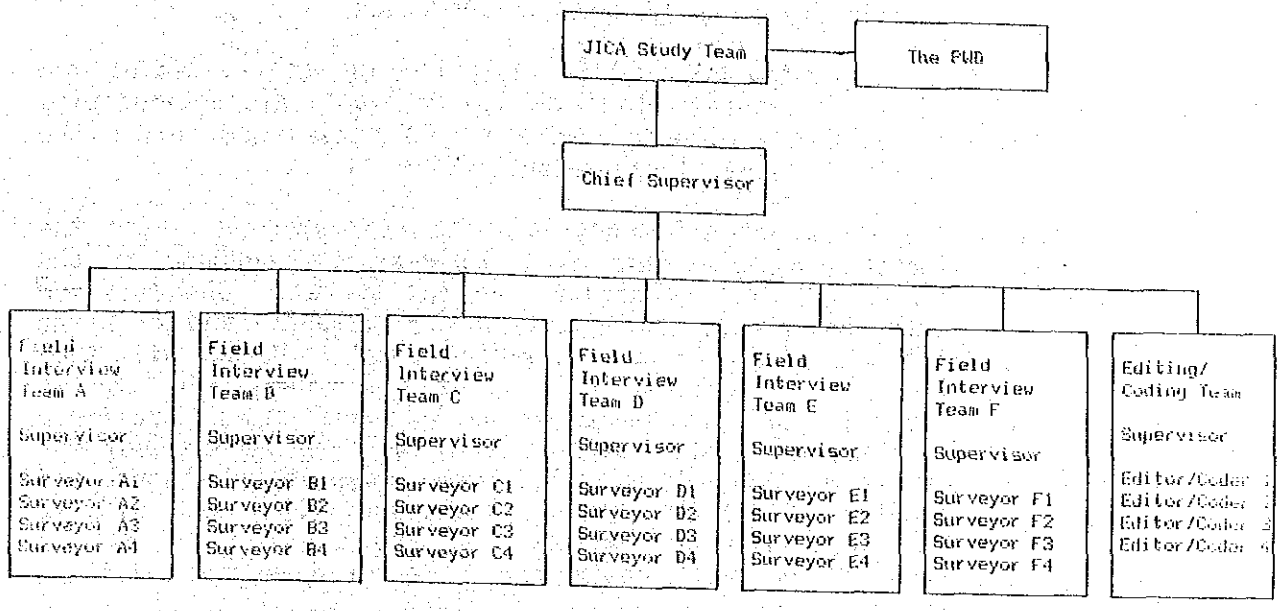
On the outset, the study team planned to recruit as many interviewers as possible who worked for the last HIS survey conducted in October/November 1987. The rationale is the advantage of experienced possessed by these interviewers. However, due to Industrial Orientation attachment and other personal commitment, most of them were unable to participate in this survey. Among this group of experienced interviewers, only eight (8) of them were available for this survey. These experienced interviewers, were appointed supervisors of the various groups, with the knowledge gained from the last survey, they can help to facilitate the execution of this HIS survey.

The rest of the surveyors were recruited with the assistance of SLO (Student Liaison Office) of both the National University of Singapore (NUS) and Nanyang Technological Institute (NTI). Ninety-nine (99) undergraduates had shown the interest to participate in this survey from various fields of academic disciplines: Engineering, Science, Arts, Business Administration, Building and Estate Management, Accountancy and Computer Science. After screening and interviewing, thirty two (32) undergraduates were selected including (6) supervisors. The supervisors were selected mainly from the experienced surveyors who had participated in the last HIS survey.

A briefing was carried out at the site office of the Ministry of National Development Building (MND Building) on 22nd April 1988, prior to the commencement of HIS survey aimed at facilitating the HIS survey. Instructions on how to carry out the HIS survey were given . The briefing also ensured that the surveyors fully understood the various survey forms and the implementation of the procedures. Attention was drawn on how the surveyors could answer properly the anticipated questions by the households: 1) Why are we selected and not the other

Figure 4.18

SURVEY ORGANISATION



households? 2) For what purpose is the survey? 3) How the informations will be treated?

At the end of the briefing, the various interviewing teams were formed with each group responsible for selected households in the various sub-zones of the Ang Mo Kio New Town.

The manual shown in Appendix 4.C was prepared to facilitate the training and communication between the consultants and the surveyors.

3) Publicity

The previous HIS survey had shown the problems associated with ill-informed households in Ang Mo Kio New Town. In order to conduct the survey smoothly and to foster better understanding and cooperation on the part of the residents, the following measures were undertaken:

1) A request for the cooperation of residents was made through the residents committee of Ang Mo Kio New Town. The member of parliament for the new town was also informed.

2) A press statement by PWD to seek the cooperation of residents was released in "The Straits Times" on 23rd April, 1988 as shown in Appendix 4.D.

3) Two hundred (200) pieces of posters which bear information on the duration of the survey was placed on the main entrance of each sample block two days prior to commencement of the His survey.

4) Interview Methodology

Courtesy, politeness with sincerity on the part of the interviewers are basic for any interviewing methods. Assurance of confidentiality is effective to obtain positive response from the respondents.

The interview methodology basically includes visiting the sample households, obtaining the relevant informations with follow up supplemental interview if needed and return the completed survey forms to the office.

The field interview begins when the surveyor visits the indicated sample household, explains the purpose of the survey and seek cooperation on the survey. The surveyor will then proceed to interview the household and fill the informations on the the "Visiting Sheet". He/she will then interview the househead and fill up form 1 by asking questions to him or her. If the househead is not available for interview, the surveyor is to make an appointment for the next visit and distribute the forms to the household members. Similarly the form 2 and 3 will be dealt with in the same manner. Finally, the result of the visit is recorded and any appointment is entered on the visiting sheet. The surveyor is to return the household, if necessary, and collect the rest of the forms. On collection, the surveyor is to check the number of forms collected by refering to the number of forms distributed as recorded in the "Visiting Sheet". When the surveyor is satisfied with the completeness of the forms, the completed forms and the corresponding "Visiting Sheet" are returned to the site office for final checking by the chief supervisor.

5) Collection of the Survey Forms

A site office was set up during the field survey period to monitor the progress of forms collection, coordination and assimilation of instructions for the surveyors whenever the need arise.

A HIS progress report table was prepared and updated at the end of each day to ensure quick feed-back and speedy appraisal of the various group performance (See Table 4.34). Those who were late in submission of forms would be urged to put in more effort to interview and collect the survey forms from the households.

Result of the field survey are briefly summarized as follows:

a) Number of households intended to be interviewed : 1135

b) Number of households whose data on trip made by members were collected : 1078

c) Number of households unable to be interviewed due to rejection or can not be contacted : 118

d) Performance ratio, (b)/(a) : 95%

e) Sample ratio (b)/49,976 : 2.2%

Compared to the last October HIS survey, the current HIS survey shows more uniformity in surveyors' performance in relative terms. However, surveyors' performance were still considerably different by individual as follows:

a) The largest number of households that a surveyor visited during two weeks survey period :58

b) Average number of households that one surveyor visited during the two weeks survey period :34

c) The smallest number of households that one surveyor visited during the two weeks survey period :10

Accordingly, the average number of households one surveyor could visit per day is computed to be 2.43 households /day/ surveyor. However, it was found that not all surveyors necessarily worked everyday during the two weeks survey period. Judging from the performance of those who worked everyday, it can be reasonably concluded that a surveyor can interview and collect daily forms with trip information of at least three households.

6) Field-work Programme

This follow-up HIS survey commenced on 23rd April and ended on 9th May 1988, the survey period spanned across a period of fourteen full working days (two full weeks). The distribution and collection of the survey forms were carried out during the two weeks period and forms were submitted to the site office regularly. 10th May was reserved as an extra day for any late collection.

The control of the field survey activities was the prime responsibility of all group supervisors. They are expected to collect the survey forms from their team members, preliminarily check it for completeness. They would return the incomplete forms to the surveyors for supplemental interview. The acceptable completed forms would then be retuned to the site office for final checking. Any problems on field would be tackled by the group supervisors at the first instance.

The monitoring of the field work progress of the HIS survey was the responsibility of the chief supervisor. He was constantly stationed at the site office where all group supervisors would have to report their progress to him. He would check the forms for its completeness as soon as they delivered to the site office. The incomplete forms would be rejected for supplemental interview to the various group supervisors in charge. The completed forms which are satisfactory would then be collected and sent back to the main office for subsequent editing and coding works.

7) Field Work Problems and Solutions

Compared to the last HIS survey, this follow-up HIS survey was less problematic. The improvement of the performance was achieved by solving the main problems faced in the last survey.

1) Taking stock of old problems encountered. The main problems encountered in the last HIS survey were:

   a) Communication difficulties due to language problems as the survey forms were written in English.

   b) Unwillingness to open the door on the part of the residents.

   c) Difficulties in obtaining cooperation from the respondents, due to poor public relation, unwarranted fear on the part of the respondents and voluminous questions.

   d) Lack of cooperation from selected households due to differences in:

      1. Level of education
      2. Race
      3. Types of dwelling units

   e) Difficulties in establishing contacts

   f) Time consuming and abortive works. Surveyors had to spend time to explain the survey and to convince the households of their participation.

2) Current Situations

   Based on what have been learned on the last HIS survey and the suggestions put forward in the Phase One draft technical paper, the following measures were taken in this survey:

   a) On communication difficulties due to language, the surveyors consisting of Singaporean Chinese, Indian and Malaysian Chinese were urged to translate the contents into their appropriate ethnic group of sample households. This was carried out and had greatly overcome the communication difficulties.

   b) The problem of unwillingness to open the door on the part of the residents was solved mainly by the pronouncement of the survey through two hundred (200) sheets of posters which were put up at the lift lobby of the sample blocks two days before the commencemnt of the survey. This had proved to be effective in facilitating residents cooperation.

   c) To gain better response and cooperation from the households, better public relation was carried this

time around; namely the pronouncement through press statement in the "The Strait Times" on 23rd April and announcement of survey through posters prepared by the PWD.

d) The tendency of surveyors visiting the households of the same ethnic group was recognized. This occurred in the follow up survey as well, but the office did not stop it as it solved the communication problems due to difference in race. Level of education affluence affect greatly the communication efficacy for obtaining information. Again the uneducated and those who stayed at point block type building show a high degree of reluctance to cooperate. However, with perseverance and persistence, communication barrier was overcome and a higher than average level of response rate.

Based on what had been learned in these two surveys, it is recommended to take into account the following points for any future works:

a) A better publicity should be considered as it will increase the response rate.

b) In the context of Singapore, the survey forms must be prepared in several languages to accommodate the non-English educated people.

4.2.4 Coding and Data Processing

1) Coding/editing

Checking, coding/editing of the survey forms were made as follows and the progress is shown in Figure 4.19.

(1) The survey forms were checked by surveyors at the first instance.

(2) The group supervisors would then check the survey forms on its completeness.

(3) The supervisors then checked the number of forms submitted against number of household members in the visiting sheets.

(4) The chief supervisor would then check again the completeness and sufficiency of forms before handing over to editors/coders in the office.

(5) Editors / coders would check and edit the forms in the office.

2) Zoning

For the purpose of analysing the trip data, zoning was made for the relevant area. Ang Mo Kio New Town was subdivided into sixteen (16) zones while the rest of the country was done based on the zoning used in CTS. Origins and destinations were then coded on the forms. The zoning maps are shown in Figures 4.20 and 4.21 for the entire country and Ang Mo Kio New Town, respectively.

3) Data Entry

Data was entered directly from the forms into the four PC's. The data entry format for three forms are shown in Figure 4.22, 4.23 and 4.24.

4) Data Check

After the entry of data, they were printed out and checked by the team. No major logical check was undertaken considering that the survey scale is small and editing was done carefully.

5) Expansion of Samples

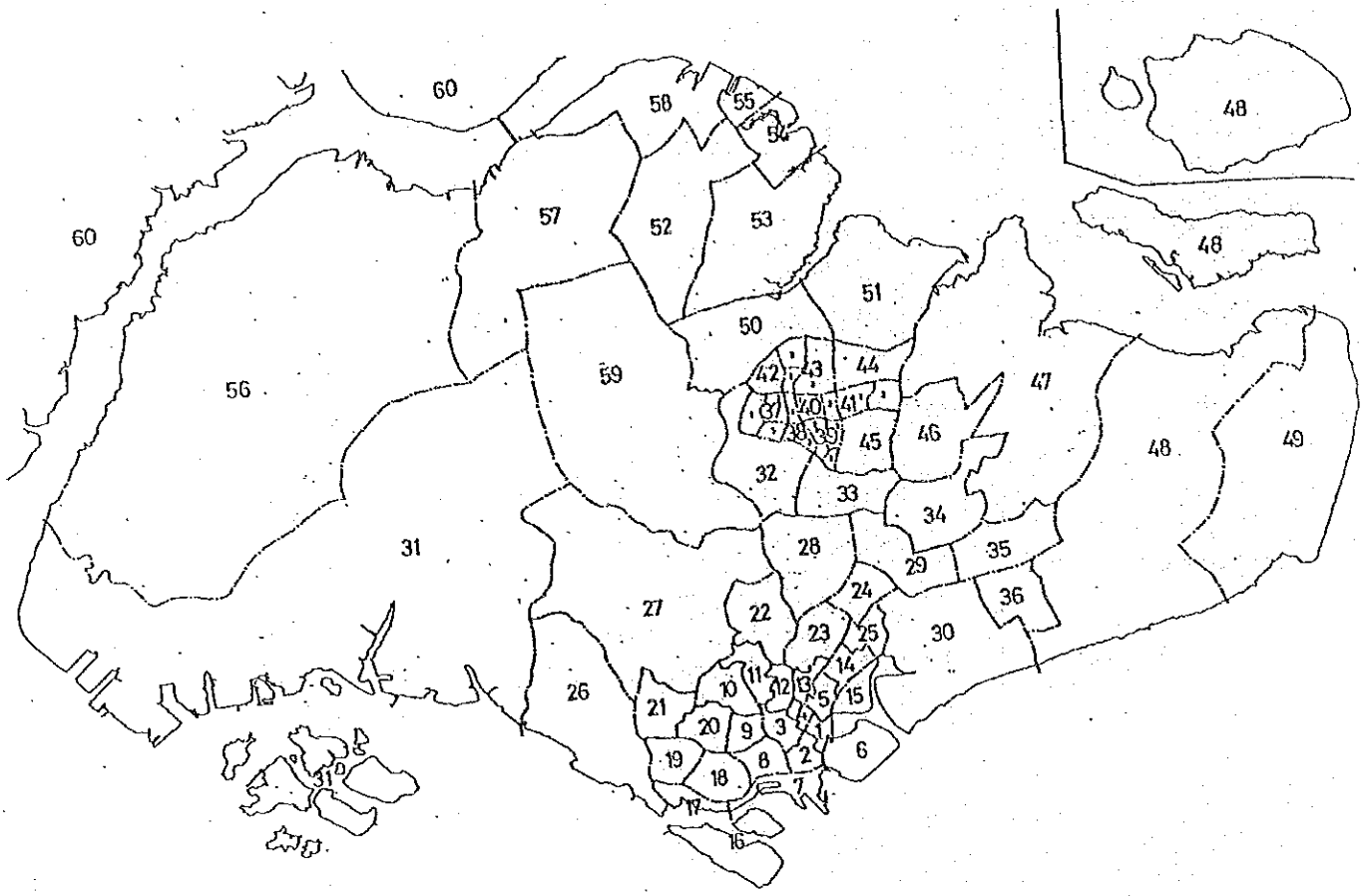
The samples were then expanded by survey zone based on the number of units by number of rooms. the resultant expansion factor is shown in Table 4.34.

Figure 4.19

MIS Progress Report Table

DATE / ITEM	23			24 SUN			25			26			27			28			29			30			1 SUN			2			3			4			5			6			7			8 SUN			9		
							A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F				A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F				A	B	C
NUMBER RECEIVED																																																									
NUMBER COMPLETED																																																									
NUMBER INCOMPLETE																																																									
% INCOMPLETE																																																									
CUMULATIVE NUMBERS OF COMPLETED FORMS																																																									
CUMULATIVE NUMBERS OF COMPLETED FORMS: BY GROUPS																																																									

Figure 4.20
HIS Traffic Zone Map for Entire Country



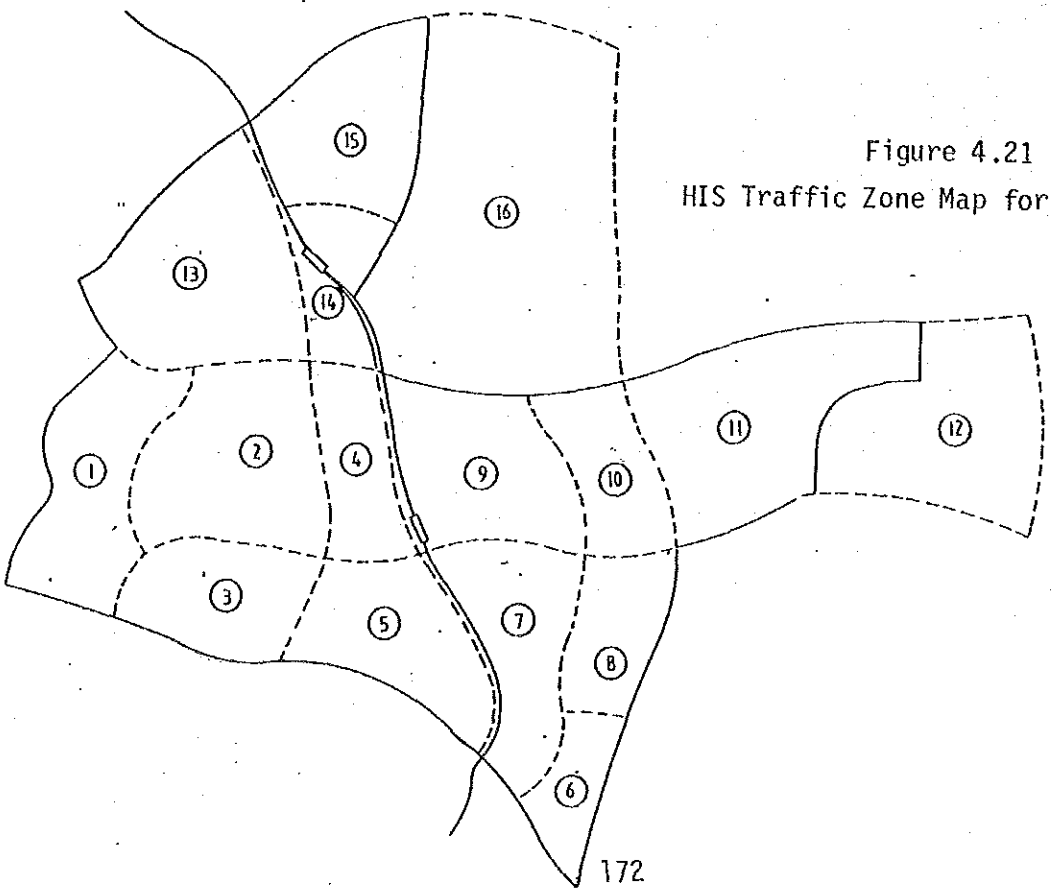
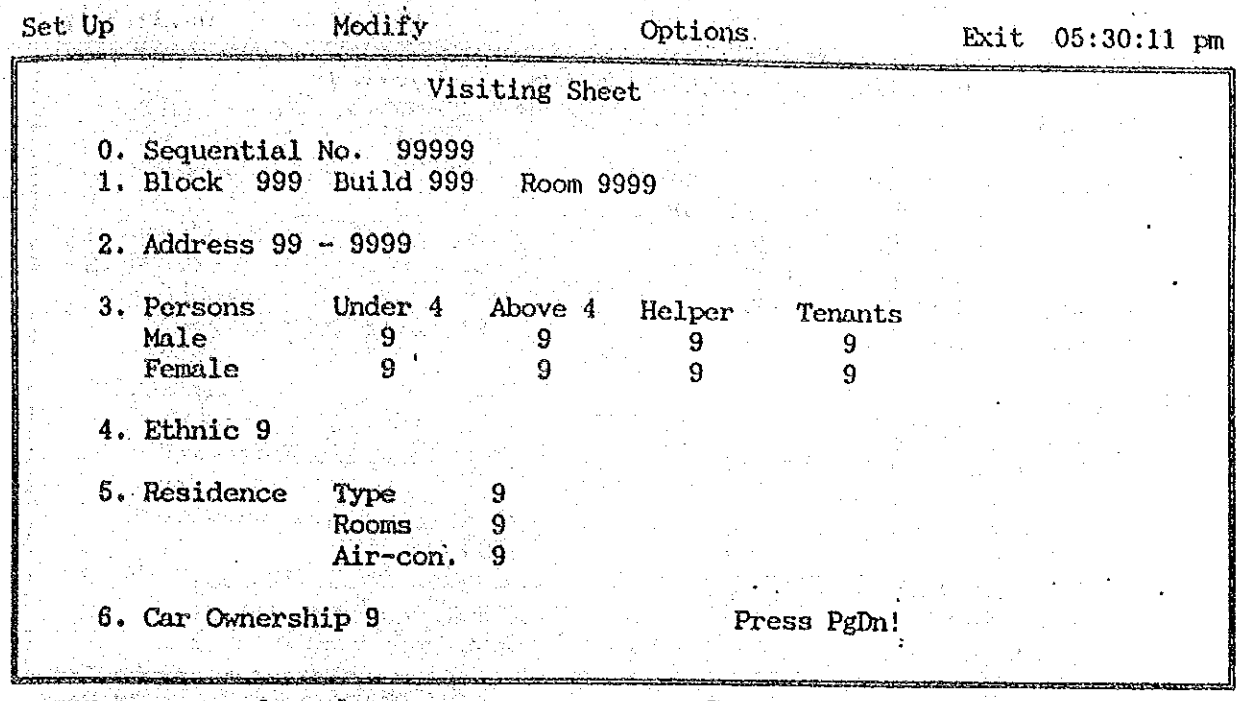


Figure 4.21
HIS Traffic Zone Map for Ang Mo Kio New Tow

Figure 4.22

Data Entry Format for Visiting Sheet & Form 1



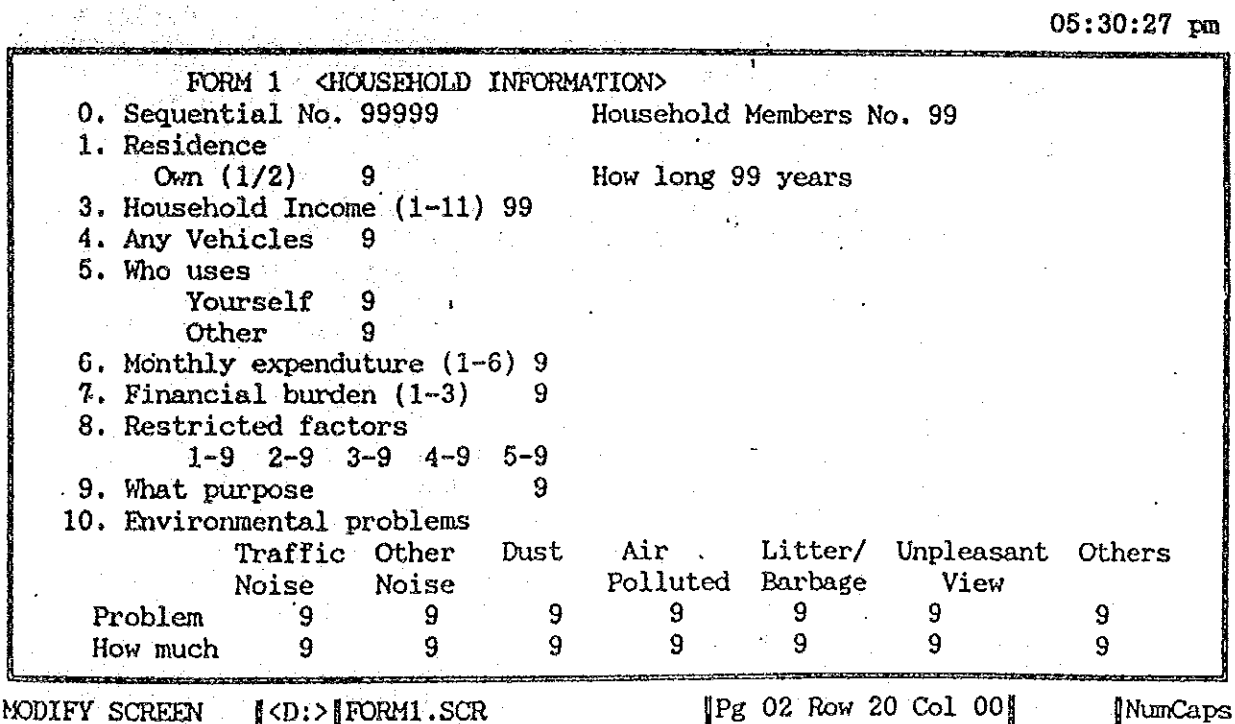


Figure 4.23

Data Entry Format for Form 2

```
                                                              05:32:31 pm
      FORM 2  <HOUSEHOLD MEMBER INFORMATION>      Screen 1
 0. Sequential No. 99999          Member No. 99

(Personal Information)
    Sex 9      Age 99  Occupation 99
               Address     Postal
    Work        99999       9999
    School      99999       9999
    Monthly Income   99

(MRT Information)
    8. Use MRT (1/2)  9
    9. Previous Mode (1-11)  99
   10. Why started using MRT?
       1.Travel time          9            99 mins.
       2.Fare                 9           $9999
       3.Punctuality          9           How 9
       4.Walking Distance     9            999meters or 999ins.
       5.Reliability          9           How 9
```

MODIFY SCREEN |<D:>|FORM2.SCR |Pg 01 Row 00 Col 00| |NumCaps

Enter text. Drag field or box under cursor with ↵. F10 for menu.

Screen field definition blackboard

```
                                                              05:32:44 pm
          FORM 2  <HOUSEHOLD MEMBER INFORMATION>  Screen 2

    (MRT Information)
      11. Compare MRT with privious mode
          1.Service Frequency a)Peak     9   b)Off-peak 9
          2.Service Hours     a)Morning  9   b)Night    9
          3.Seats             a)Peak     9   b)Off-peak 9
          4.Riding Comfort                9
          5.Cleanliness                   9
          6.Noise                         9
          7.Safety of Travel              9
      12. MRT Station  999
          1.Home <-> MRT          999 meters/ 999 mins.
            Distance 9  Condition 9  Entrance   9
          2.Bus IC <-> MRT
            Distance 9  Condition 9  Waiting    9 Location 9
          3.Car          Parking   9  Facilities 9
      13. As an Alternative? 9
          1-9  2-9  3-9  4-9  5-9  6-9
```

MODIFY SCREEN |<D:>|FORM2.SCR |Pg 02 Row 20 Col 00| |NumCaps

Enter text. Drag field or box under cursor with ↵. F10 for menu.

Screen field definition blackboard

Figure 4.24

Data Entry Format for Form 3

```
Set Up          Modify          Options          Exit  05:40:11 pm

   FORM 3 <TRIP INFORMATION>    Screen  1

0. Sequential No.   99999          Member   No. 99

1. Weather (1-4) 9
2. Origin
     Address                      9999-99
     Type of Facilities (0-14)    99
     Time                         9999
3. Destination
     Address                      9999-99
     Type of Facilities           99
     Time                         9999
4. Trip Purpose                   9

5. Did you walk from Origin to Destination? (1/2) 9
      1 Yes then Next Trip(Press PgDn Twice)
      2 No  then below... (Press PgDn)

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

                                                          05:40:23 pm

   FORM 3 <TRIP INFORMATION>    Screen 2
6. Mode of Travel
                Mode    Change?   Location  Wait
      First      99        9       9999-99   99
      2nd        99        9       9999-99   99
      3rd        99        9       9999-99   99
      4th        99
7. Car User
   Driver/Passenger? 9   No. of Passengers  9
8. Bus User
   Seats available?  9   Walking time form Origin    99(min.)
                                  to Destination 99(min.)
9. Expense for the Trip
   Taxi            Fair  $9999
   Bus                   $9999        Pass     $ 9999
   Parking               $9999        Rental   $ 9999
   Licence Fee     Daily $9999        Monthly $99999

                              then Next Trip !

MODIFY SCREEN  |<D:>|TRIP.SCR              |Pg 02 Row 20 Col 00|      |NumCaps
     Enter text.  Drag field or box under cursor with ↵.  F10 for menu.
                  Screen field definition blackboard
```

Table 4.34

Expansion Factor by Survey Zone and Unit Type

Survey Zone	Expansion Factor by Unit Type					
	1 Room	2 Room	3 Room	4 Room	5 Room	HUDC
A	0.0	49.7	32.2	35.8	17.3	35.3
B	12.2	50.4	17.2	70.3	100.0	18.1
C	44.4	53.6	50.9	50.1	42.0	0.0
D	50.8	50.0	29.4	41.0	57.7	0.0
E	0.0	58.0	49.9	58.8	54.7	0.0
F	66.0	61.8	52.0	62.4	61.7	0.0

4.2.5 TABULATION AND ANALYSIS

This section presents the findings of the 1988 HIS after expansion of data. The results are presented in tabular form to facilitate the analysis. After expansion of data, it is observed that the distribution of sample was fairly well. For example, the proportion of Chinese households is 73.6% which is very close to the 76.4% of the 85/86 Singapore national census. This is an improvement over the '87 HIS, which was 68.8%.

1) Household Characteristics

Table 4.35 shows the average household size based on the HIS surveys: 4.6 members/household in 1987 HIS and 4.4 in 1988 HIS. The medium size household (3-4 members) shows the highest proportion (49.1%). The 5-6 members category has the second largest share of the total household (36.2%), this is followed by small family-less than 2 members (7.5%) and that of the very large family -7 members and above.

In comparison to 1980 HIS, the household size has reduced from 4.9 in 1980 to 4.4 in 1988.

Table 4.35

Household Size

		Less than 2	3-4	5-6	7-8	9-10	11 and more	Total	Av. HH size
1988 HIS	No. of HH	3,733	24,527	18,077	3,488	151	0	49,976	4.4
	(%)	(7.5)	(49.1)	(36.2)	(7.0)	(0.3)	-	(100.0)	
1987 HIS	(%)	(6.4)	(46.0)	(36.8)	(9.6)	(1.0)	(0.1)	(100.0)	4.6
1980/81 CTS HIS	(%)	(13.8)	(34.3)	(31.5)	(13.3)	(5.0)	(2.2)	(100.0)	4.9

2) Ethnic Group Composition

The data on ethnic group composition is shown in Table 4.36 Chinese (73.6%) is the biggest ethnic group followed by Malay (15.0%), Indian (10.4%), mixed and others (0.9%). Compared to the 1987 HIS, 1988 HIS shows closer resemblance to the national census 85/86. For instance, Chinese race (73.6%) against (76.4%) of 85/86 census; 87 HIS shows a much lower proportion (68.8%). Although the 1988 HIS figure is higher than 87 HIS, it is still 2.8% lower than the 85/86 census. The possible reason is that Chinese households were less cooperative. There were still more refusal (though reduced compared to 87 HIS) comparing to both Malay and Indian households.

For Malay ethnic group, the percentage point is 15% from 1988 HIS against 14.9% of the 85/86 census, 87 HIS shows a lower percentage point of 14.6%.

For Indian ethnic group, both 87 and 88 HIS show a higher percentage point than the 85/86 census. However, 88 HIS shows a lower percentage than the 87 HIS for the Indian ethnic group. The possible explanation is that Indians were more cooperative and refusal from Indian households was therefore less compare to other ethnic groups.

Another feature is that the sample of not known category has been reduced from 2.8% in 87 HIS to 0.1% in 1988 HIS. This was due to the improved performance of the 88 HIS where experienced learned from the first survey helped greatly.

Table 4.36

Ethnic Group Composition

		Chinese	Malay	Indian	Mixed	Others	Known	Total
1988 HIS	No. of HH	36,793	7,490	5,185	269	189	50	49,976
	(%)	(73.6)	(15.0)	(10.4)	(0.5)	(0.4)	(0.1)	(100)
1987 HIS	(%)	(68.8)	(14.6)	(12.5)	(1.1)	(0.3)	(2.8)	(100)
1985/86 Singapore	(%)	(76.4)	(14.9)	(6.4)		(2.3)		(100)

3) Dwelling Units

Some features of dwelling units and residence are shown in Tables 4.37, 4.38 and 4.39. Majority of the people live in three-room units (53.7%) followed by four-room (22.9%) and two-room (10.9%). 85% own their units. Pattern of residing years show that there are a considerable number of people who moved to Ang Mo Kio, though the majority are still those who live there more than 6 to 10 years.

Table 4.37

Number of Rooms

		Number of Rooms						Total
		1	2	3	4	5	6 & more	
1988 HIS	No. of HH	2,696	5,432	26,859	11,452	3,537	-	49,976
	(%)	(5.4)	(10.9)	(53.7)	(22.9)	(7.1)	-	(100)
1987 HIS	(%)	(20.4)			(29.6)			(100)

Table 4.38

Ownership of Residence

		Owned	Not Owned	Not Known	Total
1988 HIS	No. of HH	42,508	7,216	252	49,976
	(%)	(85.1)	(14.4)	(0.5)	(100)
1987 HIS	(%)	(89.0)	(14.2)	(0.7)	(100)

Table 4.39

Residing Years

		Within 3 yrs	4 to 5 yrs	6 to 10 yrs	11 to 15 yrs	Longer than 16 yrs	Not Known	Total
1988 HIS	No. of HH	11,406	2,837	29,431	5,240	310	752	49,976
	(%)	(22.8)	(5.7)	(58.9)	(10.5)	(0.6)	(1.5)	(100)
1987 HIS	(%)	(18.9)	(8.8)	(64.3)	(6.3)	(0.3)	(1.4)	(100)

4) Household Income Distribution

Broadly, the household income distribution can be analysed by classifying the various income ranges into three main groups:

a. The low income category (below $500)

b. The middle income category ($500-$2999)

c. The high income category ($3000 and above)

For the low income category (blow $500), the percentage has reduced from 8.4% (87 HIS) to 6.6% at present. However, this is still higher than the 4.8% of the 82/83 household expenditure survey.

The 1988 HIS survey shows the highest percentage for the middle income category ($500-$2999) which is 85.40% compared to both 83.6% from 87 HIS and 78.4% from 82/83 household expenditure survey. The above data are shown in Table 4.40

In general, as Singapore develops into more advance stage of development, the percentage of lower income group shrinked and the percentage of middle income category increased. This can be supported by the data from 88 HIS where the percentage for the middle income group increased over both the figure from 87 HIS and 82/83 household expenditure survey. On the other hand, the percentage of low income category has reduced since the last 87 HIS. However, the same problem recurred in this survey ; 1988 HIS still failed to capture sufficient samples for the higher income group.

Table 4.40

Household Income Distribution

Household Income Range (S $/Month)	1988 HIS		1988 HIS (%)	1982/83 Household Expenditure Survey (%)
	No. of Households	(%)		
1 Below 500	3,318	(6.6)	8.4	4.8
2 500 - 999	15,486	(31.0)	32.3	26.3
3 1000 - 1499	15,695	(31.4)	27.3	21.6
4 1500 - 1999	5,374	(10.8)	10.1	14.8
5 2000 - 2499	4,052	(8.1)	9.6	15.7
6 2500 - 2999	2,093	(4.1)	4.3	
7 3000 - 3499	1,737	(3.5)	1.9	7.0
8 3500 - 3999	823	(1.6)	2.3	
9 4000 - 4999	407	(0.8)	1.5	3.8
10 5000 - 5999	388	(0.8)	0.3	6.0
11 6000 and above	205	(0.4)	0.6	
12 Not Known	398	(0.8)	1.4	
Total	49,976	(100)	100	
Average HH Income	1425		1400	2.029

5) Vehicle Ownership

Approximately one fourth of the residents own cars as shown in Table 4.41

The car ownership level of Ang Mo Kio New Town is slightly lower than the nation-wide average of 0.33 private car/household (1985).

Table 4.41

Vehicle Ownership Level

	No Vehicle	Motorcycle Only	One Car	More Than One Car	No Answer	Total
No. of Household	25,243	1,466	8,459	324	14,484	49,976
% of Total	50.5	2.9	16.9	0.6	29.0	100.0
	71.1	4.1	23.9	0.9	-	100.0

The vehicle ownership in Singapore is greatly affected by its policy to restrict or discourage ownership by imposing high taxes and charges. Ownership is further explained in relation with household income level as shown in Figure 4.25 and Table 4.42. As the income level goes up, the car ownership becomes high. Almost 60% of the households with the average household income of more than $4,000 a month own one car or more.

Figure 4.25

Vehicle Ownership Level by Income Level

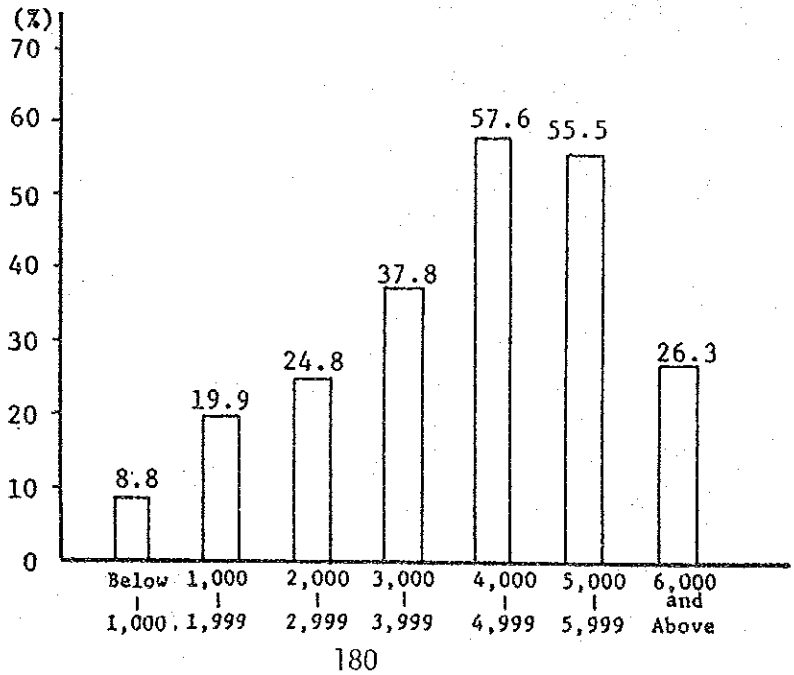


Table 4.42

Vehicle Ownership by Income Level

Household Income Level (S $/Month)	% Distribution of Households : A	% Distribution of Car-Owning Households : B	% of Car-Owning Households to Total Households
Below 1,000	38.0	18.8	8.8
1,000 - 1,999	42.6	47.6	19.9
2,000 - 2,999	12.4	17.4	24.8
3,000 - 3,999	5.2	11.0	37.6
4,000 - 4,999	0.8	2.6	57.6
5,000 - 5,999	0.6	2.0	55.5
6,000 and above	0.4	0.6	26.3
TOTAL	100.0	100.0	24.8 (Average)

2) Household Members Characteristics

1) Sex and Age Group

The data derived from the 1988 HIS is quite similar to those obtained under the 87 HIS.

In 1988 HIS, the age group with the highest percentage of households is the 26-35 years category (22.4%); this is followed by 7-16 years category (19.20%), 36-45 year category (19.0%), 17-25 years category (18.9%), 46-55 category (11.1%), over 56 years category (6.9%) and the 4-6 years category (2.5%).

Table 4.43

Sex and Age Group

Age Group	1988 HIS						1987 HIS Total %
	Male No.	(%)	Female No.	(%)	Total No.	(%)	
4 - 6	2,741	(2.6)	2,468	(2.4)	5,209	(2.5)	2.4
7 - 16	21,890	(20.8)	18,341	(17.6)	40,231	(19.2)	20.8
17 - 25	18,439	(17.5)	21,079	(20.3)	39,518	(18.9)	22.7
26 - 35	20,302	(19.3)	26,665	(25.7)	46,967	(22.4)	22.2
36 - 45	20,962	(19.9)	18,768	(18.1)	39,730	(19.0)	14.6
46 - 55	12,737	(12.1)	10,580	(10.2)	23,317	(11.1)	8.9
56 -	8,353	(7.9)	6,022	(5.8)	14,375	(6.9)	7.0
Not Known	0	(-)	-	-	-	-	1.5
Total	105,424	(100)	103,923	(100)	209,347	(100)	100
	50.4		49.6		100		

2) Occupation of the Residents

At a glance, it can be noted that the percentage composition of workers as against total samples is higher in 1988 HIS than 1987 HIS. For students, it is found that there are less students in 88 HIS (in terms of percentage) than 87 HIS. Housewife, however, shows a higher figure than before. Others , on the other hand, shows a lesser percentage point than previous survey. Another feature is that there is no "not known" category in the 1988 HIS while the previous HIS (1987) showed a considerable percentage of "not known" category.

The sector of workers shows a very close resemblance to that of the 87 survey. Production / transport workers category was the dominant sector in both 87 HIS and 88 HIS with the highest percentage of 10.7% and 13.4% respectively.

The student population shows some differing features from the last survey. In 1988 HIS, primary students claim the largest proportion of student population (12.5%). This is followed by secondary school students (9.2%), pre-university students (2.1%), tertiary students (1.5%) and vocational institute students. The last 87 HIS showed a different pattern of proportion with secondary students as the main sector of the student population. Except for the primary students and secondary students population, the rest of the sector showed a similar pattern to that of the 88 HIS. As such, 88 HIS data on the student population is more reliable. This can be explained as the educational system is the pyramid type with more students at the primary level. Contrary to 88 HIS findings, 87 HIS data showed less primary students than the secondary students. This made the latter data less reliable and this could due to failure to capture the primary student population.

Housewife population has increased by 3.4% (from 15.5% in 1987 ti 18.9 % in 1988%). Others, which are outside the main categories, have shrinked to 13.4% from the previous 14.0% in 1987.

Table 4.44

Occupation

	1988 HIS Number of Persons (%)		1987 HIS (%)
Professional/Technical Workers	16,180	(7.7)	7.5
Administrative/ Managerial Workers	7,173	(3.4)	2.7
Clerical Workers	11,357	(5.4)	6.4
Sales Workers	4,879	(2.3)	2.6
Service Workers	11,167	(5.3)	4.5
Agriculture Workers	781	(0.4)	0.7
Production/Transport Workers	28,033	(13.4)	10.7
Workers Not Classifiable	7,090	(3.4)	2.5
Workers Sub-total	86,660	(41.4)	37.6
Primary Students	26,103	(12.5)	11.2
Secondary Students	19,263	(9.2)	13.5
Pre-university Students	4,387	(2.1)	2.6
Vocational Ins. Students	2,082	(0.1)	1.5
Tertiary Students	3,216	(1.5)	1.8
Students Sub-total	55,051	(26.3)	30.6
Housewife	39,524	(18.9)	15.5
Others	28,112	(13.4)	14.0
Not Known	-	-	2.3
Total	209,347	(100)	100

3) Travel Demand Characteristics

1) Demand Level

A) Trip Rate

Trip Rate is defined as the number of trips made by a person per day. The average trip rate for the residents in Ang Mo Kio New Town is estimated to be 1.90 for a person of 4 years old and above including walk only trips, while the trip rate for the motorized trips is 1.34.

Table 4.45 shows trip rate by occupation. Workers and students make more than 2 trips per day, while housewives and others about 1.6 trips respectively. Table 4.46 shows trip rate by car ownership. The household car-owners make more trips (1.48) than non household car-owners (1.27).

Table 4.45

Trip Rate by Occupation

Occupation	Trips/person/day Motorized Trips	Walk Only Trips	Total
Professional/Technical Worker	1.94	0.19	2.13
Administrative and Managerial Worker	2.02	0.04	2.06
Clerical Worker	1.93	0.08	2.01
Sales Worker	2.08	0.37	2.45
Service Worker	1.82	0.21	2.03
Agricultural Worker and Fisherman	1.66	0.13	1.79
Production, Transport and other Manual Worker	1.69	0.28	1.97
Workers Not Classifiable by Occupation	1.05	0.42	1.47
Workers Subtotal	1.78	0.22	2.00
Student (Primary, Pre-primary, Kindergarden)	0.96	1.10	2.06
Student (Secondary)	1.50	0.55	2.05
Student (Pre-university)	1.70	0.37	2.07
Student (Vocational Institute)	1.93	0.07	2.00
Student (Tertiary)	1.82	0.20	2.02
Students Subtotal	1.29	0.76	2.05
Housewife	0.45	1.20	1.65
Others	1.32	0.28	1.60
Total	1.34	0.56	1.90

Table 4.46

Trip Rate by Sex and Car Ownership

Item	Trip Rate (Trips/person/day)	Motorized
Sex	Male 1.93	
	Female 1.86	
Car Ownership	Member of Car-Owning Household 2.01	(1.48)
	Member of Non-Car-Owning Household 1.84	(1.27)

B) Overall Demand

As shown in Table 4.47, the total number of person trips made by the residents of Ang Mo Kio New Town is estimated to be 397,000 trips per day in terms of linked trips including walk only trips. Among these trips, 70% or 280,500 trips are motorized trips. Of the total demand the movement within new town accounts for 44.5%, while that between New Town and outside areas, 55%.

Inter New Town movements are mostly (97.2%) composed of motorized trips, while 94.7% of the total walk only trips are made in New Town.

Table 4.47

Overall Demand of Ang Mo Kio Residents

		Motorized trips		Walk only trips		Total	
		No.	%	No.	%	No.	%
Intra New Town	No.	66,514	23.7	100,067	94.7	176,581	44.5
	%	(37.7)	-	(62.3)	-	(100.0)	-
Inter New Town	No.	214,123	76.3	6,190	5.3	220,313	55.5
	%	(97.2)	-	(2.8)	-	(100.0)	-
Total	No.	280,637	100.0	116,257	100.0	396,894	100.0
	%	(70.7)	-	(29.3)	-	(100.0)	-

Including trips completed in other place.

C) Demand by Purpose

Table 4.48 shows the distribution of these trips by trip purpose. Percentage distribution of demand by purpose is fairly different between motorized and walk only trips. For motorized trips, "to work" and "to school" are the dominant purposes, while for walk only trips, "to school" and "shopping" purposes registered the higher percentages.

Table 4.48

Demand by Trip Purpose

Trip Purpose	Motorized Trips		Walk Only Trips		Total		% of Walk Only Trips
	No.	(%)	No.	(%)	No.	(%)	
To work	86,176	(30.7)	7,413	(6.4)	93,589	(23.6)	7.9
To school	33,190	(11.8)	22,332	(19.3)	55,522	(14.0)	40.2
Part of Work	4,223	(1.5)	588	(0.5)	4,811	(1.2)	12.2
Personal Business	10,402	(3.7)	5,457	(4.7)	15,859	(4.0)	34.4
Shopping	6,845	(2.4)	19,232	(16.6)	26,077	(6.6)	73.8
Recreation	3,163	(1.1)	784	(0.7)	3,947	(1.0)	19.9
Eating/Social	5,453	(1.9)	5,208	(4.5)	10,661	(2.7)	48.9
To Home	131,096	(46.7)	54,949	(47.4)	186,045	(46.9)	29.5
Total	280,548	(100)	115,963	(100)	396,511	(100)	29.2

D) Demand by Facilities/Activities

The number of trips generated /attracted to/from various sort of facilities/activities is shown in Table 4.49. About a half of the total trips are generated/ attracted to/from residential facilities. For the intra-zonal trips, approximately 21% are generated/ attracted to/from School and 15% to/from Shops. On the other hand, office (16%) and school (9%) are the major facilitites of traffic generation/attraction for Inter New Town Movement.

Table 4.49

No. of Trips Generated and Attracted by Facilities/Activities

Facilities Activities	Intra New Town Traffic			Inter New Town Traffic		
	Generation	Attraction	Total	Generation	Attraction	Total
Residence	90,121	87,765	177,886	107,389	106,217	213,606
Office	3,187	3,468	6,655	35,426	35,349	70,775
Work Site	1,709	1,955	3,664	11,022	10,415	21,437
Eating	1,504	1,569	3,073	2,164	2,489	4,653
Shops	27,361	27,488	54,849	9,664	10,481	20,145
Bank	288	349	637	643	447	1,090
Bus IC	445	508	953	611	653	1,264
Airport	49	49	98	1,862	1,923	3,785
Sports	879	843	1,722	1,967	2,126	4,093
Church	807	807	1,614	898	898	1,796
Factory	9,299	9,859	19,158	11,190	11,525	22,715
School	36,845	38,188	75,033	20,691	20,661	41,352
Public	1,368	1,154	2,522	3,854	4,012	7,866
Others	2,322	2,449	4,771	12,731	12,980	25,711
Not Known	397	130	527	201	137	338
Total	176,581	176,581	353,162	220,313	220,313	440,626
Residence	51.2	49.7	50.4	48.8	48.2	48.5
Office	1.8	2.0	1.9	16.1	16.1	16.1
Work Site	1.0	1.1	1.0	5.0	4.7	4.9
Eating	0.9	0.9	0.9	1.0	1.1	1.1
Shops	15.5	15.6	15.6	4.4	4.8	4.6
Bank	0.2	0.2	0.2	0.3	0.2	0.2
Bus IC	0.3	0.3	0.3	0.3	0.3	0.3
Airport	0.0	0.0	0.0	0.8	0.9	0.9
Sports	0.5	0.5	0.5	0.9	1.0	0.9
Church	0.5	0.5	0.5	0.4	0.4	0.4
Factory	5.3	5.6	5.4	5.1	5.2	5.2
School	20.9	21.6	21.3	9.4	9.4	9.4
Public	0.8	0.7	0.7	1.8	1.8	1.8
Others	1.3	1.4	1.4	5.8	5.9	5.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

2) Demand by Household Income

Demand by income level is shown in Figure 4.26 and Table 4.50. Public trasport users are more from the lower income level compared with private transport users. It is interesting to know that the traffic distribution pattern of MRT traffic is somewhat between those of car and trunk bus as shown in Figure 4.27. This implies that the diversion to MRT was made from the public mode trip being made by the households with higher income or those of private cars. This fact would support the diversion to MRT was made largely by non fare factors.

Figure 4.26

Household Distribution of Public/Private Mode

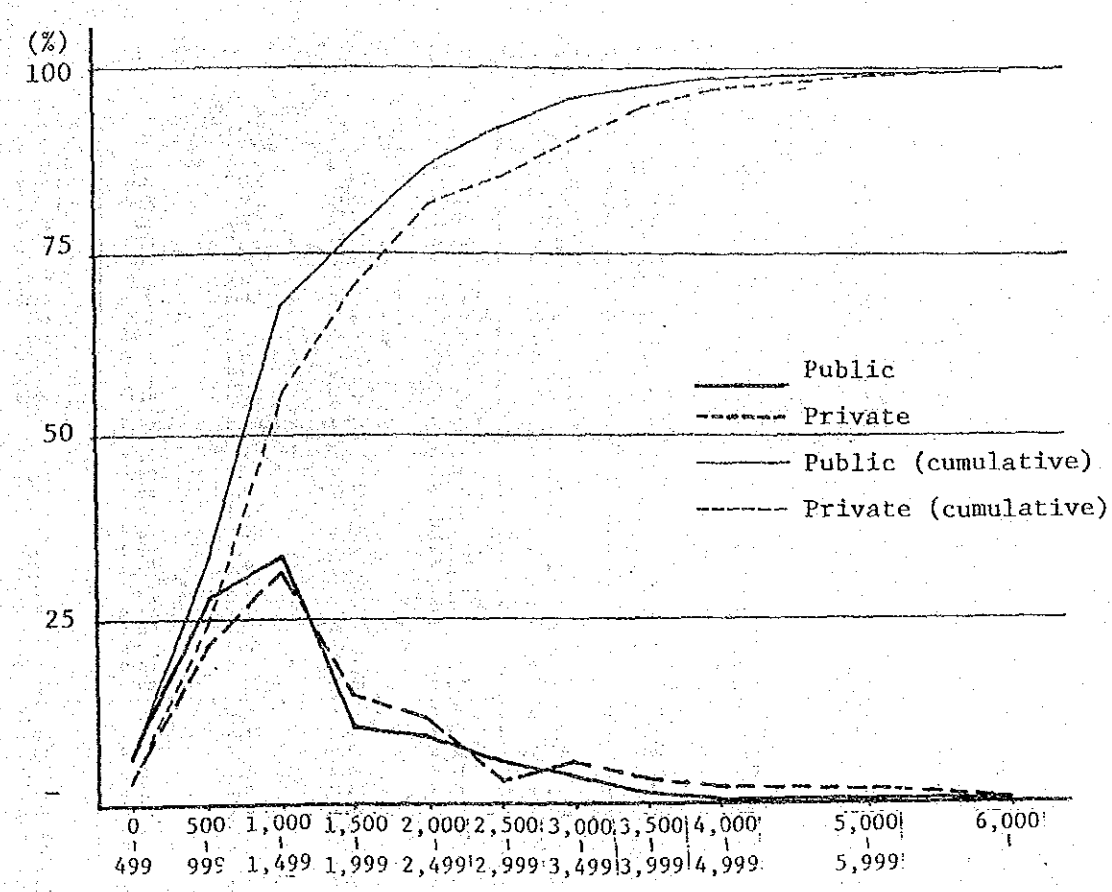


Figure 4.27

Distribution of Traffic of Major Transport Modes by Household Income

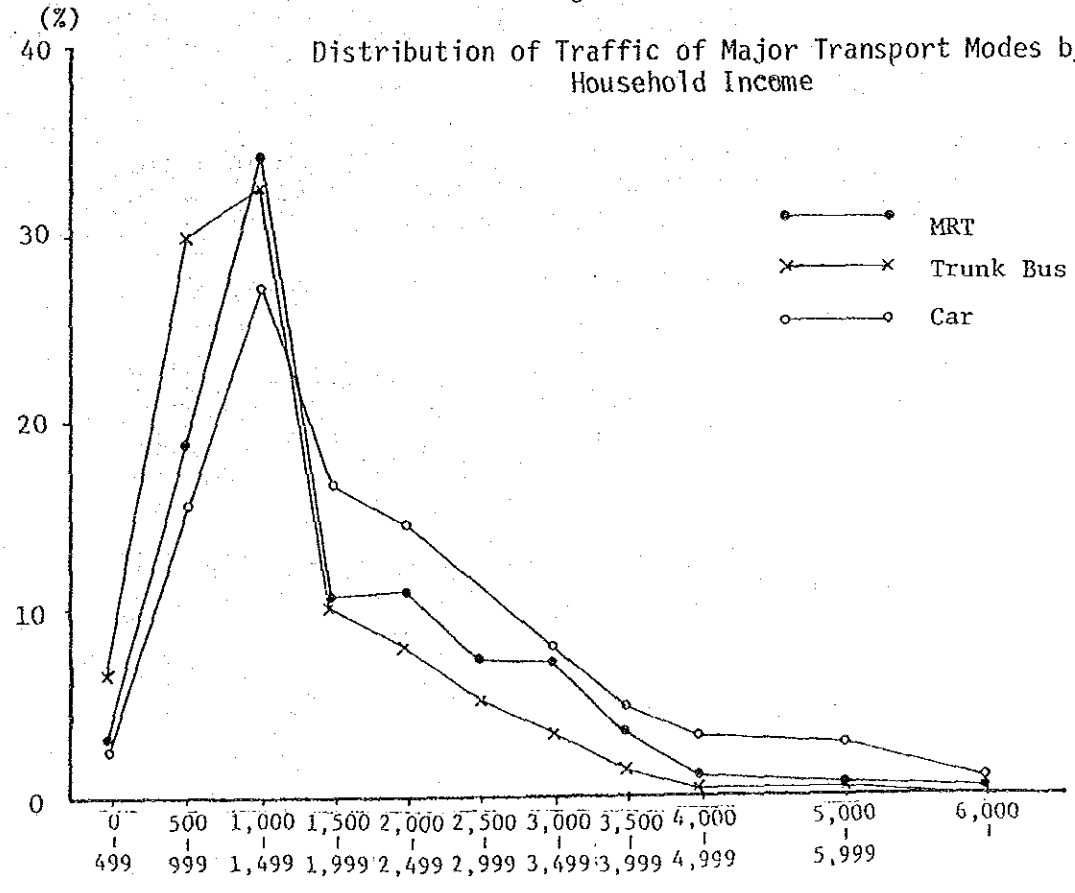


Table 4.50

Distribution of Trips by Household Income Level

	Public Mode					Private Mode					
	MRT	Trunk Bus	Feeder Bus	Others	Sub Total	Car	Car-pool	Taxi	Others	Sub Total	Total
Blow $500	1352	6497	1916	2011	11776	1031	0	0	881	1912	13687
500- 999	8065	29453	9580	13836	60934	6407	258	1413	4949	13027	73961
1000-1499	14511	31946	13172	14133	73792	11088	236	1686	6392	19301	93093
1500-1999	4538	9985	3217	5144	22884	6582	196	534	1697	9008	31892
2000-2499	1694	7980	3433	3127	19234	5841	181	0	1028	7050	26284
2500-2999	3108	5226	1686	1663	11673	1572	219	78	334	2203	13876
3000-3499	3175	3390	1199	1305	9069	3210	72	140	116	3544	12613
3500-3999	1497	1420	353	645	3915	1774	0	100	356	2230	6145
4000-4999	602	292	899	227	2020	1315	0	0	298	1613	3633
5000-5999	248	590	0	130	968	1130	0	0	98	1228	2196
6000 Over	72	246	0	214	532	288	0	154	0	442	974
Not Known	524	952	692	59	2227	0	59	62	0	121	2348
Total	42416	97977	36146	42484	219023	40244	1220	4066	16149	61679	280702
Average	1699.5	1387.5	1421.6	1386.8	1453.4	1963.4	1699.4	1480.8	1344.7	1764.4	1521.8
Blow $500	3.2	6.6	5.3	4.7	5.4	2.6	0.0	0.0	5.5	3.1	4.9
500- 999	19.0	30.1	26.5	32.6	27.8	15.9	21.1	34.8	30.6	21.1	26.3
1000-1499	34.3	32.6	36.4	33.3	33.7	27.6	19.3	39.0	39.6	31.3	33.2
1500-1999	10.7	10.2	8.9	12.1	10.4	16.4	16.0	13.1	10.5	14.6	11.4
2000-2499	11.1	8.1	9.5	7.4	8.8	14.5	14.8	0.0	6.4	11.4	9.4
2500-2999	7.3	5.3	4.7	3.9	5.3	3.9	18.0	1.9	2.1	3.6	4.9
3000-3499	7.5	3.5	3.3	3.1	4.1	8.0	5.9	3.4	0.7	5.7	4.5
3500-3999	3.5	1.4	1.0	1.5	1.8	4.4	0.0	2.6	2.2	3.6	2.2
4000-4999	1.4	0.3	2.5	0.5	0.9	3.3	0.0	0.0	1.8	2.6	1.3
5000-5999	0.6	0.6	0.0	0.3	0.4	2.8	0.0	0.0	0.6	2.0	0.8
6000 Over	0.2	0.3	0.0	0.5	0.2	0.7	0.0	3.8	0.0	0.7	0.3
Not Known	1.2	1.0	1.9	0.1	1.0	0.0	4.8	1.5	0.0	0.2	0.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Blow $500	9.9	47.5	14.0	14.7	86.0	7.5	0.0	0.0	6.4	14.0	100.0
500- 999	10.9	39.8	13.0	18.7	82.4	8.7	0.3	1.9	6.7	17.6	100.0
1000-1499	15.6	34.3	14.1	15.2	79.3	11.9	0.3	1.7	6.9	20.7	100.0
1500-1999	14.2	31.3	10.1	16.1	71.8	20.6	0.6	1.7	5.3	28.2	100.0
2000-2499	17.9	30.4	13.1	11.9	73.2	22.2	0.7	0.0	3.9	26.8	100.0
2500-2999	22.4	37.7	12.2	11.9	84.1	11.3	1.6	0.6	2.4	15.9	100.0
3000-3499	25.2	26.9	9.5	10.3	71.9	25.5	0.6	1.1	0.9	28.1	100.0
3500-3999	24.4	23.1	5.7	10.5	63.7	28.9	0.0	1.6	5.8	36.3	100.0
4000-4999	16.6	8.0	24.7	6.2	55.6	36.2	0.0	0.0	8.2	44.4	100.0
5000-5999	11.3	26.9	0.0	5.9	44.1	51.5	0.0	0.0	4.5	56.9	100.0
6000 Over	7.4	25.3	0.0	22.0	54.6	29.6	0.0	15.8	0.0	45.4	100.0
Not Known	22.3	40.5	29.5	2.5	94.8	0.0	2.5	2.6	0.0	5.2	100.0
Total	15.1	34.9	12.9	15.1	78.0	14.3	0.4	1.4	5.8	22.0	100.0

3) Modal Split

Table 4.51 shows the overall modal split, while Table 4.52 gives more detailed information on modal split by trip purpose. Characteristics are as follows:

a) 78% of the trips are made by public modes, while 22% by private modes.

b) Major public transport modes are trunk bus,(34.9% of the total demand) followed by MRT (15.1%), feeder bus (12.9%) and school bus (12.5%), while private mode include car (14.3%) followed by motorcycle (5.8%).

c) Private modes are relatively more used for "to work" and "private" trips, while for public modes, they are for "to work" and "to school" trips.

Table 4.51

Modal Share of Motorized Trips

Representative Mode		Trips		Trip Purpose Composition (%)				
		No.	%	To Work	To School	Part of Work	Private	To Home
Public Mode	MRT	42,300	15.1	27.4	5.0	0.5	20.3	46.8
	Trunk Bus	97,900	34.9	29.5	15.9	0.6	6.9	47.1
	Feeder Bus	36,200	12.9	23.2	17.7	0.1	10.4	48.6
	Scheme Bus	100	0.0	100.0	0	0	0	0
	School Bus	35,000	12.5	30.7	18.2	1.6	1.6	47.9
	Others	7,300	2.6	45.3	1.4	4.6	1.7	47.0
	Sub Total	218,800	78.0	28.8	14.0	0.8	9.0	47.4
Private Mode	Car	40,200	14.3	36.1	5.4	3.9	11.3	43.3
	Car-pool	1,200	0.4	42.5	0	0	5.4	52.1
	Taxi	4,100	1.5	20.4	7.0	3.0	22.9	46.7
	Motorcycle	16,100	5.8	44.5	0.8	4.7	1.9	45.5
	Subtotal	61,600	22.0	37.4	4.2	0.5	13.6	44.3
T O T A L		280,400	100.0	30.7	11.9	1.5	9.2	46.7

Table 4.52

Trip Generation/Attraction by Purpose and Mode

Mode	Trip Purpose							
	To Work	To School	Prt of Work	Prsnl Bsns	Shopping	Recreation	Eating	To Home
MRT	11603	2127	195	2296	2902	1155	2253	19808
Trunk Bus	28922	15578	529	3459	1433	899	826	46154
Feeder Bus	8398	6105	53	1058	1761	289	597	17585
Scheme B	128	0	0	0	0	0	0	0
School Bus	10739	6381	572	138	0	119	267	16791
Others	3319	99	339	72	0	0	53	3437
*Public	63109	30590	1788	7023	6096	2192	3996	103775
Motorcycle	7181	128	754	475	50	0	209	7349
Car	14531	2186	1561	2607	646	521	752	17437
Car-pool	519	0	0	0	0	0	65	630
Taxi	830	295	120	291	53	150	431	1899
*Private	23067	2609	2435	3379	749	671	1457	27321
Walk	6226	22267	588	5399	19232	784	5208	53561
Bicycle	1187	65	0	58	0	0	0	1388
*Walk	7413	22332	588	5457	19232	784	5208	54949
Total	93589	55522	4811	15859	26077	3947	10661	186045
MRT	12.4	3.8	4.1	14.5	11.1	29.3	21.1	10.6
Trunk Bus	30.9	28.1	13.1	21.8	5.5	22.8	7.7	24.8
Feeder Bus	9.0	11.5	1.1	6.7	6.8	7.3	5.6	9.5
Scheme B	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
School Bus	11.5	11.5	11.9	0.9	0.0	3.0	2.5	9.0
Others	3.5	0.2	7.0	0.5	0.0	0.0	0.5	1.8
*Public	67.4	55.1	37.2	44.3	23.4	63.1	37.5	55.8
Motorcycle	7.7	0.2	15.7	3.0	0.2	0.0	2.0	4.0
Car	15.5	3.9	32.4	16.4	2.5	13.2	7.1	9.4
Car-pool	0.6	0.0	0.0	0.0	0.0	0.0	0.6	0.3
Taxi	0.9	0.5	2.5	1.9	0.2	3.8	1.0	1.0
*Private	24.6	4.7	50.6	21.3	2.9	17.0	13.7	14.7
Walk	6.7	40.1	12.2	31.0	73.8	19.9	48.9	28.8
Bicycle	1.3	0.1	0.0	0.4	0.0	0.0	0.0	0.7
*Walk	7.9	40.2	12.2	31.4	73.8	19.9	48.9	29.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
MRT	27.4	5.0	0.5	5.4	6.9	2.7	5.3	46.8
Trunk Bus	29.5	15.9	0.6	3.5	1.5	0.9	0.8	47.1
Feeder Bus	23.2	17.7	0.1	2.9	4.9	0.8	1.7	48.6
Scheme B	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
School Bus	30.7	18.2	1.6	0.4	0.0	0.4	0.8	47.9
Others	15.3	1.4	4.6	1.0	0.0	0.0	0.7	47.0
*Public	28.8	14.0	0.8	3.2	2.8	1.1	1.8	47.4
Motorcycle	44.5	0.8	4.7	2.9	0.3	0.0	1.3	45.5
Car	36.1	5.4	3.9	6.5	1.6	1.3	1.9	43.3
Car-pool	42.5	0.0	0.0	0.0	0.0	0.0	5.3	52.1
Taxi	20.4	7.0	3.0	7.3	1.3	3.7	10.6	46.7
*Private	37.4	4.2	3.9	5.5	1.2	1.1	2.4	44.3
Walk	5.5	19.7	0.5	4.8	17.0	0.7	4.6	47.3
Bicycle	41.0	2.4	0.0	2.1	0.0	0.0	0.0	51.4
*Walk	6.4	19.3	0.5	4.7	16.6	0.7	4.5	47.4
Total	23.6	14.0	1.2	4.0	6.6	1.0	2.7	46.9

Modal Split between public and private transport is affected by household income level. As shown in Figure 4.28, as income level rises, private mode usage also increases. However, transport modes are dominating all the market except for the household income level of $5,000 and above.

Figure 4.29 shows the modal split between MRT and trunk bus users by household income. MRT is more relied on in the higher income level market.

Modal Split is also affected by household car ownership. Table 4.53 shows the share of modal split by car ownership for several category of transport mode. For public transport users, 75% belong to the non-car-owning households, while 74% of private transport users belong to car-owning households.

Figure 4.28

Modal Split by Household Income Level (Public vs. Private)

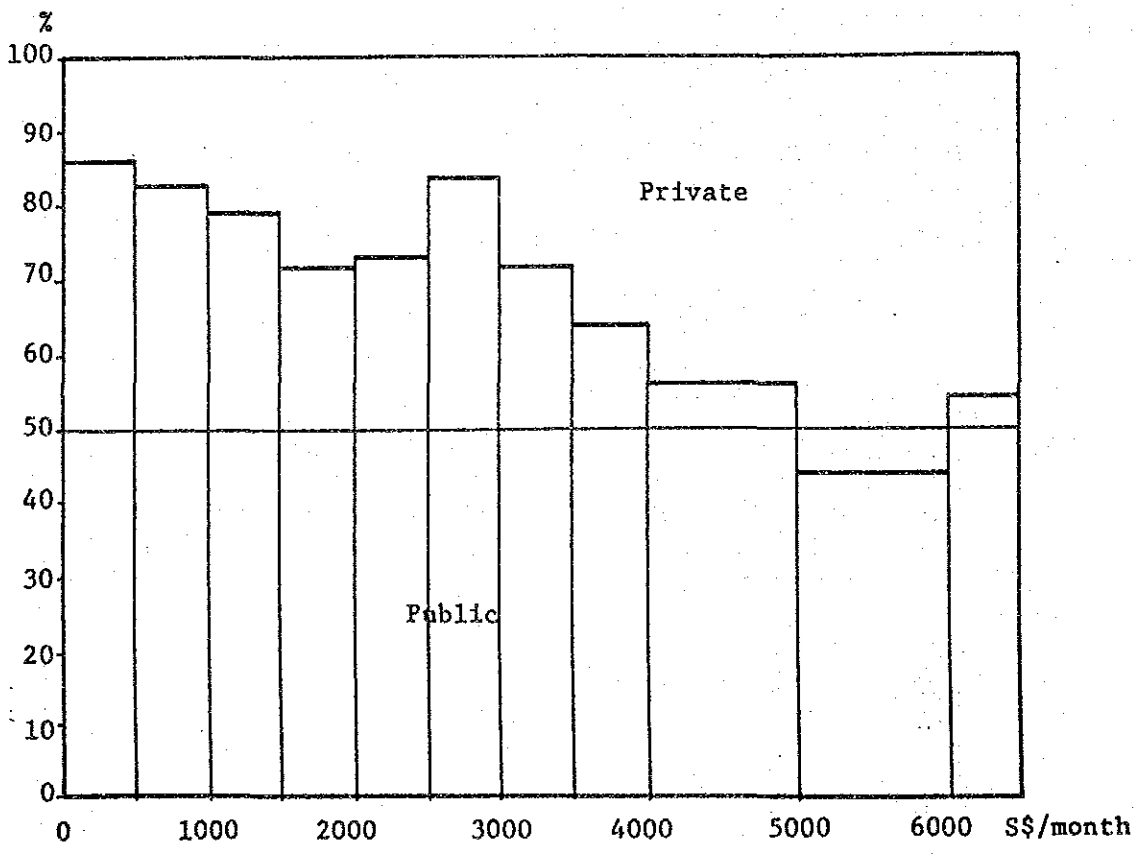


Figure 4.29

Modal Split by Household Income (MRT vs. Trunk Bus)

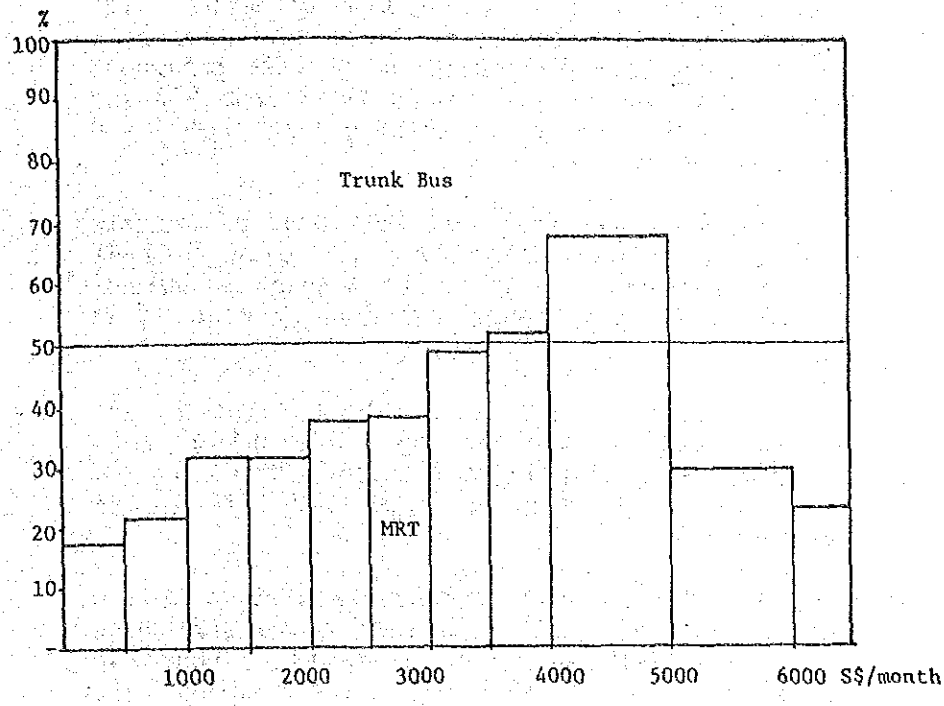


Table 4.53

Modal Split by Car Ownership

	Mode	Car Ownership		
		Owning	Non-Owning	Total
No. of Trips	MRT	11,010	31,406	42,416
	Trunk Bus	22,392	75,585	97,977
	Feeder Bus	10,262	25,884	36,146
	Others	0	128	128
	*Public	43,664	133,003	176,667
	Car	2,904	4,415	7,319
	Car-pool	0	0	0
	Taxi	8,873	7,276	16,149
	Others	35,199	5,045	40,244
	*Private	46,976	16,736	63,712
	Total	100,856	175,780	276,636
%	MRT	10.9	17.9	15.3
	Trunk Bus	22.2	43.0	35.4
	Feeder Bus	10.2	14.7	13.1
	Others	0.0	0.1	0.0
	*Public	43.3	75.7	63.9
	Car	2.9	2.5	2.6
	Car-pool	0.0	0.0	0.0
	Taxi	8.8	4.1	5.8
	Others	34.9	2.9	14.5
	*Private	46.6	9.5	23.0
	Total	100.0	100.0	100.0
%	MRT	26.0	74.0	100.0
	Trunk Bus	22.9	77.1	100.0
	Feeder Bus	28.4	71.6	100.0
	Others	0.0	100.0	100.0
	*Public	24.7	75.3	100.0
	Car	39.7	60.3	100.0
	Car-pool	-	-	-
	Taxi	54.9	45.1	100.0
	Others	87.5	12.5	100.0
	*Private	73.7	26.3	100.0
	Total	36.5	63.5	100.0

4) Hourly Distribution of Demand

The hourly distribution of demand both for public and private modes is shown in Figure 4.30. The time is based on the staring time of trips. The figure shows that there are two significant peak hours a day both for public and private transport modes. The morning peak hours start from 6-7 and last until 8-9, while the evening peak from 17-18 hours to 18-19 hours.

As for the morning peak, the peak hour of private transport occurrs slightly later than that of public transport. For public transport demand, another minor peak hours are found during 12-14 hours.

The peak ratio of public transport trips is 14% per hour both in the morning and evening peak. The peak ratio of private transport trips is 18% per hour in the morning peak and 13% in the evening peak.

Figure 4.30 also shows the hourly distribution of walk only trips. It shows that there are three peak hours: 7-10 in the morning, 12-13 hours in the afternoon and 18-19 hours in the evening. The peak ratio of the evening hours is smaller than the morning and afternoon peak.

Figure 4.31 shows the hourly distribution of demand by trip purpose.

Table 4.54 shows a summary of peak period ratio by mode and trip purpose.

Figure 4.30

Hourly Distribution of Demend Public

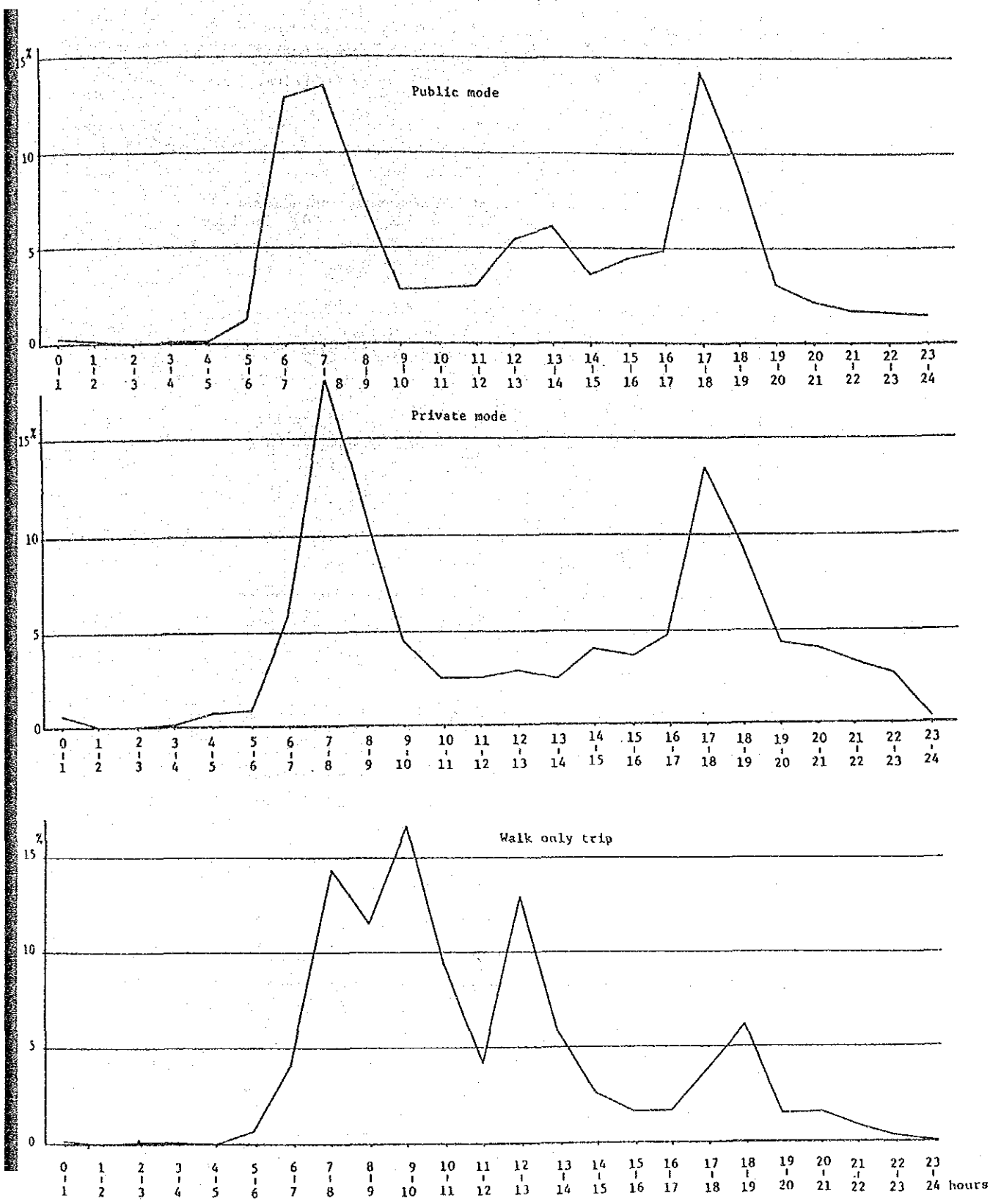


Figure 4.31

Hourly Distribution of Demand by Trip Purpose

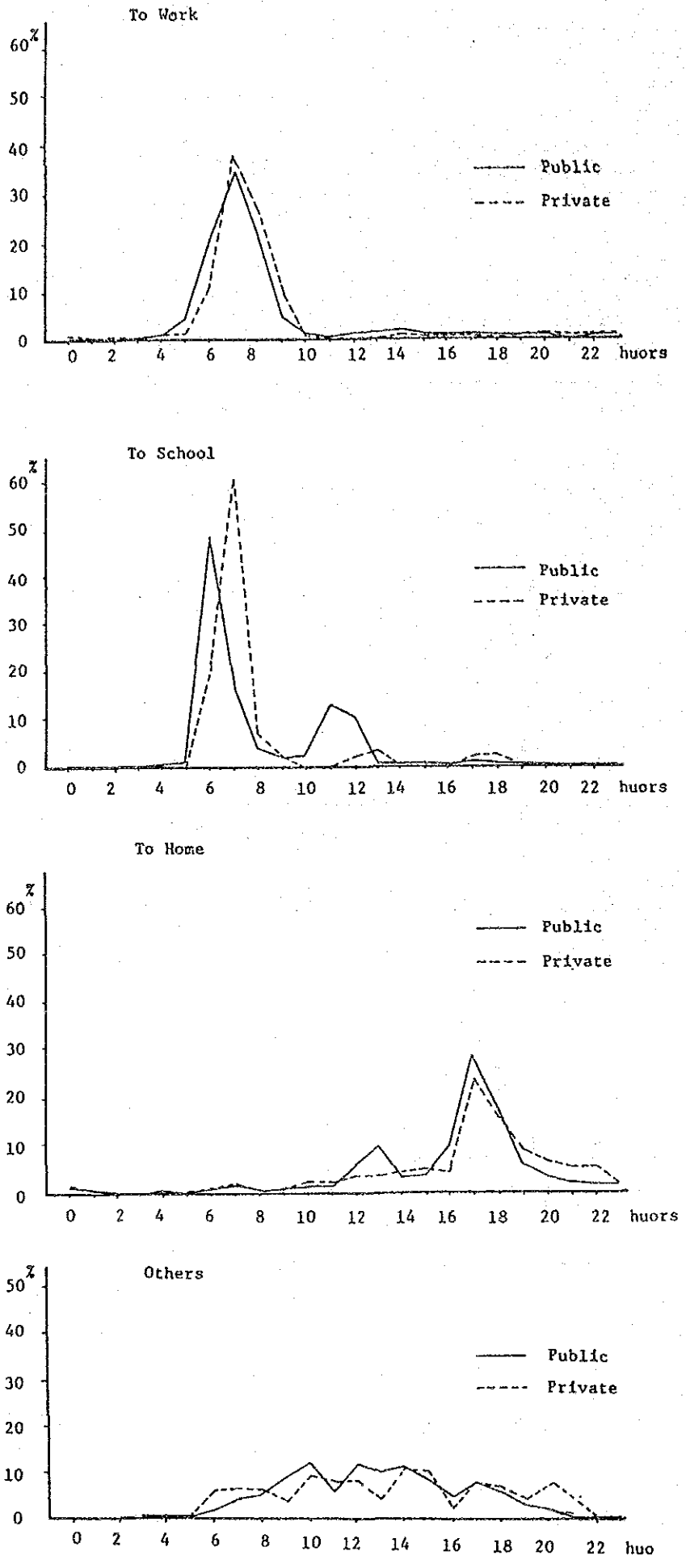


Table 4.54.

Peak Period Ratio By Mode and Trip Purpose

Peak Period	Public Mode (%)					Private Mode (%)					Walk only Trips (%)				
	To Work	To School	Others	To Home	Total	To Work	To School	Others	To Home	Total	To Work	To School	Others	To Home	Total
Morning Peak (0630-0830 hours)	61.8	56.2	9.0	1.8	27.5	62.7	82.3	14.1	2.3	29.6	44.4	54.8	31.3	5.3	24.3
Evening Peak (1645-1845 hours)	1.3	1.8	11.6	45.2	23.1	1.2	4.6	13.0	44.1	22.1	4.2	1.3	3.5	18.5	10.2

5) Travel Time

Table 4.55 shows the distribution and average travel time (door-to-door) of linked trips by mode, excluding the trips within new town.

For the public mode, the average travel times are 39.0 minutes for MRT, 47.7 minutes for trunk buses, 38.7 minutes for feeder bus, 42.5 minutes for Scheme B buses and 43.6 minutes for School/Company contract buses. For the private mode, 32.9 minutes for motorcycle, 32.5 minutes for cars, 37.5 minutes for car-pool passengers and 26.7 minutes for taxi, indicate generally shorter times for private mode.

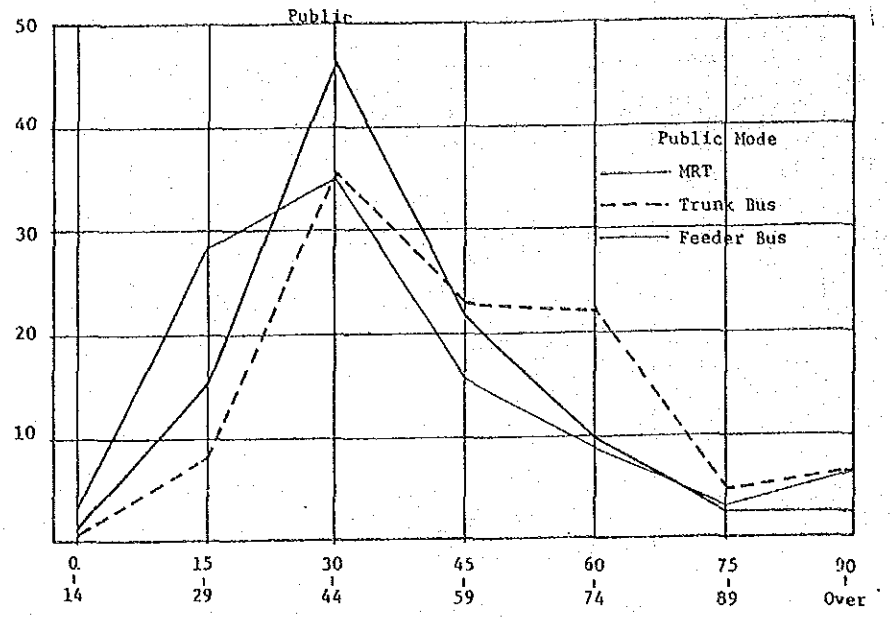
Figure 4.32 shows the distribution of travel time ranges for selected mode.

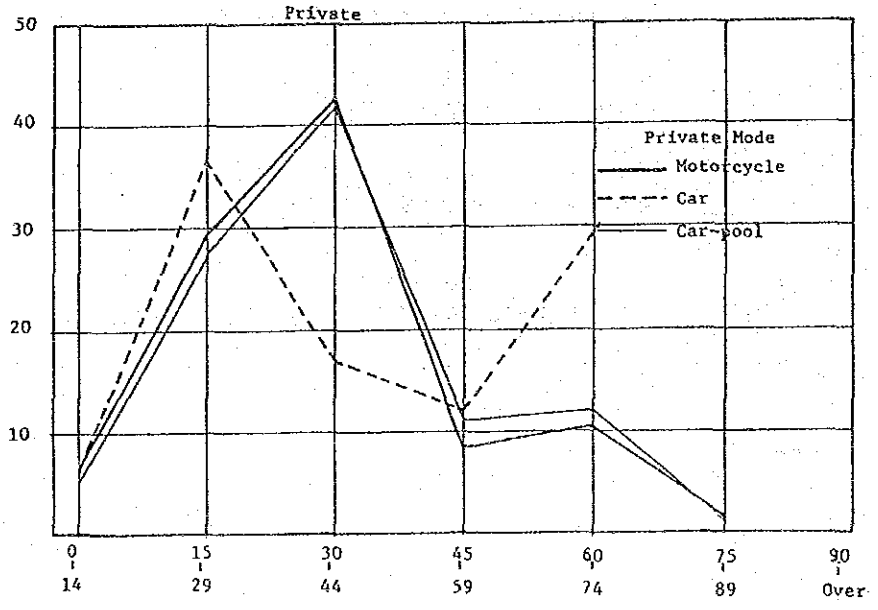
Table 4.55
Travel Time Distribution (Motorized Interzonal Only)

Representative Mode	% by Travel Time Range (Minutes)								Average (mins.)
	14 & Less	15-29	30-44	44-59	60-74	75-89	90 & more	Total	
MRT	1.7	15.7	47.2	21.3	9.7	2.2	2.3	100	39.0
Trunk Bus	0.5	8.2	35.5	23.1	21.6	4.6	6.4	100	47.7
Feeder Bus	3.1	28.0	35.3	15.4	8.8	2.8	6.6	100	38.7
Scheme B	-	-	50.0	50.0	-	-	-	100	42.5
School/ Company Bus	1.3	13.7	39.3	21.1	14.9	5.2	4.5	100	43.6
Others	-	8.9	43.1	22.4	18.2	4.1	3.3	100	43.9
Public Sub-total	1.0	11.6	39.4	22.1	17.0	3.9	4.9	100	44.4
Motorcycle	5.3	27.5	41.9	11.9	12.2	1.2	-	100	32.9
Car	5.7	29.3	42.6	9.0	10.1	1.3	1.9	100	32.5
Car-pool	5.0	36.8	16.9	11.9	29.4	-	-	100	37.5
Taxi	-	44.3	52.5	-	3.2	-	-	100	26.7
Private Sub-total	5.2	30.0	42.5	9.3	10.7	1.1	1.2	100	32.4
Total	2.0	15.8	40.1	19.2	15.6	3.3	4.1	100	41.7

Figure 4.32

Travel Time Distribution by Mode





4) OD Distribution and Traffic Movement

1) Overall Demand Distribution

As shown in Table 4.55 and Figure 4.33 the total number of person trips made by the residents of Ang Mo Kio new town is 397,000 linked trips. This comprises 281,000 motorized trips and 116,000 walk and bicycle trips. Motorized trips comprise intra-town trips of 67,000 or 24% of the total, inter-town trips of 206,000 or 73% of the total and 8,000 trips of 3% of the total which are accomplished outside the new town. As for walk and bicycle trips, about 95% of them are completed within the new town area.

Table 4.55

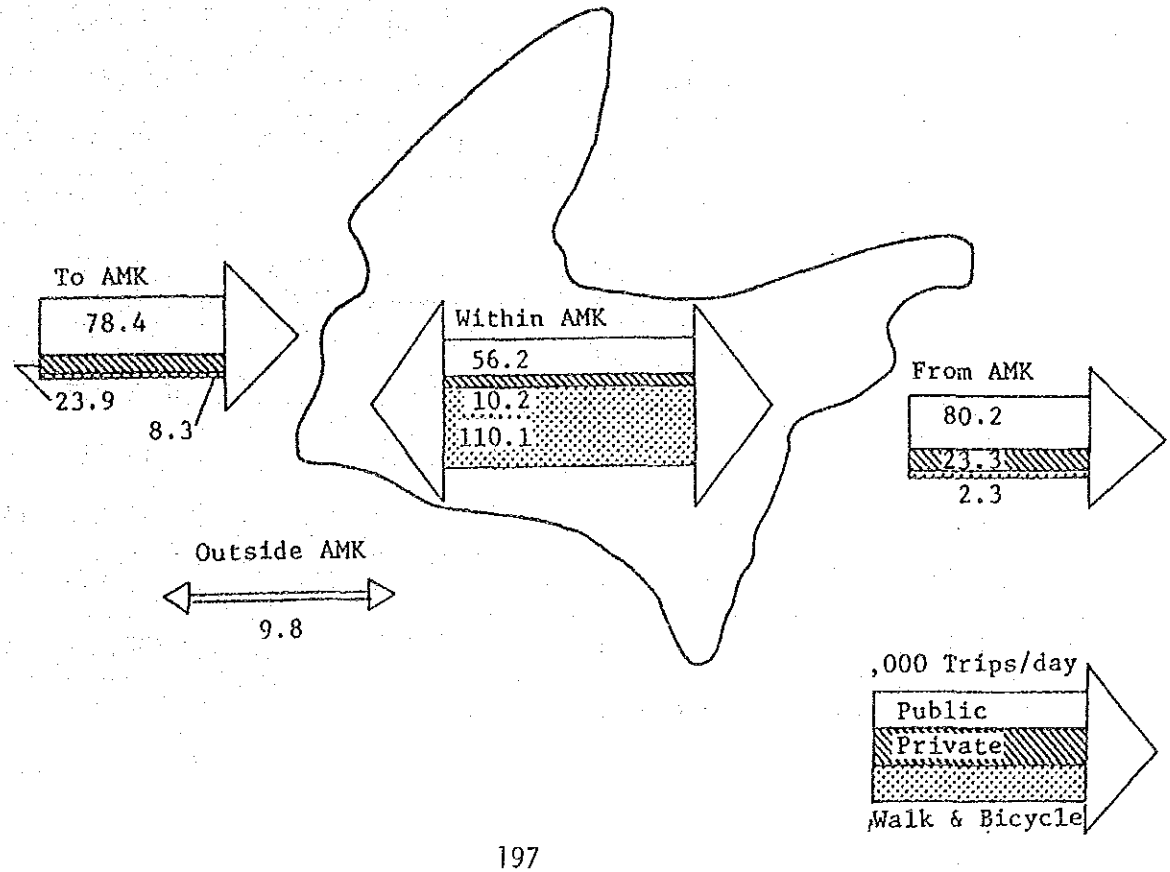
Overall Traffic Demand Distribution of
Ang Mo Kio New Town Residents

No. of Trips

	Within Ang Mo Kio New Town	From Ang Mo Kio New Town	To Ang Mo Kio New Town	Outside Ang Mo Kio New Town	Total
Motorized Trips					
Public	56,227 (25.7)	80,210 (36.6)	78,389 (35.8)	4,197 (1.9)	219,023 (100)
Private	10,287 (16.7)	23,257 (37.7)	23,934 (38.8)	4,136 (6.7)	61,614 (100)
Sub-total	66,514 (23.7)	103,467 (36.9)	102,323 (36.5)	8,333 (3.0)	280,367 (100)
Walk & Bicycle Trips	110,067 (94.7)	2,387 (2.1)	2,349 (2.0)	1,454 (1.3)	116,257 (100)
Total	176,581	105,854	104,672	9,787	396,894

Figure 4.33

Overall Traffic Demand Distribution of Ang Mo Kio
New Town Residents



2) Traffic Movement to/from Ang Mo Kio New Town

Table 4.56 and Figure 4.33 show the volume of traffic movement, between Ang Mo Kio new town and outside areas. Original SUTIS Traffic Zones are integrated into 14 zones from 60 zones. The largest inter-zonal traffic flow (42% of total) is found between the new town and the southern part of the Island including the CBD. The traffic flow between the new town and the CBD is 24% of the total. The modal split for the traffic flow to/from the new town is shown in Table 4.57.

TAble 4.56

Traffic Flow by Ang Mo Kio Residents Between
Ang Mo Kio New Town and Outside Areas

Integrated Zone	Public	Private	Total 1)
S3 South adj. AMK	8,566 (5.6)	2,851 (6.1)	12,053 (6.0)
S4 South Toa Payoh	14,349 (9.4)	3,453 (7.4)	18,153 (9.0)
S5 South adj. CBD	5,503 (3.6)	1,400 (3.0)	6,903 (3.4)
S6 South CBD	38,369 (25.3)	9,459 (20.3)	48,178 (23.8)
South Total	66,787 (44.0)	17,163 (36.9)	85,287 (42.2)
W7 West adj. CBD	9,937 (6.5)	3,425 (7.4)	13,688 (6.9)
W8 West 8	7,722 (5.1)	1,001 (2.1)	8,723 (4.3)
W9 West 9	19,299 (12.7	8,414 (18.1)	27,713 (13.7)
West Total	36,958 (24.3)	12,840 (27.6)	50,324 (24.9)
E10 East 10	11,709 (7.7)	2,714 (5.8)	14,495 (7.2)
E11 East 11	9,207 (6.1)	4,900 (10.5)	14,207 (7.0)
East Total	20,916 (13.8)	7,614 (16.4)	28,702 (14.2)
N12 North 12	2,639 (1.7)	806 (1.7)	3,980 (2.0)
N13 North 13	8,685 (5.7)	4,194 (9.0)	13,285 (6.6)
NE14 North East	15,949 (10.5)	3,948 (8.5)	20,552 (10.2)
North Total	27,273 (17.9)	8,948 (19.2)	37,817 (18.7)
Grand Total	151,934 (100)	46,565 (100)	202,130 (100)

1) Total: Including Walk and Bicycle Trips

Figure 4.34

Traffic flow to/from the Outside Areas

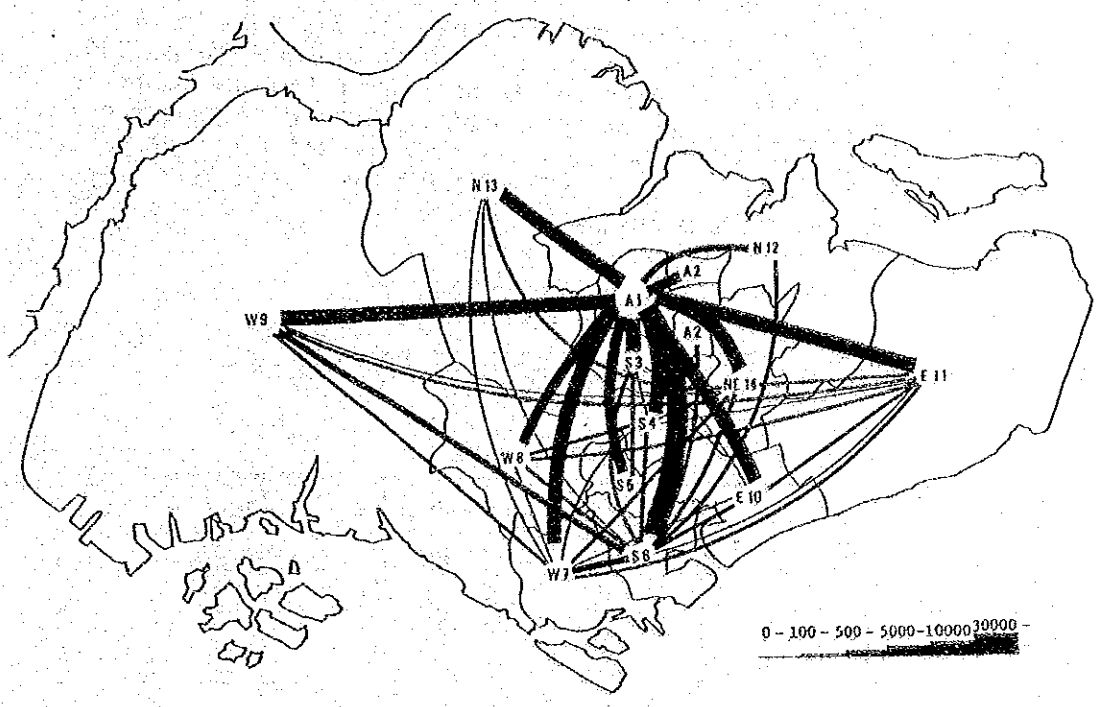


Table 4.58

Modal Share of Ang Mo Kio Residents Trips Between New Town and Outside Areas

Integrated Zone	Public	Private
S3 South adj. AMK	75.0	25.0
S4 South Toa Payoh	80.6	19.4
S5 South adj. CBD	79.7	20.3
S6 South CBD	80.2	19.8
South Total	79.6	20.4
W7 West adj. CBD	74.4	25.6
W8 West 8	88.5	11.5
W9 West 9	69.6	30.4
West Total	74.2	25.8
E10 East 10	81.2	18.8
E11 East 11	65.3	34.7
East Total	73.3	26.7
N12 North 12	76.6	23.4
N13 North 13	67.4	32.6
NE14 North East	80.2	19.8
North Total	75.3	24.7
Grand Total	76.5	23.5

3) Traffic Movement Within New Town

Traffic movement within Ang Mo Kio new town is shown in Table 4.58. The new town area is divided into 16 traffic zones as shown in Figure 4.34. Number of trips within Ang Mo Kio new town area is 176,600. 62 % are walk and bicycle trips, is also shown in Figure 4.34. The number of motorized trips within the new town is 66,500, of which the trips made by public transport are 56,200 or 84.5%, while those made by private transport is 10,300 or 15.5%. 62% of the bicycle and walk trips are intra-zonal movement.

Table 4.59

OD Table Within Ang Mo Kio New Town

Mode : Total

Origin \ Distination	1 AMK1.1	2 AMK1.2	3 AMK1.3	4 AMK2.1	5 AMK2.2	6 AMK3.1	7 AMK3.2	8 AMK3.3	9 AMK4.1	10 AMK4.2	11 AMK5.1	12 AMK5.2	13 AMK6	14 AMK7.1	15 AMK7.2	16 AMK7.3	AMK SubTot	Other SubTot	** GTotal
1 Ang Mo Kio 1.1	5692	1109	1332	874	715	624	993	635	627	301	754	-	1275	169	409	-	16337	13011	29348
2 Ang Mo Kio 1.2	1403	3671	1356	353	1035	111	554	170	414	600	958	-	1349	350	112	-	13346	8432	21778
3 Ang Mo Kio 1.3	1387	1856	2307	426	803	357	494	-	309	406	430	-	1779	302	118	60	16994	12713	29707
4 Ang Mo Kio 2.1	954	639	362	1213	1378	59	463	300	1875	409	-	-	1042	58	58	-	8863	2379	11242
5 Ang Mo Kio 2.2	872	1034	743	1382	3322	365	1286	53	1277	398	330	-	763	183	125	58	18352	15451	33803
6 Ang Mo Kio 3.1	474	111	257	59	365	-	619	145	702	236	65	-	259	-	-	-	3291	215	3506
7 Ang Mo Kio 3.2	1112	317	191	395	1305	619	15250	2535	1233	228	502	-	684	297	290	-	26103	13471	39619
8 Ang Mo Kio 3.3	558	173	59	300	59	145	2436	6095	150	697	510	-	337	-	75	77	10670	5199	15869
9 Ang Mo Kio 4.1	533	414	369	1938	1022	701	1077	150	7236	1553	557	-	391	389	547	-	17353	11422	28775
10 Ang Mo Kio 4.2	201	900	512	544	319	314	225	697	1409	4058	333	-	675	142	156	77	10152	8011	19169
11 Ang Mo Kio 5.1	819	395	490	-	939	-	502	516	1014	393	79	-	1025	-	-	-	6971	137	6905
12 Ang Mo Kio 5.2	-	-	-	-	-	-	-	-	-	-	-	-	49	-	-	-	49	-	49
13 Ang Mo Kio 6	1344	2066	1607	1141	793	257	634	337	391	517	972	49	13381	305	308	151	23793	15217	39006
14 Ang Mo Kio 7.1	-	305	496	69	183	-	237	-	312	78	-	-	306	-	-	59	2095	125	2220
15 Ang Mo Kio 7.2	337	112	115	129	125	-	296	73	331	155	-	-	295	-	-	-	1993	-	1993
16 Ang Mo Kio 7.3	-	-	59	-	58	-	-	77	-	77	-	-	206	59	-	-	531	-	531
* Ang Mo Kio Total	19365	13542	15682	5600	17313	3451	25927	10944	17247	10977	6566	49	21070	2160	2206	455	176651	105354	282135
* Others' Total	12733	8424	12900	2504	15266	52	13350	5330	11278	7934	137	-	14715	49	-	-	104072	9787	113859
** Grand Total	29098	21966	29782	11304	33179	3503	39277	16174	28525	18011	6703	49	38785	2209	2206	452	281253	115641	396894

Mode : Public

Origin \ Distination	1 AMK1.1	2 AMK1.2	3 AMK1.3	4 AMK2.1	5 AMK2.2	6 AMK3.1	7 AMK3.2	8 AMK3.3	9 AMK4.1	10 AMK4.2	11 AMK5.1	12 AMK5.2	13 AMK6	14 AMK7.1	15 AMK7.2	16 AMK7.3	AMK SubTot	Other SubTot	** [illegible]
1 Ang Mo Kio 1.1	226	522	131	611	190	341	319	339	271	291	623	-	1260	69	409	-	5633	10065	[illegible]
2 Ang Mo Kio 1.2	401	390	311	-	496	111	212	173	235	446	617	-	409	71	59	-	4535	5570	[illegible]
3 Ang Mo Kio 1.3	131	211	61	191	125	193	130	-	151	406	302	-	1439	240	119	60	4160	12063	[illegible]
4 Ang Mo Kio 2.1	654	224	120	62	545	58	160	77	702	336	-	-	820	-	59	-	3818	2932	[illegible]
5 Ang Mo Kio 2.2	559	486	-	366	562	183	357	-	183	193	370	-	705	-	62	-	5130	12065	[illegible]
6 Ang Mo Kio 3.1	244	111	193	65	193	-	541	145	545	230	65	-	259	-	-	-	2686	65	[illegible]
7 Ang Mo Kio 3.2	793	275	130	166	157	541	355	151	624	79	335	-	600	73	332	-	6094	2231	[illegible]
8 Ang Mo Kio 3.3	230	173	-	627	-	146	73	-	77	150	216	-	337	-	-	77	1755	3837	[illegible]
9 Ang Mo Kio 4.1	450	253	77	625	235	545	624	77	73	77	234	-	312	77	311	-	4849	6634	[illegible]
10 Ang Mo Kio 4.2	201	445	342	311	319	230	79	150	155	-	-	-	520	142	-	-	2901	5973	[illegible]
11 Ang Mo Kio 5.1	751	591	303	-	312	-	373	222	331	-	73	-	376	-	-	-	4473	-	[illegible]
12 Ang Mo Kio 5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
13 Ang Mo Kio 6	1229	521	1271	315	703	257	656	337	312	362	920	-	774	101	192	50	8193	10577	[illegible]
14 Ang Mo Kio 7.1	-	135	302	-	-	-	151	-	77	79	-	-	101	-	-	59	910	77	[illegible]
15 Ang Mo Kio 7.2	337	62	119	129	62	-	323	-	314	-	-	-	102	-	-	-	1314	-	[illegible]
16 Ang Mo Kio 7.3	-	-	59	-	-	-	-	77	-	-	-	-	50	59	-	-	216	-	[illegible]
* Ang Mo Kio Total	6199	4975	3730	3067	5235	2613	6065	1693	4577	3502	4287	-	3336	826	1311	216	56227	56216	[illegible]
* Others' Total	9395	6098	10004	2145	12329	52	9931	3337	9264	5701	-	-	10103	-	-	-	78395	4127	[illegible]
** Grand Total	15334	11073	12734	5212	17564	2665	14996	5529	13841	8439	4287	-	13939	826	1311	216	134619	84107	[illegible]

Mode : Private

Origin \ Distination	1 AMK1.1	2 AMK1.2	3 AMK1.3	4 AMK2.1	5 AMK2.2	6 AMK3.1	7 AMK3.2	8 AMK3.3	9 AMK4.1	10 AMK4.2	11 AMK5.1	12 AMK5.2	13 AMK6	14 AMK7.1	15 AMK7.2	16 AMK7.3	AMK SubTot	Other SubTot	GTotal
1 Ang Mo Kio 1.1	101	-	61	200	65	230	-	142	-	-	65	-	150	-	-	-	1133	2145	[illegible]
2 Ang Mo Kio 1.2	-	-	61	130	[illegible]	-	307	-	-	77	177	-	[illegible]	65	-	-	[illegible]	1706	[illegible]
3 Ang Mo Kio 1.3	-	137	-	-	45	-	-	-	-	-	125	-	321	-	-	-	[illegible]	2522	[illegible]
4 Ang Mo Kio 2.1	221	130	-	-	171	-	-	72	162	77	-	-	[illegible]	-	-	-	291	317	[illegible]
5 Ang Mo Kio 2.2	31	91	121	174	121	-	53	65	313	[illegible]	116	-	59	-	-	-	1153	2949	[illegible]
6 Ang Mo Kio 3.1	130	-	-	-	-	-	-	-	73	-	-	-	-	-	-	-	205	150	[illegible]
7 Ang Mo Kio 3.2	223	-	-	-	-	-	-	-	-	-	73	-	-	73	73	-	117	[illegible]	[illegible]
8 Ang Mo Kio 3.3	65	-	-	-	55	-	-	-	-	-	72	-	-	-	-	-	135	1071	1252
9 Ang Mo Kio 4.1	77	72	-	156	300	156	-	-	156	151	156	-	-	77	77	-	1475	2535	[illegible]
10 Ang Mo Kio 4.2	-	77	-	77	-	-	-	-	-	-	77	-	-	-	155	-	357	1549	[illegible]
11 Ang Mo Kio 5.1	65	177	121	-	116	-	73	72	150	77	-	-	49	-	-	-	303	127	[illegible]
12 Ang Mo Kio 5.2	-	-	-	-	-	-	-	-	-	-	-	-	49	-	-	-	49	-	49
13 Ang Mo Kio 6	156	-	274	103	-	-	-	-	-	-	-	49	248	-	49	-	978	4467	5445
14 Ang Mo Kio 7.1	-	-	-	-	-	-	-	-	77	-	-	-	-	-	-	-	77	19	[illegible]
15 Ang Mo Kio 7.2	-	-	-	-	-	-	73	-	-	156	-	-	49	-	-	-	278	-	[illegible]
16 Ang Mo Kio 7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
* Ang Mo Kio Total	1601	714	659	399	1337	135	411	344	937	511	860	49	1133	220	355	-	10337	23357	[illegible]
* Others' Total	3617	2224	2709	359	2700	-	2973	1132	2781	1234	137	-	4465	49	-	-	33331	4105	[illegible]
** Grand Total	4118	2908	3365	1358	3937	436	3389	1476	3718	2335	997	49	5598	269	355	-	[illegible]	27393	[illegible]

Mode : Walk and Bicycle

Origin \ Destination	1 AMK1.1	2 AMK1.2	3 AMK1.3	4 AMK2.1	5 AMK2.2	6 AMK3.1	7 AMK3.2	8 AMK3.3	9 AMK4.1	10 AMK4.2	11 AMK5.1	12 AMK5.2	13 AMK6	14 AMK7.1	15 AMK7.2	16 AMK7.3	AMK SubTot	Other SubTot	GTotal
1 Ang Mo Kio 1.1	1271	377	1137	-	191	-	120	313	156	-	-	-	169	109	-	-	[illegible]	261	[illegible]
2 Ang Mo Kio 1.2	951	2721	1981	222	488	-	75	-	120	73	64	-	1339	120	53	-	[illegible]	102	[illegible]
3 Ang Mo Kio 1.3	1250	1259	2312	212	133	61	61	-	155	-	51	-	119	53	-	-	[illegible]	128	13151
4 Ang Mo Kio 2.1	-	233	215	1151	659	-	306	161	1013	156	-	-	104	56	-	-	[illegible]	-	1136
5 Ang Mo Kio 2.2	419	481	613	543	3935	192	371	-	175	-	-	-	-	133	53	53	12963	237	[illegible]
6 Ang Mo Kio 3.1	-	-	65	-	155	-	75	-	75	-	-	-	-	-	-	-	[illegible]	-	403
7 Ang Mo Kio 3.2	159	73	31	229	312	72	15565	2425	302	113	234	-	73	140	-	-	20929	653	[illegible]
8 Ang Mo Kio 3.3	213	-	43	73	-	-	2353	5085	79	517	222	-	-	-	75	-	8720	233	[illegible]
9 Ang Mo Kio 4.1	156	77	232	1157	337	-	453	73	7002	1332	157	-	79	306	155	-	11502	233	[illegible]
10 Ang Mo Kio 4.2	-	79	-	156	-	72	142	547	1253	4063	310	-	156	-	-	77	[illegible]	389	[illegible]
11 Ang Mo Kio 5.1	-	54	91	-	-	-	155	233	457	315	-	-	-	-	-	-	1282	-	[illegible]
12 Ang Mo Kio 5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13 Ang Mo Kio 6	452	1545	119	104	-	-	79	-	79	155	52	-	11259	204	167	101	14312	151	[illegible]
14 Ang Mo Kio 7.1	-	169	173	59	132	-	146	-	158	-	-	-	234	-	-	-	1036	-	[illegible]
15 Ang Mo Kio 7.2	-	53	-	-	63	-	-	72	77	-	-	-	105	-	-	-	370	-	[illegible]
16 Ang Mo Kio 7.3	-	-	-	-	55	-	-	-	-	77	-	-	150	-	-	-	232	-	[illegible]
* Ang Mo Kio Total	3335	7353	12502	4234	11441	102	30451	8811	11733	6268	1419	-	14101	1114	597	236	110067	2307	112151
* Others' Total	251	102	188	-	237	-	141	361	233	389	-	-	147	-	-	-	2343	1454	3803
** Grand Total	3616	7355	12690	4234	11678	102	30592	9172	11966	7257	1419	-	14248	1114	597	236	112416	3841	115357

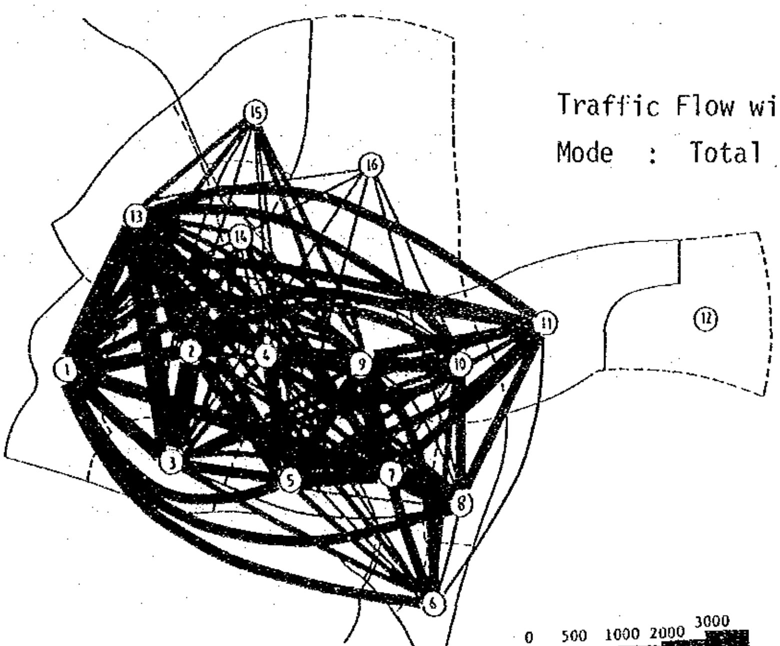


Figure 4.35

Traffic Flow within Ang Mo Kio New Town

Mode : Total Purpose : Total

5) Car Utilization

This section intends to look into more detailed characteristics of car utilization by Ang Mo Kio residents.

As shown in Table 4.60, the head of the household uses cars most frequently and regularly. 77.1% of the car users are the household heads who use them 5 to 7 days a week, while the second group includes other family members who use the car 5 to 7 days a week, which is only 12.1%.

Table 4.60

Frequency of Using Cars

User \ Frequency		Number of Days/Week						
		5-7	3-4	1-2	Seldom	Not At All	No Answer	Total
Head of Household	No.	13,466	727	279	179	653	794	16,078
	%	(77.1)	(4.2)	(1.6)				
	%	83.6	4.5	1.7	1.1	4.1	4.9	100.0
Other Family member	No.	2,108	381	502	1,235	6,056	5,796	16,078
	%	(12.1)	(2.2)	(2.9)				
	%	13.1	2.4	3.1	7.7	37.7	36.0	100.0
TOTAL	No.	15,574	1,108	781	1,414	6,709	13,299	--
		17,463 (100.0%)			8,123		--	25,586

Table 4.61 summarizes the influence of car ownership and utilization on household economy. Although some figures answered all doubtful, it can be said that car owners perceive that car ownership and utilization are not serious burden to household economy.

However, those who do not own cars say that the restrictive factors against car ownership are mainly "expensive to own" rather than "expensive to use". (See Table 4.62).
This implies that current car ownership policy is felt by the people to be restrictive more on ownership than use.

Therefore, once you are able somehow to own a car, monthly expenditure is relatively tolerable.

Table 4.61

Car Ownership and Utilization

Household Income Range : $/month	% of Owner-ship	Ave. No. of Days/ Wk to Use Cars	Ave. Expense for Car, $/month	Perception of Car Expenses Burden to Household, %		
				Highly	Slightly	Not at all
Below - 500	24.3	5.3	345.4	8.2	32.8	59.0
500 - 999	20.2	5.7	181.7	8.3	29.4	62.3
1000 - 1499	33.1	5.5	250.6	7.6	36.8	55.6
1500 - 1999	38.8	5.3	273.8	2.2	28.6	69.2
2000 - 2499	51.3	5.4	285.4	1.6	42.4	56.2
2500 - 2999	34.2	5.7	295.1	0	49.6	50.4
3000 - 3499	66.1	5.2	398.7	0	19.5	80.5
3500 - 3999	41.7	6.0	193.1	0	0	0
4000 - 4999	53.1	6.0	499.3	0	0	0
5000 - 5999	53.4	2.6	452.7	0	0	0
6000 & above	75.1	6.0	347.4	0	0	0
TOTAL	32.2	5.5	268.5	4.9	31.9	63.2

Table 4.62

Restrictive Factors from Car Ownership

(Multi-Answer)

Reason	Expensive To Own	Expensive To Use	Other Modes Available	No Car Parking	Others	No Answer	Total
No. of Household	21,348	9,614	11,762	446	3,922	1,330	48,422
(%)	(44.1)	(19.9)	(24.3)	(0.9)	(8.1)	(2.7)	(100)

Table 4.63 shows what will be the expected purposes for car use by non car owners when they own one. Majority of the households (61.0%) indicated that they would use the car (if they buy it) for "to work" purpose; 25.0% of the households, would like to use it for family activities.

Table 4.63

Expected Purpose for Car Usage Non-Car Owners

(Multi-Answer)

Purpose	To/From Work	To/From Work	Family Activities	Private Business	Others	No Answer	Total
No. of Household	20,677	246	8,468	847	1,475	2,185	33,898
(%)	(61.0)	(0.7)	(25.0)	(2.5)	(4.4)	(6.4)	100

6) Impact of MRT

The partial opening of MRT (between Yio Chu Kan and Clementi via CBD as of the HIS period, April 1988) gave considerable impact on the traffic movement to/from Ang Mo Kio New Town. Of the total motorised trips to/from AMK New Town of about 206,000/day, approximately 20% or 40,000 trips/day diverted to MRT. Table 4.64 shows the overall pattern of how the traffic has diverted to MRT. The features are as follows:

a) The diversion is significant between Ang Mo Kio and the areas where MRT is served. Of the total MRT traffic from New Town to outside areas, 86% accounts for that to the MRT served areas.

b) The modal choice has, accordingly, been significantly changed. Although MRT shares 20% of the total traffic demand, the share increases to 28% to the areas served by MRT.

Table 4.64

Modal Choice of AMK Residents
(From Town to Outside Only)

Representative Mode	To the Areas Covered by MRT		To the Areas Not Covered by MRT		Total	
	000 Trips	%	000 Trips	%	000 Trips	%
PUBLIC MODE						
1) Trunk Bus	23.6	38.3	19.4	51.0	43.0	43.2
2) MRT	17.1	27.8	2.8	7.4	19.9	20.0
3) Feeder Bus	1.2	2.0	1.2	3.2	2.4	2.4
4) School Bus	4.2	6.8	4.6	12.1	8.8	8.8
5) Others	1.5	2.4	1.1	2.9	2.6	2.6
Sub Total	47.6	77.3	29.1	76.6	76.7	77.0
PRIVATE MODE						
1) Car	8.6	14.0	6.2	16.3	14.8	14.9
2) Car-pool	0.5	0.8	0.1	0.3	0.6	0.6
3) Taxi	0.5	0.8	0.3	0.8	0.8	0.8
4) Motorcycle	4.4	7.1	2.3	6.0	6.7	6.7
Sub Total	14.0	22.7	8.9	23.4	22.9	23.0
Total	61.1	100.0	38.0	100.0	99.6	100.0
Walk/Bicycle	0.6	-	1.1	-	1.7	-

Source : 1988 AMK HIS

Table 4.65 shows the modal split among three major modes of travel between Ang Mo Kio and outside New Towns. The characteristics are as follows:

a) Reduction in average door-to-door travel time from New Town to the MRT served area is significant (39.5 minutes against 52.0 minutes by trunk bus). This is likely the most important factor to explain diversion. However, a question can be raised, at the same time, why the diversion is not so significant compared to the reduction in travel time. This is probably due to the fact that trunk bus still has a much more extensive network to serve traffic demand directly, while MRT is a single line which, therefore, has to be associated with transfers. This implies that fare system between feeder transport and MRT, such as through-ticketing and convenience at transfer point, will further affect the diversion significantly.

b) As shown in Figure 4.36, the average travel time using MRT has been reduced fairly close to the level of the car. This implies that additional efforts for further reduction by improving feeder services would give a fairly realistic opportunity to compete with car transport.

Table 4.65

Modal Choice and Travel Time of AMK Residents

From AMK To	Major Representative Mode	All Purpose		To Work	
		Modal Split (%)	Ave Travel Time (Min)	Modal Split (%)	Ave. Travel Time (Min)
The Areas Served by MRT	Trunk Bus	47.8	52.0	49.7	54.4
	MRT	34.8	39.5	29.9	44.0
	Car	17.4	35.2	20.4	34.7
	Sub Total	100.0	44.7	100.0	47.3
The Areas Not Served by MRT	Trunk Bus	68.3	46.4	63.0	48.1
	MRT	9.9	48.5	11.1	48.0
	Car	21.8	29.6	25.9	31.5
	Sub Total	100.0	42.9	100.0	43.8
All Areas	Trunk Bus	55.3	49.4	54.9	51.5
	MRT	25.7	40.8	22.5	44.8
	Car	19.0	32.8	22.5	33.3
	Sub Total	100.0	44.0	100.0	45.9

Source : 1988 AMK HIS

Figure 4.36

Average Travel Time of AMK Residents

(From Town to Outside Only)

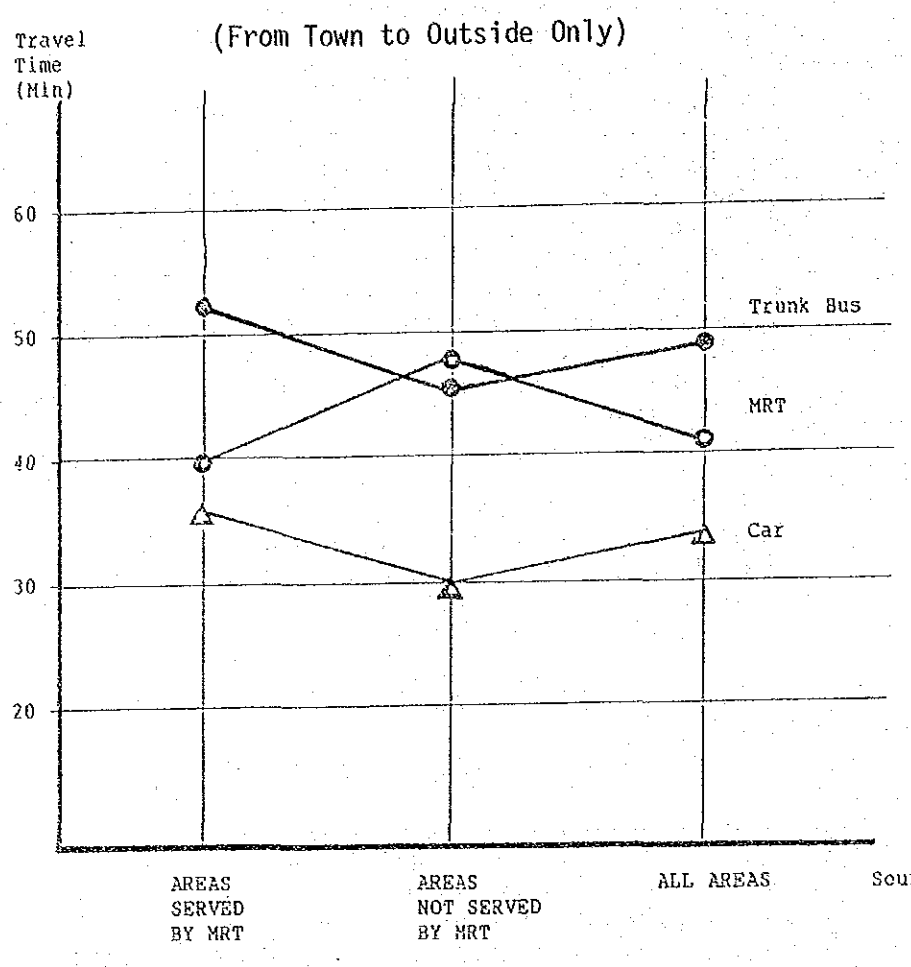


Table 4.66 shows the summary of how the activities of Ang Mo Kio residents and their perception on travel have changed due to the MRT.

The characteristics are as follows :

a) 94.2% of the residents say travel time has been reduced a reduction in average travel time of 17 minutes. Considering that 5.8% say their travel time increased by 13 minutes, the weighted average of travel time reduction is 15.3 minutes.

b) On the contrary, 91.4% of the residents say fare has been increased by 27 cents on the average, while 8.6% say it decreased by 91 cents. The weighted average of travel fare increase is 17 cents.

c) 63.5% of the residents say walking distance has increased by 11 minutes, while 36.5% say it decreased by 8 minutes. The weighted average of increase in walking distance is 4 minutes.

d) 95% of the residents feel punctuality and reliability of travel have been increased. Half of them consider the increase is considerable.

Table 4.66

Changes in Transport Features Due to MRT

		No. of Answers		% 1/	
		Decreased	Increased	Decreased	Increased
Travel Time (minutes)	1 - 5	1,439	58	96.1	3.9
	6 - 10	4,372	496	93.7	6.3
	11 - 15	4,217	318	93.0	7.0
	16 - 20	3,232	116	96.5	3.5
	21 - 30	3,534	52	98.5	1.5
	31 -	193	0	100.0	0
	No Answer	690	71	-	-
	Total	17,677	1,111	94.2	5.8
	Average	17	13	-	-
Fare (cent)	1 - 10	267	2,583	6.9	93.1
	11 - 20	58	4,063	1.4	98.6
	21 - 30	235	1,467	13.8	86.2
	31 - 50	192	1,308	12.8	87.2
	51 - 100	77	929	7.7	92.3
	101 -	151	150	50.2	49.8
	No Answer	144	457	-	-
	Total	1,124	11,957	8.6	91.4
	Average	91	27	-	-
Walking Distance (min)	1 - 5	1,358	1,049	58.8	41.2
	6 - 10	1,563	3,362	31.7	
	11 - 15	137	602	18.5	81.5
	16 - 20	71	316	18.3	81.7
	21 -	0	112	0	100.0
	No Answer	183	985	-	-
	Total	3,312	6,426	36.5	63.5
	Average	8	11	-	-
Punctuality	Slightly	510	7,633	3.4	51.2
	Considerable	215	6,547	1.5	43.9
	No Answer	246	374	-	-
Reliability	Slightly	610	5,776	4.5	42.3
	Considerable	125	7,149	0.9	52.3
	No Answer	180	820	-	-

1/ "No Answer" samples are not taken into account in % calculation.

5. BUS WAITING TIME SURVEY

5.1 OBJECTIVES

In the HIS and Officials Transport Survey conducted in 1987, waiting time at bus stops was surveyed as part of the assessment of feeder bus services. The results of these surveys yielded an average waiting time for feeder buses at bus stops of 7-8 minutes during peak periods and 10-13 minutes during off-peak periods. These figures seem to be quite long, considering that feeder bus services operate within the frequency of 3-5 minutes during peak periods.

Therefore, the survey for actual waiting at bus stops was planned to be conducted in Phase II study.

5.2 SURVEY METHOD

For this survey, bus passengers waiting for feeder buses at bus stops were observed. The surveyors would then take note of the actual waiting time of these bus passengers starting from the time of arrival at the bus stop. The details of the survey method are explained in the manual shown in Appendix 5.A.

5.3 SURVEY IMPLEMENTATION

The survey was conducted on the 13th of April 1988. Two shifts of surveyors (6 per shift) were allocated to three bus stops during the 16-hour (0600 - 2200) survey period.

Although the survey for one bus stop during the morning shift was cancelled due to shortage of surveyors, the survey was still successfully carried out.

5.4 TABULATION AND ANALYSIS

1) Average Waiting Time

Table 5.1 shows the average waiting time by time period. Even in the off-peak period, the average waiting time was less than 5 minutes. The average waiting time during the the peak period was 2.5 - 3.5 minutes.

2) Distribution of Waiting Time

Table 5.2 shows the distribution of bus waiting time at bus stops by time period. In the off-peak period, more than 50% of the passengers waited less than 3 minutes.

3) Bus Taken by Waiting Passengers

Table 5.3 shows which buses were taken by bus passengers by time period. It shows that most bus passengers took the first bus even during the peak periods.

Table 5.1

Average Waiting Time by Time Period

(minutes)

Bus Stop	Direction (Towards)	Service No.	Time Period: Morning Peak	Evening Peak	Afternoon Off-peak	Others	All Day
Street 52	Bus Interchange	265	3.1			3.1	3.1
Street 52	Street 51	265	2.5	2.9	3.4	4.1	3.6
Street 52	Street 51	261				2.6	2.6
Avenue 10	Bus Interchange	261	2.3			3.3	3.0
Avenue 10	Avenue 3	261		3.7	3.7	3.3	3.5
Avenue 6	Avenue 9	269			2.8		2.8
Avenue 6	Avenue 9	850			2.0		2.0
Avenue 6	Avenue 9	852			2.0		2.0
Avenue 6	Avenue 9	853			5.0		5.0
Avenue 6	Avenue 5	269				5.1	5.1
Avenue 5	Avenue 6	269		3.5	3.1	4.0	3.6

Note

1) Morning Peak 0630 - 0830 Hours

Evening Peak 1730 - 1930 Hours

Afternoon Off-peak 1430 - 1630 Hours

2) Surveyed Bus Stop at Avenue 6 was shifted to Avenue 5.

Table 5.2

Distibution of Waiting Time

Morning Peak

Bus Stop	Direc-tion	Service No.	Minutes -1	2-3	4-5	6-7	8-9	10-	Total	Average
St. 52	Dr 1	265	19	17	10	3	3	2	54	3.1
St. 52	Dr 2	265	0	2	0	0	0	0	2	2.5
St. 52	Dr 2	261	0	0	0	0	0	0	0	-
Ave.10	Dr 1	261	27	18	7	1	0	2	55	2.3
Ave.10	Dr 3	261	0	0	0	0	0	0	0	-
Ave. 6	Dr 4	269	0	0	0	0	0	0	0	-
Ave. 6	Dr 4	850	0	0	0	0	0	0	0	-
Ave. 6	Dr 4	852	0	0	0	0	0	0	0	-
Ave. 6	Dr 4	853	0	0	0	0	0	0	0	-
Ave. 6	Dr 5	269	0	0	0	0	0	0	0	-
Ave. 5	Dr 6	269	0	0	0	0	0	0	0	-

			-1	2-3	4-5	6-7	8-9	10-	Total
St. 52	Dr 1	265	35.2	31.5	18.5	5.6	5.6	3.7	100.0
St. 52	Dr 2	265	0.0	100.0	0.0	0.0	0.0	0.0	100.0
St. 52	Dr 2	261	-	-	-	-	-	-	-
Ave.10	Dr 1	261	49.1	32.7	12.7	1.8	0.0	3.6	100.0
Ave.10	Dr 3	261	-	-	-	-	-	-	-
Ave. 6	Dr 4	269	-	-	-	-	-	-	-
Ave. 6	Dr 4	850	-	-	-	-	-	-	-
Ave. 6	Dr 4	852	-	-	-	-	-	-	-
Ave. 6	Dr 4	853	-	-	-	-	-	-	-
Ave. 6	Dr 5	269	-	-	-	-	-	-	-
Ave. 5	Dr 6	269	-	-	-	-	-	-	-

Evening Peak

Bus Stop	Direction	Service No.	Minutes -1	2-3	4-5	6-7	8-9	10-	Total	Average
St. 52	Dr 1	265	0	0	0	0	0	0	0	-
St. 52	Dr 2	265	14	25	11	6	1	0	57	2.9
St. 52	Dr 2	261	0	0	0	0	0	0	0	-
Ave.10	Dr 1	261	0	0	0	0	0	0	0	-
Ave.10	Dr 3	261	8	13	4	4	1	2	32	3.7
Ave. 6	Dr 4	269	0	0	0	0	0	0	0	-
Ave. 6	Dr 4	850	0	0	0	0	0	0	0	-
Ave. 6	Dr 4	852	0	0	0	0	0	0	0	-
Ave. 6	Dr 4	853	0	0	0	0	0	0	0	-
Ave. 6	Dr 5	269	0	0	0	0	0	0	0	-
Ave. 5	Dr 6	269	16	18	8	10	0	2	54	3.5

			-1	2-3	4-5	6-7	8-9	10-	Total
St. 52	Dr 1	265	-	-	-	-	-	-	-
St. 52	Dr 2	265	24.6	43.9	19.3	10.5	1.8	0.0	100.0
St. 52	Dr 2	261	-	-	-	-	-	-	-
Ave.10	Dr 1	261	-	-	-	-	-	-	-
Ave.10	Dr 3	261	25.0	40.6	12.5	12.5	3.1	6.3	100.0
Ave. 6	Dr 4	269	-	-	-	-	-	-	-
Ave. 6	Dr 4	850	-	-	-	-	-	-	-
Ave. 6	Dr 4	852	-	-	-	-	-	-	-
Ave. 6	Dr 4	853	-	-	-	-	-	-	-
Ave. 6	Dr 5	269	-	-	-	-	-	-	-
Ave. 5	Dr 6	269	29.6	33.3	14.8	18.5	0.0	3.7	100.0

Cont. Table 5.2

Afternoon Off-peak

Bus Stop	Direc-tion	Service No.	Minutes -1	2-3	4-5	6-7	8-9	10-	Total	Average
St. 52	Dr 1	265	0	0	0	0	0	0	0	-
St. 52	Dr 2	265	15	15	16	7	2	0	55	3.4
St. 52	Dr 2	261	0	0	0	0	0	0	0	-
Ave.10	Dr 1	261	0	0	0	0	0	0	0	-
Ave.10	Dr 3	261	13	17	7	10	7	0	54	3.7
Ave. 6	Dr 4	269	1	3	2	0	0	0	6	2.8
Ave. 6	Dr 4	350	4	2	1	0	0	0	7	2.0
Ave. 6	Dr 4	852	0	1	0	0	0	0	1	2.0
Ave. 6	Dr 4	853	0	0	1	0	0	0	1	5.0
Ave. 6	Dr 5	269	0	0	0	0	0	0	0	-
Ave. 5	Dr 6	269	8	12	4	4	1	0	29	3.1

			-1	2-3	4-5	6-7	8-9	10-	Total
St. 52	Dr 1	265	-	-	-	-	-	-	-
St. 52	Dr 2	265	27.3	27.3	29.1	12.7	3.6	0.0	100.0
St. 52	Dr 2	261	-	-	-	-	-	-	-
Ave.10	Dr 1	261	-	-	-	-	-	-	-
Ave.10	Dr 3	251	24.1	31.5	13.0	18.5	13.0	0.0	100.0
Ave. 6	Dr 4	269	16.7	50.0	33.3	0.0	0.0	0.0	100.0
Ave. 6	Dr 4	350	57.1	28.6	14.3	0.0	0.0	0.0	100.0
Ave. 6	Dr 4	352	0.0	100.0	0.0	0.0	0.0	0.0	100.0
Ave. 6	Dr 4	853	0.0	0.0	100.0	0.0	0.0	0.0	100.0
Ave. 6	Dr 5	269	-	-	-	-	-	-	-
Ave. 5	Dr 6	269	27.6	41.1	13.8	13.8	3.4	0.0	100.0

Others

Bus Stop	Direc-tion	Service No.	Minutes -1	2-3	4-5	6-7	8-9	10-	Total	Average
St. 52	Dr 1	265	65	71	48	19	9	2	214	3.1
St. 52	Dr 2	265	17	36	21	17	6	6	103	4.1
St. 52	Dr 2	261	1	3	1	0	0	0	5	2.6
Ave.10	Dr 1	261	46	45	17	11	7	5	131	3.3
Ave.10	Dr 3	261	25	34	18	12	5	0	94	3.3
Ave. 6	Dr 4	269	0	0	0	0	0	0	0	-
Ave. 6	Dr 4	850	0	0	0	0	0	0	0	-
Ave. 6	Dr 4	852	0	0	0	0	0	0	0	-
Ave. 6	Dr 4	853	0	0	0	0	0	0	0	-
Ave. 6	Dr 5	269	3	3	1	1	0	2	10	5.1
Ave. 5	Dr 6	269	4	18	12	11	0	1	46	4.0

			-1	2-3	4-5	6-7	8-9	10-	Total
St. 52	Dr 1	265	30.4	33.2	22.4	8.9	4.2	0.9	100.0
St. 52	Dr 2	265	16.5	35.0	20.4	16.5	5.8	5.8	100.0
St. 52	Dr 2	261	20.0	60.0	20.0	0.0	0.0	0.0	100.0
Ave.10	Dr 1	261	35.1	34.4	13.0	8.4	5.3	3.8	100.0
Ave.10	Dr 3	261	25.6	36.2	19.1	12.8	5.3	0.0	100.0
Ave. 6	Dr 4	269	-	-	-	-	-	-	-
Ave. 6	Dr 4	850	-	-	-	-	-	-	-
Ave. 6	Dr 4	852	-	-	-	-	-	-	-
Ave. 6	Dr 4	853	-	-	-	-	-	-	-
Ave. 6	Dr 5	269	30.0	30.0	10.0	10.0	0.0	20.0	100.0
Ave. 5	Dr 6	269	8.7	39.1	26.1	23.9	0.0	2.2	100.0

Cont. Table 5.2

All Day

Bus Stop	Direc-tion	Service No.	Minutes -1	2-3	4-5	6-7	8-9	10-	Total	Average
St. 52	Dr 1	265	84	88	58	22	12	4	268	3.1
St. 52	Dr 2	265	46	78	48	30	9	0	217	3.6
St. 52	Dr 2	261	1	3	1	0	0	0	5	2.6
Ave.10	Dr 1	261	73	63	24	12	7	7	186	3.0
Ave.10	Dr 3	261	46	64	29	26	13	2	180	3.5
Ave. 6	Dr 4	269	1	3	2	0	0	0	6	2.8
Ave. 6	Dr 4	850	4	2	1	0	0	0	7	2.0
Ave. 6	Dr 4	852	0	1	0	0	0	0	1	2.0
Ave. 6	Dr 4	853	0	0	1	0	0	0	1	5.0
Ave. 6	Dr 5	269	3	3	1	1	0	2	10	5.1
Ave. 5	Dr 6	269	28	48	24	25	1	3	129	3.6

			-1	2-3	4-5	6-7	8-9	10-	Total
St. 52	Dr 1	265	31.1	32.8	21.6	8.2	4.5	1.5	100.0
St. 52	Dr 2	265	21.2	35.9	22.1	13.8	4.1	2.8	100.0
St. 52	Dr 2	261	20.0	60.0	20.0	0.0	0.0	0.0	100.0
Ave.10	Dr 1	261	39.2	33.9	12.9	6.5	3.8	3.8	100.0
Ave.10	Dr 3	261	25.6	35.6	16.1	14.4	7.2	1.1	100.0
Ave. 6	Dr 4	269	16.7	50.0	33.3	0.0	0.0	0.0	100.0
Ave. 6	Dr 4	850	57.1	28.6	14.3	0.0	0.0	0.0	100.0
Ave. 6	Dr 4	852	0.0	100.0	0.0	0.0	0.0	0.0	100.0
Ave. 6	Dr 4	853	0.0	0.0	100.0	0.0	0.0	0.0	100.0
Ave. 6	Dr 5	269	30.0	30.0	10.0	10.0	0.0	20.0	100.0
Ave. 5	Dr 6	269	21.7	37.2	18.6	19.4	0.8	2.3	100.0

Table 5.3

Bus Taken by Waiting Passenger by Time Period

Morning Peak

Bus Stop	Direction	Service No.	No. of Passengers Who Took 1st Bus (%)	2nd Bus (%)	3rd Bus	4th or Subsequent Bus	Total (%)
St. 52	Dr 1	65	40 (74.1)	14 (25.9)	0	0	54 (100.0)
St. 52	Dr 2	265	2 (100.0)	0 -	0	0	2 (100.0)
St. 52	Dr 2	261	0 -	0 -	0	0	0
Ave. 10	Dr 1	261	51 (94.4)	3 (5.6)	0	0	51 (100.0)
Ave. 10	Dr 3	261	0 -	0 -	0	0	0
Ave. 6	Dr 4	269	0	0	0	0	0
Ave. 6	Dr 4	850	0	0	0	0	0
Ave. 6	Dr 4	852	0	0	0	0	0
Ave. 6	Dr 4	853	0	0	0	0	0
Ave. 6	Dr 4	269	0	0	0	0	0
Ave. 5	Dr 6	269	0	0	0	0	0

Evening Peak

Bus Stop	Direction	Service No.	No. of Passengers Who Took 1st Bus (%)	2nd Bus (%)	3rd Bus	4th or Subsequent Bus (%)	Total (%)
St. 52	Dr 1	265	0 -	0	0	0	0 -
St. 52	Dr 2	265	55 (100.0)	0	0	0	55 (100.0)
St. 52	Dr 2	261	0 -	0	0	0	0
Ave. 10	Dr 1	261	0 -	0 -	0	0	0 -
Ave. 10	Dr 3	261	23 (71.9)	8 (25.0)	0	1	32 (100.0)
Ave. 6	Dr 4	269	0	0	0	0	0
Ave. 6	Dr 4	850	0	0	0	0	0
Ave. 6	Dr 4	852	0	0	0	0	0
Ave. 6	Dr 4	853	0	0	0	0	0
Ave. 6	Dr 5	269	0	0	0	0	0
Ave. 5	Dr 6	269	40 (93.0)	3 (7.0)	0	0	43 (100.0)

Cont. Table 5.3

Afternoon Off-peak

Bus Stop	Direction	Service No.	No. of Passengers Who Took 1st Bus (%)	2nd Bus (%)	3rd Bus	4th or Subsequent Bus (%)	Total (%)
St. 52	Dr 1	265	0 -	0 -	0	0	0 -
St. 52	Dr 2	265	52 (94.5)	3 (5.5)	0	0	55 (100.0
St. 52	Dr 2	261	0 -	0 -	0	0	0 -
Ave. 10	Dr 1	261	0 -	0	0	0	0
Ave. 10	Dr 3	261	49 (100.0)	0	0	0	49 (100.0
Ave. 6	Dr 4	269	6 (100.0)	0	0	0	6 (100.0
Ave. 6	Dr 4	850	7 (100.0)	0	0	0	7 (100.0
Ave. 6	Dr 4	852	1 (100.0)	0	0	0	1 (100.0
Ave. 6	Dr 4	853	1 (100.0)	0	0	0	1 (100.0
Ave. 6	Dr 5	269	0 -	0	0	0	0 -
Ave. 5	Dr 6	269	29 (100.0(	0	0	0	29 (100.0

All Day

Bus Stop	Direction	Service No.	No. of Passengers Who Took 1st Bus (%)	2nd Bus (%)	3rd Bus (%)	4th or Subsequent Bus (%)	Total (%)
St. 52	Dr 1	265	252 (94.0)	16 (6.0)	0	0	268 (100.0
St. 52	Dr 1	265	211 (98.6)	3 (1.4)	0	0	214 (100.0
St. 52	Dr 2	261	5 (100.0)	0 -	0	0	5 (100.0
Ave. 10	Dr 1	261	173 (94.5)	6 (3.3)	2 (1.1)	2 (1.1)	183 (100.0
Ave. 10	Dr 3	261	156 (92.3)	11 (6.5)	1 (0.6)	1 (0.6)	169 (100.0
Ave. 6	Dr 4	269	6 (100.0)	0	0	0	6 (100.0
Ave. 6	Dr 4	850	7 (100.0)	0	0	0	7 (100.0
Ave. 6	Dr 4	852	1 (100.0)	0	0	0	1 (100.0
Ave. 6	Dr 4	853	1 (100.0)	0	0	0	1 (100.0
Ave. 6	Dr 5	269	10 (100.0)	0	0	0	10 (100.0
Ave. 5	Dr 6	269	115 (97.5)	3 (2.5)	0	0	118 (100.0

Others

Bus Stop	Direction	Service No.	No. of Passengers Who Took 1st Bus (%)	2nd Bus (%)	3rd Bus (%)	4th or Subsequent Bus (%)	Total (%)
St. 52	Dr 1	265	212 (99.1)	2 (0.9)	0	0	214 (100.0
St. 52	Dr 2	265	102 (100.0)	0 -	0	0	102 (100.0
St. 52	Dr 2	261	5 (100.0)	0 -	0	0	5 (100.0
Ave. 10	Dr 1	261	122 (94.6)	3 (2.3)	2 (1.6)	2 (1.6)	129 (100.0
Ave. 10	Dr 3	261	84 (95.5)	3 (3.4)	1 (1.1)	0 -	88 (100.0
Ave. 6	Dr 4	269	0 -	0	0	0	0 -
Ave. 6	Dr 4	850	0 -	0	0	0	0 -
Ave. 6	Dr 4	852	0 -	0	0	0	0 -
Ave. 6	Dr 4	853	0 -	0	0	0	0 -
Ave. 6	Dr 5	269	10 (100.0)	0	0	0	10 -
Ave. 5	Dr 6	269	46 (100.0)	0	0	0	46 (100.0

Note : Time period : Morning Peak 0630 - 0830 Hours
Evening Peak 1730 - 1930 Hours
Afternoon Off-peak 1430 - 1630 Hours

Direction Dr 1 Towards Bus Interchange
Dr 2 Towards Street 51
Dr 3 Towards Avenue 3
Dr 4 Towards Avenue 9
Dr 5 Towards Avenue 5
Dr 6 Towards Avenue 6

6. ORCHARD AREA PEDESTRIAN SURVEY

6.1 INTRODUCTION

6.1.1 Objectives

The survey has three main objectives:

1) To determine the pedestrian traffic volume along Orchard Road.

2) To estimate the number of pedestrians that can possibly be diverted to the proposed new transit system.

3) To plan a suitable new transit system, based on present pedestrians' walking characteristics, to the Orchard Road area.

6.1.2 Survey Area

Figure 6.1 defines the Orchard road area. Figure 6.2 shows the locations of six selected survey stations.

6.1.3 Survey Type

This survey comprises three different tasks:

1) Pedestrian Traffic Survey

This survey was conducted at the six selected survey stations. Pedestrians walking pass the stations were counted continuously throughout the whole survey period. These pedestrians were classified into two main categories: having or not having heavy load. Within each category, they were further differentiated into three age groups: old, adult, and kid.

2) Pedestrian Interview Survey

This survey was also conducted at the six survey stations. At each station, pedestrians were randomly selected for interview. They were interviewed to determine their purposes of walking trips, origins and destinations of trips as well as modes of transport to Orchard road area.

Personal particulars, such as nationality , residence in Singapore, sex, presence or absence of heavy load, and type of pedestrian (whether they were alone, in couple or in group) were also obtained.

3) Pedestrian Pictorial Survey

Photograghs on pedestrians walking along Orchard road, at selected locations, were taken at specific time periods. The positions and directions of these pedestrians were transferred onto maps.

Figure 6.1

Orchard Road Area

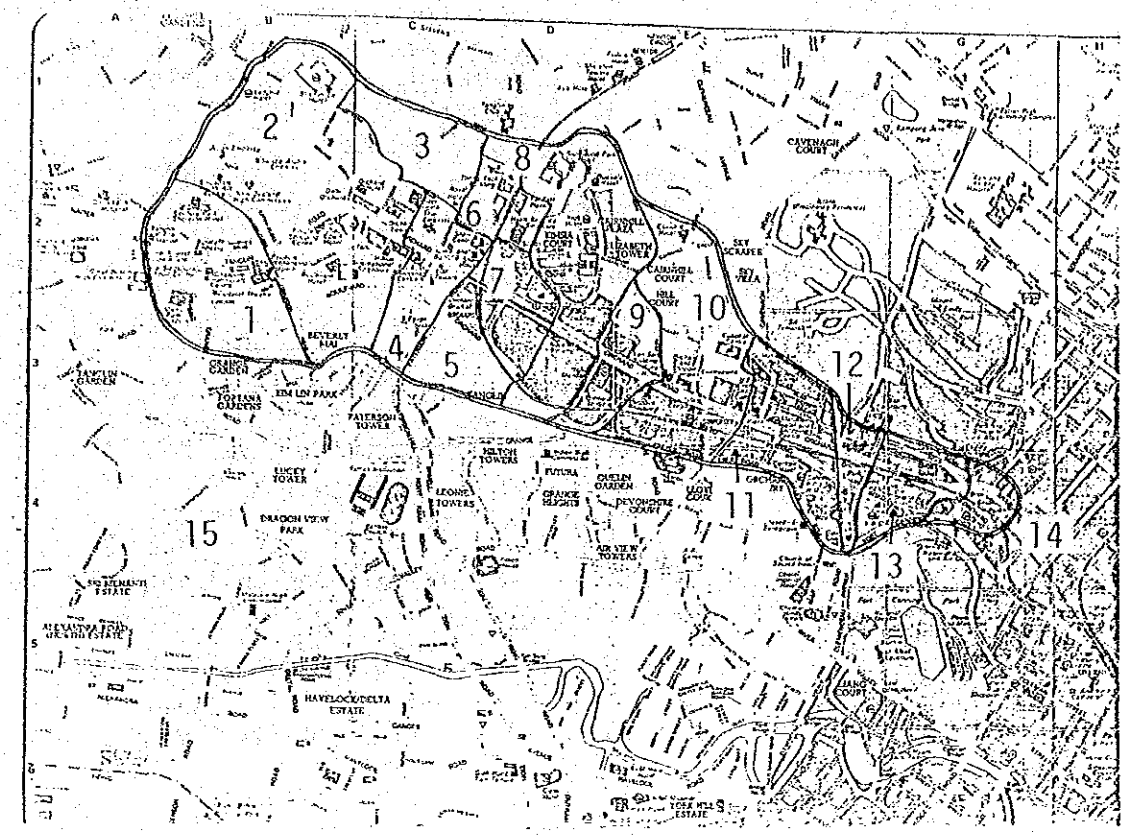
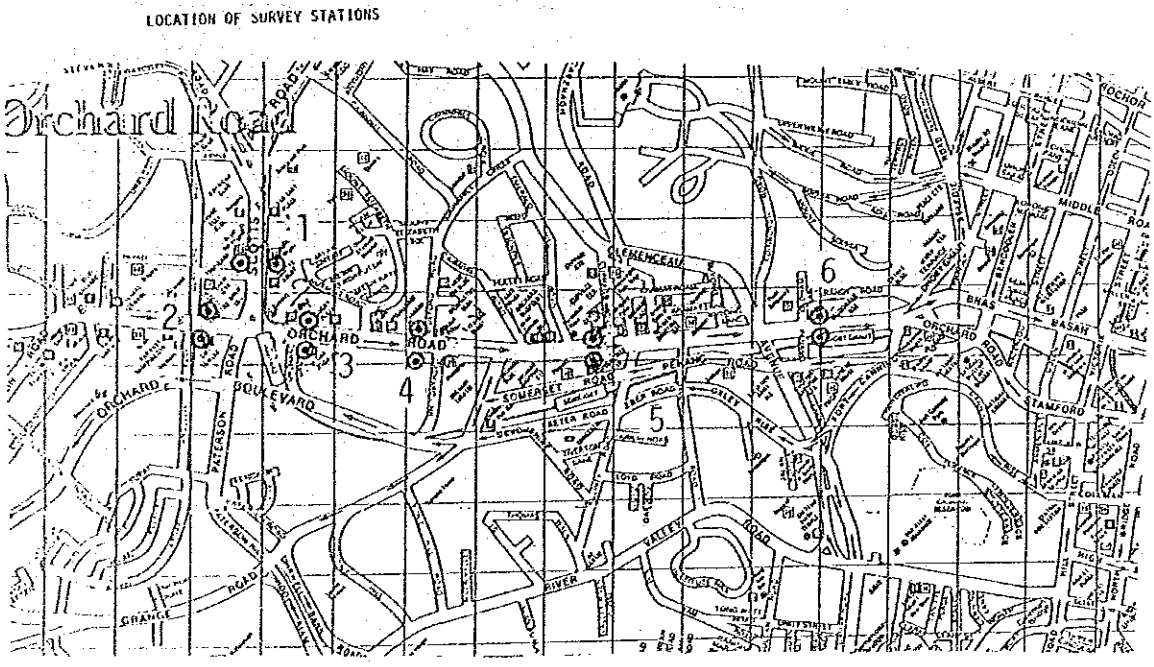


Figure 6.2

Location of 6 Survey Stations



6.2 SURVEY METHOD

6.2.1 Selection of Survey Stations

Survey stations

Six survey stations were proposed for both counting and interviewing surveys. They are enumerated in Table 6.1 below.

Table 6.1

Selected Survey Stations

Road Name		Survey Station
Scotts Road	1.	Front of Hyatt Regency/ Royal Holiday Inn
Orchard Road	2.	Front of International building/ Liat Towers
	3.	Front of Tangs/Wisma Atria
	4.	Front of Paragon/opposite Paragon
	5.	Front of Centrepoint/Specialist Centre
	6.	Front of Plaza Singapura/ Dhoby Ghaut MRT Station

The reasons for choosing these survey stations were:

1. They were located at areas where characteristic pedestrian traffic flows of Orchard road area could be sampled. The survey station was positioned between the Dhoby Ghaut MRT station and Plaza Singapura in order to capture the significant pedestrian traffic flow going and coming out from the station.

2. They were evenly distributed in the Orchard road area to ensure random samplings of pedestrian traffic flow.

6.2.2 Duration of the Survey

The survey was carried out over 3 days from 23rd to 25th of May. There were six survey stations and two survey stations were covered per day. Each day the survey would start at 0700 hour and end at 2200 hour.

The survey was conducted in two shifts per day. The morning shift would start at 0700 hour and end at 1430 hour, whereas the afternoon shift would begin at 1430 hour and end at 2200 hour.

6.3 SURVEY IMPLEMENTATION

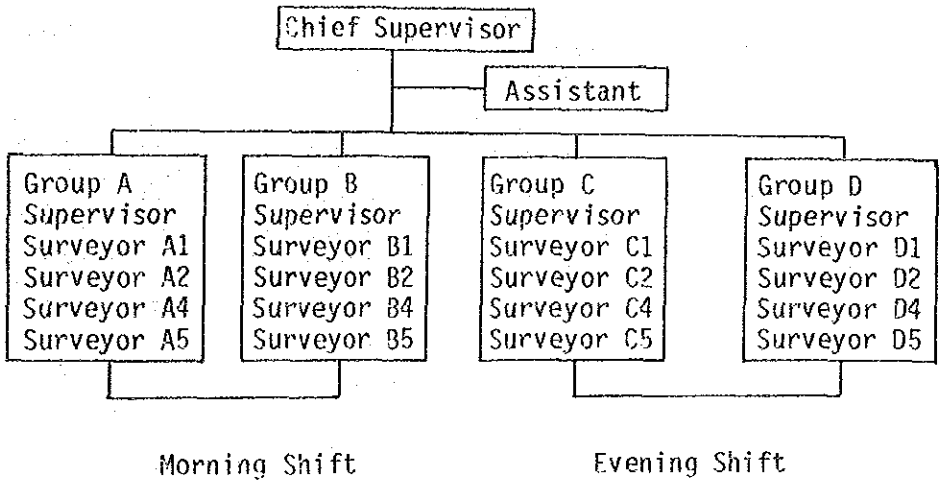
6.3.1 Organization of Survey Team

The whole survey team comprised of 26 people. The team was headed by a chief supervisor aided by an assistant. Their duties included the conduct of the pictorial survey, distribution and collection of survey forms and materials, as well as to oversee the progress of the whole survey work.

The remaining 24 people were surveyors for both the pedestrian traffic and interview surveys. These surveyors were divided into 4 groups of 6 people. Each group was headed by an supervisor appointed from the group. Surveyors of groups A and B worked in the morning shift whereas those of groups C and D worked in the afternoon shift. The organization of the survey team is shown in Figure 6.3

Figure 6.3

Survey Team Organization



6.3.2 Survey Equipment and Materials

Each pedestrian traffic counter was given a writing pad, a pen, a pedestrian traffic count survey sheet and two sets of counting machines. For pedestrian interviewers, each was given a writing pad, a pen and a stack of 80 pedestrian interview survey sheets. An auto-focus camera was used in the pictorial survey.

In a day, a total of 16 sets of counting machines, 12 writing pads, 12 pens, 16 pedestrian traffic count survey sheets, and 8 stacks of pedestrian interview survey sheets were used.

6.3.3 Field Work Program

Allocation of surveyors

Each survey station required a group of six surveyors per shift. Four groups of surveyors were required per day during the entire survey period; two groups in the morning shift and two in the afternoon shift.

At each survey station, the survey work was conducted on both sides of the road. Hence, each group of surveyors was equally team was assigned to one side of the survey station and was comprised of two traffic counters and one interviewer.

The two traffic counters would each count the number of pedestrians walking pass either from the left or the right of the station.

Survey Schedule

The Table 6.2 shows the schedules for pedestrian traffic count and interview surveys for the whole survey period.

Table 6.2

Pedestrian Traffic Count and
Interview Surveys Schedule

Date	Survey Station	Morning Shift 0645-1445hr	Afternoon Shift 1415-2215hr
23/5	1	Group A	Group C
	2	Group B	Group D
24/5	3	Group A	Group C
	4	Group B	Group D
25/5	5	Group A	Group C
	6	Group B	Group D

Each day, the morning shift surveyors would arrive at designated stations about 15 minutes early to receive their survey materials and instructions.

To ensure smooth transition between both shifts, the afternoon shift surveyors would also arrive at their respective stations 15 minutes early. After 2200 hour, their completed survey sheets and survey equipment were collected.

The schedule for pictorial survey is given in Table 6.3. Survey time periods are indicated by "*" and "#" respectively. The former refers to the time periods of 1230, 1630, 1730, and 1830 hours. The latter refers to the time periods of 1630, 1730, and 1830 hours.

Table 6.3

Survey Time Periods
of the Pictorial Survey

Dates	Times	Locations
23/5	*	1. Front of Hyatt Regency
	*	2. Front of Royal Holiday Inn
	*	3. Front of International Building
	*	4. Front of Liad Towers
24/5	#	5. Front of Tangs
	#	6. Front of Wisma Atria
	#	7. Front of MRT Station
	#	8. Side of Tangs
	#	9. Side of Lucky Plaza
	#	10. Front of Paragon
	#	11. Opposite of Paragon
25/5	#	12. Front of Peranakan Place
	#	13. Front of Centrepoint
	#	14. Specialist Center
	#	15. Front of Plaza Singapura

* 1230, 1630, 1730, 1830 hours
\# 1630, 1730, 1830 hours

Survey Methodology and Guidelines

1) Pedestrian Traffic Count Survey Sheet

A sample of the survey sheet is found in Appendix 6.A.

Survey Methodology

At each survey station, pedestrian traffic count surveyors counted only those pedestrians walking towards a designated direction at half an hour intervals. For each time interval, they counted continuously for at least 28 minutes. This was followed swiftly by recording of data and resetting of the counters

Each surveyor used six counters to count separately pedestrians who were old, adult, and kid as well as in each case, whether they carried heavy loads or not.

Guidelines of Filling Survey Sheets

a) Survey station: Surveyors were given location codes listed in Table 6.4 for the names of the survey stations. For example, a surveyor at survey station 3 and in front of Wisma Atria would use "front of Wisma Atria " to name the station.

b) Walking directions of pedestrians: The directions were indicated by the nearby buildings which the pedestrians were walking to. For example, the direction which a pedestrian walked pass the survey station 4 could be indicated as either from "Mandarin" to "Promenade" or from "Promenade" to "Mandarin".

c) Weather: Sunny referred to fine weather regardless of day or night.

d) Criteria to decide a pedestrian with heavy loads were as follows:

1. Objects which were bulky or heavy were considered heavy load.

2. A pedestrian must carry at least two objects specified above. The pedestrian could either carry them by both hands or carry them with one hand and others at his back.

e) Criteria to decide on the age groups of pedestrians:

1. Kids were primary school children and those below.

2. Old pedestrians were old people who have difficulty in walking.

3. The rest were considered adults.

2) Pedestrian Interview Survey

A sample of the survey sheet is found in Appendix 6.B.

Survey Methodology

Interviewers should select and interview 10 pedestrians per hour. To achieve random sampling, interviewers should sample a pedestrian every 5 minutes interval.

Guidelines of filling survey sheets

Locations were indicated by codes which could be obtained from Table 6.3.

Table 6.4

Interview Survey
Location Codes

Location codes	Survey Station
11	Front of Hyatt Regency
12	Front of Royal Holiday Inn
21	Front of International Building
22	Front of Liat Towers
31	Front of Tangs
32	Opposite of Wisma Atria
41	Front of Paragon
42	Opposite of Paragon
51	Front of Centrepoint
52	Specialist Center
61	Front of Plaza Singapura
62	Dhoby Ghaut MRT Station

Interviewers should be specific in indicating the origin and destination of each walking trip in terms of buildings, hotels, bus stops, taxi bays and MRT stations. This allowed accurate results of pedestrians' walking distances to be measured later from maps.

6.3.4 Problems Encountered

1) Pedestrian Traffic Survey

Generally, pedestrians could be easily counted and differentiated into six categories at all survey stations. Only at the front of Centrepoint did problems arise.

At Centrepoint, many pedestrians preferred to cross Orchard Road in front of the building even though there is no pedestrian crossing. This confused the counting process because the same pedestrian may be counted twice by surveyors on both sides of the road; once before the pedestrian crossed and once after he crossed the road.

The problem was solved by redefining a line which clearly separated pedestrians at both sides of the survey station.

2) Pedestrian Interview Survey

This survey had greater problems than the pedestrian traffic survey. Many of the pedestrians that were approached refused to cooperate because they were rushing for meals or appointments. Some of them were tourists and were not sure of names of their residences in Singapore, origins and destinations.

3) Pedestrian Pictorial Survey

The main problem in this survey was not being able to get a clear view of the whole selected locations. Very often the views were marred by trees, double-deckers and huge lorries passing by.

6.3.5 Survey Results

1) Pedestrian Traffic Survey

There were 48 survey sheets used for this survey, 8 sheets per station and 4 sheets per shift. All were successfully completed. A maximum of 1,400 pedestrians were recorded at 30 minutes per direction at the front of Centrepoint.

2) Pedestrian Interview Survey

A total of 1,802 interview forms were collected from six survey stations. This meant that an average of 150 forms were collected in 15 hours at each of the two sides of a survey station. This also implied that an average of 10 pedestrians per hour were interviewed - the target which each interviewer had to meet per hour.

The morning shift interviewers infront of Dhoby Ghaut MRT station had difficulty in achieving the target of 75 interview forms. Frequency of pedestrians passing was low in the morning. These interviewers could only manage to collect 54 forms.

3) Pedestrian Pictorial Survey

A total of 15 locations were selected for the pictorial survey; 11 of them were survey stations. Others were selected to supplement data for certain survey stations. The various locations are mentioned in Table 6.4.

6.4 CODING AND DATA PROCESSING

6.4.1 Coding and Editing for Pedestrian Survey

A manual was prepared for this work, which can be found in Appendix 6.C.

Three surveyors were selected to do the coding and editing work for their survey experience would be helpful in this work.

1) Pedestrian Traffic Count Survey Sheet

The code for walking direction of pedestrians was either 1 or 2, as shown below.

Road Names	Direction 1	Direction 2
Scott Road	To Orchard Road	Away From Orchard Road
Orchard Road	To Bras Basah Road	To Tanglin Road

After editing, both the morning and afternoon shifts results were combined and transferred into a new survey sheet. Twenty-four survey sheets were obtained. Each one gave the one-day pedestrian traffic flow for designated direction at one of the sides of a survey station.

2) Pedestrian Interview Survey

Subjectivity was found in questions 2, 5 and 6.

Question 2

Singapore was divided into 5 sectors for the purpose of coding residence of interviewees in Singapore. Residents in these sectors were further divided into those staying in hotels or non-hotel. Code numbers for this question is given in the manual.

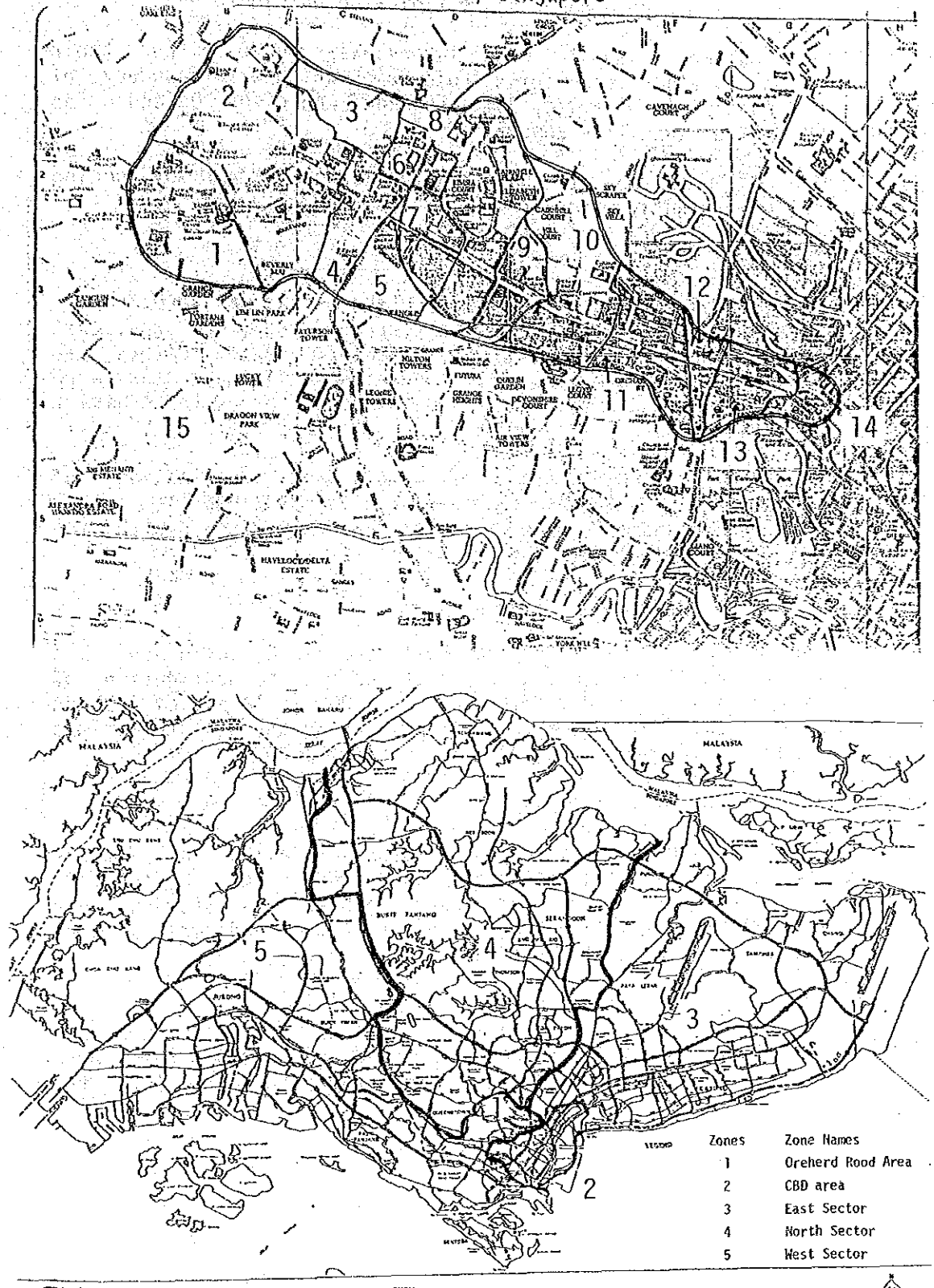
Subjectivity came in when coding residential areas overlapped into two defined sectors. For example, a person staying in Holland Road can be coded as either staying in sector 4 or 5.

Figure 6.4

ORCHARD ROAD AREA ZONES AND ZONE NAMES

ZONES	ZONE NAMES
1	Rasa Singapore
2	Ming Court Hotel
3	Draycott Drive
4	Liat Towers
5	Wisma Atria
6	Hyatt Regency
7	Tangs
8	Paragon
9	Crown Prince Hotel
10	Centrepoint
11	Meridien Hotel
12	Plaza Singapura
13	Dhoby Ghaut MRT Station
14	Y.M.C.A.
15	Others

Figure 6.5
5 Sections of Singapore



Questions 5 and 6

Orchard Road area was divided into 15 zones. These zones and their code numbers are indicated on Figure 6.4.

Problems came in when interviewers gave either their destinations or origins road names which were boundary of zones. For example, Tomlinson Road can either be coded as either zone 1 or zone 2.

The problems of subjectivity were overcome by coding consistently whenever such ambiguities occurred.

6.4.2 Zoning

To code for residence in Singapore, the island was arbitrarily divided into 5 sectors. They were Orchard area, CBD area, east sector, north sector, and west sector. These sectors are indicated in Figure 6.5. The boundaries for these sectors were drawn along the outskirts of housing estate areas to minimize ambiguity during coding work.

To facilitate the study of origin and destination of pedestrian, the Orchard Road area was divided into 14 zones. The zone boundaries were chosen so that they matched with the bus stop clusters data.

6.4.3 Measuring of Walking Distance

For each pedestrian interview sheet, the place, buildings, bus stops, and MRT stations given in the origin and destination of walking trip were identified on a 1 : 1000 scale map of Orchard Road area. Then a logical walking trip of the pedestrian was proposed and the walking distance was measured.

6.4.4 Mapping for Pictorial Survey

For each set of photographs taken on a location, only those pedestrians walking along roads were considered. Pedestrians who were crossing roads were ignored. Positions and directions of walking of these selected pedestrians were indicated on maps of the location.

6.4.5 Data Entry into Microcomputer

After the survey sheets had been coded and edited, they were checked twice before they were sent for data entry into the computers.

6.5 TABULATION AND ANALYSIS

6.5.1 Pedestrian Traffic Volume

The total number of pedestrians at each survey station is given in Table 6.5 and shown in Figure 6.5. A maximum of 38,900 pedestrians for both directions was recorded at the front of Centrepoint (Survey Station 51) during 15 survey hours. On the other hand, very few pedestrians, about one thousand, were counted at the front of Dhoby Ghaut MRT station. The same table shows that there is a large diffference in pedestrian traffic volume between each side of the road of the survey station 51/52 (Front of Centrepoint/Specialist Centre and 61/62 (Front of Plaza Singapura/Dhoby Ghaut MRT station). Table 6.5 also shows the average pedestrian traffic volume per 30 minutes of 15 hours.

6.5.2 Pedestrian Traffic Volume by Time Period

The peak period of pedestrians passing along Orchard/Scotts Road generally occurs at lunch time from 1200 to 2000 hours. The pedestrian traffic volume in these peak hours are shown in Table 6.6. It shows that approximately 15% to 20% of total pedestrians passed along Orchard/Scotts Road in the lunch time peak hours while 25% to 30% passed in the evening peak hours, excluding few survey stations. Average peak hour traffic volume per 30 minutes is about 1.25 to 1.50 times as much as the average 30 minutes volume of 15 hours.

6.5.3 Pedestrian OD Matrix

Table 6.7 shows the origin and destination trip matrix for sample pedestrians interviewed at survey stations. Figure 6.6 shows the volume of these trips between zones. The largest pedestrian traffic flow is found between Plaza Singapura (Zone 12) and Dhoby Ghaut MRT Station (Zone 13) and between Liat Tower (Zone 4) and Hyatt Regency (Zone 9). Besides these flows, the large intra-traffic flow occurs within Centrepoint (Zone 10). The figure also shows that there is few traffic interaction among Orchard, Somerset, and Dhoby Ghaut area.

Table 6.5

Pedestrian Traffic Volume at Survey Station

Road Name	Survey Station	Direction	Traffic Volume in 15 hours (0700 - 2200) Per Direction	Per Direction	Both Side of Road	Average Pedestrian Per 30 minutes Per Direction	Both Direction
Scotts Road	11. Front of Hyatt Regency	1. Towards Orchard	14,134	28,493		471	950
		2. Away From Orchard	14,359		44,747	479	
	12. Front of Holiday Inn	1. Towards Orchard	7,394	16,254		346	542
		2. Away From Orchard	8,860			295	
Orchard Road	21. Front of International Building	1. Towards Bras Basah	10,505	19,297		350	643
		2. Towards Tanglin	8,792		35,690	293	
	22. Front of Liat Towers	1. Towards Bras Basah	8,125	16,393		271	546
		2. Towards Tanglin	8,268			276	
	31. Front of C K Tangs	1. Towards Bras Basah	13,792	23,386		460	780
		2. Towards Tanglin	9,594		33,734	320	
	32. Front of Wisma Atria	1. Towards Bras Basah	4,466	10,348		149	345
		2. Towards Tanglin	5,882			196	
	41. Front of Paragon	1. Towards Bras Basah	5,865	13,165		196	349
		2. Towards Tanglin	7,300		19,881	243	
	42. Opposite Paragon	1. Towards Bras Basah	3,357	6,716		112	224
		2. Towards Tanglin	3,359			112	
	51. Front of Centrepoint	1. Towards Bras Basah	21,178	38,930		706	1,298
		2. Towards Tanglin	17,752		41,222	592	
	52. Front of Specialists Centre	1. Towards Bras Basah	1,064	2,292		35	76
		2. Towards Tanglin	1,228			41	
	61. Front of Plaza Singapura	1. Towards Bras Basah	5,946	12,324		198	411
		2. Towards Tanglin	6,378		13,295	213	
	52. Front of Dhoby Ghaut MRT Station	1. Towards Bras Basah	736	971		25	32
		2. Towards Tanglin	235			8	

Figure 6.6

Zoning Map for Coding of Residence

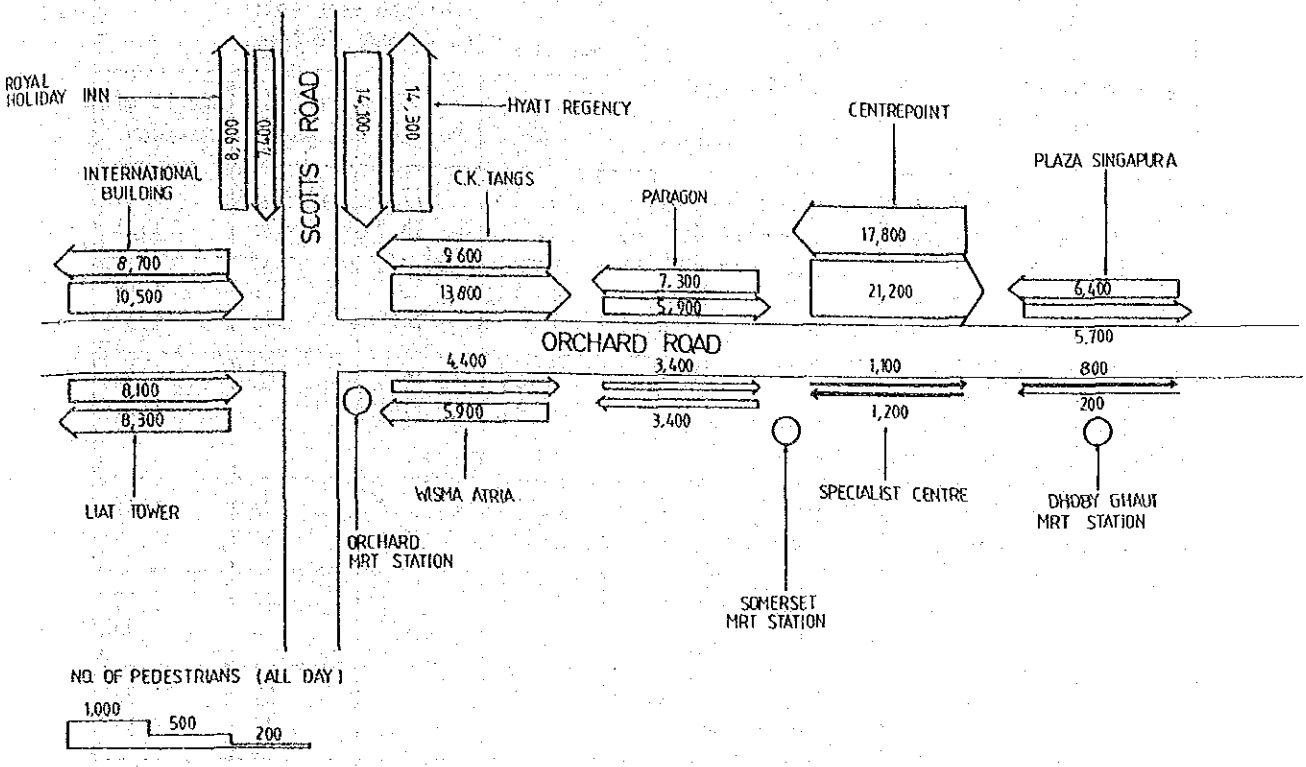


Table 6.6

Pedestrian Traffic Volume in Peak Period

Road Name	Survey Station	Direction	Afternoon Peak Hours 1200 - 1400 (2 hours)			
			Total No. of Ped	% Per day	Ave Ped/ 30 mins	Ave 30 min peak/day
Scotts Road	11. Front of Hyatt Regency	1. Towards Orchard	2,411	17.1	603	1.28
		2. Away From Orchard	2,287	15.9	572	1.19
	12. Front of Holiday Inn	1. Towards Orchard	1,480	20.0	370	1.50
		2. Away From Orchard	1,853	20.9	463	1.57
Orchard Road	21. Front of International Building	1. Towards Bras Basah	1,821	17.3	455	1.30
		2. Towards Tanglin	1,299	14.8	325	1.11
	22. Front of Liat Towers	1. Towards Bras Basah	1,526	18.8	382	1.41
		2. Towards Tanglin	1,402	17.0	351	1.27
	31. Front of C K Tangs	1. Towards Bras Basah	2,143	15.5	536	1.17
		2. Towards Tanglin	1,759	18.3	440	1.38
	32. Front of Wisma Atria	1. Towards Bras Basah	606	13.6	152	1.02
		2. Towards Tanglin	681	11.6	170	0.87
	41. Front of Paragon	1. Towards Bras Basah	859	14.6	215	1.10
		2. Towards Tanglin	1,388	19.0	347	1.43
	42. Opposite Paragon	1. Towards Bras Basah	526	15.7	132	1.18
		2. Towards Tanglin	565	16.8	141	1.26
	51. Front of Centre Point	1. Towards Bras Basah	4,990	23.6	1,248	1.77
		2. Towards Tanglin	4,060	22.9	1,015	1.71
	52. Front of Specialists Centre	1. Towards Bras Basah	181	17.0	45	1.29
		2. Towards Tanglin	206	16.8	52	1.27
	61. Front of Plaza Singapura	1. Towards Bras Basah	474	8.0	119	0.60
		2. Towards Tanglin	812	12.7	203	0.95
	62. Front of Dhoby Ghaut MRT station	1. Towards Bras Basah	72	9.8	18	0.72
		2. Towards Tanglin	62	26.3	16	2.00

Table 6.6

Pedestrian Traffic Volume in Peak Period (cont')

Road Name	Survey Station	Direction	Evening Peak Hours 1700 - 2000 (3 hours)			
			Total No. of Ped	% Per day	Ave Ped/ 30 mins	Ave 30 min peak/day
Scotts Road	11. Front of Hyatt Regency	1. Towards Orchard	3,953	28.0	659	1.40
		2. Away From Orchard	4,052	28.2	675	1.41
	12. Front of Holiday Inn	1. Towards Orchard	2,071	28.0	345	1.40
		2. Away From Orchard	2,419	27.3	403	1.37
Orchard Road	21. Front of International Building	1. Towards Bras Basah	2,749	26.2	458	1.31
		2. Towards Tanglin	2,892	32.9	482	1.65
	22. Front of Liat Towers	1. Towards Bras Basah	2,039	25.1	340	1.25
		2. Towards Tanglin	2,353	28.5	392	1.42
	31. Front of C K Tangs	1. Towards Bras Basah	3,602	26.1	600	1.30
		2. Towards Tanglin	2,709	28.2	452	1.41
	32. Front of Wisma Atria	1. Towards Bras Basah	1,337	29.9	223	1.50
		2. Towards Tanglin	1,773	30.1	296	1.51
	41. Front of Paragon	1. Towards Bras Basah	1,710	29.2	285	1.45
		2. Towards Tanglin	1,780	24.4	297	1.22
	42. Opposite Paragon	1. Towards Bras Basah	954	28.4	159	1.42
		2. Towards Tanglin	967	28.8	161	1.44
	51. Front of Centre Point	1. Towards Bras Basah	5,619	26.5	937	1.33
		2. Towards Tanglin	4,476	25.2	746	1.26
	52. Front of Specialists Centre	1. Towards Bras Basah	323	30.4	54	1.54
		2. Towards Tanglin	359	29.2	60	1.46
	61. Front of Plaza Singapura	1. Towards Bras Basah	2,257	38.0	376	1.90
		2. Towards Tanglin	2,034	31.9	339	1.59
	62. Front of Dhoby Ghaut MRT station	1. Towards Bras Basah	166	22.5	28	1.12
		2. Towards Tanglin	30	12.8	5	0.63

Figure 6.7

Pedestrian Movement between Zones

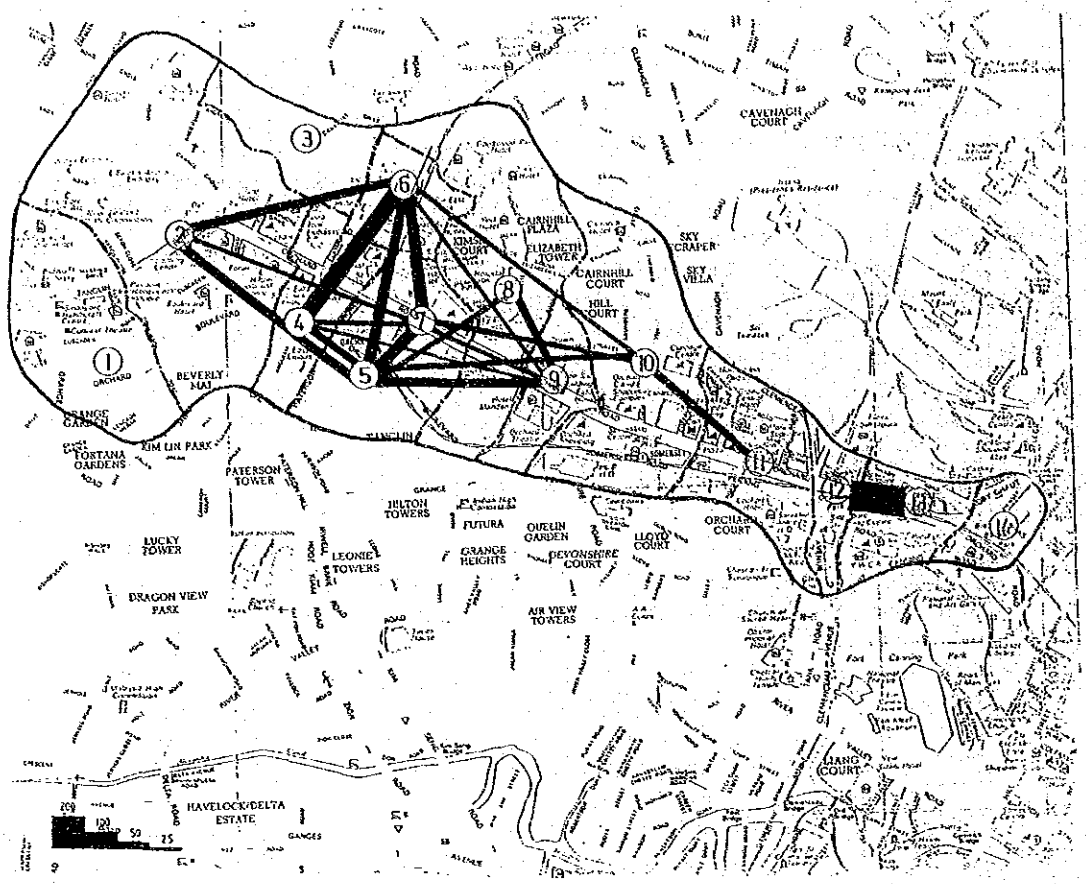


Table 6.7

Origin and Destination Table for Sample Pedestrian

(No. of Samples)

	1 Rasa S'pura	2 Ming Court	3 Draycott Drive	4 Liat Towers	5 Wisma Atria	6 Hyatt Regency	7 CK Tangs	8 Paragon	9 Crown Prince	10 Centre Point	11 Mandarin	12 Plaza S'pura	13 Dhoby Ghaut	14 YMCA	15 Others	Total
1 Rasa Singapura	-	-	-	1	2	2	1	-	-	2	-	1	1	-	1	11
2 Ming Court	-	1	-	11	27	32	14	4	7	9	3	4	2	-	4	118
3 Draycott Drive	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2
4 Liat Towers	-	6	-	49	18	50	19	2	9	11	1	-	2	-	6	173
5 Wisma Atria	2	36	-	27	16	45	47	16	33	18	3	5	3	1	4	256
6 Hyatt Regency	2	28	-	58	22	8	49	7	9	12	5	3	-	-	4	207
7 C K Tangs	3	11	-	13	24	34	30	13	10	27	3	2	2	-	4	176
8 Paragon	-	4	-	1	17	9	6	2	10	11	2	1	2	-	1	66
9 Crown Prince	2	11	-	12	30	14	23	35	2	10	2	1	4	-	2	148
10 Centre Point	1	8	-	7	24	17	11	2	6	163	22	1	6	-	9	277
11 Mandarin	-	3	-	2	8	1	7	-	3	24	-	3	14	1	2	68
12 Plaza Singapura	-	3	-	1	1	1	2	1	-	4	-	-	114	5	7	139
13 Dhoby Ghaut	-	-	-	-	1	2	-	1	-	5	3	65	9	-	13	99
14 YMCA	-	-	-	-	1	2	-	-	1	2	1	1	-	-	-	8
15 Others	-	6	-	1	5	7	6	3	-	6	-	4	7	1	4	50
Total	10	117	-	183	196	224	215	86	90	306	45	91	116	8	61	1798

6.5.4 Average Walking Distance of Pedestrians

The average walking distance of pedestrians passing Orchard/Scotts Road was 638 meters in the interview survey. It seems to be long walking distance compared with the usual walking behaviour of Singaporeans. Table 6.8 and Figure 6.7 shows the distribution of walking distance of the sample pedestrians. It shows that some long walk trips (more than 1,000m) are included in the samples. This may make the average walking distance longer. The same table also shows that more than 50% of sample pedestrian walked for less than 500 meters.

Table 6.8

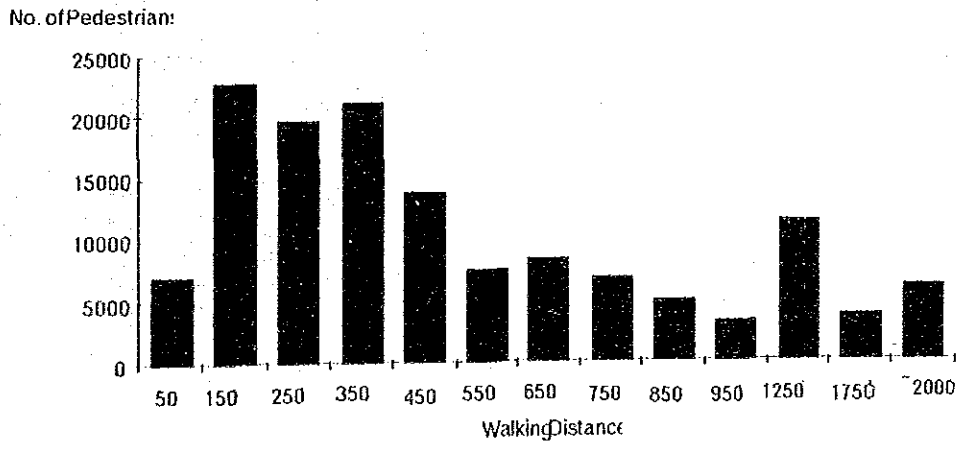
Distribution of Walking Distance

No. of Sample Pedestrians

urvey Station	Walking Distance (meter)														
	Less 100	100-199	200-299	300-399	400-499	500-599	600-699	700-799	800-899	900-999	1000-1499	1500-1999	2000-	Total	Average
ront of Hyatt Regency	4	9	16	43	21	10	11	7	8	4	8	1	9	151	637.0
ont of Holiday Inn	3	3	26	33	33	14	10	6	3	3	10	2	5	151	550.4
ont of International Bldg.	5	23	20	25	17	8	20	9	6	1	11	4	11	160	723.4
ront of Liat Towers	1	7	8	20	26	6	26	19	9	3	13	7	7	152	765.9
ront of CK Tangs	20	32	16	13	27	7	4	3	6	3	10	4	6	151	503.0
ront of Wisma Atria	15	11	18	22	19	16	8	7	7	2	18	3	5	151	615.3
ront of Paragon	0	12	15	8	6	9	5	17	14	21	31	5	4	147	816.7
posite of Paragon	2	0	2	10	22	23	13	21	5	5	35	9	4	151	836.3
ont of Centre Point	6	33	21	22	11	8	5	5	5	5	20	5	4	150	577.1
ront of Specialists Centre	7	23	32	26	16	13	6	4	0	2	11	5	7	152	535.5
ont of Plaza Singapura	3	43	33	26	12	9	2	3	3	1	3	7	6	151	471.8
ont of Dhoby Ghaut	3	6	61	12	7	6	3	3	2	3	8	5	8	127	620.2
Total	69	202	268	260	217	129	113	104	68	53	178	57	76	1794	638.1
of Total	3.8	11.3	14.9	14.5	12.1	7.2	6.3	5.8	3.8	3.0	9.9	3.2	4.2	100	

Figure 6.7

Distribution of Walking Distance



6.5.5 Characteristics of Pedestrians

1) Age and having heavy load

Tables 6.9 and 6.10 show the pedestrian traffic volume for each survey station classified into two categories: age group and having or not having heavy load. It shows that 94% of pedestrians were classified as adult, 4% as old and 3% as kids.

As for the heavy load, only 3.6% of pedestrians carried a heavy load on average.

Table 6.9

Pedestrian Traffic Volume by Age Group and Having Heavy Load

Road Name	Survey Station	Direction	Pedestrian Traffic Volume in 15 Hours (0700 - 2000)				
			Age Group				Having Heavy Load
			Old	Adult	Kids	Total	No. of Pedestrians
Scotts Road	11. Front of Hyatt Regency	1. Towards Orchard	393	13,446	295	14,134	389
		2. Away From Orchard	426	13,562	281	14,359	435
	12. Front of Holiday Inn	1. Towards Orchard	401	5,829	164	7,394	136
		2. Away From Orchard	305	8,395	160	8,860	108
Orchard Road	21. Front of International Building	1. Towards Bras Basah	360	9,839	306	10,505	243
		2. Towards Tanglin	389	8,127	276	8,792	328
	22. Front of Liat Tower	1. Towards Bras Basah	220	7,691	214	8,125	226
		2. Towards Tanglin	220	7,846	202	8,268	256
	31. Front of CK Tangs	1. Towards Bras Basah	663	12,825	304	13,792	646
		2. Towards Tanglin	406	8,926	262	9,594	643
	32. Front of Wisma Atria	1. Towards Bras Basah	136	4,212	118	4,466	130
		2. Towards Tanglin	258	5,464	160	5,882	264
	41. Front of Paragon	1. Towards Bras Basah	262	5,427	176	5,865	174
		2. Towards Tanglin	311	6,779	210	7,300	212
	42. Opposite Paragon	1. Towards Bras Basah	167	3,090	100	3,357	194
		2. Towards Tanglin	142	3,108	109	3,359	85
	51. Front of Centre Point	1. Towards Bras Basah	691	20,008	479	21,178	651
		2. Towards Tanglin	584	16,799	369	17,752	760
	52. Front of Specialists Centre	1. Towards Bras Basah	24	1,008	32	1,064	89
		2. Towards Tanglin	32	1,155	41	1,228	52
	61. Front of Plaza Singapura	1. Towards Bras Basah	183	5,417	346	5,946	452
		2. Towards Tanglin	239	5,860	279	6,378	207
	62. Front of Dhoby Ghaut MRT Station	1. Towards Bras Basah	10	690	36	736	56
		2. Towards Tanglin	3	226	6	235	2

Table 6.10

Pedestrian Traffic Volume by Percentage Composition of Age Group and Heavy Load

Road Name	Survey Station	Direction	Composition by Age Group (%)				% of Having Heavy Load			
			Old	Adult	Kids	Total	Old	Adult	Kids	Total
Scotts Road	11. Front of Hyatt Regency	1. Towards Orchard	2.8	95.1	2.1	100	3.6	2.8	-	2.8
		2. Away From orchard	3.0	95.1	2.0	100	2.6	3.0	5.0	3.0
	12. Front of Holiday Inn	1. Towards Orchard	5.4	92.4	2.2	100	3.2	1.7	6.1	1.8
		2. Away From Orchard	3.4	94.8	1.8	100	3.6	1.1	2.5	1.2
Orchard Road	21. Front of Internatrional Building	1. Towards Bras Basah	3.4	93.6	2.9	100	3.6	2.2	3.9	2.3
		2. Towards Tanglin	4.4	92.4	3.1	100	10.3	3.4	4.3	3.7
	22. Front of Liat Tower	1. Towards Bras Basah	2.7	94.7	2.6	100	5.5	2.6	5.6	2.8
		2. Towards Tanglin	2.7	94.9	2.4	100	2.7	3.1	4.0	3.1
	31. Front of C K Tangs	1. Towards Bras Basah	4.8	93.0	2.2	100	2.9	4.8	3.3	4.7
		2. Towards Tanglin	4.2	93.0	2.7	100	9.1	6.7	4.6	6.7
	32. Front of Wisma Atria	1. Towards Bras Basah	3.0	94.3	2.6	100	2.9	2.9	2.5	2.9
		2. Towards Tanglin	4.4	92.9	2.7	100	5.8	4.4	3.8	4.5
	41. Front of Paragon	1. Towards Bras Basah	4.5	92.5	3.0	100	6.5	2.7	5.1	3.0
		2. Towards Tanglin	4.3	92.9	2.9	100	4.5	2.8	2.4	2.9
	42. Opposite of Paragon	1. Towards Bras Basah	5.0	92.0	3.0	100	9.6	5.8	-	5.8
		2. Towards Tanglin	4.2	92.5	3.2	100	2.1	2.6	0.9	2.5
	51. Front of Centrepoint	1. Towards Bras Basah	3.3	94.5	2.3	100	3.5	3.1	1.9	3.1
		2. Towards Tanglin	3.3	94.6	2.1	100	4.8	4.2	6.0	4.3
	52. Front of Specialists Centre	1. Towards Bras Basah	2.3	94.7	3.0	100	4.2	8.4	9.4	9.4
		2. Towards Tanglin	2.6	94.1	3.3	100	9.4	4.2	-	4.2
	61. Front of Plaza Singapura	1. Towards Bras Basah	3.1	91.1	5.8	100	16.4	7.2	8.7	7.6
		2. Towards Tanglin	3.7	91.9	4.4	100	12.6	2.7	6.1	3.2
	62. Front of Dhoby Ghaut MRT Station	1. Towards Bras Basah	1.4	93.8	4.9	100	20.0	7.8	-	7.6
		2. Towards Tanglin	1.3	93.8	2.6	100	5.3	3.5	4.1	3.6
Average Total			3.6	93.8	2.6	100	5.3	3.5	4.1	3.5

2) Profile of Pedestrians

The following profile of pedestrians passing along Orchard and Scotts Road were derived from the pedestrian interview survey.

Nationality

Among the pedestrian interviewed, 75.5% were Singaporeans. About 24.5% were persons from various countries. Table 6.11 shows the nationality of pedestrians. Proportion of persons from other countries was higher at survey station 11 (Front of Hyatt Regency), 22 (Front of Liat Towers) and 42 (Opposite Paragon).

Table 6.11

Nationality of Pedestrians

Nationality	Survey Station							
	11 Hyatt Regency	12 Royal Holiday Inn	21 Inter-national Building	22 Liat Towers	31 C K Tangs	32 Wisma Atria	41 Para-gon	42 Opposite Paragon
Singapore	62.3	80.8	76.3	66.4	72.2	76.2	72.1	63.6
Other Countries	37.7	19.2	23.7	33.6	27.8	23.8	27.9	36.4
Total	100	100	100	100	100	100	100	100

Nationality	51 Centrepoint	52 Specialists Centre	61 Plaza Singapura	62 Dhoby Ghaut MRT Station	Total
Singapore	83.3	85.5	89.4	78.7	75.5
Other Countries	16.7	14.5	10.6	21.3	24.5
Total	100	100	100	100	100

Residence

Among the pedestrians interviewed. 15.2% of them stayed in hotels and 78% in Orchard area. The majority of pedestrians resided in flats or houses and in places other than Orchard area or CBD.

Table 6.12

Residence of Pedestrians

(%)

Type of Residence	Place of Residence			
	Orchard	CBD	Other area	Total
Hotel	11.8	2.7	0.6	15.2
Others	3.8	3.4	77.7	84.8
Total	15.6	6.1	78.3	100

Other Profile

Table 6.13 shows the other profile of pedestrians interviewed; namely; sex, having heavy load or not and walking alone, couple/group.

Table 6.13

Other Profile of Pedestrians

No. of Sample (%)

Sex		Having Heavy Load		Type of group	
Male	932 (52.0)	With	319 (17.8)	Alone	1125 (62.7)
Female	860 (47.9)	Without	1475 (82.2)	Couple	459 (25.6)
Not known	2 (0.1)			Group	209 (11.6)
				Not known	1 (0.1)
Total	1794 (100)		1794 (100)		1794 (100)

3) Purpose of Walking Trip

Table 6.14 shows the purpose of walking trips for pedestrians. The major purpose of their walking trips in Orchard area is for shopping because Orchard area is a major shopping area in Singapore. The purpose of shopping was indicated in high proportions especially in front of Hyatt Regency and Tangs.

4) Mode of Transport to Orchard Area

The distribution of transport mode used to the Orchard Area is given in Table 6.15. On the whole, it seems that the most preferred mode used is the public bus followed by the MRT with 46.7% and 20.7% of total samples counted, respectively.

Table 6.14

Purpose of Walking Trips

No. of Samples (%)

Survey Station	Purpose						
	Shopping	Eating /Social	Working /Business	Go To Work /Home	Others	Not Known	Total
11 Hyatt Regency	72 (47.7)	30 (19.9)	3 (8.6)	21 (13.9)	14 (9.3)	1 (0.7)	151 (100)
12 Royal Holiday Inn	34 (22.5)	38 (25.2)	33 (21.9)	35 (23.2)	11 (7.3)	0 (-)	151 (100)
21 International Building	34 (21.3)	47 (29.4)	44 (27.5)	20 (12.5)	13 (8.1)	2 (1.3)	160 (100)
22 Liat Towers	55 (36.2)	29 (19.1)	19 (12.5)	32 (21.1)	17 (11.2)	0 (-)	152 (100)
31 Tangs	68 (45.0)	17 (11.3)	16 (10.6)	43 (28.5)	7 (4.6)	0 (-)	151 (100)
32 Wisma Atria	47 (31.1)	29 (19.2)	13 (8.6)	45 (29.8)	17 (11.3)	0 (-)	181 (100)
41 Paragon	51 (34.7)	21 (14.3)	25 (17.0)	42 (28.6)	8 (5.4)	0 (-)	147 (100)
42 Opposite Paragon	53 (35.1)	33 (21.9)	11 (7.3)	38 (25.2)	16 (10.6)	0 (-)	151 (100)
51 Centrepoint	57 (38.0)	36 (24.0)	12 (8.0)	32 (21.3)	13 (8.7)	0 (-)	150 (100)
52 Specialists Centre	36 (23.7)	31 (20.4)	13 (8.6)	53 (34.9)	19 (12.5)	0 (-)	152 (100)
61 Plaza Singapura	31 (20.5)	22 (14.6)	4 (2.6)	74 (49.0)	20 (13.2)	0 (-)	151 (100)
62 Dhoby Ghaut MRT Station	33 (26.0)	7 (5.5)	10 (7.9)	57 (44.9)	20 (15.7)	0 (-)	127 (100)
Total	571 (31.8)	340 (19.0)	213 (11.9)	492 (27.4)	175 (9.8)	3 (0.1)	1794 (100)

Table 6.15

Mode of Transport to Orchard Area

No. of Samples (%)

Survey Station	Orchard	Car	Public Bus	City Tour Bus	Other MRT	MRT	Walking	Others	Not Known	Total
11 Hyatt Regency	29 (19.2)	8 (5.3)	55 (36.4)	3 (2.0)	0 (-)	25 (16.6)	20 (13.2)	10 (6.6)	1 (0.7)	151 (100)
12 Royal Holiday Inn	14 (9.3)	11 (7.3)	89 (58.9)	0 (-)	2 (1.3)	16 (10.6)	9 (6.0)	10 (6.6)	0 (-)	151 (100)
21 International Building	12 (7.5)	6 (3.7)	103 (64.4)	0 (-)	0 (-)	19 (11.9)	12 (7.5)	6 (3.7)	2 (1.3)	160 (100)
22 Liat Towers	30 (19.7)	13 (8.6)	59 (38.8)	1 (0.7)	0 (-)	28 (18.4)	16 (10.5)	5 (3.3)	0 (-)	152 (100)
31 Tangs	12 (7.9)	8 (5.3)	76 (50.3)	0 (-)	0 (-)	32 (21.2)	8 (5.3)	15 (9.9)	0 (-)	151 (100)
32 Wisma Atria	21 (13.9)	7 (4.6)	63 (41.7)	0 (-)	0 (-)	47 (31.1)	6 (4.0)	7 (4.6)	0 (-)	151 (100)
41 Paragon	20 (13.6)	14 (9.5)	65 (44.2)	0 (-)	1 (-)	23 (15.6)	17 (11.6)	7 (4.8)	0 (-)	147 (100)
42 Opposite Paragon	43 (28.5)	9 (6.0)	48 (31.8)	1 (0.7)	0 (-)	34 (22.5)	5 (3.3)	11 (7.3)	0 (-)	151 (100)
51 Centrepoint	15 (10.0)	14 (9.3)	78 (52.0)	1 (0.7)	2 (1.3)	29 (19.3)	6 (4.0)	5 (3.3)	0 (-)	150 (100)
52 Specialists Centre	13 (8.6)	20 (13.2)	62 (40.8)	1 (0.7)	2 (1.3)	40 (26.3)	8 (5.3)	6 (4.0)	0 (-)	152 (100)
61 Plaza Singapura	0 (-)	10 (6.6)	94 (62.3)	1 (0.7)	0 (-)	32 (21.2)	11 (7.3)	3 (2.0)	0 (-)	151 (100)
62 Dhoby Ghaut MRT Station	15 (11.8)	12 (9.4)	46 (36.2)	0 (-)	0 (-)	46 (36.2)	6 (4.7)	2 (1.6)	0 (-)	127 (100)
Total	224 (12.5)	132 (7.4)	838 (46.7)	8 (0.4)	7 (0.4)	371 (20.7)	124 (6.9)	87 (4.8)	3 (0.2)	1794 (100)

6.5.6 Pedestrian Density of Selected Area

The density of pedestrians on the selected pavement area were calculated from the pictorial survey. Appendix 6.D shows the distribution of pedestrians by time period with the direction to which they are walking. These pedestrians plotted within the fixed pavement area were counted and calculated into terms of density or space per pedestrian. Table 6.16 shows the density of pedestrians by survey point for several survey time periods. Places most congested with pedestrians are those areas located in front and opposite the Hyatt Hotel.

Table 6.16

Density of Pedestrians and Space Per Pedestrian

Name of Survey Point	Survey Time Period	Pavement (meter)			Number of Pedes	Density	Space/Pedes
		Length	Width	Area		Sq. meter	Sq. feet/Pes
1A (11)	1230	100	5	500	34	0.068	150
Front of Hyatt	1625	100	5	500	61	0.122	84
Hotel	1720	100	5	500	68	0.136	75
	1830	100	5	500	54	0.108	94
1B (12)	1220	100	3	300	37	0.123	83
Opposite of	1515	100	3	300	29	0.097	105
Hyatt Hotel	1725	100	3	300	46	0.153	66
	1835	100	3	300	47	0.157	65
21	1245	58/42	5/10	710	42	0.059	172
Front of	1635	63/37	5/10	685	25	0.036	279
International	1740	60/40	5/10	700	27	0.039	264
Building	1820	58/42	5/10	710	79	0.111	92
22	1240	100	8	800	16	0.020	510
Front of	1630	100	8	800	7	0.009	1165
Liat Tower	1735	100	8	800	43	0.054	190
	1825	100	8	800	34	0.043	240
31	1615	100	10	1000	66	0.066	154
Opposite Wisma	1715	100	10	1000	75	0.075	136
Atria	1838	100	10	1000	60	0.060	170
32	1620	100	10	1000	12	0.012	849
In front of	1625	100	10	1000	32	0.032	318
Wisma Atria	1828	100	10	1000	30	0.030	340
	1829	100	10	1000	14	0.014	728
32	1615	100	10	1000	42	0.042	243
Orchard MRT	1715	100	10	1000	49	0.049	208
	1836	100	10	1000	33	0.033	309
3	1623	100	5	500	31	0.062	164
In front of	1725	100	5	500	25	0.050	204
Tangs	1826	100	5	500	10	0.020	510
3	1630	100	5	500	43	0.086	118
Side of Lucky	1730	100	5	500	10	0.020	510
Plaza	1824	100	5	500	29	0.058	176
41	1635	50	3	150	15	0.100	102
Front of	1735	50	3	150	23	0.153	66
Paragon	1820	50	3	150	25	0.0167	61
42	1644	100	7	700	16	0.023	446
Opposite of	1737	100	7	700	17	0.024	420
Paragon	1818	100	7	700	34	0.049	210
51	1626	50	3	150	13	0.087	118
Peranakan Place	1726	50	3	150	11	0.073	139
	1834	50	3	150	32	0.213	48
52	1625	80	5	400	15	0.038	272
Opposite of	1721	80	5	400	6	0.015	679
Peranakan Place	1840	80	5	400	21	0.053	194
51	1630	50	3	150	19	0.127	80
Centrepoint	1725	50	3	150	34	0.227	45
	1835	50	3	150	35	0.233	44
61	1630	50	5	250	21	0.084	121
In front of	1740	50	5	250	21	0.054	121
Plaza Singapura	1845	50	5	250	16	0.064	159

PUBLIC WORKS DEPARTMENT

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PWD/RD/27/85

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15 Oct 87

Branch Heads
MND Building and
SIA Building

2AO, PWD HQ

FCR, PWD

Dear Colleagues

TRANSPORT SURVEY OF PWD OFFICERS IN MND & SIA BUILDINGS

The MRT would start running early next month. Its influence on travel patterns, especially for work journeys, is expected to be considerable.

2 The PWD (Roads Division) is very interested in the shifts of such travel patterns as well as in people's use of the feeder bus systems within HDB new towns.

3 To help obtain such information, the Division will conduct 2 transport surveys among PWD officers housed in the MND and SIA Buildings. The first one will be done tomorrow and my colleagues will be distributing survey forms to your staff. A copy of this form is attached for your reading. The 2nd survey will be conducted early next year after the commencement of our MRT system.

4 As the results of these surveys will provide important feedback on impending and significant changes in our travel patterns, I would request your cooperation and the cooperation of your staff in these surveys.

5 Many thanks.

Yours Sincerely

JOSEPH YEE
HEAD
ROADS PLANNING & DESIGN BRANCH
ROADS DIVISION
PWD SINGAPORE

OCT2
JY(2)
/dc

Some Explanatory Notes on Filling Up The Transport Survey Forms.

1. The form is made up of 3 parts, viz:

   1.1 Form A - General Information

   1.2 Form B - Trip Information

   1.3 Form C - Assessment of Feeder Bus Services

2. These forms are designed to be self-explanatory. However, the following notes have been prepared to assist you in completing them.

Form A - General Information

3. Sections 1 to 10 are aimed at obtaining general information on the socio-economic background of your household. The information you provide will be kept strictly confidential.

4. "Parking place" in Section 7 refers to the place you normally park your vehicle at your home. "Off Road" parking would include parking in HDB open and multi-storey car parks.

5. Section 11 "Kiss and Ride" refers to a situation in which you receive a ride to the bus stop/interchange from where you continue your journey by transferring onto a public transport mode.

6. "Park and Ride" refers to a situation in which you drive your car to a designated car park from where you continue your journey by transferring onto a public transport mode/car-pool.

Form B - Trip Information

7. This form is intended to gather data on the trips you would make tomorrow. The form is divided into "trip" columns (eg. 1st trip, 2nd trip etc). Please consider carefully what constitutes a trip before filling up the corresponding "trip" columns. To assist you, refer to "Guidelines on how to fill up Form B".

8. For the purpose of this survey, please give us <u>your</u> trip information for Friday, 16 Oct 87 from 0.00 hrs to 2359 hrs. You need only fill up information of <u>your own trips</u>. Information of trips made by your household members are not required in this survey.

TSF1
JY(2)
/dc