
Personal Travel Characteristics of New Zealanders

**Analysis of Home Interview
Survey Data**

Transfund New Zealand Research Report No. 183

Personal Travel Characteristics of New Zealanders

Analysis of Home Interview Survey Data

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GLOSSARY OF COMMONLY USED ABBREVIATIONS

A73, A78, A92; AK	Auckland (1973, 1978, 1992) household interview surveys (HIS)
C69, C78, C90; CH	Christchurch (1969, 1978, 1990) HIS
D78, D90; DN	Dunedin (1978, 1990) HIS
CD-ROM	Compact Disc, Read Only Memory
Emp	Employees
E0, E1, E2+	Employees per household (none, 1, 2 or more)
HBW (HB-W)	Home-based Work Trip Purpose
HBNW (HB-NW)	Home-based Non-work Trip Purpose
HA78; HAM	Hamilton (1978) HIS
HE78; HERT	Heretaunga (1978) HIS
HH	Household
HIS	Household or Home Interview Survey
NT78	NUT (1978) survey
NHB	Non-home-based Trip Purpose
NUTS (1978)	National Urban Transport Survey 1978
MT89	MOT (1989) survey
MOT (1989)	Ministry of Transport Survey 1989
P1, P2, P3, P4, P5+	Persons per household (none, 1, 2, 3, 4, 5 or more)
Per	Persons
V0, V1, V2, V3+	Vehicles per household (none, 1, 2, 3 or more)
Veh	Vehicle(s)
W71, W78, W88; WN	Wellington (1971, 1978, 1988) HIS

CONTENTS

Glossary	4
Executive Summary	7
Abstract	8
1. Introduction	9
2. Data Available in New Zealand	10
3. Household Interview Survey Sample & Expanded Statistics	11
4. Household Composition	14
5. Trip Generation: per Person & per Household	18
6. Initial Comparisons	22
6.1 Comparisons Between Cities	22
6.2 Comparisons Over Time	22
7. Person Trip-Making Characteristics	24
7.1 Person Trips per Household by Mode	24
7.2 Person Trips by Mode by Time of Day	28
7.3 Person Trips per Household by Vehicle Ownership	28
7.4 Person Trips per Household by Household Income	30
7.5 Person Trips per Household by Trip Purpose	30
8. Vehicle Driver Trip-Making Characteristics	33
8.1 Vehicle Driver Trips per Household by Vehicle Ownership	33
8.2 Vehicle Driver Trips per Household by Trip Purpose	33
8.3 Vehicle Driver Trips by Purpose by Time of Day	36
8.4 Vehicle Driver Trip Rates by Purpose by Category Model	38
8.5 Vehicle Occupancy	47
8.6 Trip Length Frequency	47
9. Conclusions	50
10. Recommendations	50
11. References	52
Key Personnel	52
APPENDICES	
A1 CD-ROM	55
A2 Data Collection	59
A3 Analysis of New Zealand Data	61

List of Tables

3.1	Sample statistics of household (HH) interview surveys for New Zealand cities, available up to 1996.	12
3.2	Global statistics of household (HH) interview surveys for New Zealand cities, available up to 1996.	13
4.1	Percentage of households (HH) in each of the categories, of numbers of persons, employees, and vehicles.	16
5.1	Daily trip rates per person and per household.	20
7.1	Daily person trip rates by travel mode.	25
8.1	Trip length frequencies for 3 main groups of Household Interview Surveys. 49	

List of Figures

4.1	Number of persons, employees, and vehicles per household.	15
4.2	Trends in percentage of households in each of the categories, of numbers of persons, employees, and vehicles for Auckland City.	17
5.1	Distribution of trips per household for Wellington 1988 survey.	18
5.2	Daily trip rate trends per person and per household.	21
7.1	Daily trip rate trends by the primary travel modes of driver, passenger and public transport.	26
7.2	Travel mode choice as % of total daily trips by time of day for the Auckland surveys.	27
7.3	Travel mode choice as % of total trips for each hour, from Auckland (1992) survey.	28
7.4	Daily person trip rates by household (HH) vehicle ownership.	29
7.5	Daily person trip rate trends by trip purpose.	31
7.6	Daily person trip rates by trip purpose.	32
8.1	Daily vehicle trip rates by household vehicle ownership.	34
8.2	Daily vehicle trip trends by trip purpose.	35
8.3	Daily vehicle trip rates by trip purpose.	36
8.4	Vehicle trips by purpose as % of total trips by time of day for the three Auckland surveys.	37
8.5	Vehicle trips by purpose as % of total trips for each hour (Auckland 1992 survey).	38
8.6	Daily vehicle trip rates by vehicle per person household category for three Auckland surveys.	40
8.7	Daily vehicle trip rates by vehicle per person household category for three Christchurch surveys.	41
8.8	Daily vehicle trip rates by vehicle per person household category for three Wellington surveys.	42
8.9	Daily vehicle trip rates by vehicle per employee household category for three Auckland surveys.	43
8.10	Daily vehicle trip rates by vehicle per employee household category for three Christchurch surveys.	44
8.11	Daily vehicle trip rates by vehicle per employee household category for three Wellington surveys.	45
8.12	Vehicle trip rate trends by household category for Auckland, Christchurch and Wellington surveys.	46
8.13	Vehicle occupancy by trip purpose.	47
8.14	Vehicle occupancy by time of day for Wellington, Dunedin and Auckland surveys.	48

Executive Summary

The Project

This research project, carried out between 1995-1997, has explored the personal travel characteristics of New Zealanders that have been recorded in various household interview surveys (HIS) carried out over the last 30 years. It has brought together all the household interview survey data, both in electronic form and as documents, that are still available in New Zealand.

The electronic data have been loaded into a database and analysed to identify those variables in each survey that were:

- identical in definition,
- similar and comparable,
- similar but not directly comparable, and
- different.

The personal travel characteristics were then analysed to compare the global statistics for each study. Person and household trip rates have also been analysed to determine their stability between cities, and within cities over time, for the following types of trips:

- Person trips by mode, vehicle ownership and purpose,
- Vehicle driver trips by vehicle ownership, purpose, household category, occupancy, and duration.

A supporting CD-ROM has been produced, containing all of the collected survey data and original study documentation. The original printed documentation has been “scanned” to produce an electronic copy for which a document viewer is provided on the CD. The CD also includes the survey data in ASCII and MSAccess database format, as well as the spreadsheets and data referred to within the report. The spreadsheets have been compressed as zip files on the diskette accompanying the report (in the envelope inside the back cover). The CD containing the survey data is held at Transfund New Zealand, and copies of it are available on request.

Conclusions

Too few household interview surveys have been carried out in New Zealand from which rigorous statistical analysis could be carried out. The findings of this study are therefore more indicative than conclusive. That said, the analysis in the report suggests the following:

- Person trip rates vary only slightly between cities.
- Person trip rates vary only slightly over time.
- Vehicle driver trip rates vary slightly between cities.
- Vehicle driver trip rates increase over time as vehicle ownership increases.
- If public transport trip rates are low, vehicle driver trip rates are high.
- Vehicle passenger trip rates do not vary.
- Vehicle driver trip rates for household categories of vehicles by employees and vehicles by persons vary only slightly over time.

Recommendations

- More home interview surveys should be carried out in New Zealand. They should be timed to coincide with census years at 5, 10, 15 or 20 year intervals.

- Further research should be undertaken to produce guidelines for a standardised home interview survey for New Zealand cities. This will ensure all necessary data are collected and are in a useful format.

The format would need to be flexible, and the standardised survey could be expected to evolve over time with the changes in the country's transportation system and society.

- The possibility that home interview surveys could be conducted as part of the Department of Statistics census should be investigated. This would help minimise the cost associated with home interview surveys.
- Further research should be directed at establishing generation, distribution and mode choice models that are best suited to New Zealand.
- A research project should be undertaken to correlate trip making with:
 - Level of public transport;
 - Standard of roading provided;
 - Geographical environment;
 - Presence of tertiary institutes;
 - Presence of bulk transport facilities (air, sea);
 - Economic activity (agricultural, industrial, available commercial, retail).
- A research project should be undertaken to retrieve, document, and analyse the external traffic data surveys that were carried out with each home interview survey.
- A research project should be undertaken to retrieve, document, and analyse the commercial vehicle traffic data surveys that were carried out with and without each home interview survey, where such data exist.

Abstract

This research project, carried out between 1995-1997, explores the personal travel characteristics of New Zealanders that have been recorded in various household interview surveys (HIS) carried out over the last 30 years. It has brought together all the household interview survey data, both in electronic form and as documents, that are still available in New Zealand.

The trip generation rates per person and per household for person trips by mode, vehicle ownership and purpose, and for vehicle driver trips by vehicle ownership, purpose, household category, occupancy, duration have been analysed. Also the stability of trip rates both between cities, and within cities over time, has been researched.

1. Introduction

Transfund New Zealand's total annual roading budget is some NZ\$750 million (as at 1997). A proportion of this goes towards new construction works. To justify the construction of a new part of the road network infrastructure, each potential project must undergo a cost-benefit analysis. For strategic projects in urban areas the analysis often includes the use of computer-based transportation models. The transportation models are calibrated using statistics and functions derived from a sample Household Interview Survey (HIS). Such data are generally collected only in the main centres in New Zealand because of the costs involved. Outside these areas, the computer transportation models are built using the modeller's skills and information from a HIS that can be imported into such models.

In the main centres such surveys are carried out about every 10 to 20 years. It is not known whether this time period is short enough so that the data remain relevant for the period between surveys. In other words, how stable is the data? If it is not stable then decisions about strategic roading projects involving millions of dollars may be being made on out-of-date data. However, if the trip-making characteristics are stable, then maybe fewer HIS are needed.

Another issue is the stability of trip-making characteristics across cities. A single survey in one main centre may be enough to apply to the whole of New Zealand, or it may need to be extended to cover many of the smaller cities in New Zealand as well.

A further topical issue is the amount of money that should be spent on public transport. Currently is too little or too much being spent? Multi-modal traffic models are only now being developed in New Zealand that can help answer this question. The stability of the data used to calibrate these multi-modal models is vitally important, as it will affect the decision either to build a new road, or instead to increase public transport services. The objectives of this stage of this project, carried out between 1995 and 1997, are three-fold;

- To analyse the household interview data without reference to time, and to analyse the stability of the data across cities and across time;
- To gain a better understanding of the trip-making process;
- To provide a rudimentary database, in the form of a report, of trip-making characteristics to help better calibrate transportation models.

A supporting CD-ROM has been produced, containing all the collected survey data and original study documentation. It also includes the survey data in ASCII and MSAccess database format, as well as the spreadsheets and data referred to within the report. It is available from Transfund New Zealand¹ on request. The spreadsheets have been compressed as zip files, contained on the diskette accompanying the report (in the envelope inside the back cover).

¹ PO Box 2331, Lambton Quay, Wellington

2. Data Available in New Zealand

During the data collection stage of this project, up to 1996, some of the home interview survey data had already been lost. Appendix 2 of this report explains how the data were collected.

Of all the studies carried out, the 1978 National Urban Transport Survey (NUTS) was the only one that specifically surveyed six cities at the one time. The others were all carried out for transportation studies within a specific city.

Hence the format of those studies was generally such that average weekday travel logs were recorded. For Wellington 1971 and Auckland 1973, only trips by motorised vehicles were recorded. Hence no walking or bicycle trips have been recorded for person trips. For NUTS 1978, walk and cycle trips were only recorded if they were a direct trip to or from work or school.

One of the data sets located was the New Zealand Household Travel Survey carried out by the Ministry of Transport (MOT) in 1989/90. It differs from the other surveys in that it surveyed a sample of households over the whole of New Zealand. It recorded two days of travel log, where those days could be any day of the week and at any time of the year. It therefore includes travel data on weekends and during public holidays.

The full list of survey data analysed during this study is then:

Dunedin (D)	1978, 1990
Christchurch (C)	1969, 1978, 1990
Wellington (W)	1971, 1978, 1988
Hamilton (HA)	1978
Heretaunga (HE)	1978
Auckland (A)	1973, 1978, 1992
NUTS	1978
MOT	1989

To view the areas covered by each study refer to maps (Figures A3.1.1 to A3.1.9) in Appendix 3.1.

3. Household Interview Survey Sample & Expanded Statistics

Each household interview survey has recorded trips made by a sample of the population on a particular day. For each study the days and month surveyed, along with the sampled and expanded number of households and persons older than 5 years who were interviewed, are shown in Table 3.1.

The survey sample rates (except for MOT 1989/90) lie between 1.5% and 5%. That sampling rate has been suggested by Hobbs (1979) for cities with between 250,000 and 1,000,000 people. The sampling for Christchurch, Wellington and Auckland lies within that range. For smaller cities, Hobbs (1979) suggests a larger sampling rate. However, while this is commendable, budgets have not always allowed for such luxuries. The sampling rates used for other cities surveyed in New Zealand are consistent with those used for Christchurch, Wellington and Auckland, and should not diminish their usefulness.

The global statistics that occurred for each survey are shown in Table 3.2. The National Urban Transportation Survey (NUTS) did not expand the surveyed data, and hence subsequent trip rate results vary slightly from the expanded survey results.

For more detailed global and sample statistics refer to the Appendices, and to HIS_STATS.XLS spreadsheets in the zipped files on the diskette, or in the Appendix section of the CD-ROM.

Table 3.1 Sample statistics of household interview surveys for New Zealand cities, available up to 1996.

Survey City	Survey Year	Month of year surveyed	Days surveyed	Surveyed Households in HH file	Expanded Households	% of study area total	Surveyed Persons > 5yr making trips	Expanded Persons	% of study area total	Notes:
Auckland	1973	Sept-Nov	?	5739	226060	2.54%	16171	636533	2.54%	Unexpanded see note below
Auckland	1978	?	Mon-Thur	1408			3965			Unexpanded see note below
Auckland	1992	Mar/Apr	Mon-Fri	9957	315737	3.15%	9957	778431	1.28%	Unexpanded see note below
Christchurch	1969	?	?	1251	81745	1.53%	3494	227742	1.53%	Unexpanded see note below
Christchurch	1978	?	Mon-Thur	929			2578			Unexpanded see note below
Christchurch	1990	Apr/May	Mon-Thur	6175	119400	5.17%	5505	288939	1.91%	Unexpanded see note below
Dunedin	1978	?	Mon-Thur	490			1371			Unexpanded
Dunedin	1990	Mar/Apr	Mon-Fri	998	35858	2.78%	2356	84651	2.78%	Unexpanded
Heretaunga	1978	?	Mon-Thur	421			1180			Unexpanded
Hamilton	1978	?	Mon-Thur	502			1499			Unexpanded
Wellington	1971	Sept-Nov	Mon-Fri	1938	93590	2.07%	5769	278664	2.07%	Unexpanded
Wellington	1978	?	Mon-Thur	945			2624			Unexpanded
Wellington	1988	?	?	3085	120602	2.56%	7847	282028	2.78%	Unexpanded
NUTS TOTAL	1978	?	Mon-Thur	4695			13217			Unexpanded
MOT TOTAL	1989-90	July-July incl.Holidays	Mon-Sun	3541	1180679	0.30%	7549	3298421	0.23%	2 Day Trip Record

NOTES:

AKLD 1992 Only 1 respondent per household recorded a travel log.

CHCH 1969 Expansion factor in HH and PP files differed from that in the TT file.
The latter was accepted as more accurate.
Hence HH and PP files were expanded by the ratio of: TT expanded Households/TT Households
Persons are All Persons not those > 5yrs.

CHCH 1990 Only 1 respondent per household recorded a travel log.
Trip data is available for Saturday as well. Only Mon-Thur has been used for analysis.

MOT 1989 Households are those that had people.
Persons are All Persons not those > 5yrs.
A two day travel log was recorded. Those days may have been on weekends or public holidays.
Trip rates reported in this study have been divided by two.

3. Household Interview Survey Sample & Expanded Statistics

Table 3.2 Global statistics of household (HH) interview surveys for New Zealand cities, available up to 1996.

Survey City	Survey Year	Households	Population	Employees	Vehicles	Vehicle per HH	Vehicles per 1000 people	Vehicles per 1000 employees
Auckland	1973	226060	710619	312514	289208	1.28	407	925
Auckland	1978	* 1408	4300	1774	1813	1.29	422	1022
Auckland	1992	315737	844248	411285	548392	1.74	650	2372
Christchurch	1969	81745	227742	96204	90568	1.11	400	935
Christchurch	1978	* 929	2788	1120	1252	1.35	449	1118
Christchurch	1990	119400	318069	134508	229997	1.93	723	1710
Dunedin	1978	* 490	1472	662	595	1.21	404	899
Dunedin	1990	35858	91513	39846	49044	1.37	536	1231
Heretaunga	1978	* 421	1291	473	548	1.30	424	1159
Hamilton	1978	* 502	1605	371	762	1.52	475	1042
Wellington	1971	93590	6524	137390	104275	1.11	331	759
Wellington	1978	* 945	2876	1316	1122	1.19	390	853
Wellington	1988	120602	335709	166210	189611	1.57	565	1141
NUTS TOTAL	1978	* 4695	14332	6076	6092	1.30	425	1003
MOT TOTAL	1989-90	1180679	3298421	1521546	2502848	2.12	759	1645

* = Unexpanded

4. Household Composition

From the surveyed statistics extracted for each study, the household composition by people, employees and vehicle ownership has been derived. The trends over time for household variables have been plotted on Figure 4.1.

The trends over time can be summarised as:

- Persons per household are on the decline,
- Vehicles per household are on the increase,
- Employees per household are reasonably stable.

Another way to illustrate these trends is to look at the percentage of households with different numbers per household. For example the trends for the percentage of households with 0, 1, 2, or 3+ vehicles per household, are shown on Table 4.1 and illustrated for the three Auckland surveys on Figure 4.2.

The Household Occupancy Trends show a slight increase in the percentage of households with 1 and 2 persons per household. Correspondingly there are decreases in the percentage of households with 3, 4 or 5+ persons per household. This further illustrates the decline in the average number of persons per household, seen in Figure 4.1.

The plot of Household Employment Trends shows an increase in the percentage of households with no employees, and a decrease in the percentage of households with one employee. Meanwhile the percentage of households with 2+ employees has increased only slightly. Figure 4.1 shows that the average number of employees per household has remained reasonably stable over time. Over this period of New Zealand's history the level of unemployment has increased. From the demographics shown in Figure 4.2, this unemployment has had the greatest effect on households that had only one employee.

The trends in vehicle ownership show that the percentage of households with 0 and 1 vehicles is declining, while those with 2 or 3+ are increasing. Hence Figure 4.1 shows an overall increase in the average number of vehicles per household.

Between cities surveyed at the same time Figure 4.1 shows that:

- Persons per household are reasonably constant,
- Employees per household vary between cities,
- Vehicles per household vary between cities.

Though the latter two of the above statements cannot be shown to be statistically significant, there is a practical significance, as discussed in Trip Generation, section 5 of this report.

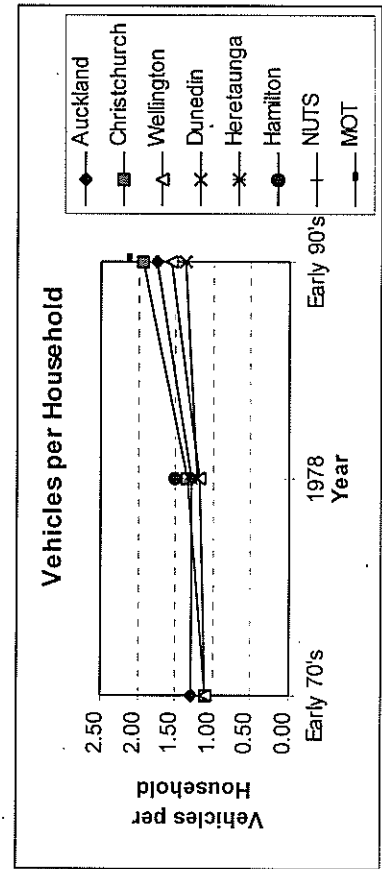
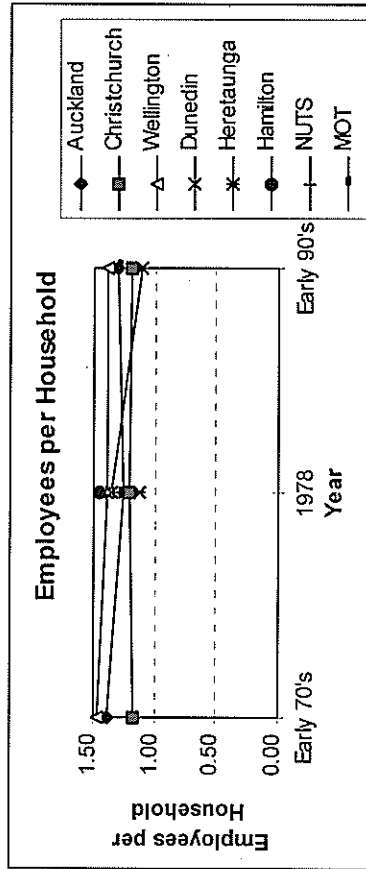
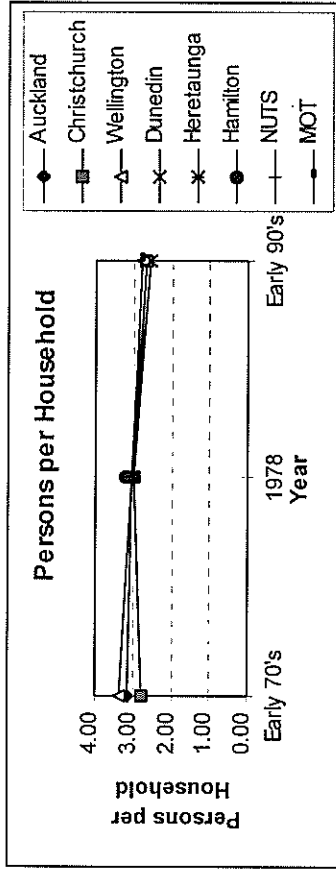
4. Household Composition

Figure 4.1 Number of persons, employees, and vehicles per household.

	Persons per HH \pm 0.27		
	Early 70's	1978	Late 80's/Early 90's
Auckland	3.14	3.05	2.67
Christchurch	2.79	3.00	2.66
Wellington	3.37	3.04	2.78
Dunedin		3.00	2.55
Heretaunga		3.07	
Hamilton		3.20	
NUTS		3.05	
MOT			2.79

	Employees per HH \pm 0.18		
	Early 70's	1978	Late 80's/Early 90's
Auckland	1.38	1.26	1.30
Christchurch	1.18	1.21	1.19
Wellington	1.47	1.39	1.38
Dunedin		1.35	1.11
Heretaunga		1.12	
Hamilton		1.46	
NUTS		1.29	
MOT			1.29

	Vehicles per HH \pm 0.24		
	Early 70's	1978	Late 80's/Early 90's
Auckland	1.28	1.29	1.74
Christchurch	1.11	1.35	1.93
Wellington	1.11	1.19	1.57
Dunedin		1.21	1.37
Heretaunga		1.30	
Hamilton		1.52	
NUTS		1.30	
MOT			2.12



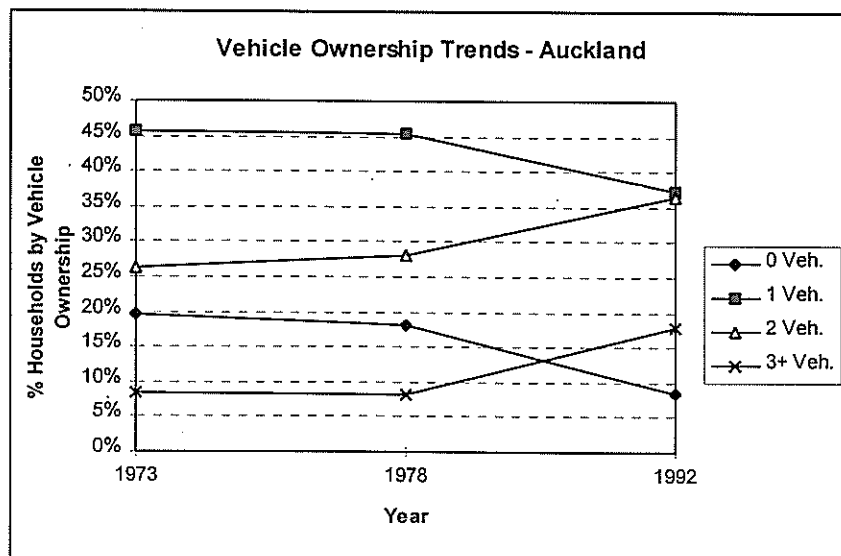
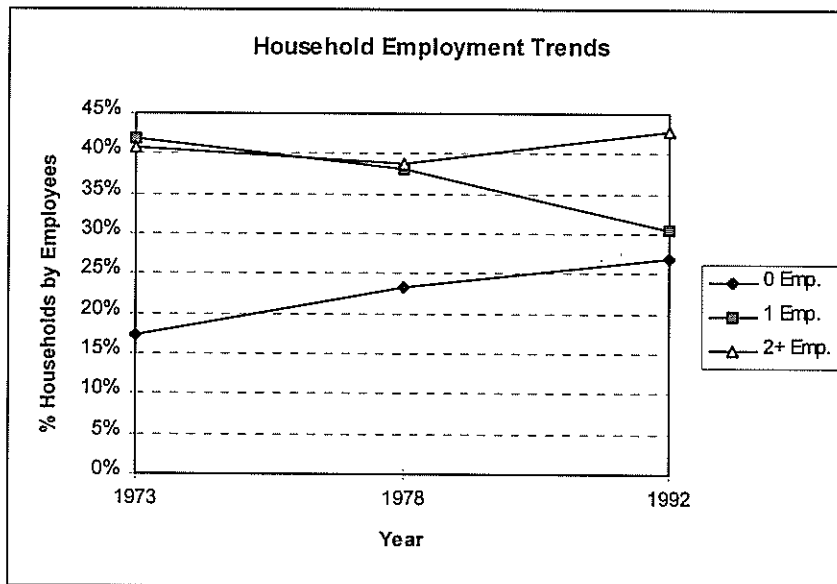
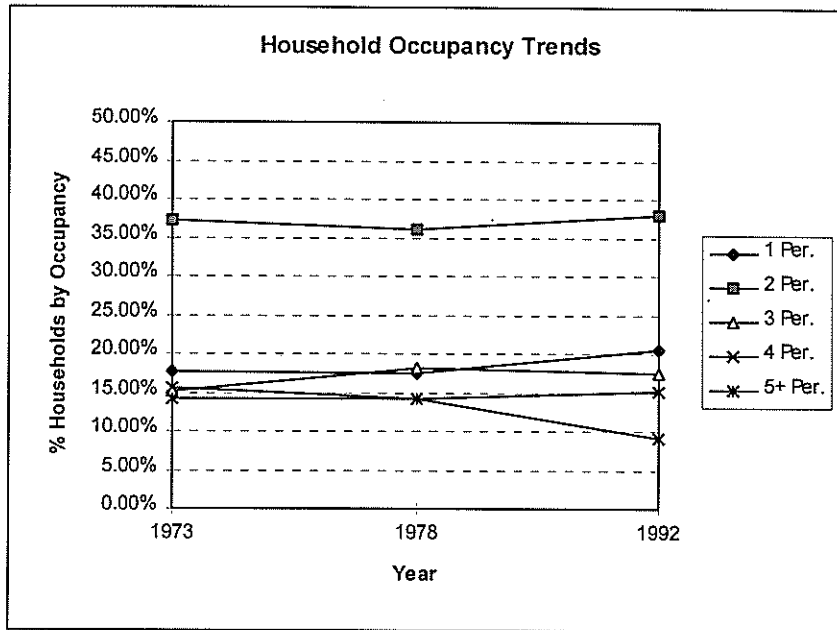
PERSONAL TRAVEL CHARACTERISTICS OF NEW ZEALANDERS

Table 4.1 Percentage of households (HH) in each of the categories, of numbers of persons, employees, and vehicles.

% HOUSEHOLDS BY PERSONS						
Survey City	Survey Year	% HH with 1 Per.	% HH with 2 Per.	% HH with 3 Per.	% HH with 4 Per.	% HH with 5+ Per.
Auckland	1973	17.74%	37.12%	15.23%	15.67%	14.24%
Auckland	1978	17.33%	36.08%	18.25%	14.20%	14.13%
Auckland	1992	20.43%	37.81%	17.39%	15.23%	9.14%
Christchurch	1969	17.88%	39.19%	15.48%	12.64%	14.81%
Christchurch	1978	17.33%	37.46%	15.61%	16.25%	13.35%
Christchurch	1990	23.19%	38.13%	17.12%	14.15%	7.41%
Dunedin	1978	14.90%	38.98%	16.53%	15.92%	13.67%
Dunedin	1990	26.56%	33.47%	16.03%	15.23%	8.71%
Heretaunga	1978	18.76%	35.87%	15.44%	12.83%	17.10%
Hamilton	1978	13.15%	36.65%	17.73%	14.74%	17.73%
Wellington	1971	12.29%	37.52%	17.63%	16.96%	15.59%
Wellington	1978	15.87%	40.85%	15.45%	13.76%	14.07%
Wellington	1988	20.80%	31.59%	17.14%	16.98%	13.48%
NUTS TOTAL	1978	16.46%	37.66%	16.68%	14.63%	14.57%
MOT TOTAL	1989-90	18.26%	33.94%	16.71%	17.56%	13.53%
% HOUSEHOLDS BY EMPLOYEES						
Survey City	Survey Year	% HH with 0 Emp.	% HH with 1 Emp.	% HH with 2+ Emp.		
Auckland	1973	17%	42%	41%		
Auckland	1978	23%	38%	39%		
Auckland	1992	27%	31%	43%		
Christchurch	1969	21%	49%	29%		
Christchurch	1978	26%	37%	37%		
Christchurch	1990	33%	31%	37%		
Dunedin	1978	25%	29%	46%		
Dunedin	1990	9%	29%	62%		
Heretaunga	1978	26%	42%	32%		
Hamilton	1978	19%	34%	47%		
Wellington	1971	12%	46%	42%		
Wellington	1978	18%	40%	43%		
Wellington	1988	24%	31%	45%		
NUTS TOTAL	1978	23%	37%	40%		
MOT TOTAL	1989-90	24%	35%	41%		
% HOUSEHOLDS BY VEHICLES						
Survey City	Survey Year	% HH with 0 Veh.	% HH with 1 Veh.	% HH with 2 Veh.	% HH with 3+ Veh.	
Auckland	1973	20%	46%	26%	8%	
Auckland	1978	18%	45%	28%	8%	
Auckland	1992	9%	37%	36%	18%	
Christchurch	1969	19%	54%	23%	4%	
Christchurch	1978	16%	46%	28%	9%	
Christchurch	1990	9%	36%	32%	24%	
Dunedin	1978	19%	50%	24%	7%	
Dunedin	1990	18%	45%	26%	12%	
Heretaunga	1978	13%	54%	26%	8%	
Hamilton	1978	12%	47%	31%	10%	
Wellington	1971	22%	50%	22%	6%	
Wellington	1978	20%	50%	23%	6%	
Wellington	1988	12%	45%	28%	15%	
NUTS TOTAL	1978	17%	48%	27%	8%	
MOT TOTAL	1989-90	13%	39%	35%	13%	

4. Household Composition

Figure 4.2 Trends in percentage of households in each of the categories, of numbers of persons, employees, and vehicles for Auckland City.



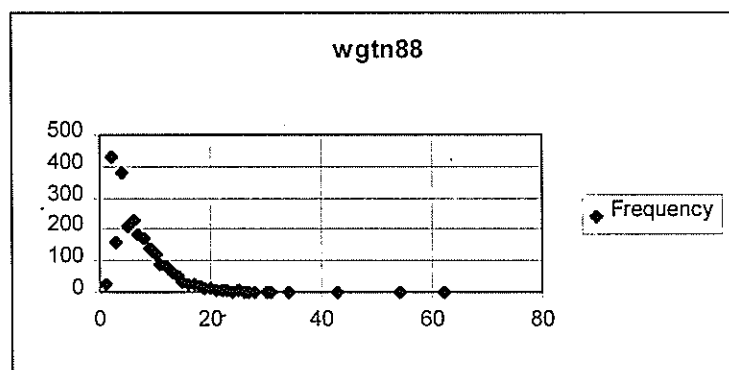
5. Trip Generation: per Person & per Household

To compare the travel-making characteristics of each study, the trip rates for the basic generating units of people and households were considered.

The trip rates calculated are the average trip rates over all persons and all households. By referring to Appendix 3.2 in the CD-ROM, and the spreadsheet file entitled HIS_STATS on the diskette, in fact only 87%-96% of households actually recorded that they made trips. Also, the vehicle driver trips that were recorded gave an even lower percentage of households, ranging from 61% to 81%. This is presumably a valid response for the day of travel on the survey questionnaire.

The aim was then to assess the consistency of personal trip-making characteristics. A typical plot of trips per household by frequency for Wellington 1988 is shown on Figure 5.1. As expected, the distribution of trips per household is not normally distributed.

Figure 5.1 Distribution of trips per household for Wellington 1988 survey.



Using the central limit theorem, it has been assumed that the mean trips per household on different days are normally distributed. Analyses of variance have therefore been carried out on the following groups (marked 1 for city, and 2 for year) of data:

City	Early 70s	1978	Late 80s
Auckland	1	1, 2	1, 2
Wellington	1	1, 2	1, 2
Christchurch	1	1, 2	1, 2
Dunedin	—	2	2

5. Trip Generation: per Person & per Household

An estimate of the standard deviation has been calculated from the mean of the two error mean squares. The resulting trip rates and 95% confidence intervals are shown on Table 5.1.

Plotting trip rates over time, as in Figure 5.2, shows that the trends for each city are not consistent. That is, some city generation rates are increasing and some are decreasing. This suggests that there may be an interaction between the variables of city and year. With such a small amount of data to choose from, this is the only term available as an error term, and therefore the error rates will be inflated and tests less likely to be significant. It is therefore difficult to make decisive conclusions from the data. Within the error bounds reported in Table 5.1, statistically person trip rates are similar both over time and between cities at the same time. Vehicle trip rates, on the other hand, do show a slight variation.

In more practical terms however, a trip rate difference of one has a dramatic effect. For example, a vehicle trip rate of 5 in a city of 100,000 households gives 500,000 trips per day. A vehicle trip rate of 6, while not statistically different, gives 600,000 trips per day or an increase in traffic of 20%. That 20% increase in traffic on a city's roads has a very great effect, especially as delays caused by congestion are exponential rather than linear.

Table 5.1 Daily trip rates per person and per household.

DAILY PERSON TRIPS PER HOUSEHOLD				
Survey City	Early 70s	1978	Late 80s/ Early 90s	
Auckland		9.35	8.30	
Christchurch	12.78	9.00	12.36	
Wellington		9.23	10.87	
Dunedin		9.54	11.32	
Heretaunga		9.60		
Hamilton		10.92		
NUTS Total		9.47		
MOT Total			11.80	

NOTE: The 1978 NUTS data only recorded walk or cycle trips that were directly to/from work or school. Hence person trips are likely to be under reported.

Error Mean Square = 1.674 95% Confidence = ± 2.59

DAILY PERSON TRIPS PER PERSON				
Survey City	Early 70s	1978	Late 80s/ Early 90s	
Auckland		3.32	3.37	
Christchurch	5.38	3.24	5.11	
Wellington		3.33	4.65	
Dunedin		3.41	4.79	
Heretaunga		3.43		
Hamilton		3.66		
NUTS Total		3.36		
MOT Total			4.15	

NOTE: The 1978 NUTS data only recorded walk or cycle trips that were directly to/from work or school. Hence person trips are likely to be under reported.

Error Mean Square = 0.302 95% Confidence = ± 1.10

DAILY VEHICLE DRIVER TRIPS PER HOUSEHOLD				
Survey City	Early 70s	1978	Late 80s/ Early 90s	
Auckland	4.81	5.51	5.33	
Christchurch	5.87	5.47	6.96	
Wellington	4.96	4.78	5.19	
Dunedin		5.22	5.46	
Heretaunga		6.32		
Hamilton		6.73		
NUTS Total		5.53		
MOT Total			5.87	

Error Mean Square 1 = 0.208

Error Mean Square 2 = 0.253

Average = 0.231 95% Confidence = ± 0.96

DAILY VEHICLE DRIVER TRIPS PER PERSON				
Survey City	Early 70s	1978	Late 80s/ Early 90s	
Auckland	1.71	1.81	2.16	
Christchurch	2.07	1.82	2.88	
Wellington	1.67	1.57	2.22	
Dunedin		1.74	2.31	
Heretaunga		2.06		
Hamilton		2.10		
NUTS Total		1.81		
MOT Total			1.87	

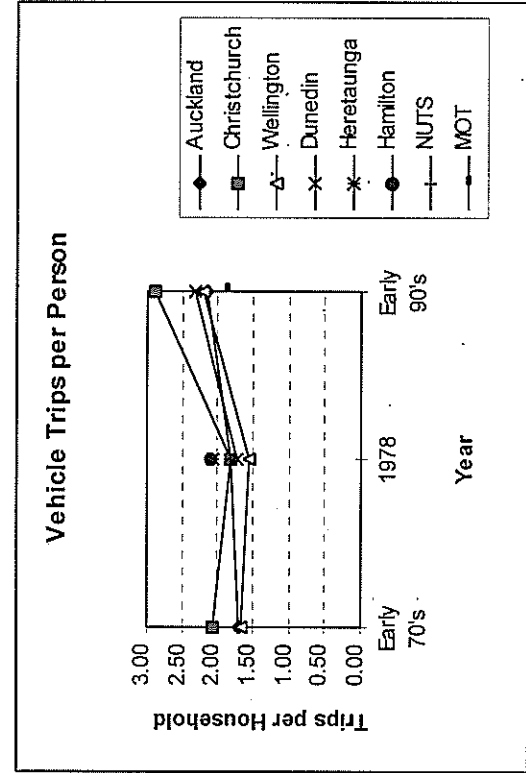
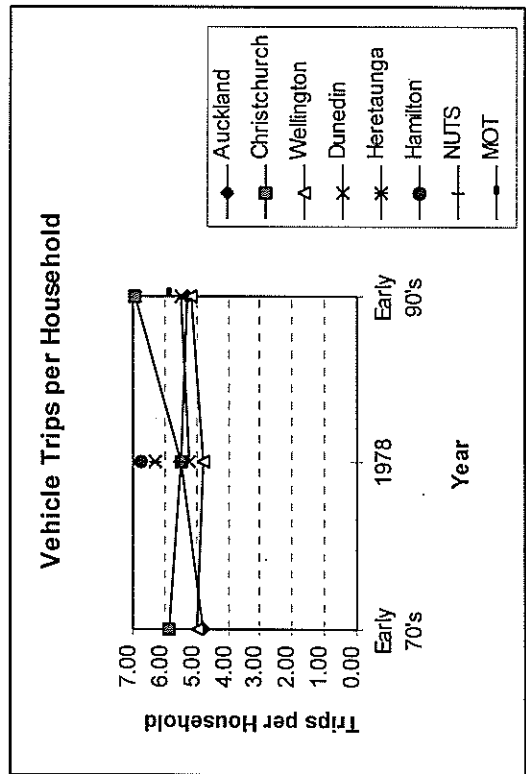
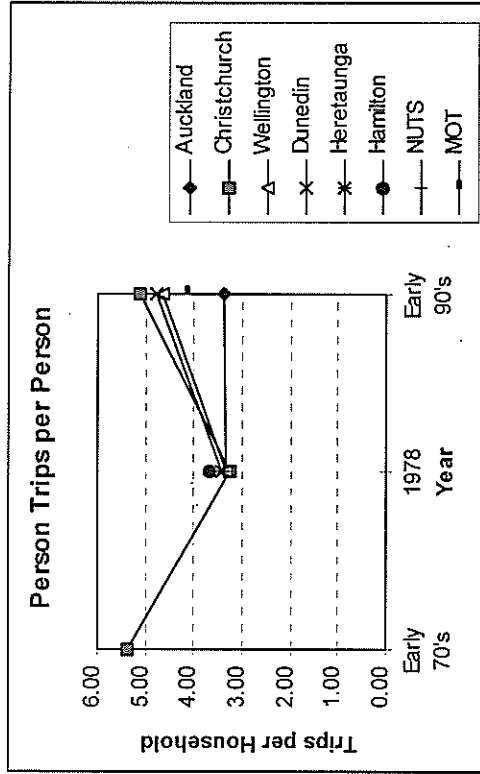
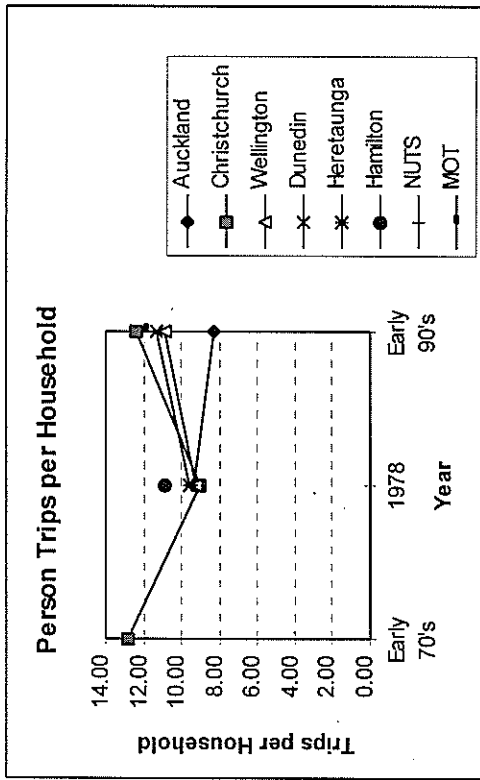
Error Mean Square 1 = 0.032

Error Mean Square 2 = 0.044

Average = 0.038 95% Confidence = ± 0.39

5. Trip Generation: per Person & per Household

Figure 5.2 Daily trip rate trends per person and per household.



6. Initial Comparisons

6.1 Comparisons Between Cities

Table 5.1 shows the person trip rates per household and per person. For the cities surveyed during the 1978 NUTS study, very little variation is recorded in the person trip generation rates. By the late 80s-early 90s, a variation in the person trip generation rates does appear to have emerged. That variation is not statistically significant but ranges from 8.30 to 12.36 trips per household. Comparing these rates with the household composition values shown on Figure 4.1 reveals no obvious explanation for the variation in trip generation rates.

A similar comparison of vehicle driver trip rates reveals a greater variation in both 1978 and the late 80s-early 90s. These can be shown to be statistically significant and suggest that, for vehicle driver trips at least, there is a variation between cities. By referring back to Figure 4.1 the only variation in household composition that may account for these variations are the levels of employees and vehicles per household. Given that vehicle driver trips are being considered, then household vehicle ownership should have an effect on trip generation.

For example, for Hamilton, in 1978 with 1.5 vehicles per household, has the highest vehicle trip generation of 6.7 trips per household. The next highest vehicles per household is Christchurch but this generated only 5.5 trips per household, whereas Heretaunga with similar vehicle ownership generates 6.3 trips per household. At the other end of the scale, Wellington and Dunedin have similar vehicle ownership but their vehicle trip rates are 4.8 and 5.2 respectively. Obviously other factors beyond household composition affect the vehicle trip generation within a city. One such factor may be the level of public transport available, explored in section 7.1 of this report where mode choice is reported.

6.2 Comparisons Over Time

Within each survey the way in which person trips were recorded varies. While Table 5.1 and Figure 5.2 show person trips for the 1978 NUTS study, it is suspected that these trips have been under-reported because walk and cycle trips were recorded only if they were directly to or from work or school. As mentioned in section 6.1 "Comparisons Between Cities", the variations in person trip rates are not statistically significant. Furthermore, given that 1978 is likely to be under-reported, person trip generation rates may not have changed over time.

6. *Initial Comparisons*

Vehicle driver trip rates have a more consistent definition between studies, and numerically are increasing slightly although this can not be shown to be statistically significant. Practically however, a rise from 4.8 to 5.3 vehicle driver trips per household, for the 315,000 households in Auckland in 1992, gave a traffic generation increase from 1.51M vehicles to 1.67M vehicles, i.e. 10% more traffic. Similarly in Christchurch, an increase from 5.87 to 6.96 over 119,000 households gave traffic generations of 700,000 and 828,000 vehicles respectively, an increase of 18%.

This increase in vehicle driver trips corresponds to the increasing level of household vehicle ownership. As the overall person trips are not increasing significantly, then a shift in mode choice should be evident. This is explored in section 7.1 of this report.

7. Person Trip-Making Characteristics

7.1 Person Trips per Household by Mode

The type and number of person trips recorded, in each of the household interview surveys that have been carried out, vary and must be considered carefully. The person trip rates by mode shown in Table 7.1 illustrate some of the possible variations. All the surveys have recorded person trips by motorised vehicles, whether as vehicle driver, passenger, as by public transport or “other”. “Other” is a fairly loose definition for anything other than the vehicle classes of car, truck or motorbike.

The greatest difference in survey methods occur for those trips made by bicycle or walking, i.e. the “slow” modes. In studies that have recorded these trips, they account for up to three trips per household and this typically raised the overall trips per household from around 9 to 12. When looking at total trip rates per household, be aware that the following variations in the survey methods were used:

- Wellington 1971 No walk or cycle trips recorded
- Auckland 1973 No walk or cycle trips recorded
- NUTS 1978 Only recorded walk or cycle trips that were directly to/from work or school.

From Table 7.1, vehicle driver trips in all studies make up the greatest proportion of trips, followed by vehicle passenger trips. The choice between the remaining minor modes depends largely on the provision of public transport within a city, and the topography, especially in relation to bicycle use.

In Wellington, which has a high level of public transport use, the vehicle driver trip rates are correspondingly low. In Heretaunga and Hamilton where the public transport use is low, the vehicle driver trip rates are high. In these cases, given that people are using their vehicles rather than public transport, they in turn make more vehicle trips than have been recorded in other studies. Regardless of what happens to public transport or vehicle driver trip rates, the rates for vehicle passengers remains fairly constant.

By re-arranging the data for the three consistent mode choices of vehicle driver, vehicle passenger, and public transport, the trip rate trends over time have been shown on Figure 7.1.

In general there has been a decline in the use of public transport over the years. Vehicle driver trips have fluctuated mainly upwards, while vehicle passenger trips have remained relatively stable. As suspected in section 6 of this report, an increase in the vehicle driver trip rates is balanced by a decrease in public transport use.

7. Person Trip-Making Characteristics

Table 7.1 Daily person trip rates by travel mode.

Survey City	Survey Year	Person Trips/HH by Mode:					
		Vehicle Driver	Vehicle Pass.	Public Trans.	Other	Bicycle	Walk
Auckland	1973	4.81	1.91	1.02	0.00	-	-
Auckland	1978	5.51	1.92	0.86	0.01	0.15	0.90
Auckland	1992	5.33	1.59	0.50	0.00	0.13	0.76
Christchurch	1969	5.87	1.50	0.98	0.06	1.63	2.74
Christchurch	1978	5.47	1.60	0.58	0.06	0.70	0.58
Christchurch	1990	6.96	1.51	0.52	0.03	1.20	2.14
Dunedin	1978	5.22	1.80	0.93	0.15	0.05	1.39
Dunedin	1990	5.46	1.86	0.42	0.00	0.33	3.25
Heretaunga	1978	6.32	1.52	0.30	0.00	0.57	0.89
Hamilton	1978	6.73	2.16	0.47	0.02	0.55	0.99
Wellington	1971	4.96	1.84	1.66	0.00	-	-
Wellington	1978	4.78	1.78	1.54	0.01	0.15	0.98
Wellington	1988	5.28	1.87	0.97	0.11	0.22	2.41
NUTS TOTAL	1978	5.53	1.81	0.86	0.03	0.33	0.91
MOT TOTAL	1989	5.87	2.61	0.37	0.03	0.42	2.50
Survey City	Survey Year	% Trips by Mode:					
		Vehicle Driver	Vehicle Pass.	Public Trans.	Other	Bicycle	Walk
Auckland	1973	62%	25%	13%	0%	0%	0%
Auckland	1978	59%	21%	9%	0%	2%	10%
Auckland	1992	64%	19%	6%	0%	2%	9%
Christchurch	1969	46%	12%	8%	0%	13%	21%
Christchurch	1978	61%	18%	6%	1%	8%	6%
Christchurch	1990	56%	12%	4%	0%	10%	17%
Dunedin	1978	55%	19%	10%	2%	1%	15%
Dunedin	1990	48%	16%	4%	0%	3%	29%
Heretaunga	1978	66%	16%	3%	0%	6%	9%
Hamilton	1978	62%	20%	4%	0%	5%	9%
Wellington	1971	59%	22%	20%	0%	0%	0%
Wellington	1978	52%	19%	17%	0%	2%	11%
Wellington	1988	49%	17%	9%	1%	2%	22%
NUTS TOTAL	1978	58%	19%	9%	0%	3%	10%
MOT TOTAL	1989	50%	22%	3%	0%	4%	21%

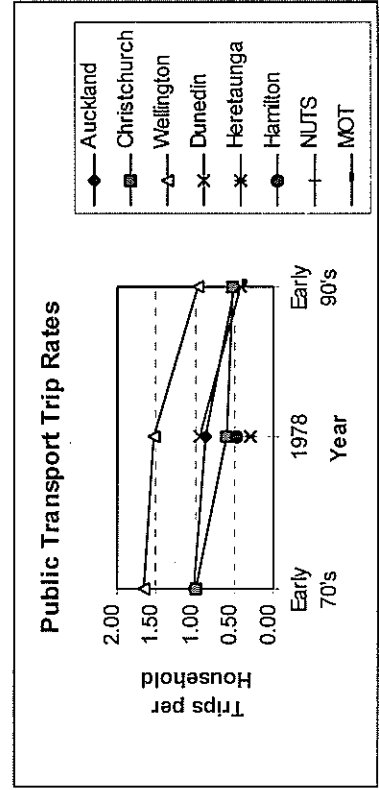
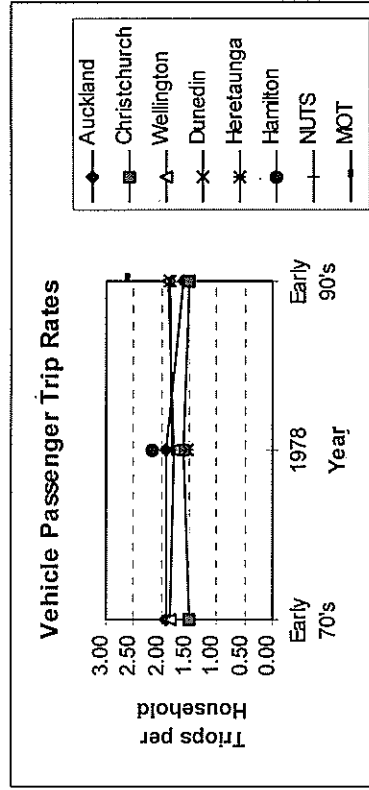
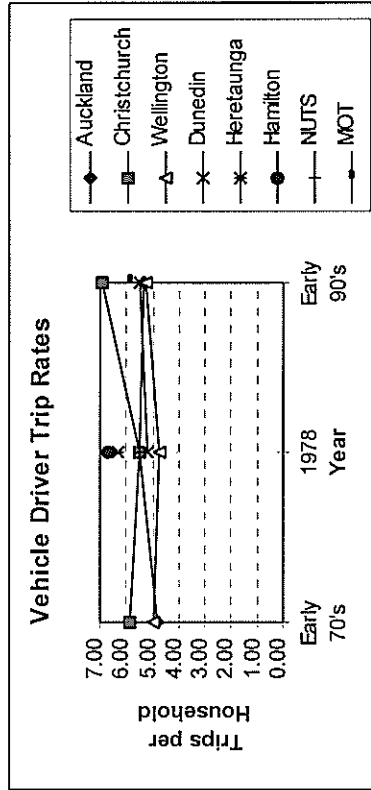
NOTES: Wgtn 1971 and AKLD 1973 did not record walk or bicycle trips.
NUTS 1978 only recorded walk or bicycle trips if they were directly to/from work or school.

Figure 7.1 Daily trip rate trends by the primary travel modes of driver, passenger and public transport.

VEHICLE DRIVER TRIPS \pm 0.96			
City	Early 70's	1978	Late 80's/ Early 90's
Auckland	4.81	5.51	5.33
Christchurch	5.87	5.47	6.96
Wellington	4.96	4.78	5.28
Dunedin		5.22	5.46
Heretaunga		6.32	
Hamilton		6.73	
NUTS		5.53	
MOT			5.87

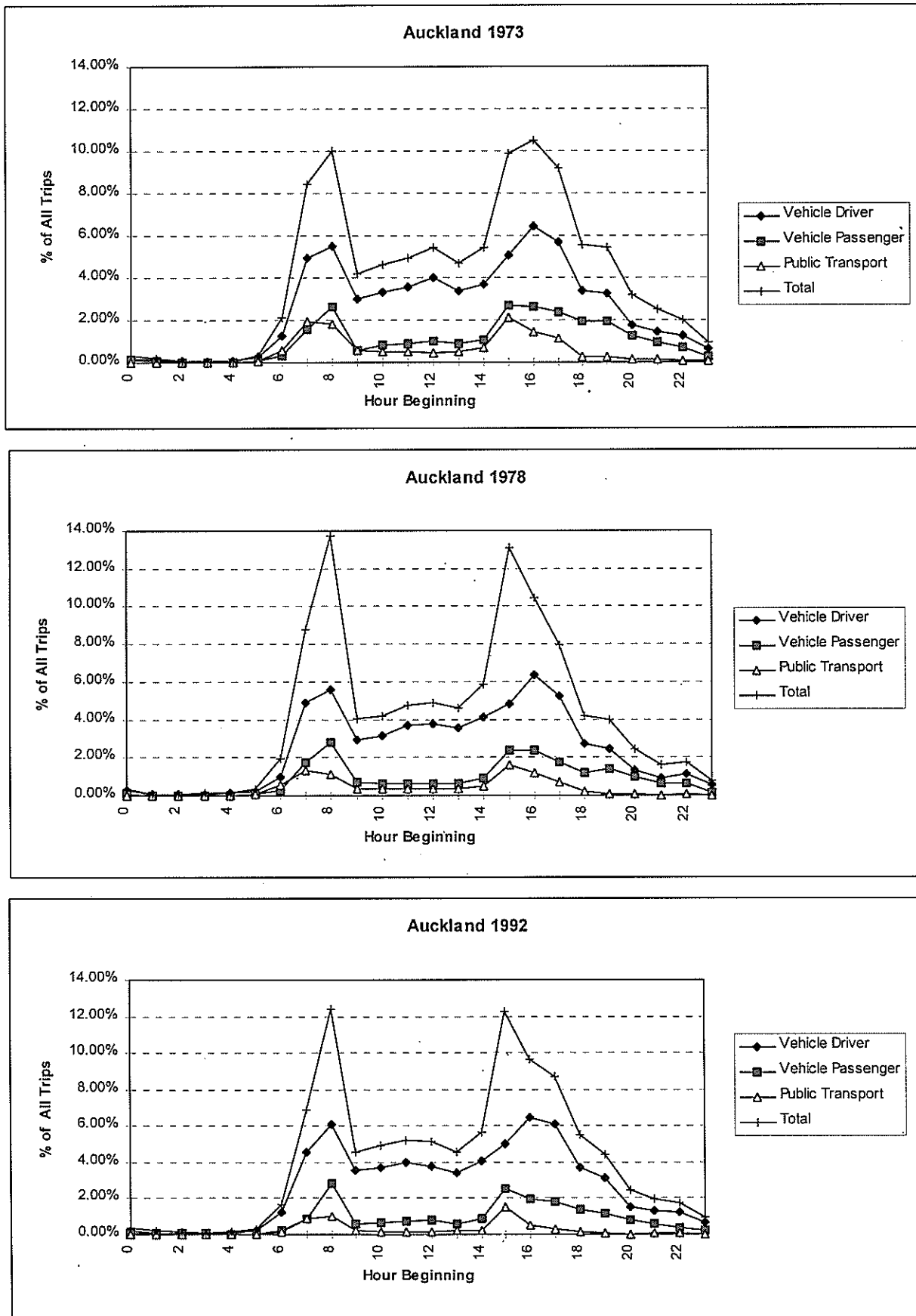
VEHICLE PASSENGER TRIPS \pm 0.26			
City	Early 70's	1978	Late 80's/ Early 90's
Auckland	1.91	1.92	1.59
Christchurch	1.50	1.60	1.51
Wellington	1.84	1.78	1.87
Dunedin		1.80	1.86
Heretaunga		1.52	
Hamilton		2.16	
NUTS		1.81	
MOT			2.61

PUBLIC TRANSPORT TRIPS \pm 0.29			
City	Early 70's	1978	Late 80's/ Early 90's
Auckland	1.02	0.86	0.50
Christchurch	0.98	0.58	0.52
Wellington	1.66	1.54	0.97
Dunedin		0.93	0.42
Heretaunga		0.30	
Hamilton		0.47	
NUTS		0.86	
MOT			0.37



7. Person Trip-Making Characteristics

Figure 7.2 Travel mode choice as % of total daily trips by time of day for the Auckland surveys.

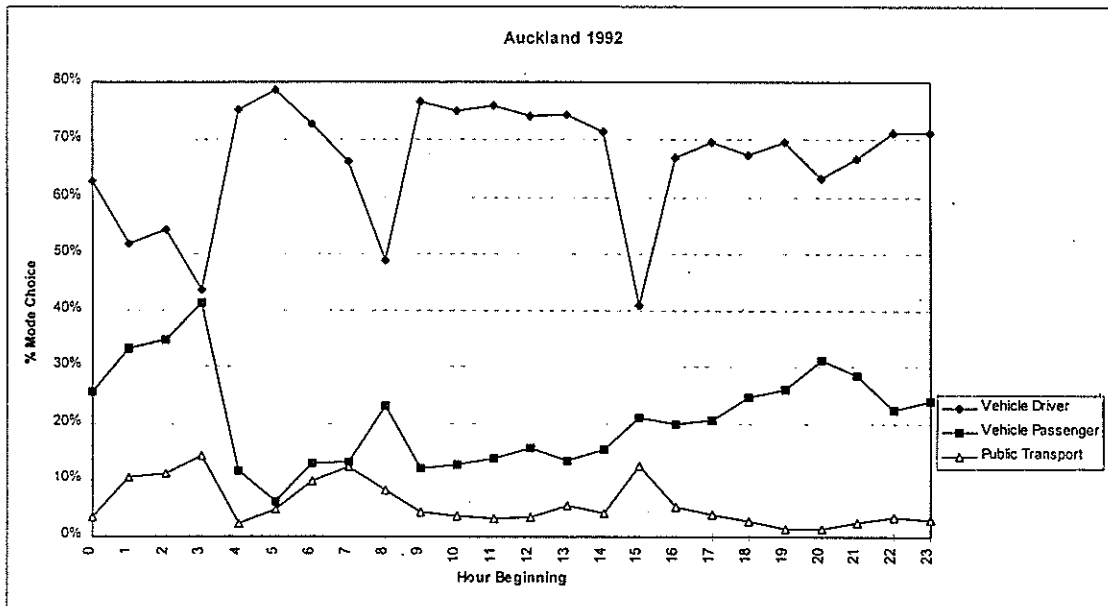


7.2 Person Trips by Mode by Time of Day

The full analysis of each study by hour is shown in the spreadsheets listed in Appendix 3.6 (see relevant files on the CD-ROM or the accompanying diskette). To keep reporting concise, only a plot of mode choice versus time for the three Auckland studies has been illustrated in Figure 7.2. The basic trend of morning and evening peaks is evident in all studies, and more recently the interpeak hours have become more consistent with the noon-hour traffic flows.

To illustrate the change in mode split during the day, Figure 7.3 shows data taken from the Auckland 1992 survey. During the peak times, vehicle passenger, public transport and walking trips to work and school increase. This then decreases the percentage of the total trip-making that vehicle driver trips represent. It must be stressed that this does not necessarily mean that fewer vehicle driver trips are being made, but that more trips are being made by other modes, and hence the vehicle driver percentage is lower.

Figure 7.3 Travel mode choice as % of total trips for each hour, from Auckland (1992) survey.



7.3 Person Trips per Household by Vehicle Ownership

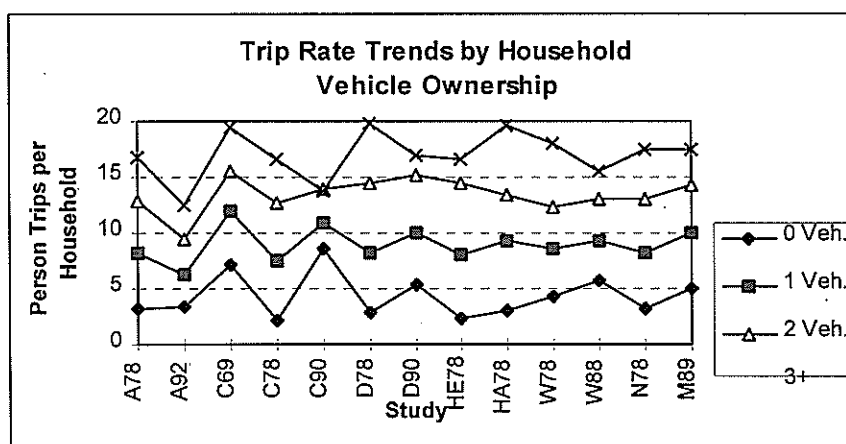
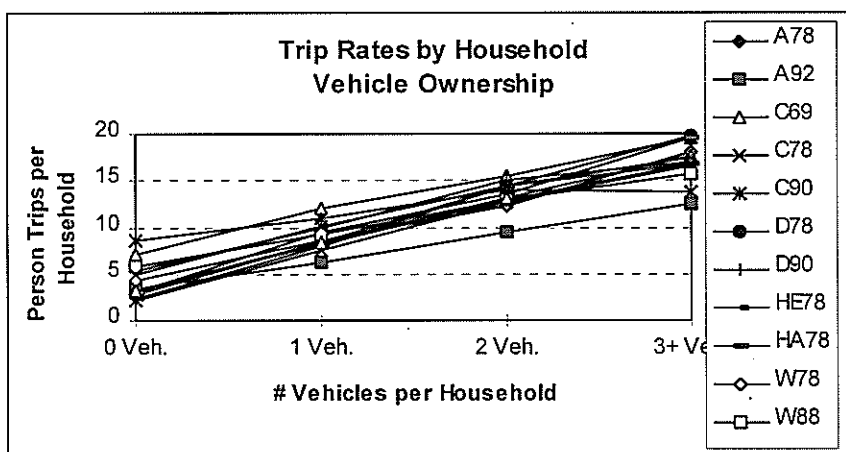
In section 4 of this report, the percentage of households owning 0, 1, 2 and 3+ vehicles was considered. For those four categories of household, the person trips per household for each study are recorded on Figure 7.4.

When these trip rates are plotted, it can be seen that the number of trips a household makes steadily increases as more vehicles become available.

7. Person Trip-Making Characteristics

Figure 7.4 Daily person trip rates by household (HH) vehicle ownership.

Survey City	Survey Year		Person Trips per HH by Households with:				
			0 Veh.	1 Veh.	2 Veh.	3+ Veh.	All
Auckland	1978	A78	3.19	8.26	12.92	16.78	9.35
Auckland	1992	A92	3.34	6.29	9.52	12.42	8.30
Christchurch	1969	C69	7.14	11.94	15.51	19.47	12.78
Christchurch	1978	C78	2.18	7.57	12.63	16.52	9.00
Christchurch	1990	C90	8.52	10.91	14.01	13.76	12.36
Dunedin	1978	D78	2.86	8.29	14.50	19.79	9.54
Dunedin	1990	D90	5.33	9.98	15.09	17.02	11.32
Heretaunga	1978	HE78	2.38	7.97	14.43	16.69	9.60
Hamilton	1978	HA78	2.97	9.36	13.45	19.57	10.92
Wellington	1978	W78	4.35	8.64	12.32	18.08	9.23
Wellington	1988	W88	5.74	9.24	12.98	15.62	10.87
NUTS TOTAL	1978	N78	3.17	8.30	13.09	17.55	9.47
MOT TOTAL	1989	M89	4.98	10.03	14.35	17.51	11.80
95% Confidence		+/-	3.78	3.15	3.07	1.22	2.59



Over time, as vehicle ownership has increased, the percentage of households owning two and three or more vehicles has increased. This then should have led to an overall increase in person trips per household. As this does not appear to have happened, something else must have kept the household person trip rate down. One possible reason is a corresponding decrease in the number of persons per household over time.

7.4 Person Trips per Household by Household Income

The recorded data in the HIS have allowed eleven studies to be analysed. Of those analysed only four recorded income per household. (NB Many studies recorded income per person but the income bands could not be combined accurately enough to derive income per household.) The other seven studies were for NUTS 1978 which recorded socio-economic ratings based upon the surveyor's judgement of the household chattels and appearance.

To try to standardise the studies, the income levels are ranked from A to E.

A - represents the lowest income band, and ranges between 1% to 18% of households.

B - is the second income band and ranges from 9% to 18% of households.

C - is the middle band and ranges from 33% to 70% of households.

D and E - are the upper bands, ranging from 1% to 17% of households.

Obviously the data recorded per household vary dramatically, and further comparisons were not considered.

The data extracted from the studies are summarised in the spreadsheet listed in Appendix 3.3.6 (see the relevant file on the CD-ROM or accompanying diskette).

7.5 Person Trips per Household by Trip Purpose

Each study had its own way of recording origin and destination land uses and purposes. The possibility of splitting Non-Home-Based into work and non-work was explored, but the data could not be extracted from all the studies. The data that could be derived are listed in Appendix 3.3.2 (see the relevant file on the CD-ROM or accompanying diskette). To analyse consistent trip purposes, each study purpose was grouped into the following:

- Home-Based Work (HBW)
- Home-Based Non-work (HBNW)
- Non-Home Based (NHB)

For the MOT data, the trip purpose was recorded only as a single entity such as "home". Subsequently these data could not be used for this analysis.

The resulting trips per household by purpose are shown on Figures 7.5 and 7.6. Statistically it is suggested that these rates are not significantly different. This reinforces the earlier findings that person trip rates have not varied over time.

7. Person Trip-Making Characteristics

Figure 7.5 Daily person trip rate trends by trip purpose.

HOME-BASED WORK \pm 0.63				
City	Early 70's	1978	Late 80's/Early 90's	
Auckland	1.69	1.74	1.70	
Christchurch	2.09	1.80	1.45	
Wellington	2.48	1.98	2.54	
Dunedin		2.28	1.68	
Heretaunga		2.10		
Hamilton		2.22		
NUTS		1.94		
HOME-BASED NON-WORK \pm 1.87				
City	Early 70's	1978	Late 80's/Early 90's	
Auckland	3.94	4.73	4.81	
Christchurch	6.68	4.68	7.84	
Wellington	3.67	4.37	5.22	
Dunedin		4.67	6.41	
Heretaunga		4.80		
Hamilton		5.31		
NUTS		4.71		
NON-HOME BASED \pm 1.29				
City	Early 70's	1978	Late 80's/Early 90's	
Auckland	2.10	2.87	1.79	
Christchurch	4.01	2.52	3.07	
Wellington	2.32	2.88	3.11	
Dunedin		2.59	3.23	
Heretaunga		2.71		
Hamilton		3.39		
NUTS		2.82		

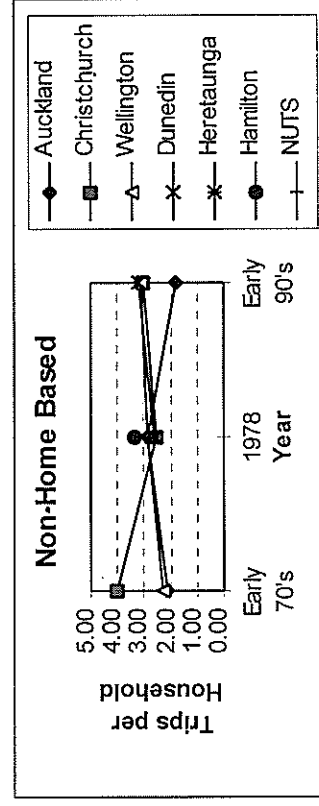
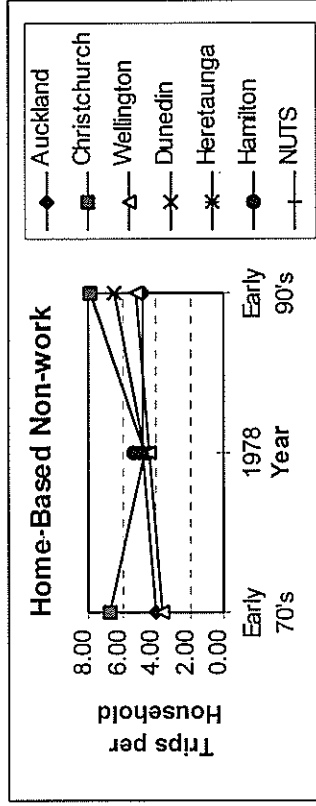
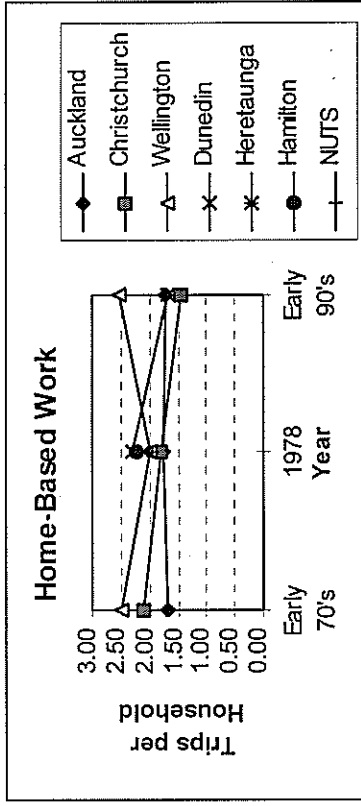
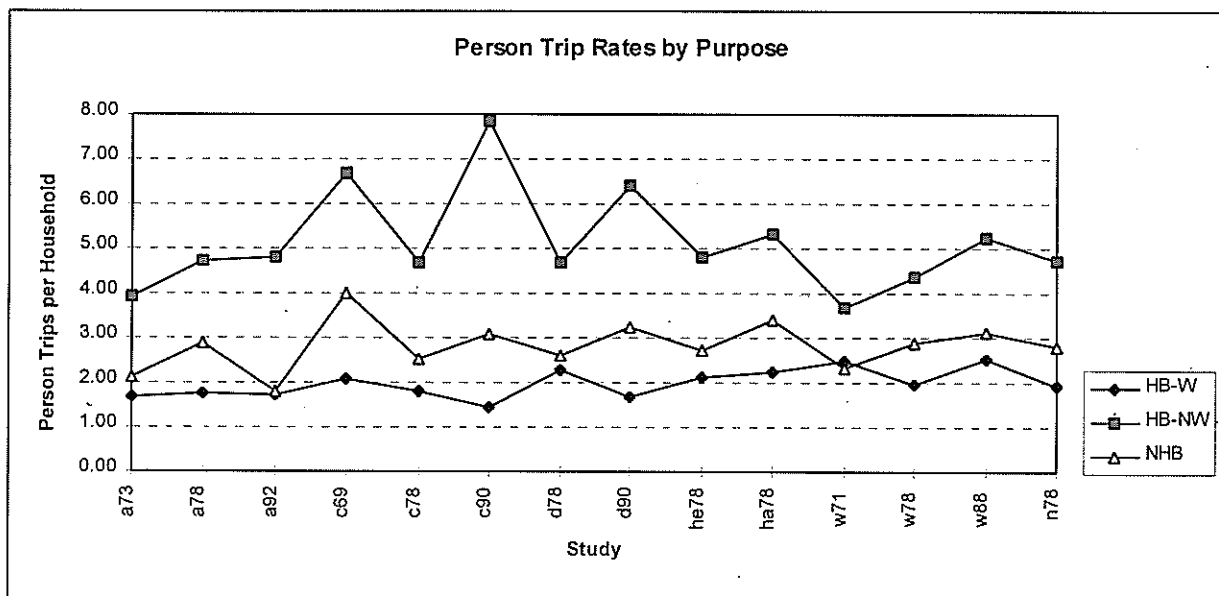


Figure 7.6 Daily person trip rates by trip purpose.



8. Vehicle Driver Trip-Making Characteristics

8.1 Vehicle Driver Trips per Household by Vehicle Ownership

The daily vehicle driver trips give a more direct comparison for each study. The surveyed trip rates are recorded on Figure 8.1.

As seen in section 7.3 of this report, the trips per household steadily increase as the level of vehicle ownership increases. As vehicle ownership has increased over time (see section 4), so have the vehicle driver trip rates.

From the 95% confidence intervals shown on Figure 8.1, trip rates for households with 0 and 1 vehicles are relatively constant. The vehicle driver trip rates vary in households owning 2 and 3+ vehicles. As the trend is toward higher vehicle ownership, then the variation in vehicle driver trips can be expected to increase.

8.2 Vehicle Driver Trips per Household by Trip Purpose

The daily vehicle trips per household by purpose are shown on Figures 8.2 and 8.3. The purposes are the same as those used in section 7.5 of this report, namely:

- Home-Based Work (HBW)
- Home-Based Non-Work (HBNW)
- Non-Home Based (NHB)

A more detailed range of trip purposes is listed in the category model analysis in Appendix 3.4 (see relevant files on the CD-ROM or accompanying diskette).

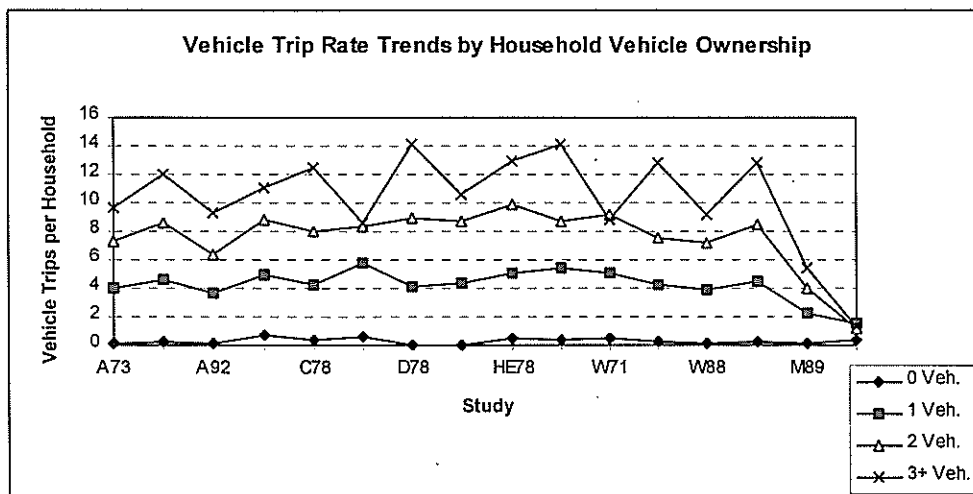
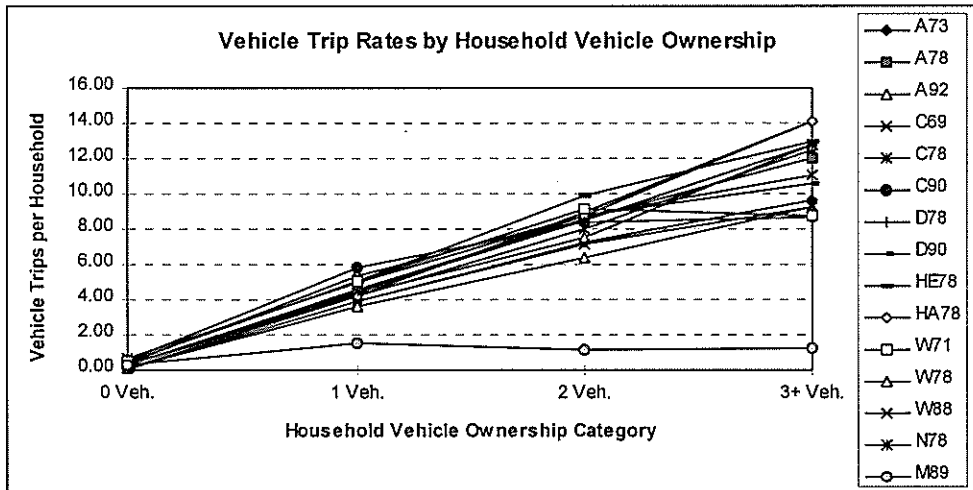
In most studies about one Home-Based Work vehicle trip is made per household. The exceptions are Heretaunga (1978) and Hamilton (1978), which are part of an overall higher vehicle trip generation related to a lower use of public transport, and for Auckland (1992).

The Home-Based Non-Work and Non-Home Based purposes show a slightly greater variation in trip generation. Again Heretaunga and Hamilton have higher values than the other surveys, because people use their own cars rather than public transport.

In Christchurch (1990), an increase in Home-Based Non-Work trips has occurred which accounts for the higher total vehicle trip generation. This is likely to be related to the decline in public transport use.

Figure 8.1 Daily vehicle trip rates by household vehicle ownership.

Survey City	Survey Year		Vehicle Trips per HH by Households with:				
			0 Veh.	1 Veh.	2 Veh.	3+ Veh.	All
Auckland	1973	A73	0.09	3.94	7.26	9.66	4.53
Auckland	1978	A78	0.28	4.54	8.56	12.03	5.51
Auckland	1992	A92	0.07	3.63	6.38	9.24	5.33
Christchurch	1969	C69	0.69	4.93	8.78	11.06	5.29
Christchurch	1978	C78	0.30	4.21	8.04	12.51	5.47
Christchurch	1990	C90	0.55	5.80	8.40	8.63	6.84
Dunedin	1978	D78	0.05	4.16	8.97	14.09	5.22
Dunedin	1990	D90	0.05	4.36	8.72	10.54	5.45
Heretaunga	1978	HE78	0.43	5.06	9.87	12.94	6.32
Hamilton	1978	HA78	0.36	5.37	8.75	14.12	6.73
Wellington	1971	W71	0.47	5.08	9.16	8.78	5.13
Wellington	1978	W78	0.25	4.27	7.57	12.80	4.78
Wellington	1988	W88	0.08	3.89	7.18	9.21	5.19
NUTS TOTAL	1978	N78	0.27	4.52	8.45	12.80	5.53
MOT TOTAL	1989	M89	0.08	2.19	3.98	5.39	5.87
95% Confidence		\pm	0.33	1.52	1.12	1.27	0.98



8. Vehicle Driver Trip-Making Characteristics

Figure 8.2 Daily vehicle trip rate trends by trip purpose.

HBW ± 0.32				
City	Early 70's	1978	Late 80's/ Early 90's	
Auckland	1.00	0.99	1.34	
Christchurch	1.31	1.10	1.03	
Wellington	1.21	0.96	1.08	
Dunedin		1.09	0.99	
Heretaunga		1.32		
Hamilton		1.45		
NUTS		1.09		
HBNW ± 0.85				
City	Early 70's	1978	Late 80's/ Early 90's	
Auckland	2.26	2.33	2.63	
Christchurch	2.38	2.39	3.96	
Wellington	2.05	1.93	2.48	
Dunedin		2.18	2.30	
Heretaunga		2.66		
Hamilton		2.57		
NUTS		2.30		
NHB ± 0.50				
City	Early 70's	1978	Late 80's/ Early 90's	
Auckland	1.54	2.19	1.36	
Christchurch	1.92	1.98	1.98	
Wellington	1.87	1.89	1.77	
Dunedin		1.94	1.76	
Heretaunga		2.75		
Hamilton		2.29		
NUTS		2.13		

(See glossary for explanation of abbreviations)

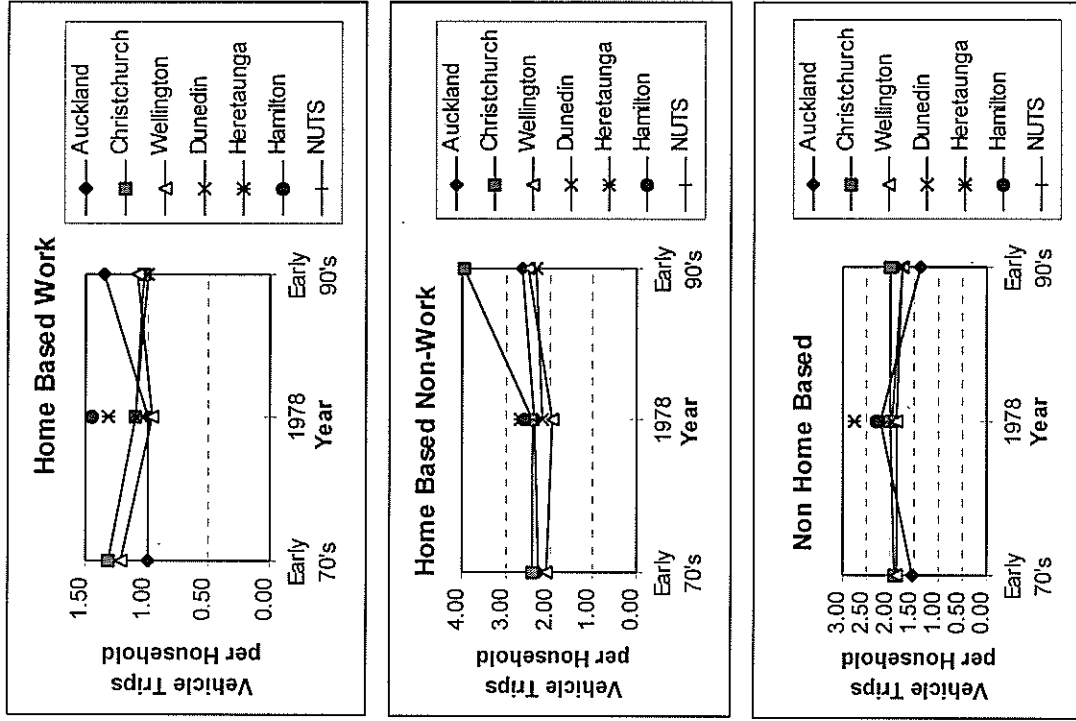
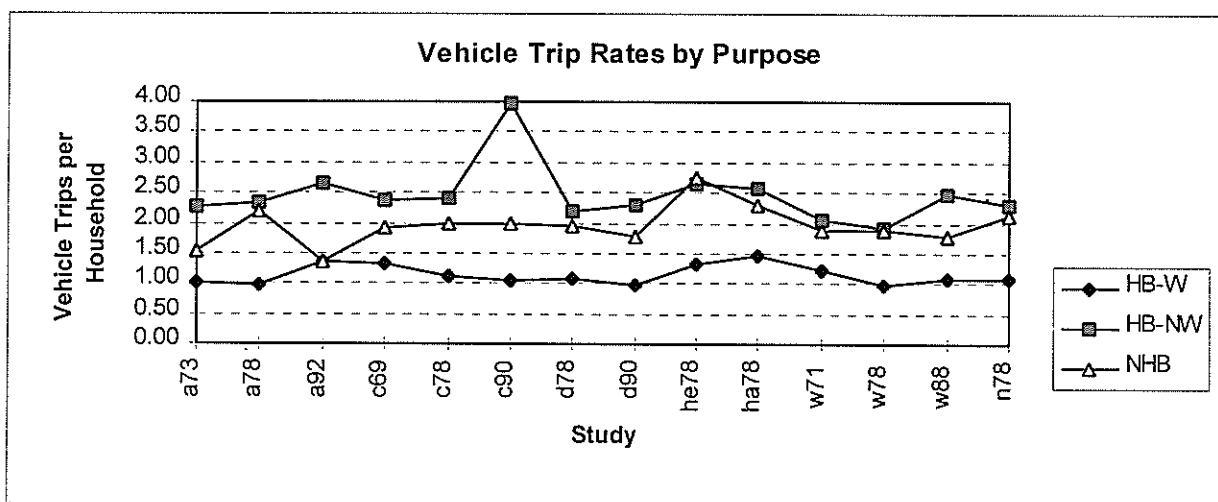


Figure 8.3 Daily vehicle trip rates by trip purpose.



8.3 Vehicle Driver Trips by Purpose by Time of Day

The full analysis of each study by hour is listed in Appendix 3.5 (see relevant files on the CD-ROM or accompanying diskette). To keep reporting concise only a plot of trip purpose versus time for the three Auckland studies has been illustrated on Figure 8.4. The basic trend of morning and evening peaks is evident in all studies.

To illustrate the change in trip purpose during the day, Figure 8.5 shows data taken from the Auckland 1992 survey. In the small hours of the morning the largest proportion of trips is made up of non-work to home trips, i.e. social trips returning home. From 3am to 8am the largest proportion of trips is from home to work. After 8am many trips are still home to work but, as well, a large number of home to non-work trips occur, such as home to school or shopping. These are possibly followed by non-home-based trips such as school to work. Through the middle of the day most trips are of home-based non-work or non-home-based nature. Between 4pm and 7pm the work to home trips are not as prominent as the morning home to work trips as many non-home-based and home to non-work trips occur as well. Non-work to home trips are then prominent through to the wee small hours.

8. Vehicle Driver Trip-Making Characteristics

Figure 8.4 Vehicle trips by purpose as % of total trips by time of day for the three Auckland surveys.

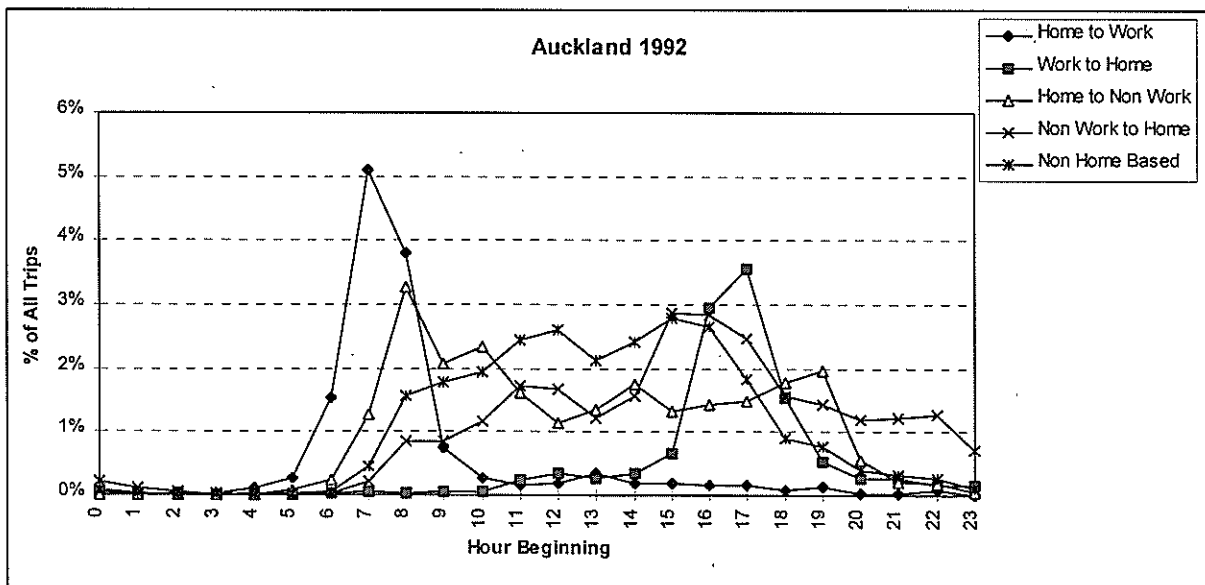
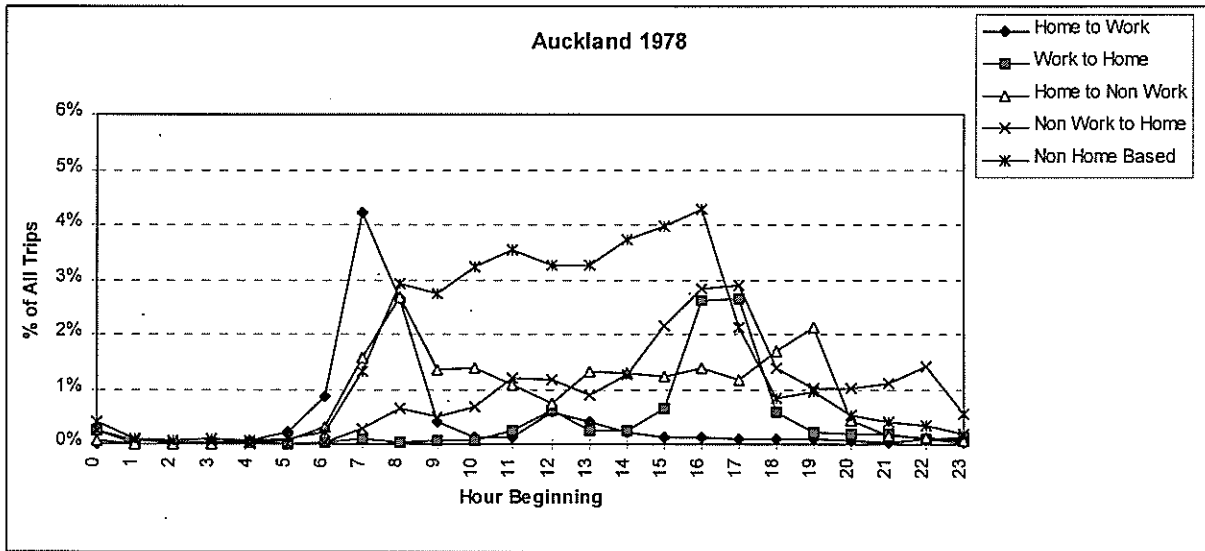
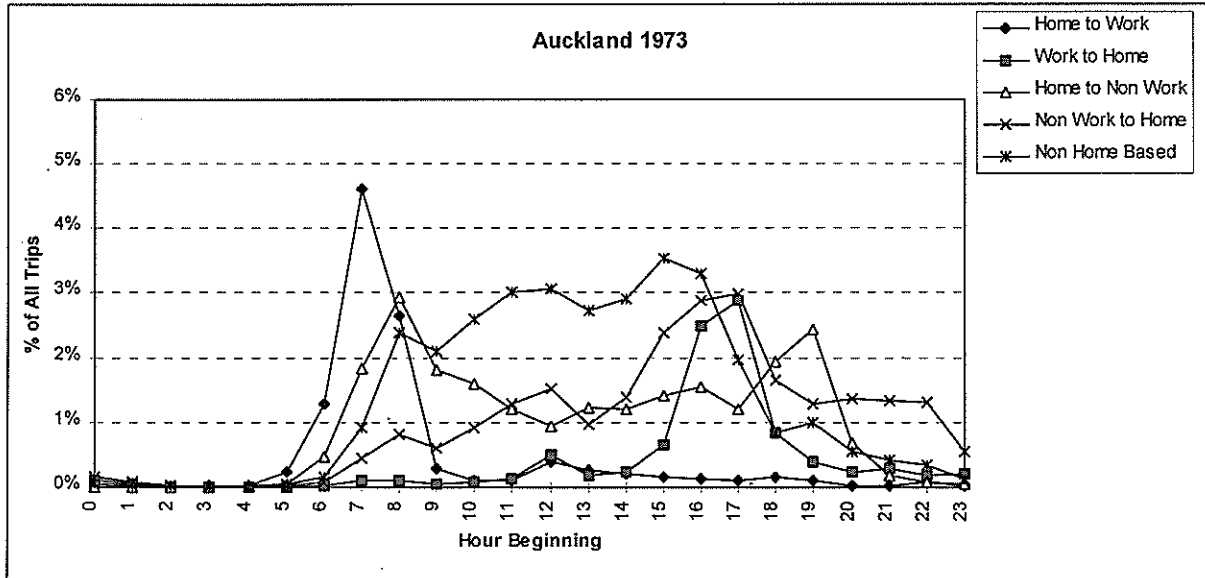
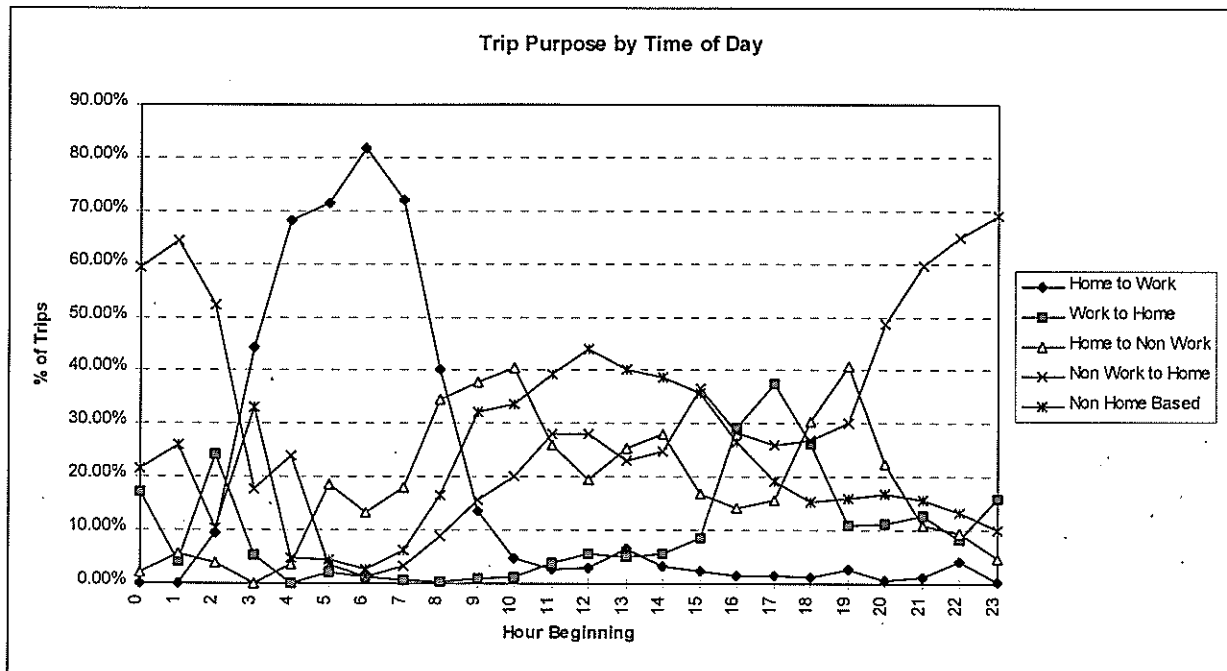


Figure 8.5 Vehicle trips by purpose as % of total trips for each hour (Auckland 1992 survey).



8.4 Vehicle Driver Trip Rates by Purpose by Category Model

The derivation of category models for each of the studies that has been carried out is listed in Appendix 3.4 (see relevant files on the CD-ROM or accompanying diskette). The household categories extracted were:

- Vehicle Ownership by Persons >5 years
- Vehicle Ownership by Employees

The possibility of vehicles by income was explored but the highly variable definition of income over the various studies (see section 7.4 of this report) meant that any comparisons would be merely speculative. The data extracted are listed in Appendix 3.6 (see relevant files on the CD-ROM or accompanying diskette).

The definitions of purpose between the various studies is such that true comparisons are difficult. Hence it was necessary to amalgamate trip purposes into the following:

- Home-Based Work (HBW)
- Home-Based Non-Work (HBNW)
- Non-Home-Based. (NHB)

Comparing the category models by trip purpose for each study is not straightforward. All models listed in Appendix 3.4 are included on the CD-ROM, and the relevant spreadsheets are filed on the accompanying diskette for reference.

8. Vehicle Driver Trip-Making Characteristics

For a general overview, a comparison between the total trips per household category models for Auckland, Christchurch and Wellington has been made. The category models for vehicles by persons per household for these are shown in Figures 8.6 (Auckland), 8.7 (Christchurch), and 8.8 (Wellington). The category models for vehicles by employees per household are shown in Figures 8.9 (Auckland), 8.10 (Christchurch) and 8.11 (Wellington).

Two hypothesis have been investigated and they are:

- Category models are stable over time,
- Category models are consistent between cities (for the same years).

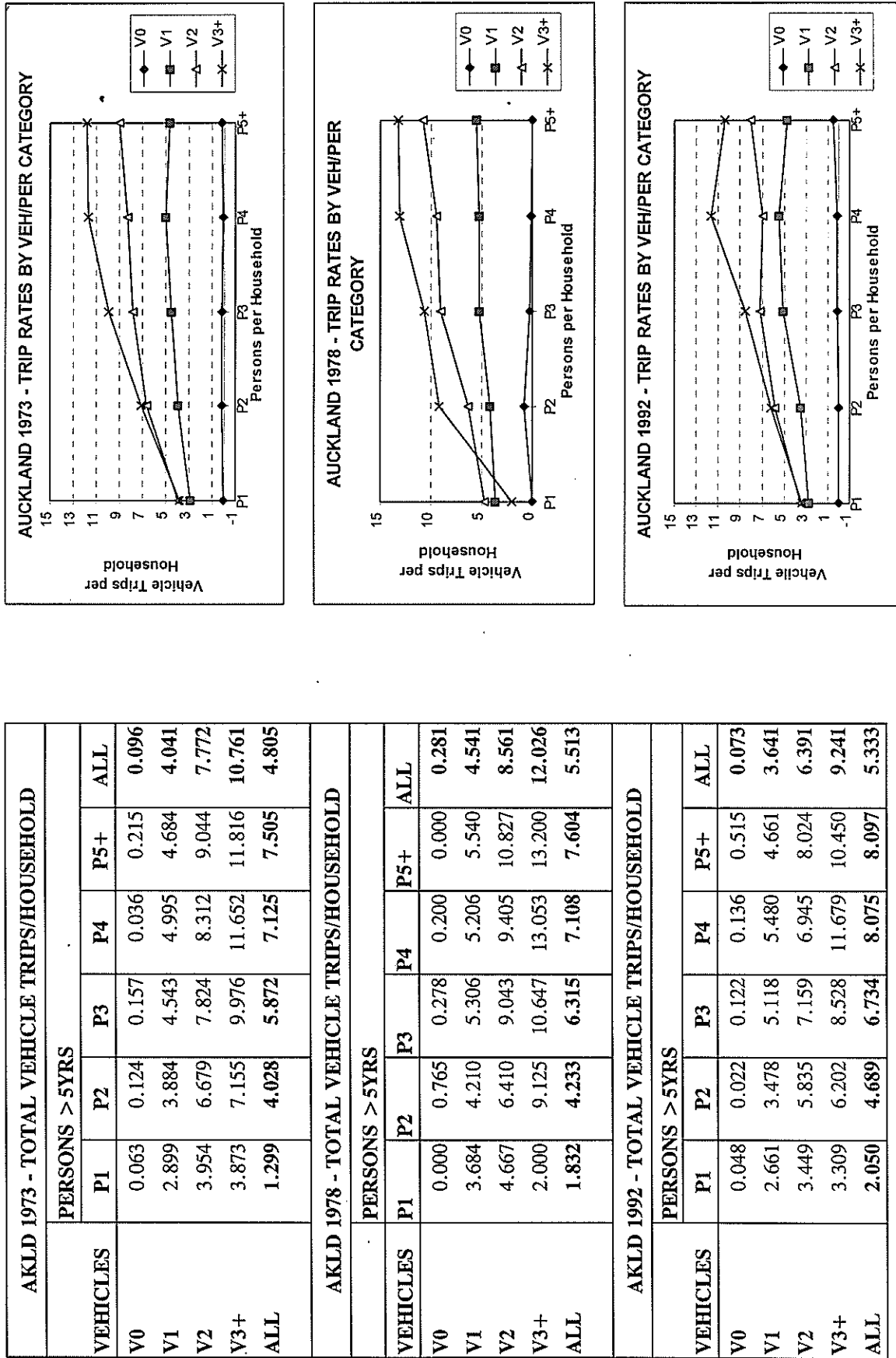
To explore the first hypothesis, Auckland, Christchurch, and Wellington data over the three years that were available have been compared. Within a category model matrix, each category such as 1 vehicle by 2 persons can be described as a "cell". When comparing any two studies, some cell values are similar, such as for Auckland 1992 and Wellington 1978 for the 1 vehicle by 2 persons cell. Over time some cells increase, some decrease, some go up and then down.

To statistically test whether or not like cells are different, the cells with the greatest number of households present, namely 1 vehicle by 1 employee and 1 vehicle by 2 persons, have been compared. These data are shown on Figure 8.12.

Statistically the values do not vary but the large variation in trip rate trends affects the statistics.

These variations in the trip rates for each cell are likely to be dependent upon the number of households surveyed in each category cell. The information available on the CD-ROM, and the relevant spreadsheets filed on the accompanying diskette, and listed in Appendix 3.4, show that in some cases very few households were surveyed. Hence variations in trip rate occur between studies.

Figure 8.6 Daily vehicle trip rates by vehicle per person household category for three Auckland surveys.



8. Vehicle Driver Trip-Making Characteristics

Figure 8.7 Daily vehicle trip rates by vehicle per person household category for three Christchurch surveys.

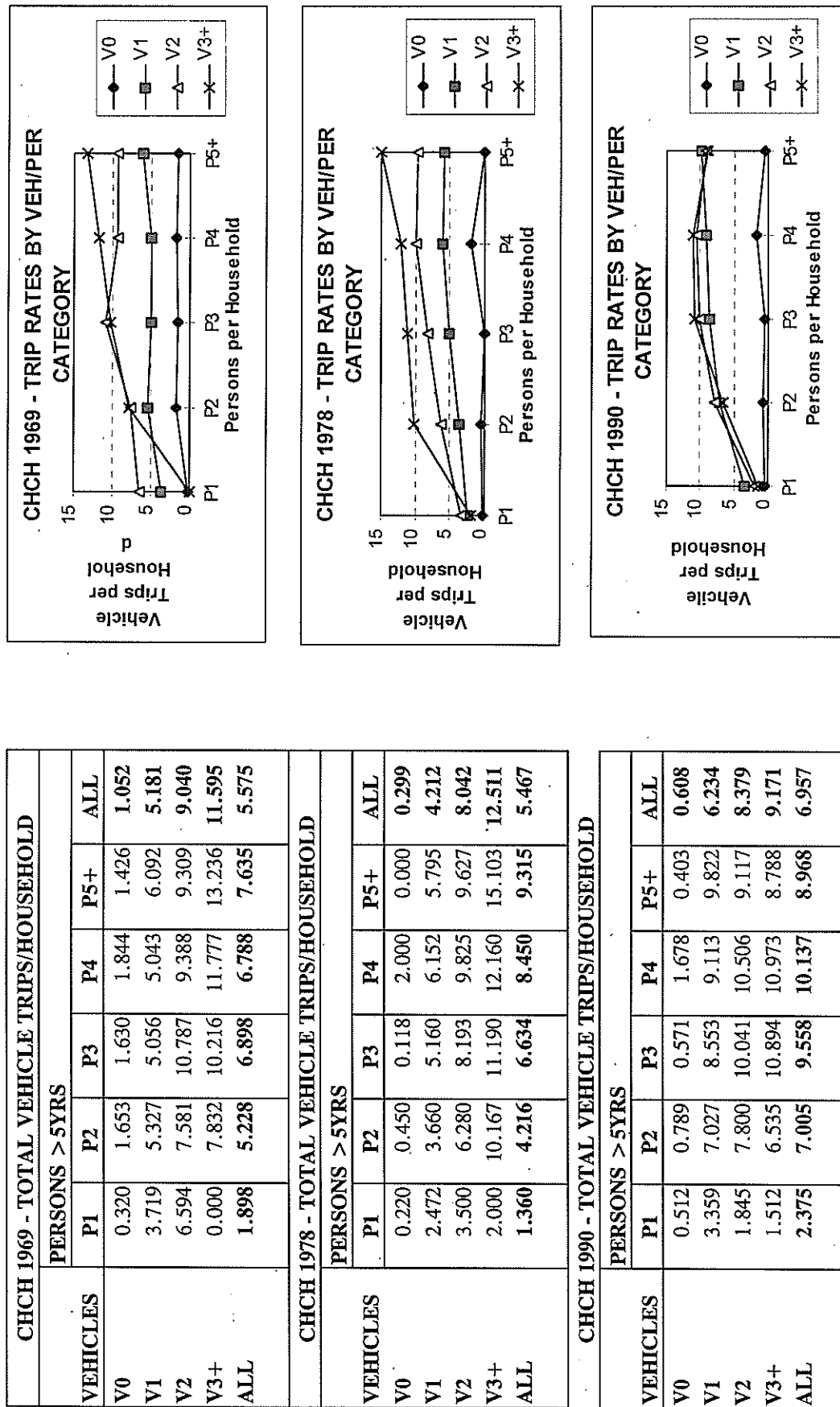
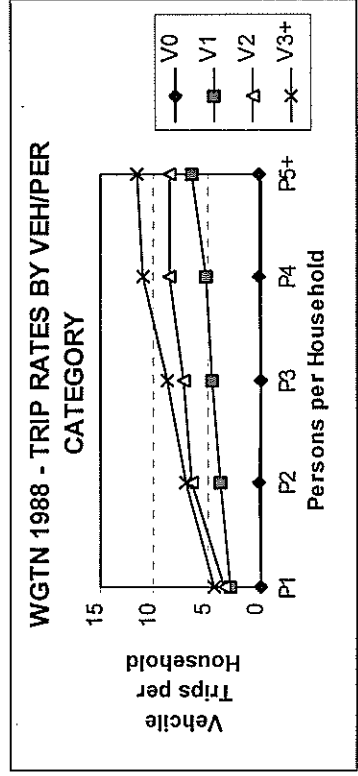
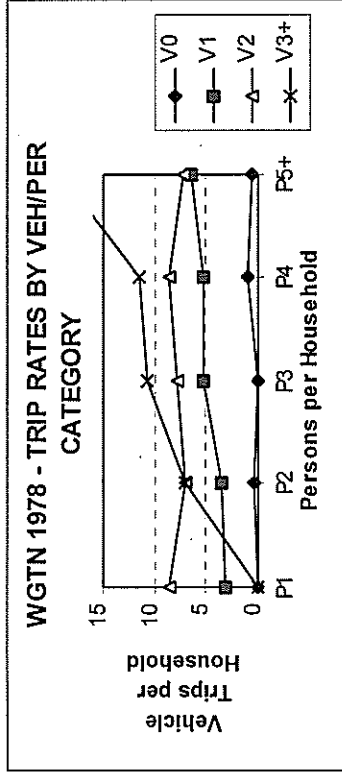
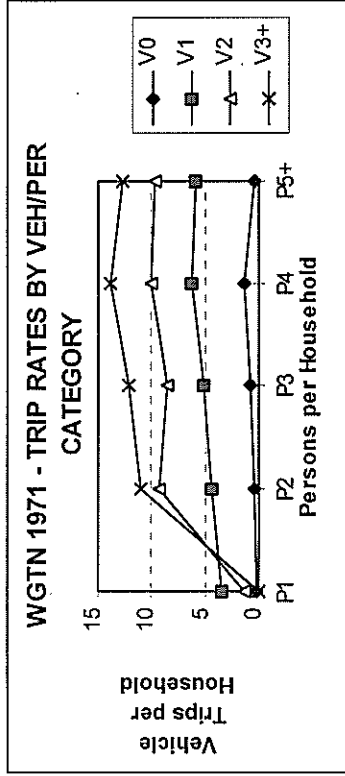


Figure 8.8 Daily vehicle trip rates by vehicle per person household category for three Wellington surveys.

WGTN 1971 - TOTAL VEHICLE TRIPS/HOUSEHOLD						
VEHICLES	PERSONS > 5YRS					
	P1	P2	P3	P4	P5+	ALL
V0	0.221	0.316	0.738	1.408	0.431	0.460
V1	3.348	4.372	5.198	6.248	5.820	9.889
V2	1.281	9.232	8.624	10.107	9.734	9.361
V3+	0.000	11.088	12.144	13.894	12.740	12.545
ALL	1.378	4.308	5.861	7.152	7.050	5.131

WGTN 1978 - TOTAL VEHICLE TRIPS/HOUSEHOLD						
VEHICLES	PERSONS > 5YRS					
	P1	P2	P3	P4	P5+	ALL
V0	0.026	0.362	0.000	1.000	0.625	0.250
V1	3.058	3.536	5.222	5.339	6.509	4.275
V2	8.500	7.080	7.784	8.578	7.271	7.570
V3+	0.000	7.000	10.667	11.438	19.125	12.797
ALL	1.647	3.821	6.082	6.877	7.594	4.777

WGTN 1988 - TOTAL VEHICLE TRIPS/HOUSEHOLD						
VEHICLES	PERSONS > 5YRS					
	P1	P2	P3	P4	P5+	ALL
V0	0.000	0.227	0.051	0.223	0.216	0.082
V1	2.783	3.795	4.519	5.042	6.460	3.890
V2	3.418	6.545	7.307	8.602	8.631	7.177
V3+	4.351	6.953	8.728	10.954	11.583	9.206
ALL	2.029	4.715	6.260	7.887	8.248	5.193



8. *Vehicle Driver Trip-Making Characteristics*

Figure 8.9 Daily vehicle trip rates by vehicle per employee household category for three Auckland surveys.

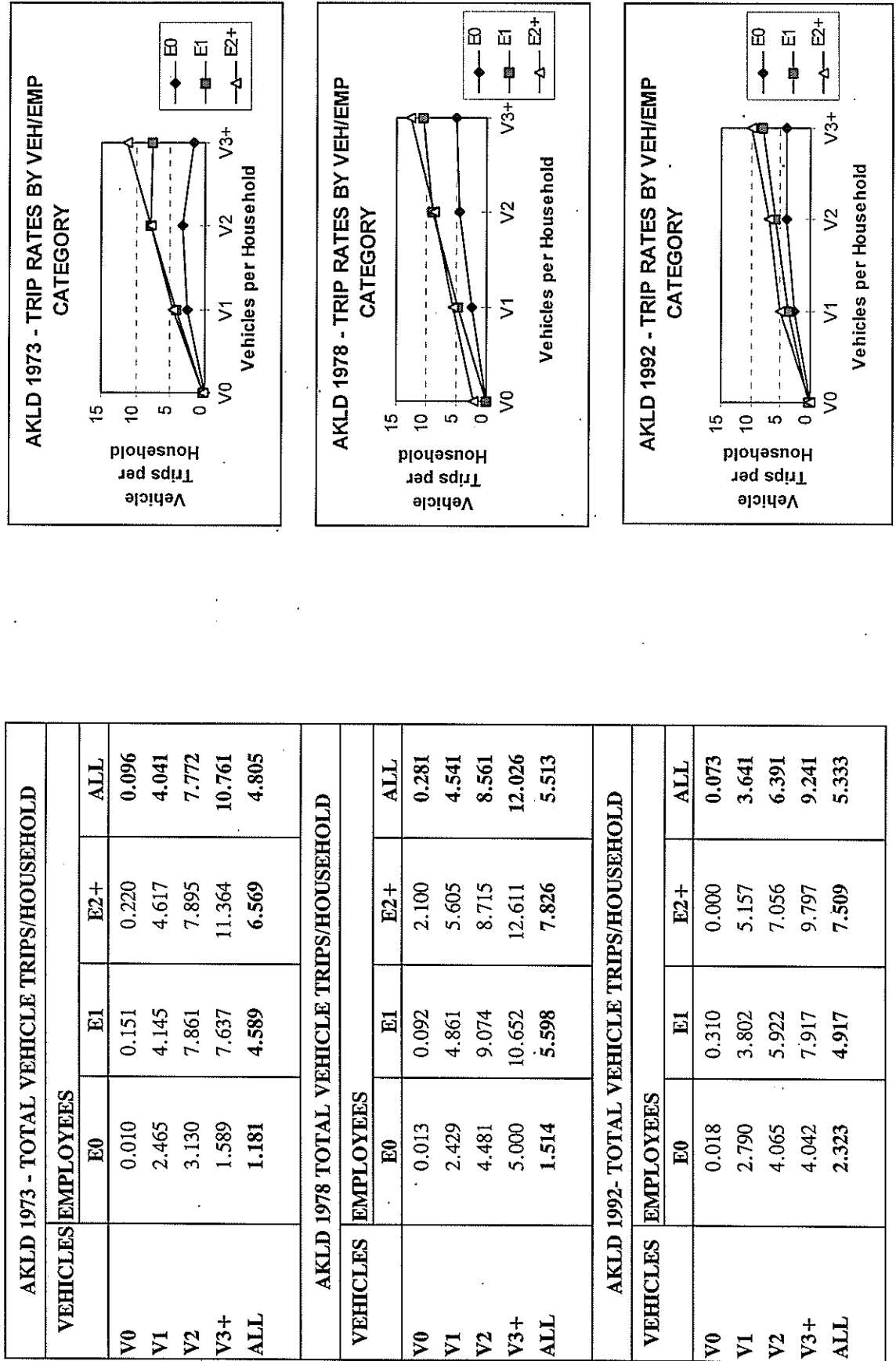
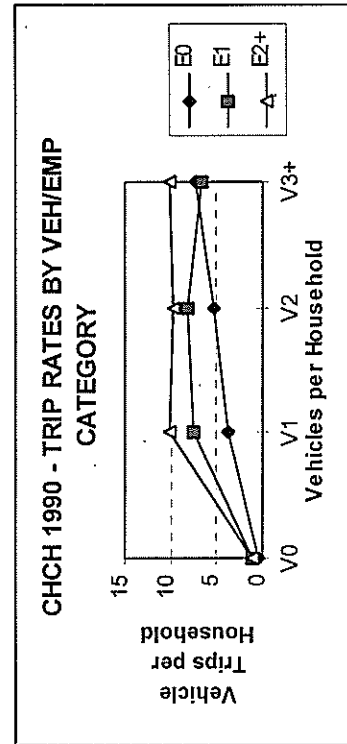
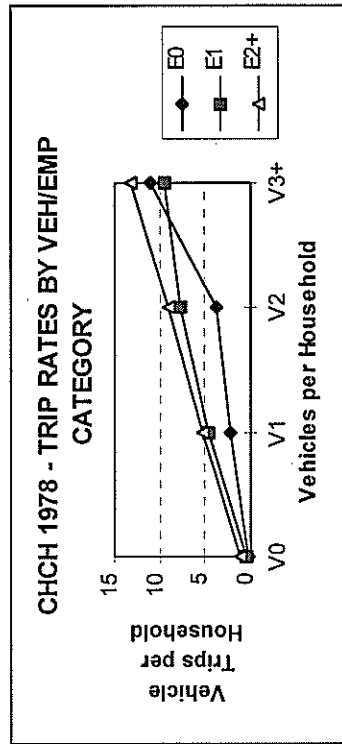
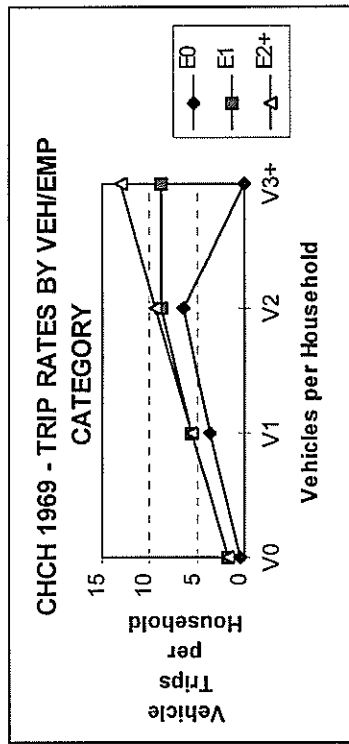


Figure 8.10 Daily vehicle trip rates by vehicle per employee household category for three Christchurch surveys.

CHCH 1969 - TOTAL VEHICLE TRIPS/HOUSEHOLD					
VEHICLES	EMPLOYEES				
	E0	E1	E2+	ALL	
V0	0.342	1.662	1.792	1.052	
V1	3.638	5.490	5.537	5.181	
V2	6.461	8.837	9.429	9.040	
V3+	0.000	8.735	12.978	11.595	
ALL	2.184	5.857	7.209	5.575	

CHCH 1978 - TOTAL VEHICLE TRIPS/HOUSEHOLD					
VEHICLES	EMPLOYEES				
	E0	E1	E2+	ALL	
V0	0.140	0.439	1.000	0.299	
V1	2.314	4.667	5.357	4.212	
V2	3.833	7.725	9.076	8.042	
V3+	11.000	9.533	13.214	12.511	
ALL	1.734	5.342	8.216	5.467	

CHCH 1990 - TOTAL VEHICLE TRIPS/HOUSEHOLD					
VEHICLES	EMPLOYEES				
	E0	E1	E2+	ALL	
V0	0.462	1.150	1.122	0.608	
V1	3.834	7.391	10.048	6.234	
V2	5.251	8.156	9.648	8.379	
V3+	7.171	6.519	10.161	9.171	
ALL	3.448	7.262	9.825	6.957	



8. Vehicle Driver Trip-Making Characteristics

Figure 8.11 Daily vehicle trip rates by vehicle per employee household category for three Wellington surveys.

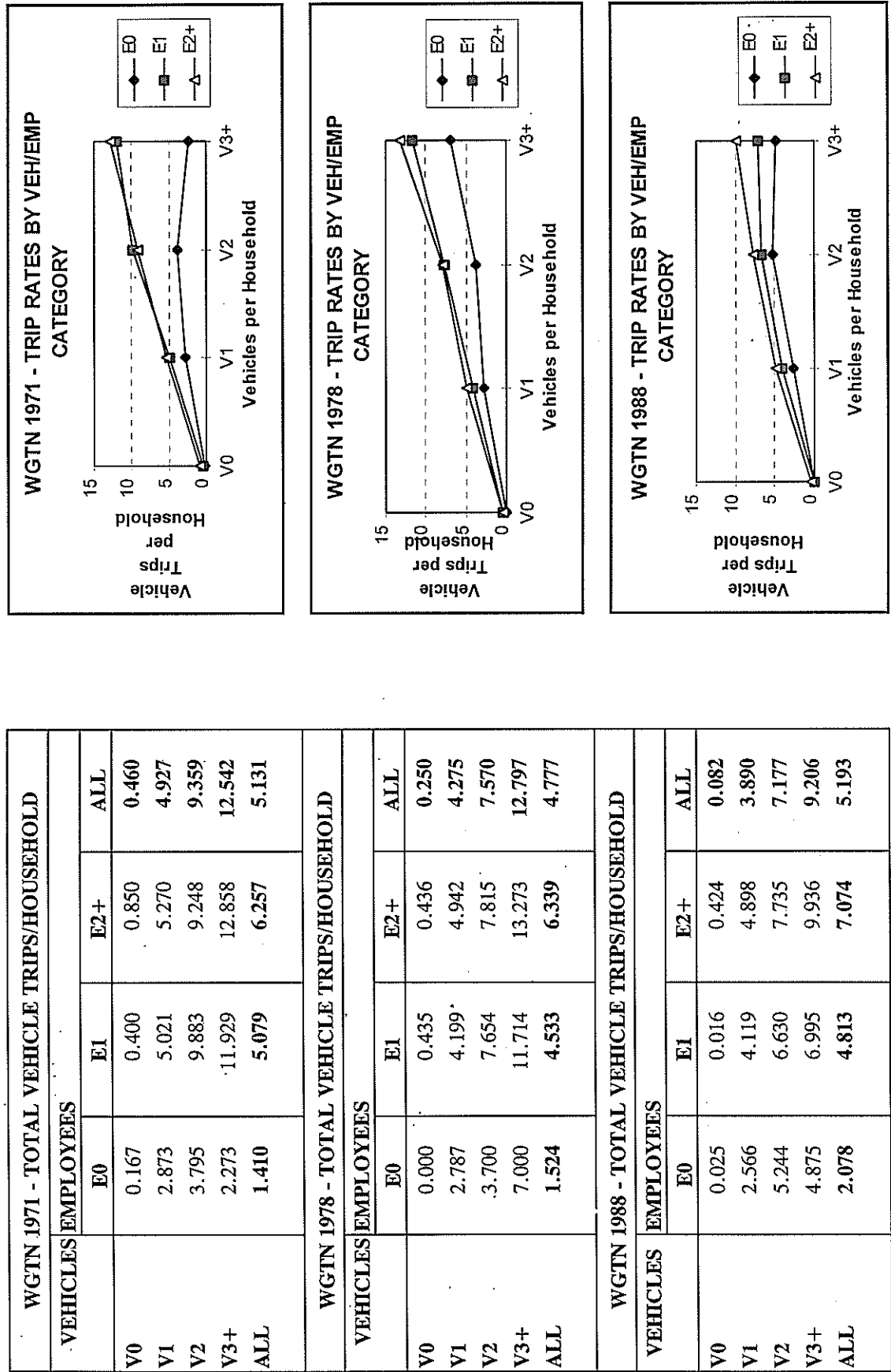
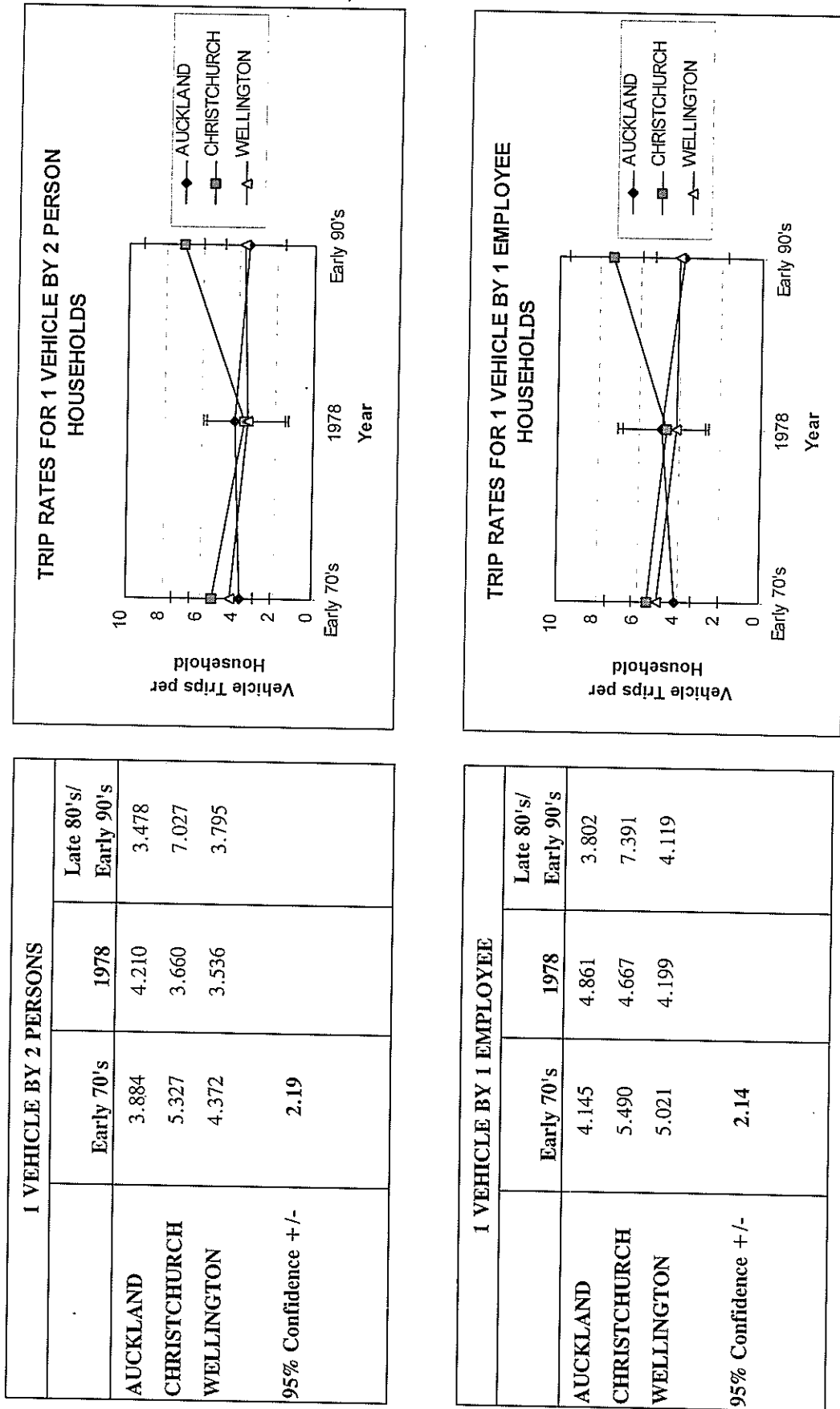


Figure 8.12 Vehicle trip rate trends by household category for Auckland, Christchurch and Wellington surveys.

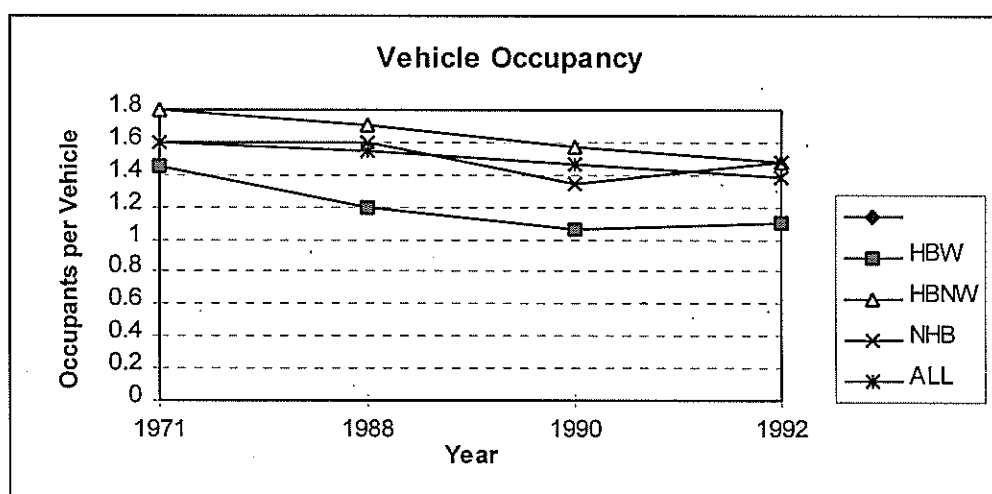


8.5 Vehicle Occupancy

Of all the studies carried out, only four have recorded vehicle occupancy. Figures 8.13 and 8.14 show the vehicle occupancies by purpose and by time of day. Values for the studies vary markedly. Of note though is that home-based work trips have a much lower vehicle occupancy than home-based non-work and non-home-based trips.

Figure 8.13 Vehicle occupancy by trip purpose.

Survey City	Survey Year	HBW	HBNW	NHB	All
Wellington	1971	1.45	1.80	1.60	1.60
Wellington	1988	1.20	1.70	1.60	1.54
Dunedin	1990	1.06	1.57	1.34	1.47
Auckland	1992	1.10	1.48	1.48	1.39



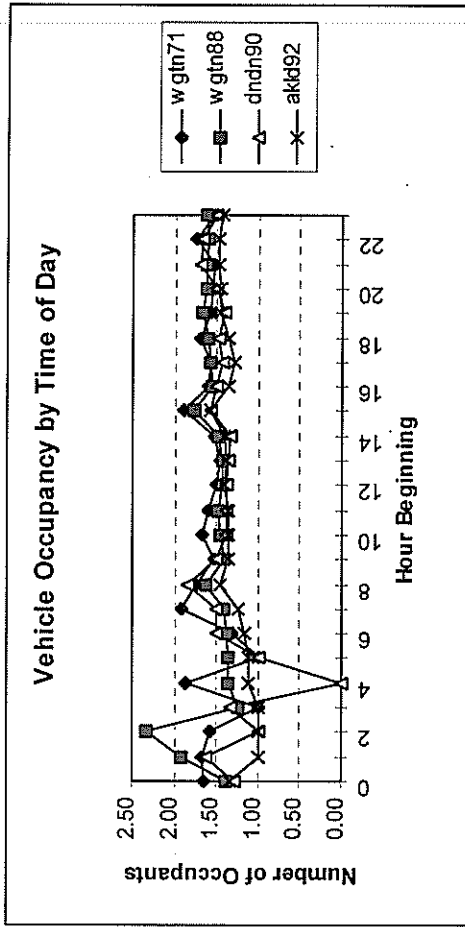
8.6 Trip Length Frequency

The total vehicle minutes and vehicle trip durations by purpose have been extracted and are shown in Table 8.1. One of the difficulties in this analysis was the different ways in which start and finish times were recorded. Some surveys used the 24-hour clock, some used the hour with am or pm, some used minutes, some used decimals of hours. In some cases the time was recorded as 9999, presumably where it was undecipherable. If then the end time was 105, the trip duration became -9894 minutes. If the start was 105 and the end was 9999, then the duration became +9894 minutes. A few such errors were found within the analysis. As these errors could not be corrected, the data have been omitted from the analysis. The values used in this analysis are between 0 and 120 minutes, and hence some biasing may have occurred in the analysis.

Trip durations vary between cities. This may be related to the physical size of the city and the level of service available within the road network. Hence comparisons are not all that relevant. Of interest is the change in trip durations within a city over time, although no general conclusion can be made. Trip lengths in Auckland however have increased (possibly because of the increase in traffic and resulting traffic congestion) and all other cities have decreased.

Figure 8.14 Vehicle occupancy by time of day for Wellington, Dunedin and Auckland surveys.

TIME	WG71	WG88	DND90	AKL92
0	1.65	1.39	1.29	1.33
1	1.67	1.93	1.63	1.00
2	1.59	2.33	1.00	1.00
3	1.00	1.25	1.33	1.00
4	1.88	1.35	-	1.11
5	1.00	1.35	1.00	1.13
6	1.30	1.39	1.50	1.15
7	1.93	1.42	1.50	1.23
8	1.76	1.63	1.85	1.45
9	1.54	1.41	1.51	1.36
10	1.66	1.45	1.39	1.36
11	1.60	1.48	1.39	1.37
12	1.51	1.43	1.39	1.42
13	1.46	1.44	1.35	1.37
14	1.53	1.47	1.34	1.40
15	1.89	1.76	1.57	1.59
16	1.59	1.56	1.51	1.36
17	1.57	1.59	1.42	1.30
18	1.69	1.61	1.47	1.36
19	1.59	1.69	1.40	1.47
20	1.56	1.64	1.50	1.47
21	1.52	1.62	1.69	1.47
22	1.74	1.60	1.69	1.49
23	1.54	1.62	1.50	1.43



8. Vehicle Driver Trip-Making Characteristics

Table 8.1 Trip length frequencies for 3 main groups of Household Interview Surveys.

HBW home-based work; HBNW home-based non-work; NHB non-home-based

TOTAL VEHICLE MINUTES TRAVELLED BY PURPOSE												
Survey City	HBW			HBNW			NHB			ALL		
	Early 70's	1978	Late 80's Early 90's	Early 70's	1978	Late 80's Early 90's	Early 70's	1978	Late 80's Early 90's	Early 70's	1978	Late 80's Early 90's
Auckland	4558875	25493	8434772	7938059	42560	10700639	5375284	40176	5067511	17872218	108229	24202922
Christchurch	1523910	15176	1643012	2479978	25049	4964668	1821600	20874	2563071	5825488	61099	9170751
Wellington	1313046	16463	2236941	1614291	21634	3386484	1468351	22289	2650071	4395688	60386	8273496
Dunedin		6819			11469			8884			27172	
Hamilton		7467			12654			12148			32269	
Heretaunga		6763			10060			8673			25496	
NUTS		78181			123426			113044			314651	
VEHICLE DRIVER TRIP DURATION BY PURPOSE												
Survey City	HBW			HB-NW			NHB			ALL		
	Early 70's	1978	Late 80's Early 90's	Early 70's	1978	Late 80's Early 90's	Early 70's	1978	Late 80's Early 90's	Early 70's	1978	Late 80's Early 90's
Auckland	27.9	18.6	20.4	16.7	13.1	14.4	16.5	13.2	15.1	18.6	14.2	16.2
Christchurch	15.3	15.1	13.6	13.5	11.4	10.5	13.4	11.6	10.7	13.4	12.2	11.0
Wellington	18.3	18.5	17.2	14.8	11.9	12.0	14.5	12.8	12.4	15.6	13.6	13.2
Dunedin		13.0			10.8			9.5			10.8	
Hamilton		11.6			9.6			8.9			9.7	
Heretaunga		11.4			9.4			9.1			9.7	
NUTS		15.5			11.5			11.5			12.3	

9. Conclusions

Too few household interview surveys have been carried out in New Zealand from which rigorous statistical analysis could be carried out. The findings of this study are therefore more indicative than conclusive. That said, the analysis in the report suggests the following:

- Person trip rates vary only slightly between cities.
- Person trip rates vary only slightly over time.
- Vehicle driver trip rates vary slightly between cities.
- Vehicle driver trip rates increase over time as vehicle ownership increases.
- If public transport trip rates are low, vehicle driver trip rates are high.
- Vehicle passenger trip rates do not vary.
- Vehicle driver trip rates for household categories of vehicles by employees and vehicles by persons vary only slightly over time. It could not be concluded whether the variation was more a function of the number of households surveyed in each cell, or if it represented a general change in personal travel characteristics.

10. Recommendations

- More home interview surveys should be carried out in New Zealand. They should be timed to coincide with census years at 5, 10, 15 or 20 year intervals.
- Further research should be undertaken to produce guidelines for a standardised home interview survey for New Zealand cities. This will ensure all necessary data are collected and are in a useful format.

The format would need to be flexible in order to reflect changes in the transport system and society. It would specify the minimum data collection requirements and the format in which that data should be collected and collated. This will ensure that all necessary data are collected and are in a useful format.

The standardised survey could be expected to evolve over time with the country's transportation system.

10. *Recommendations*

- The possibility that home interview surveys could be conducted as part of the Department of Statistics census should be investigated. This could be sample- or population-based, and the survey could be part of the census paper or a separate document. This would help minimise the cost associated with home interview surveys.
- Further research should be directed at establishing generation, distribution and mode choice models that are best suited to New Zealand. Examples could be determining:
 - the best household category variables for New Zealand;
 - special generators, e.g. airports, universities;
 - a distribution model to cope with employment distribution problems.
- A research project should be undertaken to correlate trip making with:
 - level of public transport;
 - standard of roading provided;
 - geographical environment;
 - presence of tertiary institutes;
 - presence of bulk transport facilities (air, sea);
 - economic activity (agricultural, industrial, available commercial, retail).
- A research project should be undertaken to retrieve, document, and analyse the external traffic data surveys that were carried out with each home interview survey, where the data exist. Such data are needed as the transportation system analysis is incomplete without it. The number of comparable studies is small and further studies must be used for ongoing analysis. Preferably, studies carried out in different cities at the same time, such as those done in 1978 for the NUTS study.
- A research project should be undertaken to retrieve, document, and analyse commercial vehicle traffic data surveys that were carried out with and without each home interview survey, where the data exist. The transportation system and analysis of it is incomplete without a representation of commercial vehicles.

11. References

Hobbs, F.D. 1979. *Traffic Planning and Engineering*. 2nd edition, Pergamon Press Limited, England.

Hutchison, B.G. 1974. *Principles of Urban Transport Systems Planning*. Scripta Book Company, USA.

FHA 1990. *Calibration and Adjustment of System Planning Models*. Federal Highway Administration (FHA), US Department of Transportation, Washington DC.

Wigan, M.R. 1987. Australian Personal Travel Characteristics. *ARRB Special Report 38*. Australian Road Research Board, NSW.

Key Personnel

The project team was Messrs Grant Smith, Transportation and Traffic Systems Ltd, as project leader, David Robinson, Michael Blyleven, Mark Inder, and John Falconer, Transportation and Traffic Systems Ltd, as researchers.

The Transit New Zealand Project Manager was Transportation Engineer Ken Glew.

Appendices

A1 CD-ROM

- A1.1 Contents**
- A1.2 CD-ROM Directory Structure**
- A1.3 Original Study Report Viewer**

A2 Data Collection

A3 Analysis of New Zealand Data

A3.1 Definition of the Transportation Study System

A3.2 Transportation Study System

- A3.2.1 Transportation Study System – Global Statistics
- A3.2.2 Household Interview Survey – Sample Statistics
- A3.2.3 Trip Generation – per Person and per Household
- A3.2.4 Vehicle Ownership

A3.3 Person Trip Characteristics

- A3.3.1 Trips Generated per Household by Vehicle Ownership
- A3.3.2 Person Trips by Trip Purpose
- A3.3.3 Person and Household Trip Rates by Mode
- A3.3.4 Vehicle Occupancy
- A3.3.5 Trip Length Frequency
- A3.3.6 Person Trips Generated per Household by Household Income

A3.4 Vehicle Driver Trip Rates by Purpose by Category Model

A3.5 Vehicle Driver Trips by Purpose by Time of Day

A3.6 Person Trips by Mode by Time of Day

Appendix 1 CD-ROM

A1.1 Contents

The CD-ROM for this research project¹ is written in standard ISO 9660 format using the DOS 8.3 filename format. On the CD are the scanned originals of the document reports, the HIS survey data text files, the ASCII and MSAccess database survey files, the MSEXcel analysis spreadsheets, and the associated spreadsheets.

The original study reports were scanned at a resolution to minimise the amount of space each page took, while maintaining readability. Where graphics were scanned, the resolution was increased. Typical resolutions for text pages were 75 dots per inch (dpi) and for graphics 150 dpi. These files were then stored as standard DOS bitmaps.

The total size of all bitmaps is approximately 860 Mbytes. To fit on a single CD, each bitmap was compressed using the MSDOS utility COMPRESS giving a space saving of approximately 70%. The files can be decompressed by using the MSDOS utility EXPAND.

The reports can also be viewed using a specially written package called REPORTS, available on the CD-ROM (see section A1.3, Report Viewer).

The Home Interview Survey (HIS) Data is stored in the Directory '/data', in two formats: the original text format as supplied to Transportation & Traffic Systems Ltd (TTS), and Microsoft Access files (MDB suffix). The original text files are stored in a subdirectory called '/data/text'. Each region has a subdirectory under that, i.e. '/data/text/auckland/'. These directories contain the expanded data files, and other files used in the analyses process and in converting the data to MSAccess. Under these directories are the raw data directories with data as supplied directly to TTS.

The Microsoft Access databases are in the subdirectories '/data/msaccess'. Each region has a subdirectory under that and has data for all years. Each database has the tables for Person, Households, and Trips, plus a number of tables giving the translations of the codes used in the survey, and some queries used in the data analyses process.

Some programs were written in FORTRAN and AWK script for the interpretation of the data, and are stored in the region directory.

¹ For information about the CD, contact the Research Programme Administrator, c/- Transfund New Zealand, PO Box 2331, Lambton Quay, Wellington. As not every reader will require the entire data collection that is on the CD, a diskette containing the files of the spreadsheets listed in these Appendices, accompanies this report (in the pocket inside the back cover).

A1.2 CD-ROM Directory Structure

+---Analyses	This document and associated spreadsheets
+---Apdx_XLS	
+---Doc	
\---Doc_XLS	
+---Data	MSAccess Database Files of HIS
+---MSAccess	
+---AUCK	
+---CHCH	
+---DNDN	
+---MOT	
+---NUTS	
\---WGTN	
\---Text	Raw HIS data as supplied to TTS
+---AUCK73	
\---Raw	
+---AUCK92	
\---Raw	
+---CHCH69	
\---Raw	
+---CHCH90	
\---Raw	
\---ZIP	
+---DUN90	
\---Raw	
+---NUTS78	
\---Raw	
+---Nuts89	
+---WGTN71	
\---Raw	
\---WGTN88	
\---Raw	
\---Reports	Scanned Survey and Study Reports
+---AUCKLAND	
+---1973	
+---CTSRBRpt	

A1.3 Original Study Report Viewer

About the Viewer

The Report Viewer was written to be a simple index and page retrieval system for the scanned pages. It is written in Pascal using Borland Delphi, and resides in the root directory of the CD-ROM. The viewer may be run straight from the CD-ROM.

Platform

The report viewer will only run on Windows 95 or Windows NT.

Operation

To use the viewer the CD-ROM must be mounted on either a local CD-ROM drive or mapped to a network drive.

Using the Windows Explorer, locate the file REPORT.EXE and double click on the file to activate it.

A screen will appear looking for a file PAGENDX.DAT. Use the browse button to find the file in the CD-ROM. It is in the REPORTS directory. Click on OK and the Viewer will display the Selector Form.

Functions

- **Selecting a City/Year/Report/Section**
Use the buttons on the right of the form to show and select the desired report. Once the city is selected, the other values available for that city are filled in. For example, choosing Dunedin fills in the years available with 1964 and 1990. When Dunedin and 1964 are selected, the available report is "Report on Comprehensive Transportation Study for Dunedin".
- **Viewing a page**
Click on the button with the red arrow → to open the image viewer.
- **To change pages**
Press the Page Up, Page Down, up arrow or down arrow to move singly through the pages in the section.
Press the Home and End keys to go to the start or end of the section.
The computer will beep if you try to access a page which does not exist.
- **Printing Setup**
Use the Menu option Files/Print Setup to choose your printer.

-
- **Printing pages**
Open the City/Year/Report/Section/Page that you wish to print.
Choose the menu option Files/Print. The standard Print dialogue will show.
To print the current page click OK.
To print a range of pages enter the page numbers in the 'From' and 'To' edit boxes and click OK.
To print all pages in this section, click on ALL and then click OK.
 - **Edit Report Viewer**
Choose the Menu option. Files, Exit or press Alt F4.

Appendix 2 Data Collection

The first task of this research project was to locate all Home Interview Survey (HIS) data that were still available in New Zealand. Of the list of possibilities reported in the study brief, reports of some form or other were able to be located. Not all reports contained information that was specifically relevant to the HIS carried out for each study. Electronic data for each study were somewhat more difficult to locate. This was expected and hence the need to locate the data now, before more of it was lost. The study brief stated that:

Indications are that relevant data are available for:

<i>Dunedin</i>	<i>1990</i>
<i>Christchurch</i>	<i>1964, 1970, 1990</i>
<i>Wellington</i>	<i>1971, 1978, 1989</i>
<i>Hamilton</i>	<i>1968, 1978</i>
<i>Heretaunga</i>	<i>1978</i>
<i>Auckland</i>	<i>1973, 1978, 1992</i>

Of the suggested studies electronic data could be located for all but three, namely:

Wellington	1963
Invercargill	1967
Hamilton	1968

The HIS-DATA.XLS spreadsheet shows the reports and computer files found for each of the HIS carried out in New Zealand over the last 30 years. The diskette accompanying this report (in the pocket inside the back cover) contains files of this and associated spreadsheets.

Having found the relevant data, the data had to be collated to determine the format of each study and to establish the completeness of the data. This proved to be a very time-consuming task as each study was quite unique. First the raw ASCII data files were imported into an ACCESS database according to the data formats reported. Many of the reported data formats proved to have errors and hence many attempts were made to correct the data importing process.

That done, a unique household numbering system was established for each survey to check for duplicate records. It was then discovered that there were duplicates in a number of the data sets. These are tabulated in the INDEX.XLS spreadsheet. The task of trying to correct the duplicates was not only enormous but also potentially jeopardised the integrity of the data set. Where obvious corrections were possible they have been made, but in general the data sets have been left as they were.

Further analysis of data was then carried out to establish the field definitions and to determine whether there was an appropriate common format that could be established. Because of the uniqueness of each survey, it soon became evident that each survey should be analysed individually. Some fields were obviously the same, others were similar but had subtle differences, some fields could be combined to derive common data, and many fields were specific to the questions of the survey. A full list of fields for each survey is shown below. Each field is marked as being the same (S), variable (V) or derivable (D).

See spreadsheet files

HHFIELDS.XLS

PPFIELDS.XLS

TTFIELDS.XLS

on the diskette accompanying this report.

The HIS data collected for this project have been of varying quality. In almost all cases there are difficulties in analysing the data, including incorrect field definitions, duplicate records, missing or discontinuous records, illogical values in particular fields and inconsistencies between household/person/trip records. If all the inconsistencies were obvious from the beginning then the file importation would have been much simpler. Similarly, if a standard survey format could have been specified, the analysis could have been much simpler.

The following spreadsheets and their file names refer to the files on the diskette:

Data	HIS_DATA.XLS
Table Indexing	INDEX.XLS
Proposed HH Fields	HHFIELDS.XLS
Proposed PP Fields	PPFIELDS.XLS
Proposed TT Fields	TTFIELDS.XLS

Appendix 3 Analysis of New Zealand Data

The brief for this study outlined the data that were to be extracted and analysed. The following sections list the subsequent analysis, and relevant spreadsheets (files for which are on the accompanying diskette).

Instructions for using Spreadsheet Files on Diskette

Excel spreadsheets containing the survey data analysis have been compressed into a zipped file, on the diskette accompanying this report (in the pocket inside the back cover). The single file is named "HISData.zip".

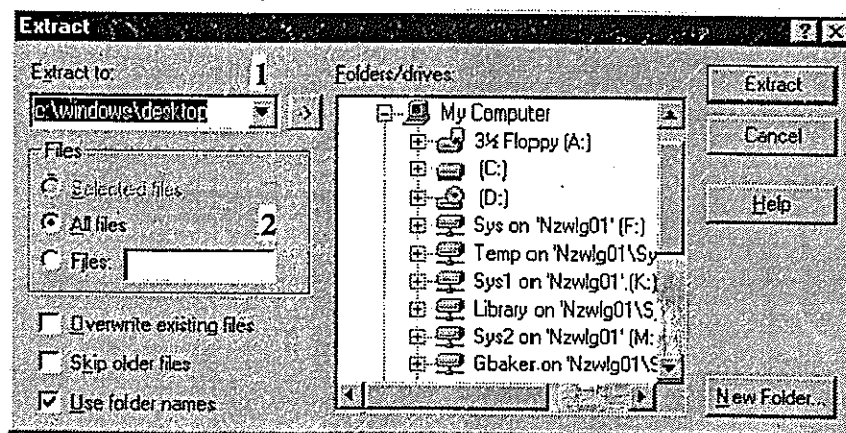
The data can be extracted using several freely available zip utilities such as Winzip or PKUnzip.

If you do not have a zip utility installed on your machine you can download one from www.winzip.com Download and install Winzip using the instructions on the site.

Once you have Winzip installed you can open the file by double clicking on it in Windows Explorer. This will launch Winzip.

To extract the files click the "Extract" button on the toolbar.

The "Extract" dialog box as shown below will be displayed.



In this dialog box, enter the directory to which you want to extract the spreadsheets in the "Extract to" box (1), for example "c:\ssfiles".

Make sure that "All files" is selected in the "Files" option group (2).

Clicking the "Extract" button will extract the files to the directory. These are then accessible through Windows Explorer or from Excel.

A3.1 Definition of the Transportation Study System

Maps: see pp. 64-72 for Figures A3.1.1-A3.1.9 showing the areas covered by the transport studies.

A3.2 Transportation Study System

A3.2.1 Transportation Study System - Global Statistics

A3.2.2 Household Interview Survey - Sample Statistics

A3.2.3 Trip Generation - per Person and per Household

A3.2.4 Vehicle ownership

See pp. 73-74 for list of the relevant spreadsheet files that are on the accompanying diskette.

A3.3 Person Trip Characteristics

A3.3.1 Person Trips Generated per Household by Vehicle Ownership

A3.3.2 Person Trips by Trip Purpose

A3.3.3 Person and Household Trip Rates by Mode

A3.3.4 Vehicle Occupancy

A3.3.5. Trip Length Frequency

A3.3.6 Person Trips Generated per Household by Household Income

See pp. 75-76 for list of the relevant spreadsheet files that are on the accompanying diskette.

A3.4 Vehicle Driver Trip Rates by Purpose by Category Model

Vehicles by employees

Vehicles by persons

See p. 76 for the list of the relevant spreadsheet files that are on the accompanying diskette.

A3.5 Vehicle Driver Trips by Purpose by Time of Day

See p. 77 for the list of the relevant spreadsheet files that are on the accompanying diskette.

A3.6 Person Trips by Mode by Time of Day

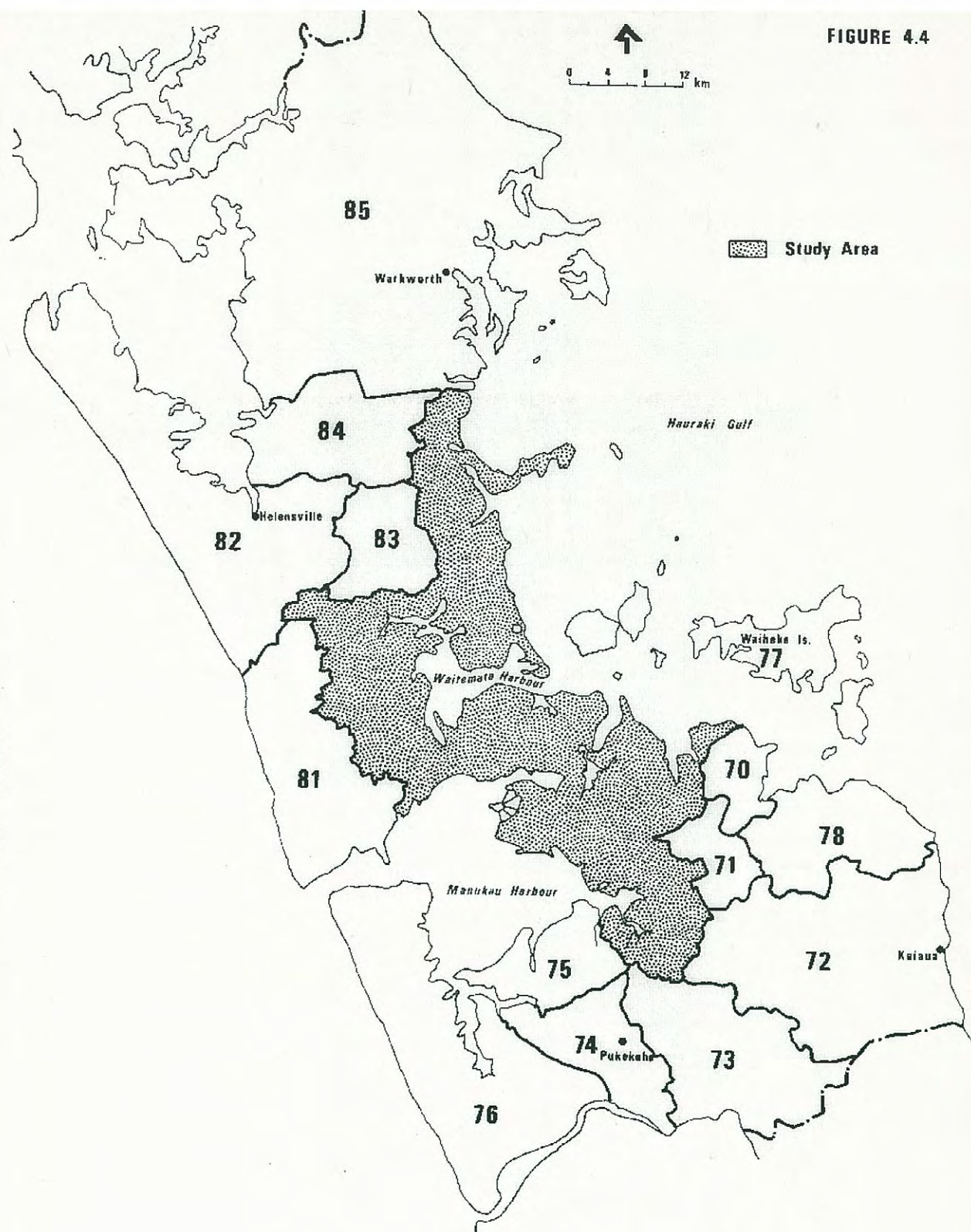
See p. 77 for the list of the relevant spreadsheet files that are on the accompanying diskette.

A3.1 Definition of the Transportation Study System

The study area, zone system and external entry points were overlaid onto a map of the area for each home interview survey. Some of this work may have been undertaken already in stage 2 but must be repeated in the stage 3 report. Where model road networks exist these will be reported as well.

Maps of the study areas are shown as Figures A3.1.1 to A3.1.9 (pp. 64-72).

FIGURE 4.4

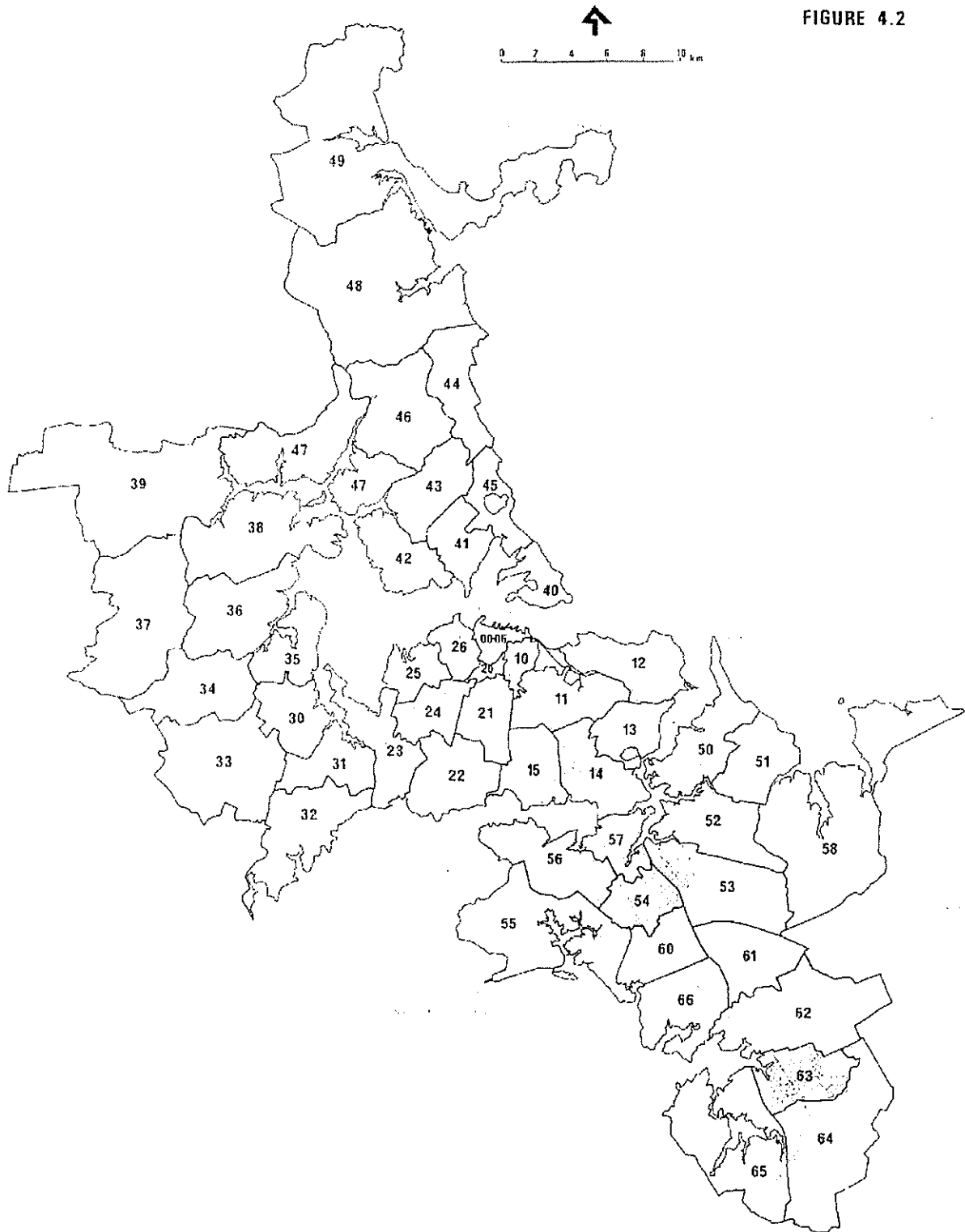


AUCKLAND 1973 - STUDY AREA AND EXTERNAL ZONES

Fig A3.1.1

Source : Auckland CTSR Background Report 1973

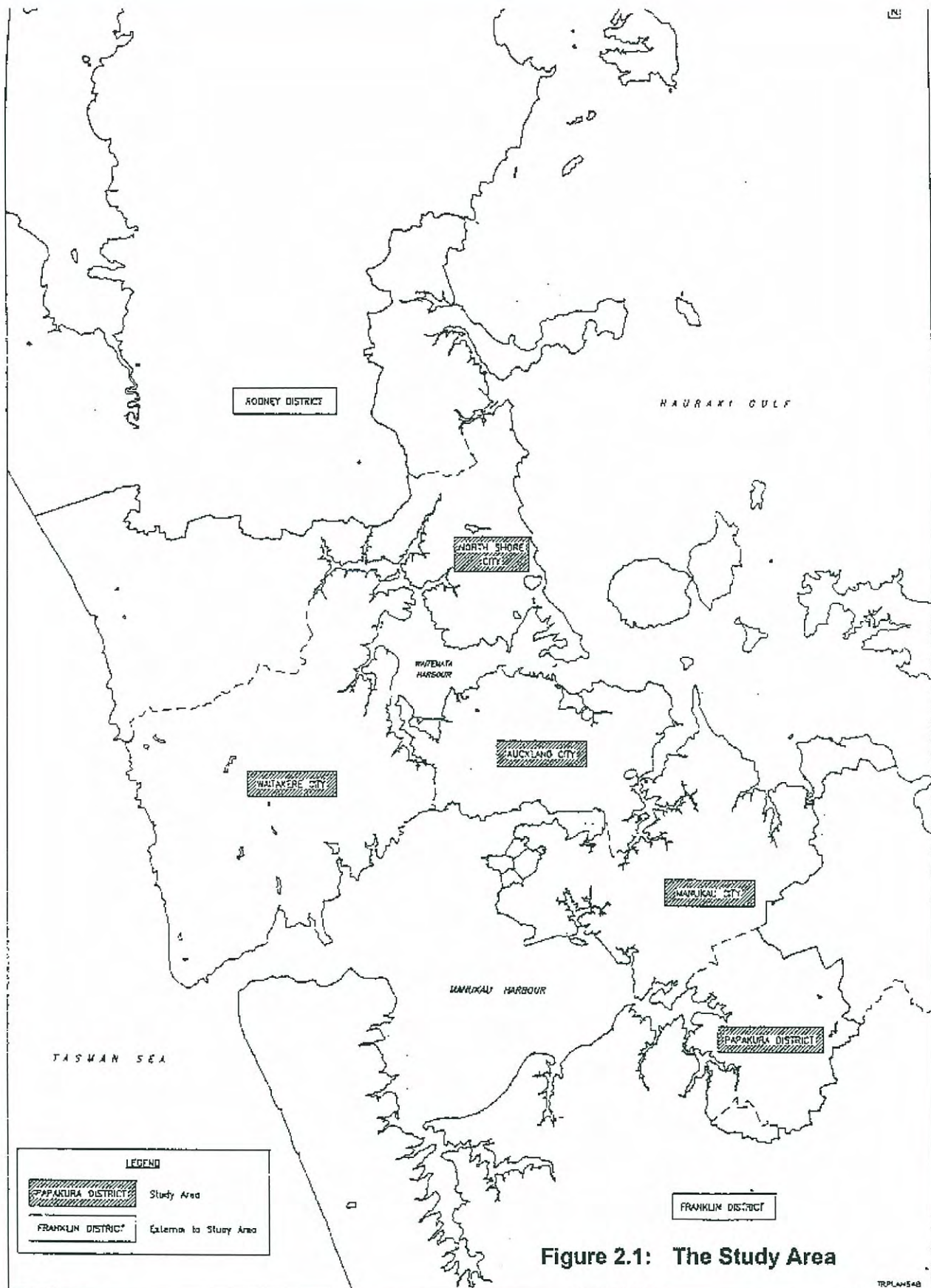
FIGURE 4.2



AUCKLAND 1973 - ZONE AREA

Source : Auckland CTSR Background Report 1973

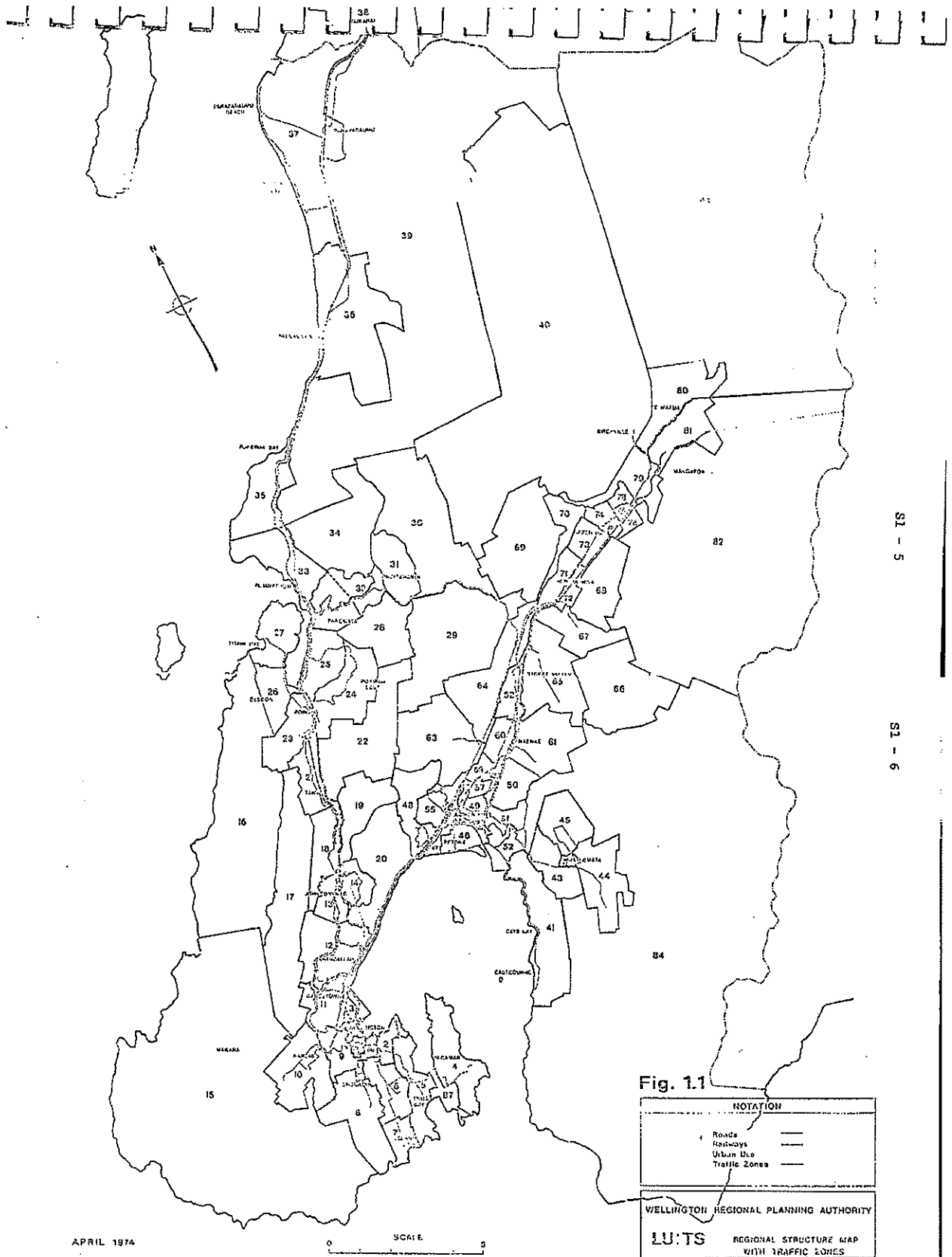
Fig A3.1.2



AUCKLAND 1992 - STUDY AREA

Source : Auckland Transport Models Project - Home Interview Survey
September 1995

4 Fig A3.1.3



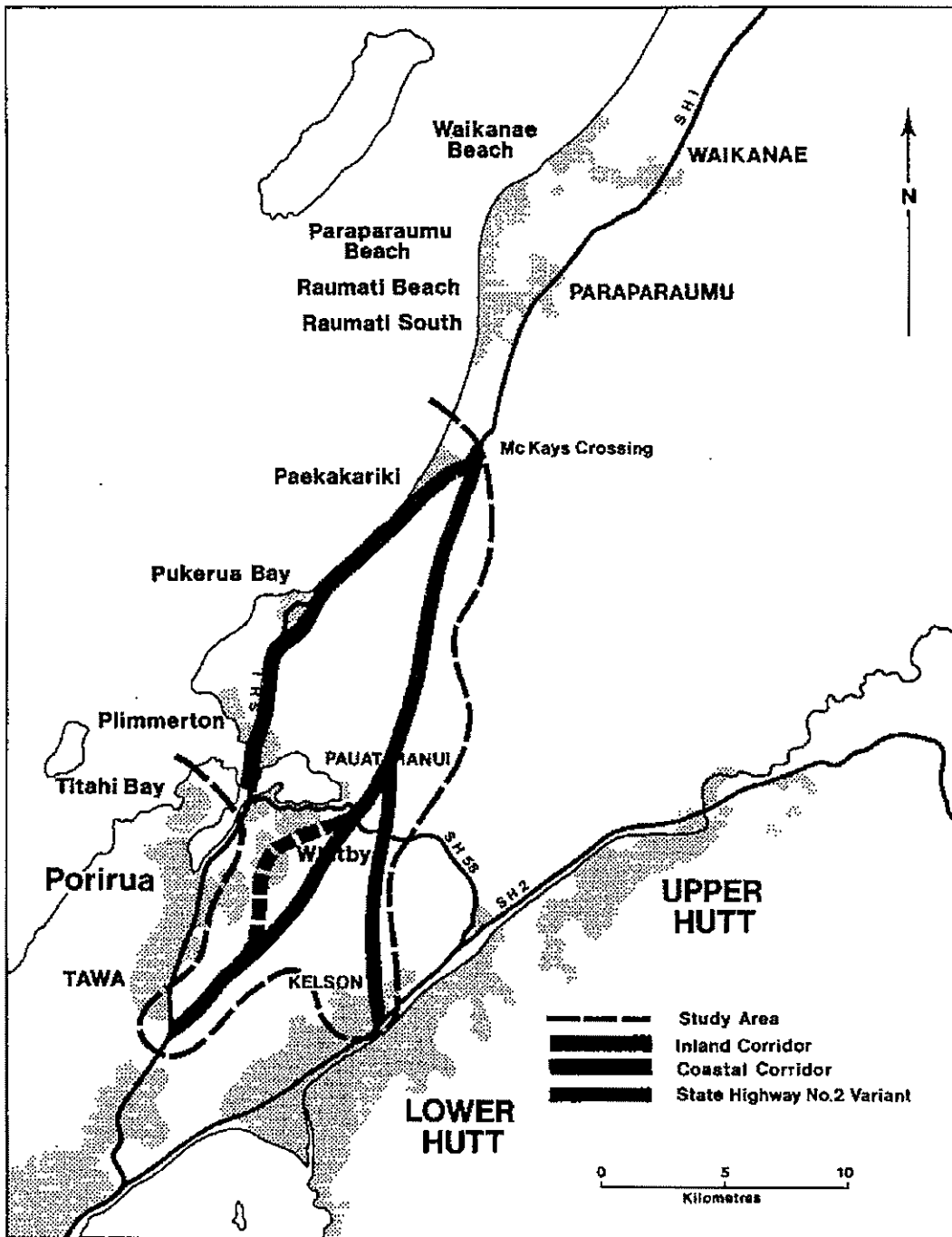
S1 - 5

S1 - 6

WELLINGTON 1971 - STUDY AREA

Source : Wellington Region Land Use and Transportation Study
 Report of Studies June 1975

Fig A3.1.4

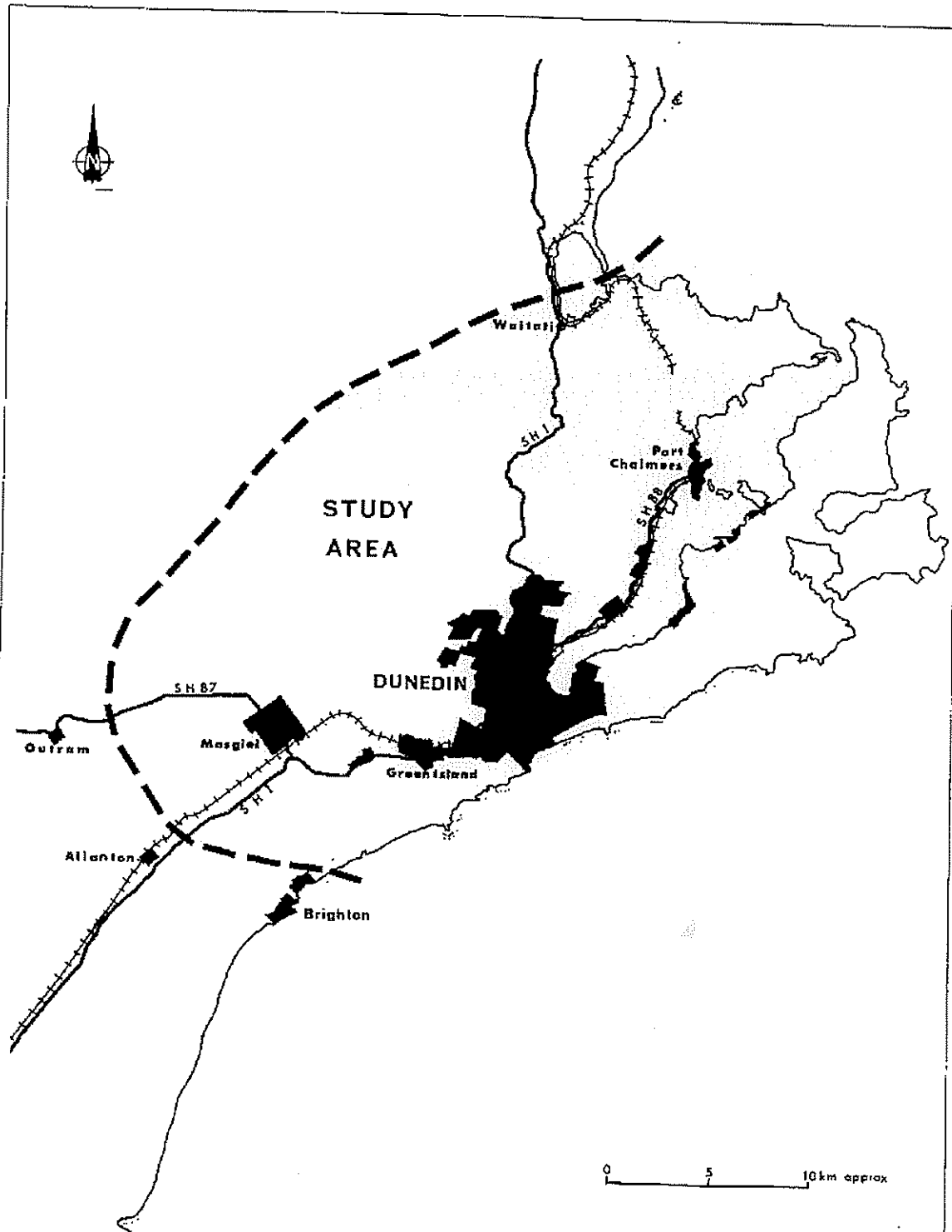


LOCATION AND STUDY AREA

WELLINGTON 1988 - STUDY AREA

Source : Technical Report 3 - Traffic Characteristics, Projections and Implications Wellington Regional Council August 1989

Fig A3.1.5



TRANSPORTATION STUDY	STUDY AREA BOUNDARY	Figure 2
Dunedin City Council Gabites Porter Ltd.		

DUNEDIN 1990 - STUDY AREA

Source : Dunedin Transportation Study - Study Methodology Report
Gabites Porter February 1992

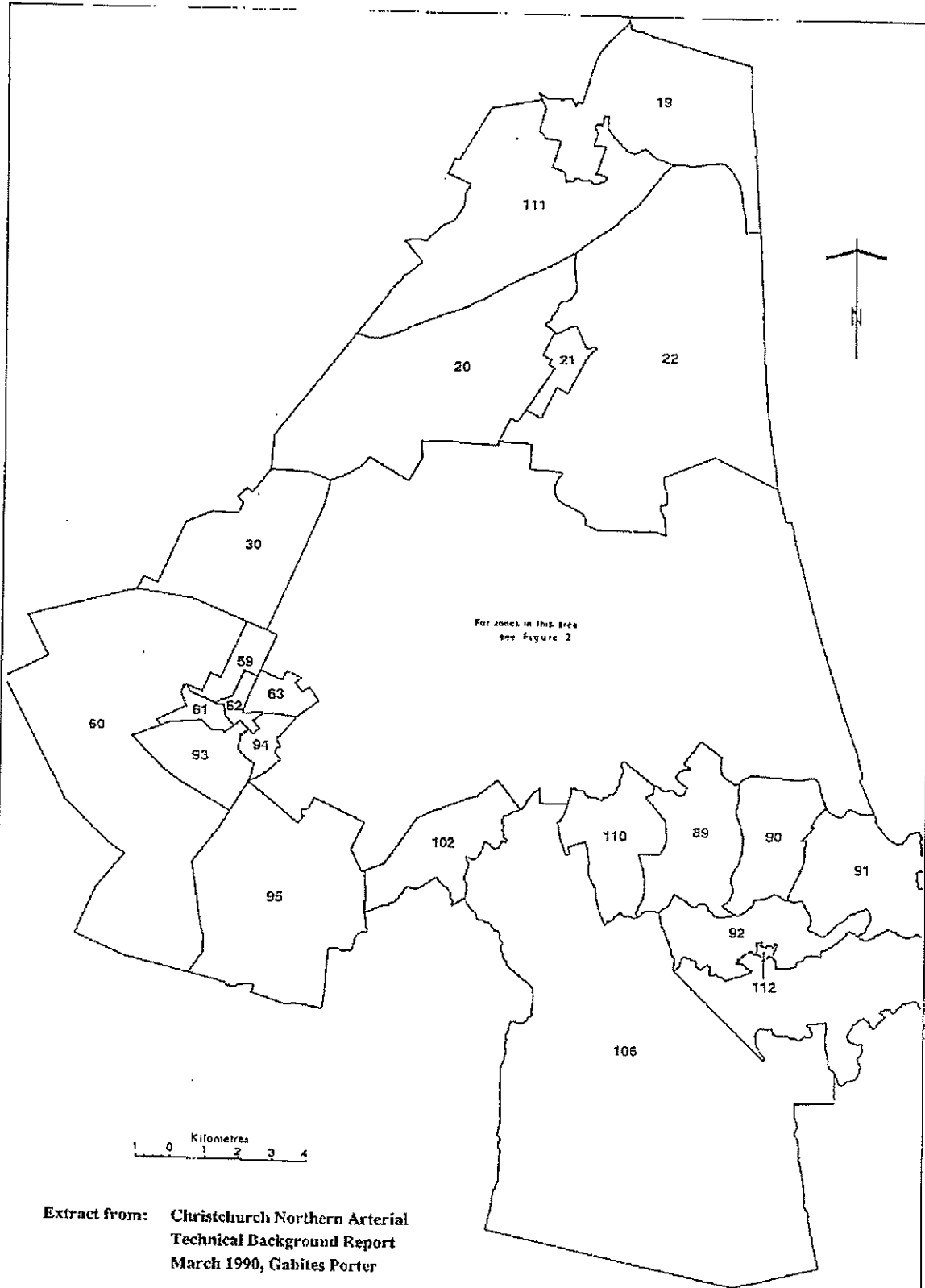
Fig A3.1.6



DUNEDIN 1990 - ZONES

Source : Dunedin Transportation Study - Study Methodology Report
Gabites Porter February 1992

Fig A3.1.7

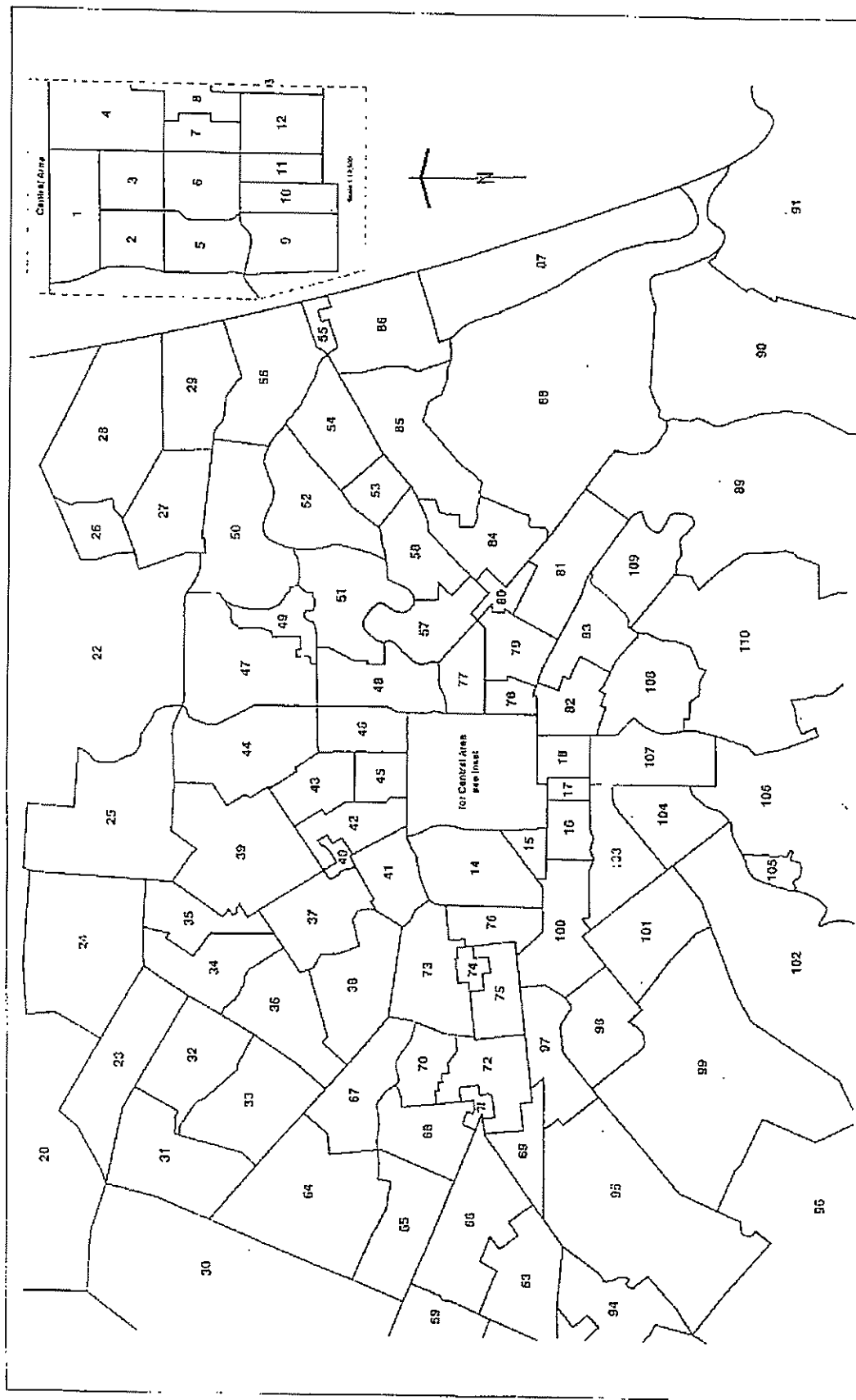


Extract from: Christchurch Northern Arterial
Technical Background Report
March 1990, Gabites Porter

**CHRISTCHURCH 1990 - STUDY AREA
AND OUTER ZONE BOUNDARIES**

Source : Christchurch Transportation Study Road Network Model
Extension and Review 1991

Fig A3.1.8



CHRISTCHURCH 1990 - ZONE BOUNDARIES

Source : Christchurch Transportation Study Road Network Model
 Extension and Review 1991

Fig A3.1.9

A3.2 Transportation System Study

A3.2.1 Transportation Study System - Global Statistics

The report "Calibration and Adjustment of System Planning Models" FHA (1990) provides a useful series of tables and appendices of statistics for comparing home interview data. These statistics will give a comparison not only between New Zealand cities but against American cities as well.

The global statistics are based on Appendix Table A-1 in FHA (1990).

- Total population
- Total number of households
- Percentage renter-occupied housing
- Workers as a percentage of population
- Average number of vehicles per household
- Population per vehicle or vehicle per 1000 population
- Workers per vehicle or vehicles per 1000 workers
- People per household
- Workers per household
- Percentage of households with 0 vehicles
- Percentage of households with 1 vehicle
- Percentage of households with 2 vehicles
- Percentage of households with 3+ vehicles

These spreadsheets are in the relevant files on the accompanying diskette:

HIS_STAT.XLS
HIS_VHH.XLS
HIS_PHH.XLS
HIS_EHH.XLS

A3.2.2 Household Interview Survey - Sample Statistics

The HIS are samples of a population. Statistics defining the HIS are:

- Number of people surveyed
- % of study area population
- Number of households interviewed
- % of study area households
- Month of year undertaken

Compare the sample rates used with Table 3.2 in Hobbs (1979).

See spreadsheet file HIS_STAT.XLS on accompanying diskette.

A3.2.3 Trip Generation - Per Person And Per Household

The first step is to look at trip rates by the basic generating units of people and households.

Statistics from Appendix Table A-2 in FHA (1990):

- Person trips per person
- Person trips per household
- People per household
- People per vehicle
- Vehicles per household
- Vehicle trips per household

See spreadsheet file HIS_STAT.XLS on accompanying diskette.

The following four spreadsheet files are on the diskette:

HIS_STAT.XLS
HIS_VHH.XLS
HIS_PHH.XLS
HIS_EHH.XLS

A3.2.4 Vehicle Ownership

Vehicles per household and vehicles per 1000 people are reported in the global statistics.

Analyse household vehicle ownership data, Figures 2.1.1, 2.1.2, 2.1.3 in Wigan (1987):

- Plot % of 0,1,2+(2,3+) vehicles available against household income

See spreadsheet file HIS_STAT.XLS on accompanying diskette.

A3.3 Person Trip Characteristics

A3.3.1 Person Trips Generated per Household by Vehicle Ownership

Statistics from Appendix Table A-3 in FHA (1990):

- Person trips per household by 0, 1, 2, 3+ vehicles per household

See spreadsheet file HIS_tbyv.xls on accompanying diskette.

A3.3.2 Person Trips by Trip Purpose

Statistics from Appendix Table A-6 in FHA (1990):

- Percentage distribution of person trips by home-based work, home-based non-work and non-home-based. Analyse the possibility of splitting non-home-based into non-home-based work and non-home-based non-work.

Also subdivide home-based trips, statistics from Table 2.2 in Hutchison (1974):

- Percentage of total home-based internal trips between home and destination purposes.

See spreadsheet file HIS_tbyp.xls on accompanying diskette.

A3.3.3 Person and Household Trip Rates by Mode

Statistics from Table 3.4.1 and Figure 3.4.2 in Wigan (1987):

- A comparison of overall standard household and person trip generation rates by mode.

Statistics from Figure 3.11.1 in Wigan (1987):

- Main trip modal split of households with 1, 2 and 3+ vehicles.

Statistics from Figure 6.0.1 in Wigan (1987):

- Standard person trip rates for public transport usage by level of household vehicle ownership.

See spreadsheet file HIS_tbym.xls on accompanying diskette.

A3.3.4 Vehicle Occupancy

Report vehicle occupancy by trip purpose, statistics from Table A-9 in FHA (1990). See Figure 8.13 and Figure 8.14 in this report.

A3.3.5 Trip Length Frequency

From the available HIS data, the durations of trips by purpose were able to be derived. Hence a first order trip length frequency analysis can be undertaken. Report time frequencies for:

- vehicle driver trips
- all trips
- by trip purpose, compare with Table A-8 in FHA (1990)
- by other modes, all trips, where data available

See Table 8.1 in the main report.

A3.3.6 Person Trips Generated per Household by Household Income

Statistics from Appendix Table A-4 in FHA (1990):

- Person trips per household by household income brackets
- Incomes to be indexed to a base year value

See spreadsheet file HIS_tbyi.xls on accompanying diskette.

A3.4 Vehicle Driver Trip Rates by Purpose by Category Model

Category analysis of all vehicle driver trips:

- 0, 1, 2, 3+ workers by 0, 1, 2, 3+ vehicles per household
- 0, 1, 2, 3, 4, 5+ people by 0, 1, 2, 3+ vehicles per household

Analyse the possibility of category models based on:

- people by workers by vehicles available
- household income by vehicles available, Table A-5 in FHA(1990)
- lifestyle categories, Table 2.5.5 in Wigan (1987)

Each spreadsheet consists of two worksheets, the first with the suffix "veh_emp", and the second with the suffix "veh_p>5".

For example, spreadsheet "AK73catm.xls" contains:

worksheets "AK73catm-veh_emp" and "AK73catm-veh_p>5".

For the relevant spreadsheets, open the following files on the accompanying diskette.

AK73catm.xls
AK78catm.xls
AK92catm.xls
CH69catm.xls
CH78catm.xls
CH90catm.xls
DN78catm.xls

DN90catm.xls
HA78catm.xls
HE78catm.xls
NUTScatm.xls
WN71catm.xls
WN78catm.xls
WN88catm.xls

A3.5 Vehicle Driver Trips by Purpose by Time of Day

Percentage of trips by purpose over the day is similar to Figure 1.10 in Hutchison (1974), but using percentages, time of departure and directional trip purposes; i.e.: home to work and work to home.

- Plot % of all trips against time
- Plot % of trips by purpose against time
- Plot % of NHB origins as % of other purposes against time
- Plot % of NHB destinations as % of other purposes against time

Each spreadsheet consists of one worksheet.

For example, spreadsheet "AK73_p_t.xls" contains:

- worksheet "AK73_vtbyptime"

For the relevant spreadsheets, open the following files on the accompanying diskette.

AK73_p_t.xls	HA78_p_t.xls
AK92_p_t.xls	HE78_p_t.xls
CH69_p_t.xls	NUTS_p_t.xls
CH78_p_t.xls	WN71_p_t.xls
CH90_p_t.xls	WN78_p_t.xls
DN78_p_t.xls	WN88_p_t.xls
DN90_p_t.xls	

A3.6 Person Trips by Mode by Time of Day

Percentage of trips by mode over the day. This gives the modal split for different parts of the day. Analyse by trip arrivals and trip departures.

- Plot % of all trips by mode against time of day
- Plot % of all trips by all modes against time of day

Each spreadsheet consists of one worksheet.

For example, spreadsheet "AK73mbyt.xls" contains:

- worksheet "AK73-tbmodebytime"

For the relevant spreadsheets, open the following files on the accompanying diskette.

AK73mbyt.xls	HA78mbyt.xls
AK78mbyt.xls	HE78mbyt.xls
AK92mbyt.xls	MT89mbyt.xls
CH69mbyt.xls	NT78mbyt.xls
CH90mbyt.xls	WN71mbyt.xls
DN78mbyt.xls	WN78mbyt.xls
DN90mbyt.xls	WN88mbyt.xls

