Roads and Traffic Authority

Trip Generation and Parking Generation Surveys

Housing for Seniors

Analysis Report

Hyder Consulting Pty Ltd
ABN 76 104 485 289
Level 5, 141 Walker Street
Locked Bag 6503
North Sydney NSW 2060
Australia
Tel: +61 2 8907 9000
Fax: +61 2 8907 9001
www.hyderconsulting.com

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Author	Jacky Leung	
Checker	Ken Hollyoak	
Approver	Jim Dumont	

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1 INTRODUCTION

1.1 Study Brief / Outcomes

In the next decade, there will be an increase in the sector of the population nearing retirement or reaching 65 years. This brings a need for transportation information about retirement villages and elderly person's communities, and the potential effects these may have on traffic in residential areas. This includes projected pedestrian, vehicle and cycle movements and traffic associated with these sites.

The RTA is concerned that the traffic generation and parking data in their *Guide to Traffic Generating Developments* contains data that was collected prior to 1993, and that does not reflect current traffic patterns.

RTA proposes to progressively update its trip generation and parking demand data for a range of land uses. To commence the process, Hyder was appointed to undertake a detailed analysis of the land use covering elderly persons' accommodation. The study includes new surveys which record not only traffic characteristics relating to vehicle and person trips, but also includes interview surveys with visitors to determine postcode origins and travel mode.

The collected information was then to be compared to equivalent data in overseas traffic generation and car parking databases. This assessment may help identify an alternative source of trip generation and parking demand databases that could have relevance to Australian conditions.

1.2 Housing for Seniors

Housing for seniors can take a great many forms

- Age Restricted "Retirement Communities/Villages"
- "Seniors Only" Apartments
- Continuing Care Retirement Communities
- Assisted Living
- Skilled Nursing Facilities

The RTA's intention is to analyse the 'newer' type of development which caters for active retirees with cars, but also contains an element of nursing & care for when these services are required. It was not the intention to study fully-fledged nursing homes where there is no evidence of independent living.

The type of 'newer' Independent living can take the form of

- **Retirement villages** – These are communities for seniors aged 55 and over or who have retired from full time employment. Generally residents must be able to shower and cook for themselves. The average age of village residents is low to mid 70's and the average entry age is mid to high 60's. Accommodation can range from bed-sitter apartments to 3 bedroom homes.
- **'Over 55's" developments** – These are blocks of houses or apartment buildings constructed and sold on the condition that only people aged 55 and over can live there. Residents are able to own the unit outright.

1.3 Approach

The approach to this generation study is described below:

- Hyder prepared a list of around 25 sites for RTA to review by using aerial photos and online information. Sites that had a minimum number of access points were preferred as these minimised survey costs.
- When the list of sites was reduced to 15, Hyder undertook detailed assessments of the sites, contacting the development managers and occupiers to obtain comprehensive information including number of occupied units, number of employees and access to public transport. The group was then further reduced to 10 which were agreed with the RTA.
- Hyder then arranged traffic counts on weekdays and weekends at the sites. The survey periods were based upon available historic and international data and reflected observed peak conditions. The survey data involved parking accumulation counts (where possible), vehicle counts and person counts.
- Hyder analysed the surveyed site data using linear regression and considered the generated data as a function of the key variables.
- Automatic traffic counters were placed on adjacent major roads to determine the network morning and evening peak hour periods on the survey day close to the residential sites. Alternatively data was used from RTA count sites if available.
- Hyder then compared the generation rates established with information from other databases from Australia and overseas.
- Hyder prepared a report to summarise the findings of the survey and data analysis.
- The reporting is presented in two documents. The first, this report, contains the analysis covering all of the calculations and comparisons.
- The second report contains the raw data from the surveys and other data such as site plans and tabulated person-trip data (Hyder report no. F0004-AA002363-AAR-01).

The analysis process is captured in the flowchart below

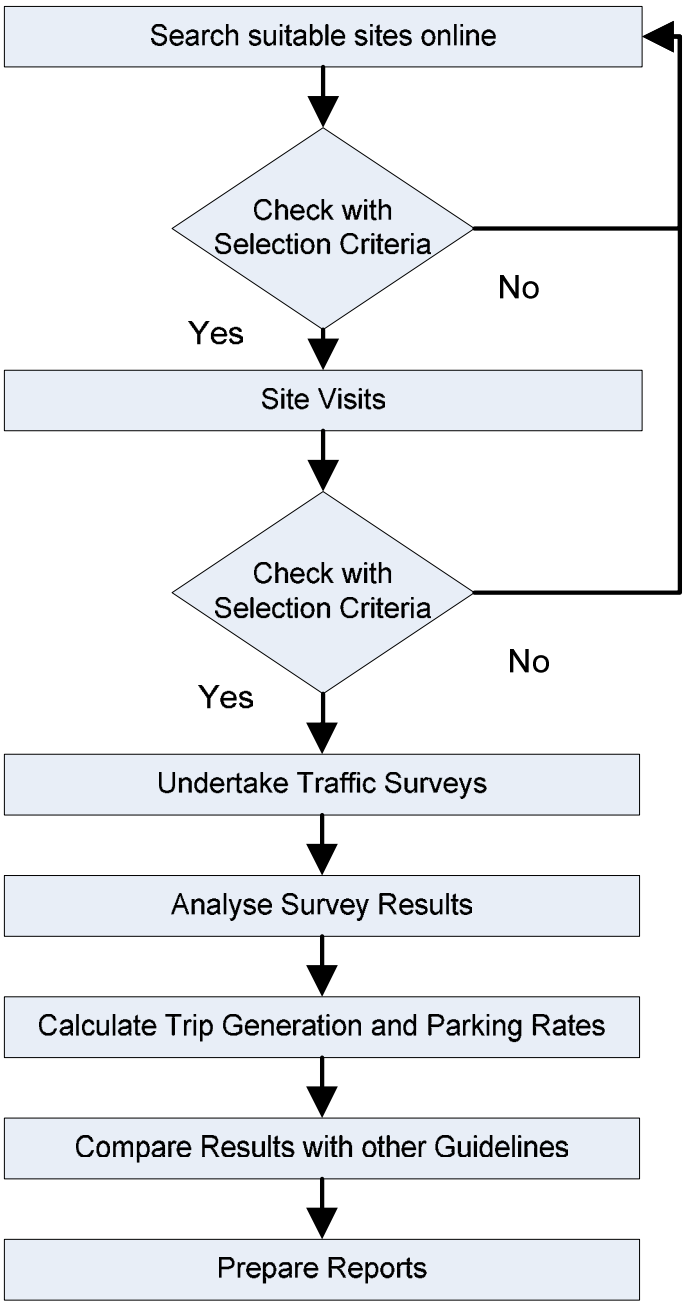


Figure 1-1 Approach

1.4 Report Structure

This analysis report has the following structure:

- **Chapter 1: Introduction** – background to the study, Approach and report structure;
- **Chapter 2: Survey methodology** – description of the survey and site selection process;
- **Chapter 3: Survey analysis** – analyse the survey results using linear regression;
- **Chapter 4: Comparison of survey results with overseas databases –** compare the NSW survey results with other country's databases such as TRICS (United Kingdom), NZTPDB (New Zealand) and ITE (United States)
- **Chapter 5 : Summary**

2 SURVEY METHODOLOGY

2.1 Site Selection Criteria

The selection of appropriate sites was the key process in the project.

It was necessary to ensure that the sites selected represented the whole of the state. The selected sites had to show a geographic spread and range of sizes. To achieve this spread, five sites were selected in the Sydney Metropolitan Area and five sites were selected in regional centres.

In order for the study data to be robust, it was necessary to show that the sites operated "independently " in traffic terms and that all traffic movements (vehicles and pedestrians) were generated as a result of the proposed site use (i.e. the site was not shared with another use which also generated trips). The table below identifies the factors that were crucial in determining that the selected sites were suitable for isolated analysis.

Table 2-1 Survey Sites Selection Criteria

Selection Criteria	Description
Out-of-centre (Isolated)	The business is free-standing and has provided off-street parking for its own exclusive use.
Unconstrained parking	The provision of car parking satisfies peak daily demand and most seasonal demands
Ease for surveying	The number of entrances/exits are minimised and can easily be seen
Fairly recent construction	The building / business has opened within the last 15 years
Accessibility Score	This scoring system was developed by RTA to measure access to public transport The chosen site should have scores less than 75 to indicate that sites are primarily dependent on cars rather than public transport.
No on-street parking	All residents, staff and visitors can park on site and can be recorded by traffic surveyors
Limited pedestrian access	Pedestrians may only enter the site at a few dedicated entrances.
Reasonable geographic spread	The sites are well distributed across the region.
A range of sizes	The sites should represent a range of sizes

2.2 Site Selection Methodology

The selection of sites was, in the first instance undertaken using local knowledge, the phone book, internet sources and Google Earth.

An initial list of around 25 sites was assembled. Hyder then prepared a check list and examined each site using a more detailed analysis to eliminate unsuitable sites, and leaving 15 preferred sites that best met the requirements.

A visit was then undertaken to each of the sites to confirm that they were acceptable and to record site specific details such as car parking and the number of access points. Discussions were held with the site owner of landlord to establish more detailed information about the number of units, number of employees etc.

This resulted in a list of 10 sites which were then discussed and agreed with the RTA. Sites SH1 to SH5 are located in the Sydney Metropolitan Area whilst sites SH6 to SH10 are in Non-Metropolitan Areas.

The details of the selected sites are summarised in Table 2.2 below.

The locations of the sites are shown on Figure 2.1 and Figure 2.2.

Table 2-2 Site Details of the Selected Sites

Site ID	SH1	SH2	SH3	SH4	SH5	SH6	SH7	SH8	SH9	SH10
Suburb	Dee Why 2099	Allambie Heights 2100	North Parramatta 2151	Richmond 2753	Prestons 2170	Bonnells Bay 2264	Wamberal 2260	Kincumber 2251	Tahmoor 2573	Bowral 2576
Network Peak Hours										
Year of Network Survey Dates	2005	2009 21/3-27/3	2005	2009 23/3-29/3	2009 6/4-12/4	2009 21/3-1/4	2004	2009 21/03-25/3	2009 19/3-25/3	2006
AM Peak - Weekdays	0800-0900	0800-0900	0800-0900	0800-0900	0900-1000	0900-1000	0800-0900	1100-1200	0900-1000	0800-0900
PM Peak - Weekdays	1700-1800	1700-1800	1700-1800	1500-1600	1600-1700	1500-1600	1500-1600	1600-1700	1700-1800	1500-1600
Peak - Weekends	1200-1300	1200-1300	1200-1300	1100-1200	1200-1300	1100-1200	1200-1300	1100-1200	1100-1200	1100-1200
Site Details - Senior Housing										
Accommodation Type	S + H	S + H	S + H + A	S + H + A	S + H	S	S	S	S	S + H
Funded (Resident / Government)	Resident	Resident	Resident	Resident	Both	Resident	Resident	Resident	Resident	Resident
Original Unit Cost	200k-250k	200k-480k	180k-220k	Unknown	135k-175k	300k-400k	90k-95k	365k-520k	95K	385k-645k
Year Constructed	1988-2000	1966-2009	1994-2001	1983-2005	1999-2003	1996	1983-1986	2002-2007	1997	1986
Village Bus	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
Village Bus Frequency per week	9	2	10	2	4	4	No	3	No	No
No. of Units Provided (Total)	272	83	276	174	214	250	62	76	42	86
No. of Occupied Units (Self)	180	40	116	43	147	240	51	70	38	68
No. of Residents (Self)	226	48	157	43	217	350	51	92	50	100-110
No. of Occupied Units (Low-care)	25	38	50	61	67	N/A	N/A	N/A	N/A	13
No. of Residents (Low-care)	25	39	50	61	67	N/A	N/A	N/A	N/A	
No. of Occupied beds (High-care)	N/A	N/A	98	70	N/A	N/A	N/A	N/A	N/A	N/A
No. of Residents (High-care)	N/A	N/A	98	70	N/A	N/A	N/A	N/A	N/A	N/A
No. of employee (Total)	15	32	160	130	30	8	3	10	1	19
No. of employee (at one time)	N/A	12	45	30-40	<30	8	2	1	1	19
Accessbility Score	<79	<79	<79	<79	<79	0.5	32	32	6.5	8
Parking Spaces										
Residents	110	17	82	26	155	500	62	111	42	80
Staff	as Visitor	16	25	as Visitor	11	4	as Visitor	as Visitor	1	as Vistor
Visitors / Loading bays	32	11	32	52	28	75	11	28	16	10
Total	142	44	139	78	194	579	73	139	59	90
Cars Ownership										
No Car	Unknown		54		83	0	16	4	16	
1 Car	Unknown	17	59	15	83	230	37	39	22	60
2 Cars	Unknown		5		0	10	0	10	0	
No. of Cars (Total)	Unknown	17	69	15	83	250	37	59	22	60

Note: S: Self-contained, H: Hostel (Low-care), A: Aged care (High-care)

Figure 2-1 Site Location - Sydney Metropolitan Area

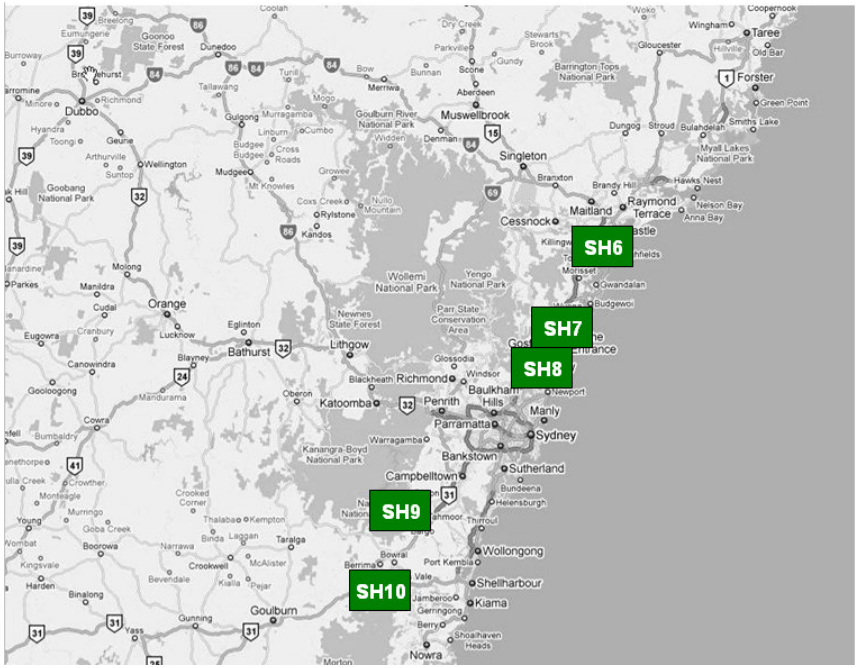


Figure 2-2 Site Location – Non-Metropolitan Area

2.3 Challenges

There were a number of difficulties encountered in selecting the sites. Some of these are described below.

- There were a great number of sites under construction and many of the sites were only partly occupied. Often construction vehicles and workers shared the same entrance as general traffic so it was difficult to separate the types of traffic
- Some of the site owners talked about the age characteristics of the occupants of the sites. Sites which opened 15 years ago with a number of active 60 year old residents now had large communities of less active 75 year olds. Although the occupancy was obviously cyclical, it took time for new sites to settle down to achieve a more balanced mixture of older and younger occupants.
- It was hard to count the number of residents' vehicles parked on site in the parking survey element of the counts because many of the units had a lock up garage. This meant that it was not possible to do an accurate parking accumulation on the sites.

2.4 Anecdotal Information

Discussions with the owners of the properties revealed a number of opinions

- The busiest days are generally Monday or Wednesday
- The busiest times were generally at mid day.
- At the weekend, there was little anecdotal evidence to distinguish the traffic patterns on a Saturday or a Sunday.

2.5 Survey Process

The surveys were undertaken in March 2009 outside of any school holidays or public holidays. Based upon information given to us by the site owners (and by reference to the overseas surveys described later in this report), the surveys were undertaken between 10am and 8pm.

Interview surveys were also conducted over a four hour period at each site. The purpose of these interviews was to establish the following facts

- The travel mode of residents/ visitors
- Whether staff/visitors are parked on-site or off-site
- Visitors' home postcodes
- Trip purpose such as pass by, multi purpose or single purpose

The site managers were also issued with a questionnaire which posed the following questions.

Table 2-3 Summary of site manager's questionnaire

Name and address of development	
Type of development	**Housing for seniors**
Number of separate units Total By type say studio, one bed, two bed etc	
Year constructed	
Original price range of units (approx)	
Funded by (Resident / Government)	
Site area	
Individual garages (Yes/No) Total garages if different from number of units	
Management staff parking	
Visitor parking	
Village bus (yes/no) Service frequency (trips from development per day)	
Number of staff Total On site at one time	
Number of units occupied Occupied but away say on holiday	
Total number of permanent residents Units	
Number of res units with cars No car 1car 2 cars More than 2 cars	
Busiest day of week for visits Residential units	

Some managers did not have all of the information but all provided the minimum necessary to analyse the data (i.e. number of units, parking numbers).

2.6 Data Recorded

The following information was recorded by the traffic surveyors on site:

- Weather on the survey day
- Number of vehicles parked on site at the commencement of the survey. *(Surveyors generally could not record the number of cars in lock up garages).*
- Number of vehicles (*cars and commercial vehicles*) entering and leaving the site
- Vehicle occupancy
- Number of pedestrian / cyclists entering and leaving the site
- Number of vehicles parked on site at the completion of the survey (Visible to surveyors)
- The travel mode of residents/ visitors (sample interview survey)
- Whether people are parked on-site or off-site (sample interview survey)
- People's home postcode (sample interview survey)
- Trip purpose such as pass by, multi purpose or single purpose. (sample interview survey)

Hourly traffic volumes on the adjacent major road to determine main road peak hours were also collected using Automatic traffic counters or RTA traffic count stations.

This information would help establish person trips, vehicle trips, and help establish the occupancy of any off-site parking spaces.

2.7 Additional Surveys

Although site owners identified the busiest weekday times for the elderly housing was towards midday, Hyder undertook two check counts - one on a rural site and one on an urban site, to check traffic generation characteristics in the traditional AM peak hour period.

The results of these additional surveys are discussed later in this report.

3 Survey Analysis

3.1 Survey Output Requirements

The data was analysed with the key parameters needing to be established being

- Weekday site peak hour generation
- Weekday hourly generation in adjacent network AM peak
- Weekday hourly generation in adjacent network PM peak
- Weekday daily trip generation
- Weekend site peak hour generation
- Weekend peak hourly generation in adjacent network peak
- Weekend daily trip generation

3.2 Key Variables for Trip Rate Calculation

The trip generation calculation that was to be performed would depend upon the variable that was interrogated. Of the variables that were considered for the trip rate calculation were the following

- Number of units
- Site area / site density
- Number of staff
- Number of residents

It was noted that TRICS which had the most information of all of the foreign databases primarily used number of dwellings (58 sites), then site area (51 sites) and finally there were two sites using site density (2 sites).

The New Zealand database relied only on the number of dwellings and the ITE guide also only used the number of units.

The number of dwellings/units is considered to be the most reliable variable to choose. The other variables are discussed below in terms of their applicability.

- Site area / site density

  It is often the case that sites with a greater site area may simply have more open space. For example, the sites in Bowral that were examined were set in larger grounds than those at city centre locations such as Dee Why, even though the number of units was similar.

- Number of staff

  The number of staff generally related to the level of care that was present on the site. Where independent living units were available, staff numbers were relatively low, but as the amount of care that was required for residents increased so did the number of staff. Interestingly however, this did not increase the trip generation rate significantly, possibly because a rise in the care level was balanced by a corresponding drop in the number of resident trips. As such, the number of trips not made by the residents was offset by the trips made by staff.

- Number of residents

  The number of residents in each unit varied across the selected sites from between 1.0 and 1.5 residents per unit with the average around 1.26. Furthermore, whilst the number of residents per unit might be acceptable for interrogating data from existing sites where the number of residents is known, it will not be possible to be definitive about the number of residents per unit in future development applications when they are being assessed.

In summary therefore, it is considered that the most appropriate key variable is the number of units, or more specifically the number of occupied units. Based on information provided by site managers, we have omitted units that are unoccupied from the calculation of trip generation.

3.3 Average Trip Rates per Occupied Unit

The summary of survey data for each of the preferred 10 sites is shown in Table 3-1 below. The detailed results are contained in **Appendix A**.

Table 3-1 Traffic Results Summary – Trips / Occupied Unit

	Sydney Metropolitan Area					Non-Metropolitan Area				
Site ID	**SH1**	**SH2**	**SH3**	**SH4**	**SH5**	**SH6**	**SH7**	**SH8**	**SH9**	**SH10**
No. of Occupied Units (Total)	**205**	**78**	**264**	**174**	**214**	**240**	**71**	**70**	**38**	**81**
Weekdays										
Person-based Trips										
- Site Peak Hour	126	31	110	80	91	149	31	39	34	44
Trips/ Unit	0.61	0.40	0.42	0.46	0.43	0.62	0.61	0.56	0.89	0.54
- Vehicle Network AM Peak	Network AM peak is outside of survey periods									
Trips/ Unit										
- Vehicle Network PM Peak	116	8	23	56	44	86	26	22	1	43
Trips/ Unit	0.57	0.10	0.09	0.32	0.21	0.36	0.51	0.31	0.03	0.53
Daily Total Person Trips	854	163	653	481	528	1,037	182	225	139	269
Trips/ Units	4.17	2.09	2.47	2.76	2.47	4.32	3.57	3.21	3.66	3.32
Vehicle-based Trips										
- Site Peak Hour	87	20	62	55	54	105	20	27	21	37
Trips/ Unit	0.42	0.26	0.23	0.32	0.25	0.44	0.39	0.39	0.55	0.46
- Network AM Peak	Network AM peak is outside of survey periods									
Trips/ Unit										
- Network PM Peak	74	5	12	41	36	54	16	16	1	27
Trips/ Unit	0.36	0.06	0.05	0.24	0.17	0.23	0.31	0.23	0.03	0.33
Daily Total Car Trips	584	95	351	285	294	685	100	146	63	204
Trips/ Unit	2.85	1.22	1.33	1.64	1.37	2.85	1.96	2.09	1.66	2.52
Daily Total CV Trips	9	10	30	26	38	59	9	6	12	5
Trips/ Unit	0.04	0.13	0.11	0.15	0.18	0.25	0.18	0.09	0.32	0.06
Daily Total Vehicle Trips	593	105	381	311	332	744	109	152	75	209
Trips/ Unit	2.89	1.35	1.44	1.79	1.55	3.10	2.14	2.17	1.97	2.58
% CV	1.5%	9.5%	7.9%	8.4%	11.4%	7.9%	8.3%	3.9%	16.0%	2.4%
Weekend										
Person-based Trips										
- Site Peak Hour	31	29	95	73	89	123	28	35	22	46
Trips/ Unit	0.15	0.37	0.36	0.42	0.42	0.51	0.55	0.50	0.58	0.57
- Vehicle Network Peak	13	16	76	44	47	123	6	35	15	37
Trips/ Unit	0.06	0.21	0.29	0.25	0.22	0.51	0.12	0.50	0.39	0.46
Daily Total Person Trips	163	151	620	373	483	452	119	111	114	182
Trips/ Units	0.80	1.94	2.35	2.14	2.26	1.88	2.33	1.59	3.00	2.25
Vehicle-based Trips										
- Site Peak Hour	20	15	56	46	50	85	15	20	11	33
Trips/ Unit	0.10	0.19	0.21	0.26	0.23	0.35	0.29	0.29	0.29	0.41
- Network Peak	9	11	45	30	31	79	3	18	6	27
Trips/ Unit	0.04	0.14	0.17	0.17	0.14	0.33	0.06	0.26	0.16	0.33
Daily Total Car Trips	95	95	334	241	268	312	56	65	58	131
Trips/ Unit	0.46	1.22	1.27	1.39	1.25	1.30	1.10	0.93	1.53	1.62
Daily Total CV Trips	10	2	22	7	16	3	0	0	2	3
Trips/ Unit	0.05	0.03	0.08	0.04	0.07	0.01	0.00	0.00	0.05	0.04
Daily Total Vehicle Trips	105	97	356	248	284	315	56	65	60	134
Trips/ Unit	0.51	1.24	1.35	1.43	1.33	1.31	1.10	0.93	1.58	1.65
% CV	9.5%	2.1%	6.2%	2.8%	5.6%	1.0%	0.0%	0.0%	3.3%	2.2%

* CV – Commercial Vehicle

A review of the data reveals a number of observations

- The surveys were undertaken on a range of occupied units from 38 to 264.

- The weekday site peak hour trip generation rate varies from 0.23 vehicle trips per unit to 0.55 vehicle trips per unit with an average of 0.37 trips. As such the busiest site has more than double the trip rates compared to the quietest site.
- The weekday daily trip rate varied from 1.35 vehicle trips per unit to 3.1 vehicle trips per unit with an average of 2.10 vehicle trips per unit.
- The network PM peak hour during weekdays are often between 3pm and 6pm while the network peak hour in weekend are close to noon time. More trips are observed during weekend at network peak than weekday network PM peak. Therefore, network peak hour traffic has more impact by the senior housing in weekend.

The bottom section of this table expresses the weekend traffic characteristics as a percentage of the weekday traffic characteristics and the last column expresses the non metropolitan traffic characteristics as a percentage of the metropolitan traffic characteristics.

Table 3-2 Trips Rate Summary – Comparison of Location Area

	Sydney Metropolitan Area SH1 to SH5			Non-Metropolitan Area SH6 to SH10			All Survey Sites SH1 to SH10			Avg Non-metro / Metro %
Trips/ Unit	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	
Weekdays										
Person-based Trips										
- Site Peak Hour	0.40	0.61	0.46	0.54	0.89	0.64	0.40	0.89	0.55	139.3%
- Veh Network AM Peak	Network AM peak is outside of survey periods									
- Veh Network PM Peak	0.09	0.57	0.26	0.03	0.53	0.35	0.03	0.57	0.30	135.6%
Daily Total Person Trips	2.09	4.17	2.79	3.21	4.32	3.62	2.09	4.32	3.20	129.5%
Vehicle-based Trips										
- Site Peak Hour	0.23	0.42	0.30	0.39	0.55	0.44	0.23	0.55	0.37	149.9%
- Network AM Peak	Network AM peak is outside of survey periods									
- Network PM Peak	0.05	0.36	0.17	0.03	0.33	0.23	0.03	0.36	0.20	128.9%
Daily Total Car Trips	1.22	2.85	1.68	1.66	2.85	2.22	1.22	2.85	1.95	131.7%
Daily Total CV Trips	0.04	0.18	0.12	0.06	0.32	0.18	0.04	0.32	0.15	144.5%
Daily Total Vehicle Trips	1.35	2.89	1.80	1.97	3.10	2.39	1.35	3.10	2.10	132.6%
Weekend										
Person-based Trips										
- Site Peak Hour	0.15	0.42	0.34	0.50	0.58	0.54	0.15	0.58	0.44	157.6%
- Veh Network Peak	0.06	0.29	0.21	0.12	0.51	0.40	0.06	0.51	0.30	192.6%
Daily Total Person Trips	0.80	2.35	1.90	1.59	3.00	2.21	0.80	3.00	2.05	116.6%
Vehicle-based Trips										
- Site Peak Hour	0.10	0.26	0.20	0.29	0.41	0.33	0.10	0.41	0.26	163.1%
- Network Peak	0.04	0.17	0.13	0.06	0.33	0.23	0.04	0.33	0.18	168.9%
Daily Total Car Trips	0.46	1.39	1.12	0.93	1.62	1.29	0.46	1.62	1.21	115.9%
Daily Total CV Trips	0.03	0.08	0.05	0.00	0.05	0.02	0.00	0.08	0.04	37.5%
Daily Total Vehicle Trips	0.51	1.43	1.17	0.93	1.65	1.31	0.51	1.65	1.24	112.2%
Weekend/ Weekdays %										
Person-based Trips										
- Site Peak Hour	38.0%	68.3%	74.3%	92.0%	64.7%	84.0%	38.0%	64.7%	79.9%	
Daily Total Person Trips	38.0%	56.4%	67.9%	49.3%	69.4%	61.1%	38.0%	69.4%	64.1%	
Vehicle-based Trips										
- Site Peak Hour	41.5%	62.3%	67.4%	74.1%	73.7%	73.3%	41.5%	73.7%	70.9%	
Daily Total Car Trips	38.0%	48.6%	66.4%	56.0%	56.7%	58.4%	38.0%	56.7%	61.9%	
Daily Total CV Trips	58.4%	46.9%	44.5%	0.0%	16.7%	11.5%	0.0%	26.4%	25.0%	
Daily Total Vehicle Trips	38.0%	49.3%	64.9%	47.0%	53.4%	54.9%	38.0%	53.4%	59.2%	

- The trip rates in Non-Metropolitan Areas are generally higher than the sites in the Sydney Metropolitan Area. The average daily vehicle trip rates in Non-Metropolitan Area in weekday and weekend are 33% and 12% higher than in Sydney respectively.

A graphical summary of the daily trips for both person trips and vehicle trips is shown below both for weekdays and weekends for each of the sites.

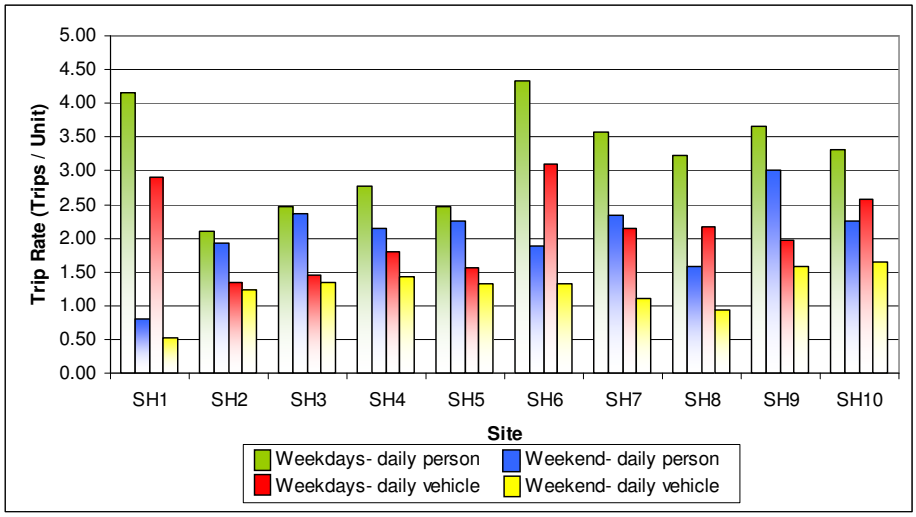


Figure 3-1 Daily Trip Rate – Weekdays and Weekend

- The number of daily trips during weekdays is higher than the weekend. However, there is no constant ratio between the weekday and weekend volumes across all of the sites.
- There is no significant difference for the trip rate pattern between Sydney Metropolitan Area (SH1 to SH5) and Non-Metropolitan area (SH6 to SH10)
- SH1 has a significantly reduced number of weekend trips when compared with weekdays. There is no obvious reason to explain this.

3.4 Simple Linear Regression

As required in the project brief, the data has been analysed to determine the most consistent measure of trip generation and parking demand, using a simple linear regression approach that is the highest R^2 value.

The coefficient of determination (R^2) has been used to provide a measure of the usefulness of the regression equation. It measures the proportion of variation in Y (trip behaviour) that is explained by the independent variable X (such as number of occupied units) in the regression model. The values vary from 0 to 1 with higher value represents higher degree of correlation. In this study, this correlation coefficient (R^2) above 0.8 is preferred in order to accept the results to the desired level of correlation. In other words, at least 80% of the variation in trip behaviour can be explained by the variability in the selected independent variable in the acceptable level.

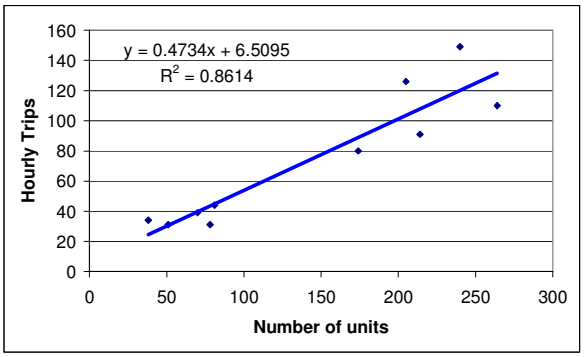
As stated in Section 3.2, the number of occupied units is used as the key independent variable for this regression analysis. The trip behaviour in the following periods is plotted against the number of units.

- Site Peak Hour
- Daily Total
- Road Network PM Peak in weekdays and Peak in weekend

'Person' trips and 'vehicle' trips are plotted separately.

3.4.1 Site Peak Hour

- For the person trips, R^2 is 0.86 in weekdays and 0.68 at the weekend
- R^2 of the vehicle trips is 0.74 in weekdays and 0.64 at the weekend
- R^2 for the weekdays is reasonably acceptable
- R^2 is lower at the weekend because site SH1 has a significantly lower level of trips without any obvious reason.



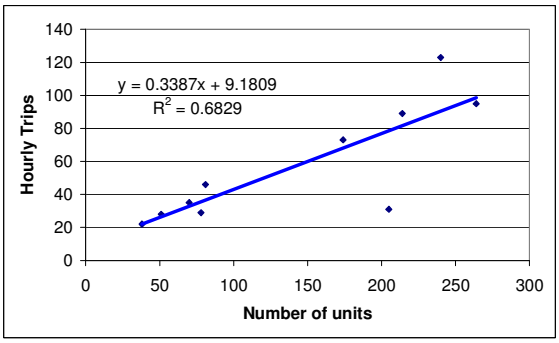
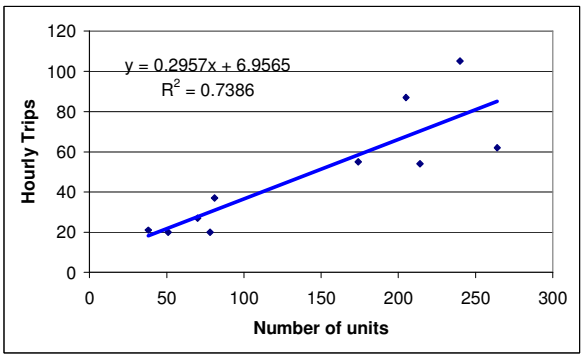


Figure 3-2 Person Trips – Site Peak Hour, Weekdays **Figure 3-3 Person Trips – Site Peak Hour, Weekend**



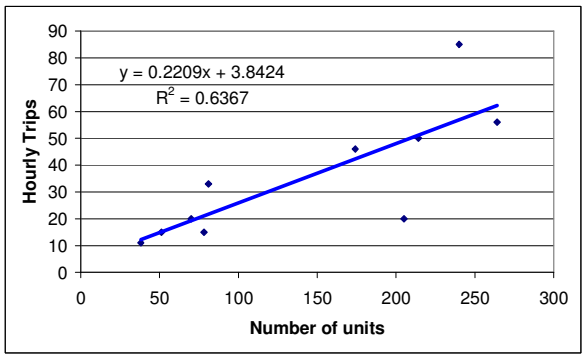


Figure 3-4 Vehicle Trips – Site Peak Hour, Weekdays **Figure 3-5 Vehicle Trips – Site Peak Hour, Weekend**

3.4.2 Daily Total Trips

- For the person trips, R^2 is 0.79 in weekdays and 0.76 at the weekend
- R^2 of the vehicle trips is 0.70 in weekdays and 0.78 at the weekend
- R^2 is generally acceptable for daily total trips

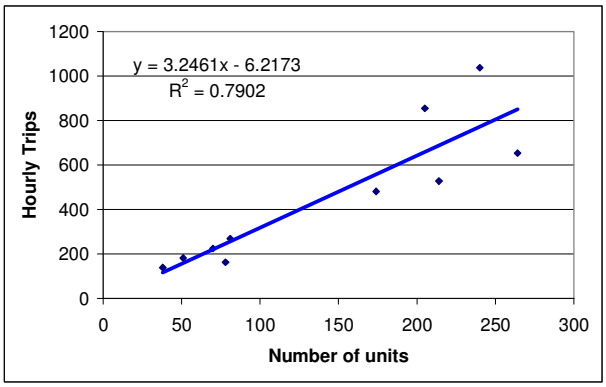


Figure 3-6 Person Trips – Daily, Weekdays

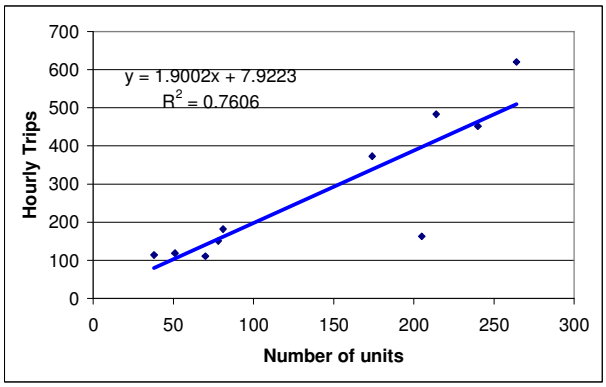


Figure 3-7 Person Trips – Daily, Weekend

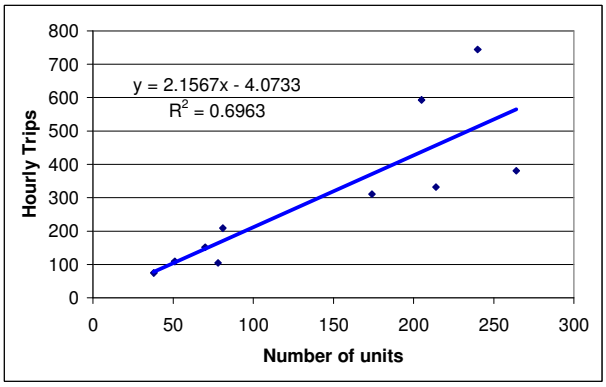


Figure 3-8 Vehicle Trips – Daily, Weekdays

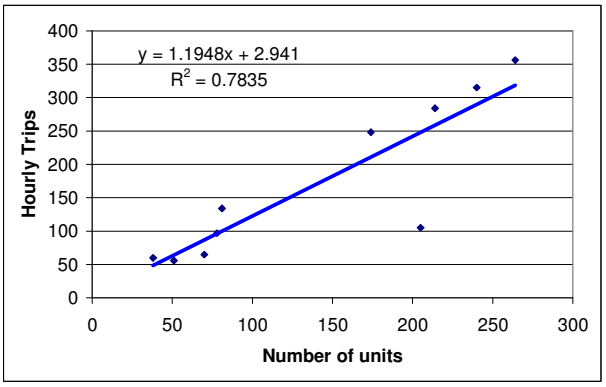


Figure 3-9 Vehicle Trips – Daily, Weekend

3.4.3 Road Network Peak

The AM network peak on the adjacent roads (usually 8am to 9am) was generally outside the survey period (which started at 10am). The reason being that, based upon anecdotal and international data, the peak generation from this type of site generally occurred towards midday whereas the generally accepted AM network peak is 8am to 9am. The surveys of the elderly housing were therefore commenced at 10am. As a result, only the network weekday PM peak was recorded and this is plotted below.

There is usually only one peak period during the weekend which generally occurred at noon time. Another graph is plotted for this.

- R^2 is between 0.36 to 0.50 which indicates that the degree of correlation is quite low between trips in network peak hour and the number of units. The trip behaviour from the sites during the network peak period may not be adequately explained by the unit numbers. Therefore, if the impact on the adjacent network peak hour is to be considered, site specific data would be better than using average values.

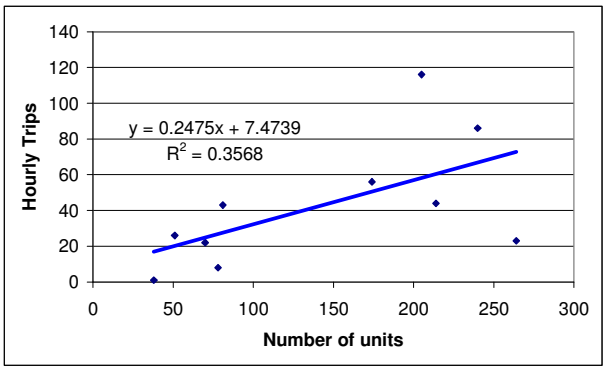


Figure 3-10 Person Trips – Network PM Peak, Weekdays

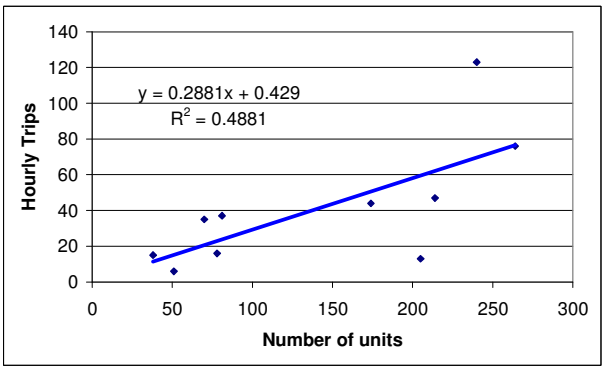


Figure 3-11 Person Trips – Network Peak, Weekend

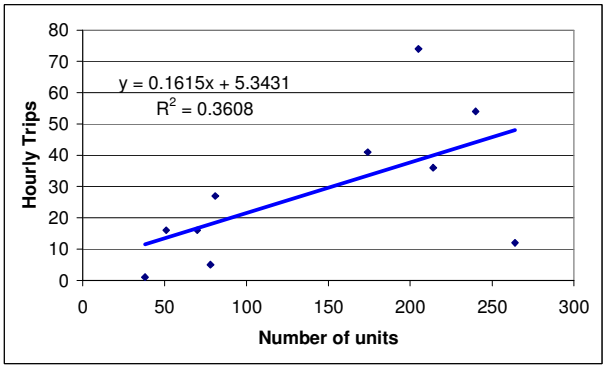


Figure 3-12 Vehicle Trips – Network PM Peak, Weekdays

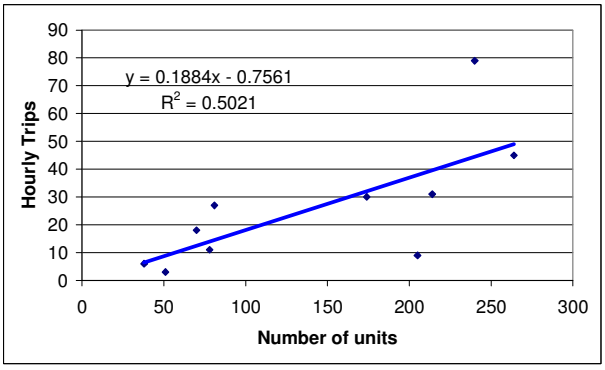


Figure 3-13 Vehicle Trips – Network Peak, Weekend

3.4.4 Conclusions about Linear Regression analysis

Both the 'site peak hour' trips and 'daily trips' have a reasonably high correlation with the number of occupied units. Confidence levels of 63% to 86% that trip behaviour can be explained by the number of units are obtained.

Neither the trips during 'network PM peak hour' in weekday nor 'network peak hour in weekend' have an acceptable correlation with the number of occupied units.

3.5 Interview Survey Results

3.5.1 Primary Trips / Pass-By Trips / Multi-purpose Trips

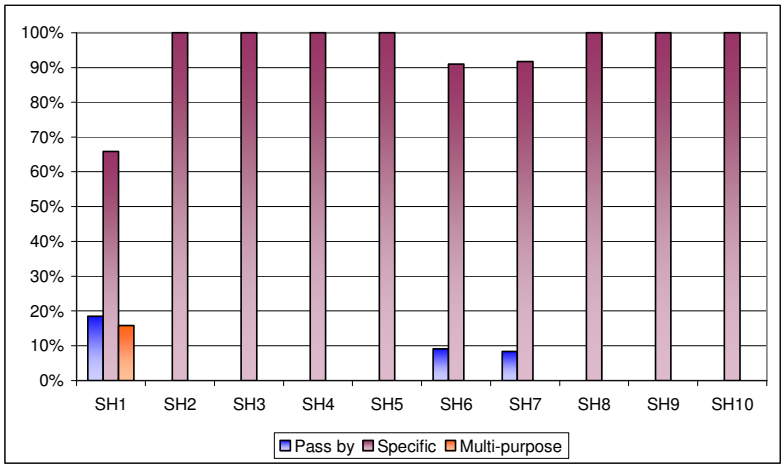


Figure 3-14 Trip Purpose – Weekdays

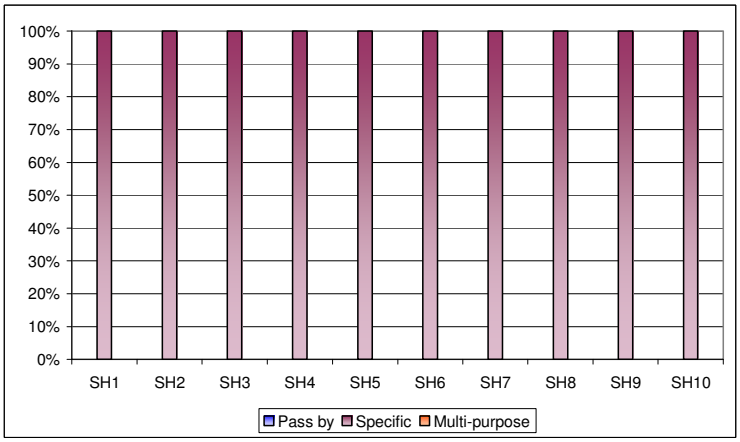


Figure 3-15 Trip Purpose – Weekends

It is clear from the interview survey that trips to elderly peoples housing are, unsurprisingly, specific trips – very few are pass-by or multi purpose trips.

3.5.2 Origin Postcode

The following maps show the postcode from which people are visiting the elderly housing. As one postcode commonly has more than one suburb name, only one of the suburb names has been shown on these figures.

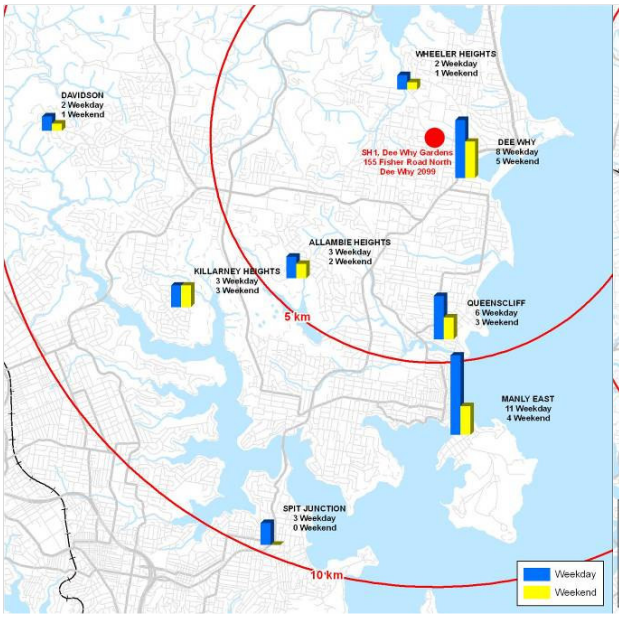


Figure 3-16 SH1 - Origin Postcode

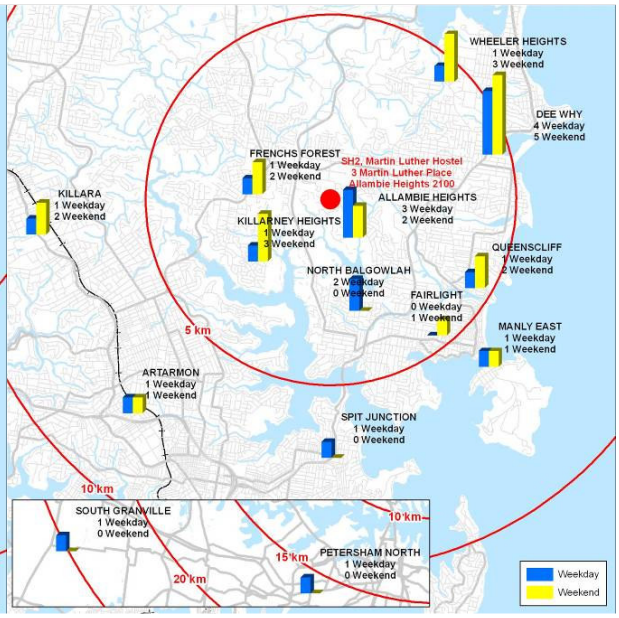


Figure 3-17 SH2 - Origin Postcode

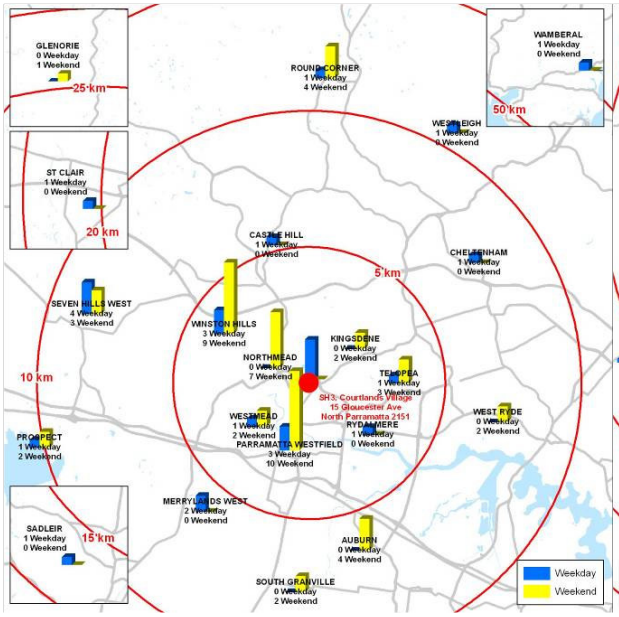


Figure 3-18 SH3 - Origin Postcode

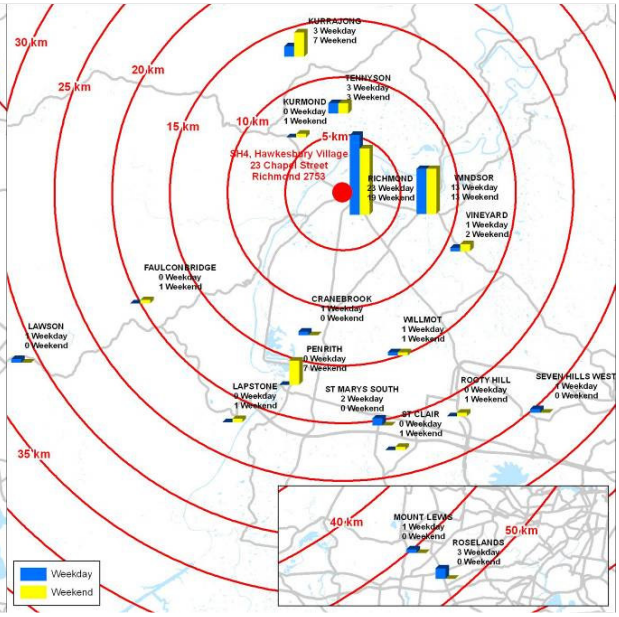


Figure 3-19 SH4 - Origin Postcode

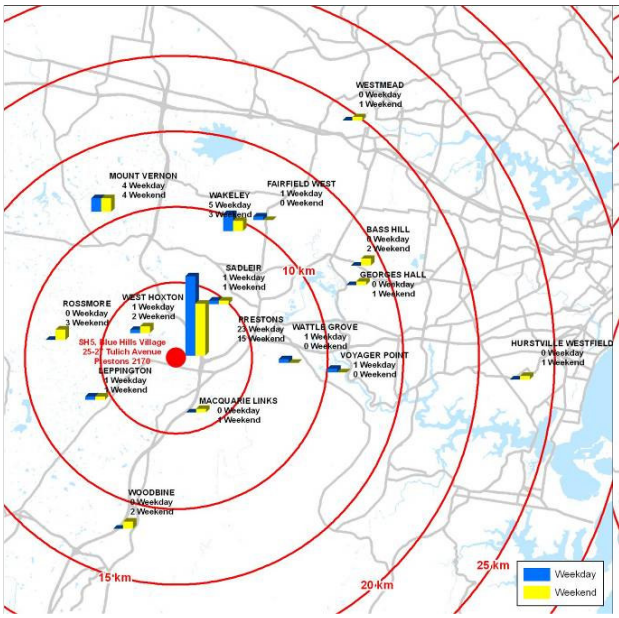


Figure 3-20 SH5 - Origin Postcode

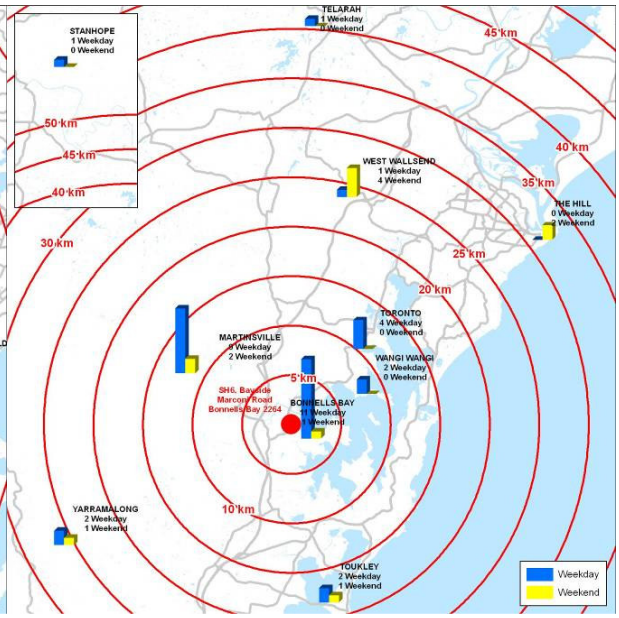


Figure 3-21 SH6 - Origin Postcode

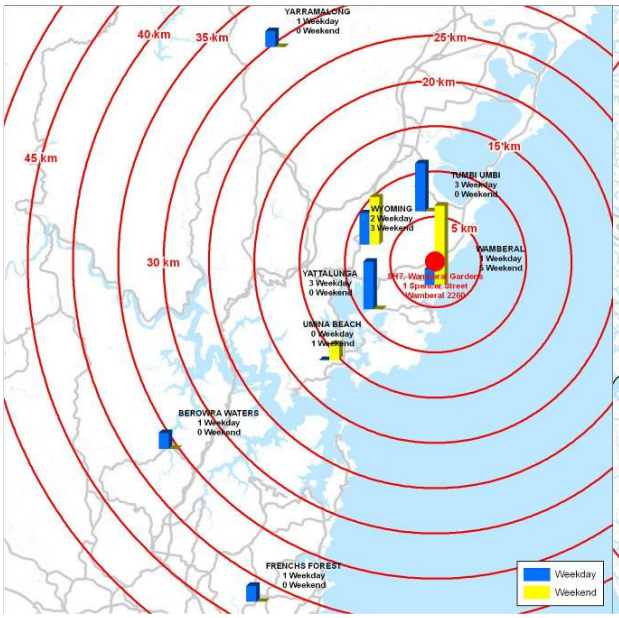


Figure 3-22 SH7 - Origin Postcode

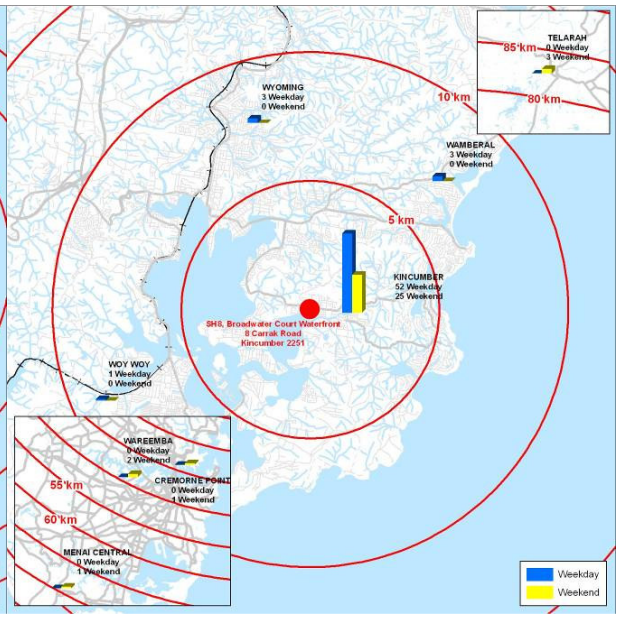


Figure 3-23 SH8 - Origin Postcode

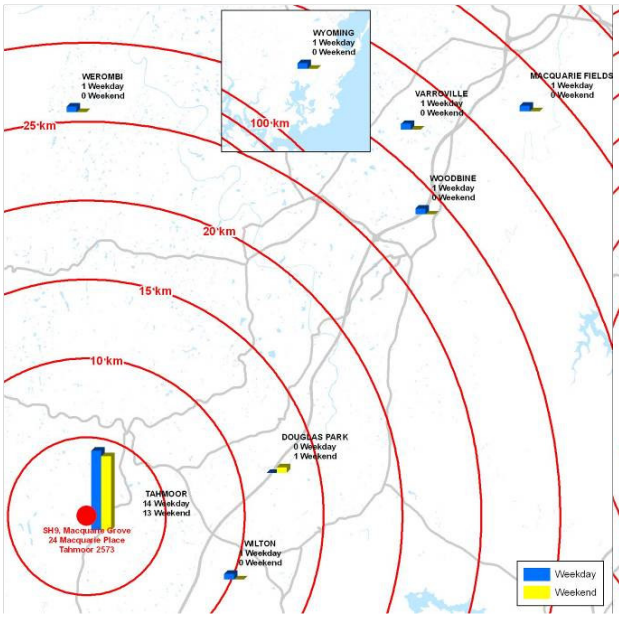


Figure 3-24 SH9 - Origin Postcode

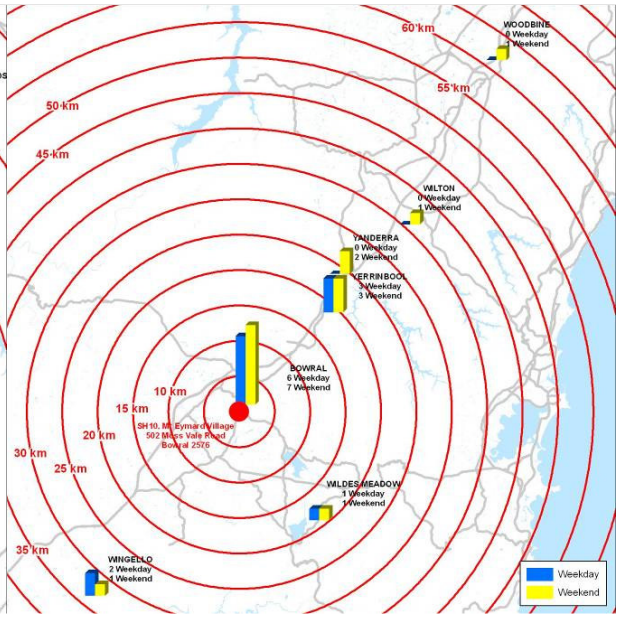


Figure 3-25 SH10 - Origin Postcode

It is not surprising that the majority of people visiting the site are from areas which are relatively close to the site. Generally, people in non-Metropolitan Areas are prepared to travel longer distances than the people in Sydney.

3.5.3 Mode of Travel

The following graphs show the mode of travel used to reach the sites.

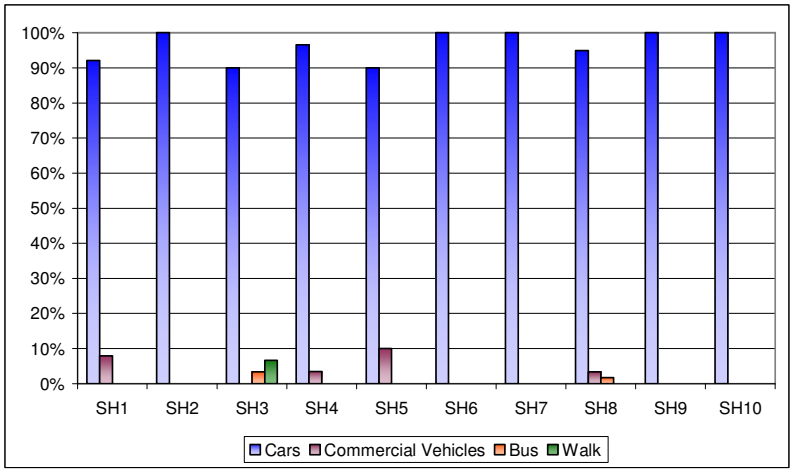


Figure 3-26 Mode of Travel – Weekdays

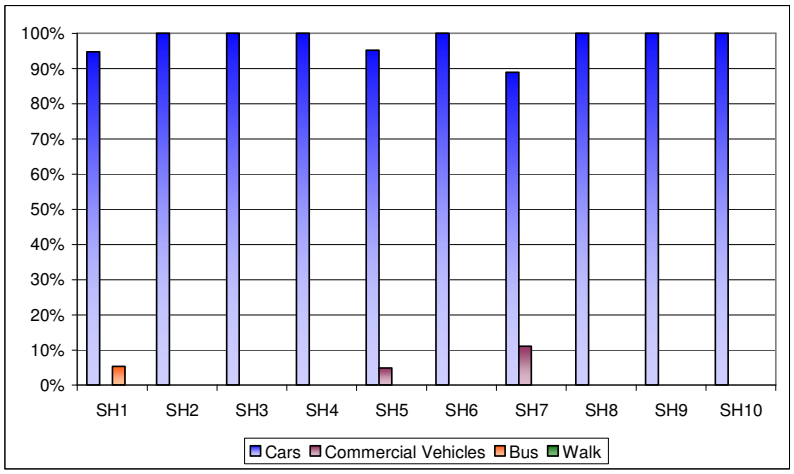


Figure 3-27 Mode of Travel – Weekends

The predominant mode of travel is the car with many of the sites recording 100% vehicle trips and with the others recording above 90% car use. No significant access to the survey sites by bicycle was recorded.

Public bus stops are located at the front entrance of site SH1 and SH3 which could explain why there is an element of public transport use at these sites. In addition, Site SH7 has a direct pedestrian link out onto the Entrance Road which has a number of bus services running along it.

3.5.4 Parking On-site / Off-site

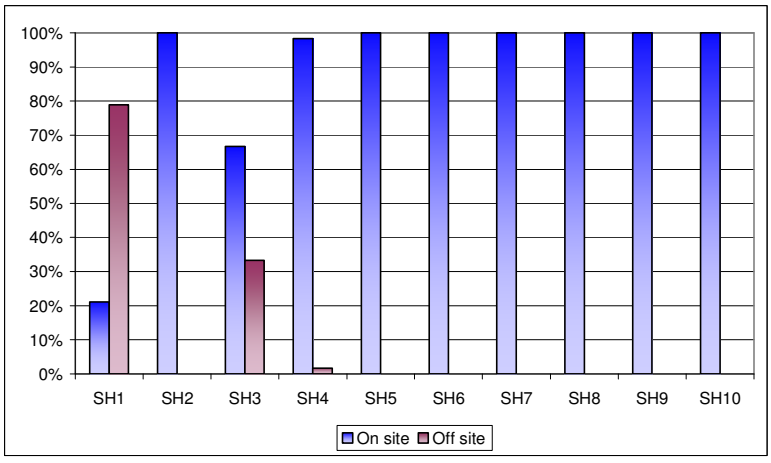


Figure 3-28 Parking on-site / off-site – Weekdays

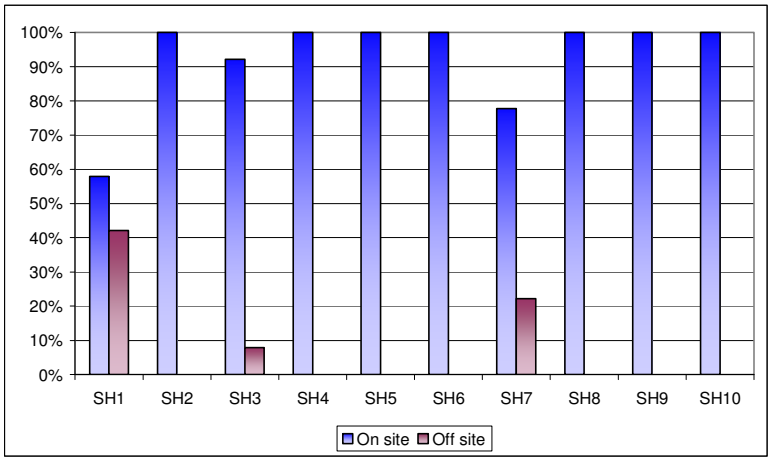


Figure 3-29 Parking on-site / off-site – Weekends

The parking survey revealed that the majority of sites recorded close to 100% of all parking occurring on site. The exceptions are listed below together with a brief explanation of why this might have been the case.

- SH1 – Dee Why. The Dee Why site is in a built up area and there is a considerable amount of off site car parking
- SH3 – North Parramatta – A higher level of aged care service is provided at this site. Visiting staff may therefore have a tendency to park their cars on adjacent local streets and then walk to work rather than to use up the relatively limited on site parking.

3.6 Additional AM Peak Survey Results

As stated earlier, the surveys in this study were carried out between 10am and 8pm (in accordance with the brief) which covered most of the activities for senior people (according to other studies and anecdotal information).

However, additional surveys have been undertaken on Wednesday 6th May 2009 at two selected sites to ascertain the traffic conditions prior to the 10am / 8pm surveyed period and see what traffic was generated in the generally accepted AM network peak period. The two sites were chosen to represent one metropolitan and one non-metropolitan site.

SH4 is located in Sydney with a high care facility whilst SH8 is in Central Coast at a typical retirement village. The surveys ran from 6am until 12 noon which allow two hours overlap to compare with the existing survey results. The findings are summarised below:

3.6.1 SH4 – Sydney with High-care Facility

Figure 3-30 and Figure 3-31 show the result comparison of AM surveys in May and the survey in March.

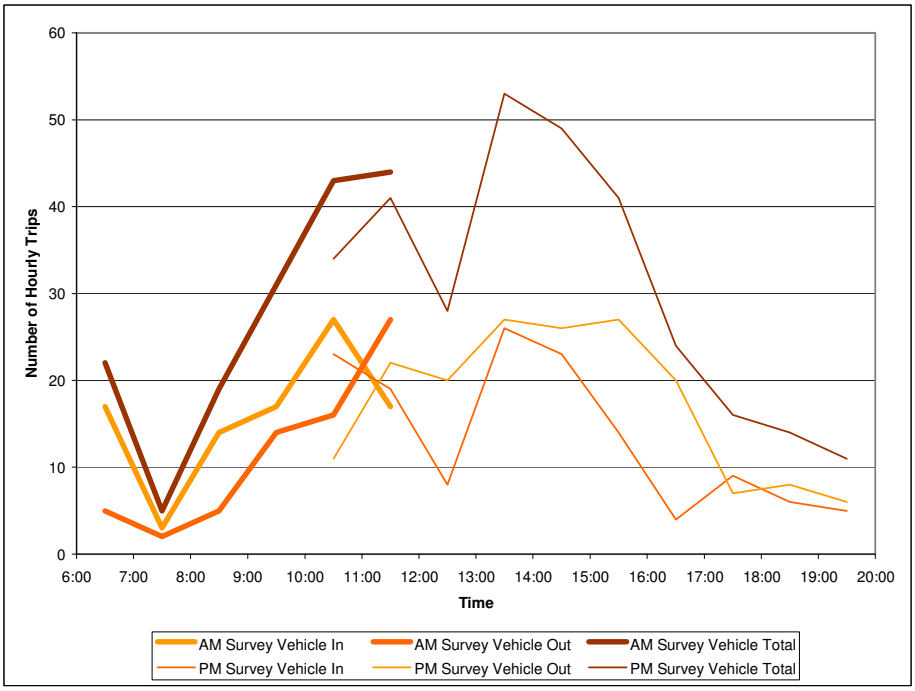


Figure 3-30 SH4 – AM Survey Results (Weekday) – Vehicle Trips

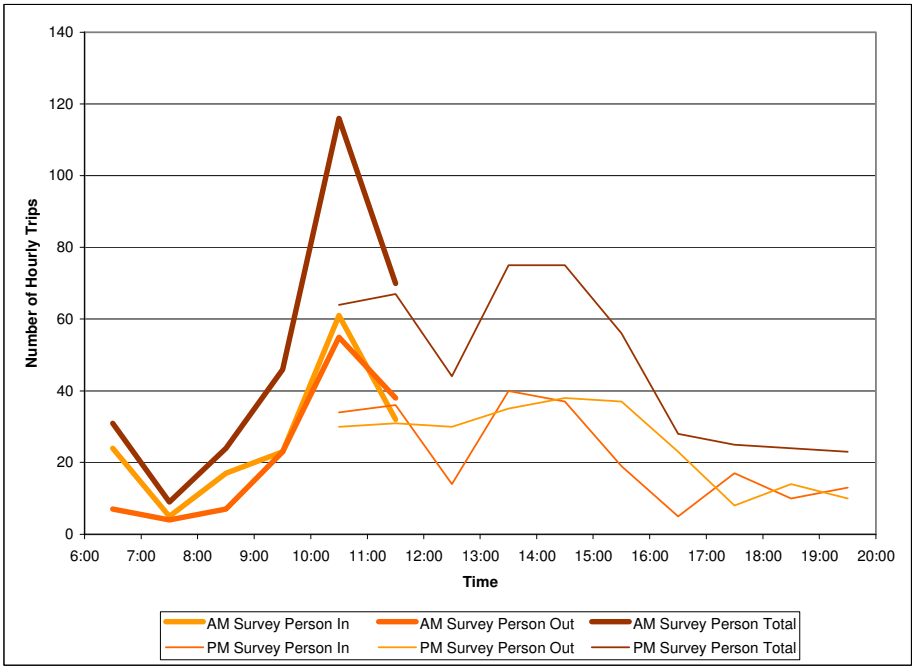


Figure 3-31 SH4 – AM Survey Results (Weekday) – Person Trips

The results indicate that the number of vehicle trips in the “overlap” period (i.e. 10am and 12 noon) of the newer AM survey (6am-12noon) and the older 10am to 8am surveys are reasonably similar.

It should be noted that in the second SH4 survey, the number of person trips is significantly higher than the first survey. This is because there were twenty people walking in at 10am and out again 30 minutes later. This was probably due to a special event and would probably not happen everyday. Without these 20 additional people in this short period, the person trip characteristics match relatively well between the two surveys.

The survey results confirm that the site peak hour for vehicle trips is generally around midday and not in the generally accepted network morning peak (0800-0900). The surveys revealed that the AM peak trip generation rate is around 43% of the peak hour rate.

3.6.2 SH8 – Non-Metropolitan Area Retirement Village

The figures below show the results of the surveys in March and May.

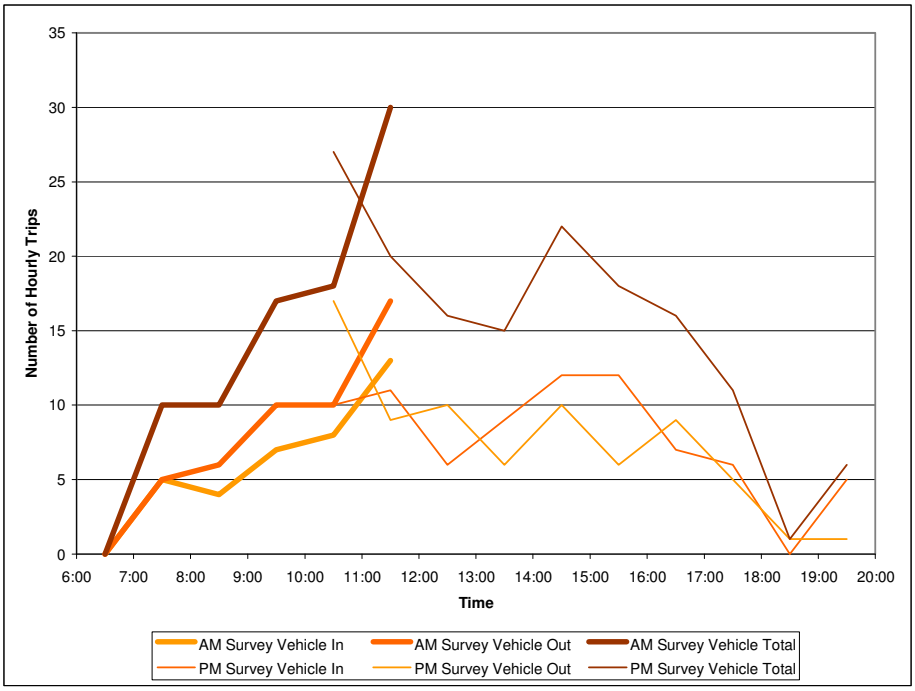


Figure 3-32 SH8 – AM Survey Results (Weekday) – Vehicle Trips

The results indicate that the number of vehicle trips between 10am and 12noon is very similar in both surveys.

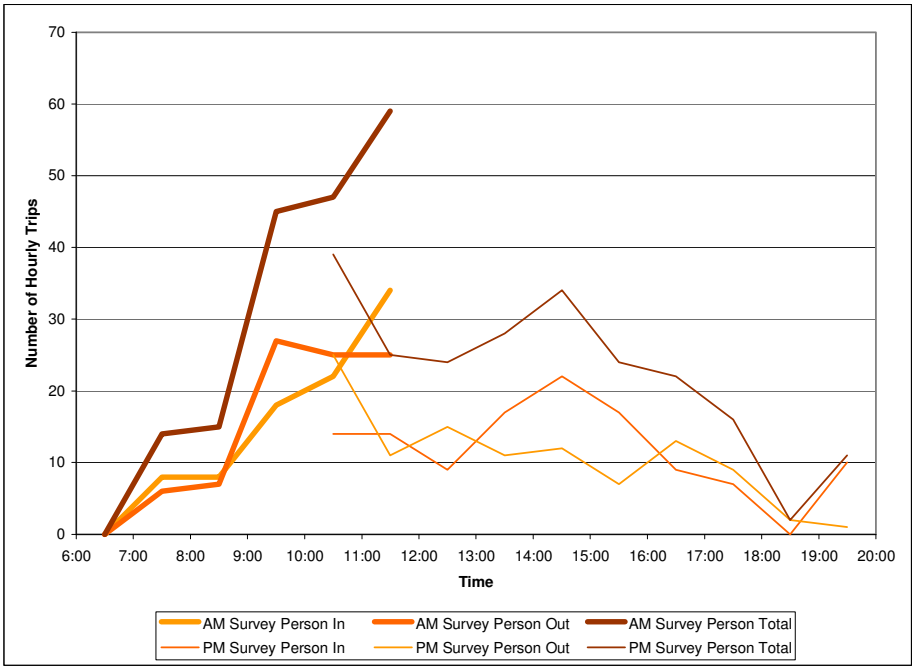


Figure 3-33 SH8 – AM Survey Results (Weekday) – Person Trips

The high volume of person trips from 9am to 10am is due to two vehicles carrying 10 people out of the site, which could be a village bus service. Forty four people were observed to walk to or from the site in the May survey but none were observed in the March survey but there is no apparent reason for this.

The surveys show that the site peak hour is around midday and not in the normal network morning peak (0800-0900). The AM peak trip generation rate is 33% of the peak hour rate.

3.6.3 Conclusion of AM Peak Surveys

The vehicle arrival / departure patterns at the sites in the new May 2009 surveys are very similar to the March 2009 between 10am and 12pm so it is fair to assume that the longer March 2009 surveys could be extrapolated to include the data between 0600 and 10AM.

We can conclude that the March 2009 survey is correct in identifying the generated peak hour as after 10am and the generated traffic rate in the generally used AM network peak of 8AM to 9AM would be some 33% - 43% of the peak generation period.

3.7 Parking Provision

As stated earlier, the use of lock up garages on nearly all of the sites meant that it was not possible to complete parking accumulation surveys. With information provided by the site managers and by using the recorded on-site observations, the number of parking spaces per unit ratio can be calculated, not only for residents but for staff and visitors as well.

Table 3-3 Parking Provision Summary – SH1 to SH10

Site ID	SH1	SH2	SH3	SH4	SH5	SH6	SH7	SH8	SH9	SH10
Site Details - Senior Housing										
Accommodation Type	S + H	S + H	S + H + A	S + H + A	S + H	S	S	S	S	S + H
Village Bus	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
Village Bus Frequency per week	9	2	10	2	4	4	No	3	No	No
No. of Units Provided (Total)	272	83	276	174	214	250	62	76	42	86
No. of Occupied Units (Self-cotained)	180	40	116	43	147	240	51	70	38	68
No. of employee (Total)	15	32	160	130	30	8	3	10	1	19
No. of employee (at one time)	N/A	12	45	30-40	<30	8	2	1	1	19
Parking Spaces										
Residents	110	17	82	26	155	500	62	111	42	80
Staff	as Visitor	16	25	as Visitor	11	4	as Visitor	as Visitor	1	as Visitor
Visitors / Loading bays	32	11	32	52	28	75	11	28	16	10
Total	142	44	139	78	194	579	73	139	59	90
Space / Unit Provided										
Residents	0.40	0.20	0.30	0.15	0.72	2.00	1.00	1.46	1.00	0.93
Staff	-	0.19	0.09	-	0.05	0.02	-	-	0.02	-
Visitors / Loading bays	0.12	0.13	0.12	0.30	0.13	0.30	0.18	0.37	0.38	0.12
Total	0.52	0.53	0.50	0.45	0.91	2.32	1.18	1.83	1.40	1.05
Cars Ownership (Self-contained Unit)										
No Car	Unknown		54			0	16		16	
1 Car	Unknown	17	59	15	83	230	37	39	22	60
2 Cars	Unknown		5		0	10	0	10	0	
No. of Cars (Total)	Unknown	17	69	15	83	250	37	59	22	60
Cars Ownership / Self-contained Occupied Unit	Unknown	0.43	0.59	0.35	0.56	1.04	0.73	0.84	0.58	0.88
Trip Generation										
Daily Vehicle Trips / All Occupied Unit										
Weekdays	2.89	1.35	1.44	1.79	1.55	3.10	2.14	2.17	1.97	2.58
Weekend	0.51	1.24	1.35	1.43	1.33	1.31	1.10	0.93	1.58	1.65

Note: S: Self-contained, H: Hostel (Low-care), A: Aged care (High-care)

- Parking provision varies from 0.45 spaces per unit to 2.32 spaces per unit with an average of 1.07 spaces.
- However, the car ownership only varies between 0.35 cars per unit and 1.04 cars per unit with an average of 0.67. This suggests that car parking provision significantly exceeds demand on all of the sites.
- Higher car ownership has been found in Non-Metropolitan sites compared with the Sydney Metropolitan sites. This may be because higher care services tend to be provided in the city whereas elderly housing in towns appears to provide for more active residents.

4 COMPARISON OF NSW FINDINGS WITH OVERSEAS DATABASES

4.1 Introduction

A number of Australian and overseas guidance documents and traffic generation databases have been examined to see if they are comparable to the results established from this study. These are examined below.

4.2 Australian Documents

4.2.1 National Documents

Austroads has a document in production entitled "The Guide to Traffic Management Part 12 – Traffic Impact of Developments". This is not yet issued or indeed available for comment but the website gives an overview of the processes for assessing the traffic and transport impacts of land use developments: These include

- policy and planning considerations
- development profiles and issues
- traffic impact assessment
- developments and access management

4.2.2 State Documents

Most of the Australian states produce a document(s) which shows how to undertake traffic / transport impact assessments. Most of these documents refer to sources of traffic generation data. The documents, and other anecdotal information, are discussed below for each of the states.

Table 4-1 Recommended Sources of Trip Rate Information

NSW	The RTA "Guide to Traffic Generating Developments" is generally used. The latest version of the document was published in 2002 but much of its data is around 20 years old. A number of consultancies use their own data collection efforts to argue variations to the RTA Guide (both up and down) but invariably use the RTA guide as the starting point.
Victoria	The RTA Guide to Traffic Generating Developments is used extensively and some documents refer to a Victorian document "Guidelines for Transport Impact Assessment Reports for major land use and development proposals (2006)" often referred to as "The Transport Impact Assessment Report (TIAR) Guidelines". To a lesser extent the Institute of Transportation Engineers (ITE) Trip Generation, 8th Edition publication is still used. Again, consultancies tend to use their own data collection efforts to assemble traffic generation figures.
Queensland	Most Council Planning Guidelines refer to both the RTA Guide to Traffic Generating Developments and the "Guidelines for Assessment of Road Impacts for Developments (2006) produced by Queensland Transport.
South Australia	The library at Department for Transport, Energy and Infrastructure (South Australia) has confirmed that they have "the RTA's version of Guide to Traffic

	generating developments" although they were also able to provide a copy of the "Land use traffic generation guidelines"(1987) which was produced by the Director-General of Transport South Australia Anecdotal evidence suggests that traffic assessments still generally refer to the RTA Guide to Traffic Generating Developments whilst historically emphasis was placed on the South Australian “Land Use Traffic Generation Guidelines”. Certain documents suggest that the Director General Transport South Australia has published a Guide to Traffic Generating Developments but its use is not yet extensive and the Departmental Library has failed to find a copy.
Western Australia	Transport Assessment Guidelines for Developments was issued in 2006 for trial and evaluation. The document is divided into 5 volumes with the final volume giving more detailed considerations. The document was endorsed by the Western Australia Planning Commission Transport Committee as a “working” document for voluntary trial and evaluation. Transport officers within the Dept for Planning and Infrastructure are using the guidelines to assist them in assessing the transport implications of land use development proposals and officers within local government are being encouraged to do the same. Anecdotal evidence suggests that there is still an "old school" mentality that is still persisting with the use of the South Australia Land Use Traffic Generation Guidelines (1987), the RTA Guide to Traffic Generating Developments (2002) and the ITE Trip Generation Handbook (USA).
Australian Capital Territory	It is believed that the ACT generally use the RTA Guide to Traffic Generating Developments
Northern Territory	Unknown
Tasmania	Tasmania generally uses the RTA guidelines when assessing traffic generating developments. This only varies when contemporary and relevant traffic count data that supports using other figures is available.

This summary generally endorses work undertaken by Ian Clark of Flow Transportation Services who produced a report entitled “Guidelines for Undertaking Transport assessments in New Zealand and Australia”. This included a table showing the documents that some Australian states (and New Zealand) produce and which also recommends where practitioners should obtain trip rate information.

Table 4-2 Recommended Sources of Trip Rate Information

Guideline	Recommended Source (s)
Auckland	Not specified, but to be specified in forthcoming supplementary guidance as: New Zealand Trips and Parking Database (and related Transfund Research Reports) RTA "Guide to Traffic Generating Developments" (2002) ITE "Trip Generation" (2003) TRICS database
Victoria	Not specified
Queensland	RTA "Guide to Traffic Generating Developments" (2002) ITE "Trip Generation" (2003) Main Roads, local government and consultants databases
Western Australia	South Australia Guidelines, (1987) RTA "Guide to Traffic Generating Developments" (2002) ITE "Trip Generation" (2003)

Each of the key Australian documents is described below

NSW

The RTA guide includes both traffic generation and parking impact information for a wide range of land uses. Even so, some of the uses range across a broad spectrum of developments. For example, this study has shown the RTA classification for aged and disabled persons housing covers a wide range. It states that "*this research concentrates on subsidised developments (often run by religious organisations). Generation rates of resident funded developments are often greater, as indicated at the higher end of the range.*"

The RTA guide also confirms that the guide as a whole is "*a summary of basic traffic generation information for various land uses to assist people who may not have traffic engineering training*". It also recommends that "*comparisons may be drawn however between the traffic generation potential of various land use types enabling a rough assessment of the traffic generation implications of land zoning. Departures from the average generation rates for individual development proposals may be adopted in which case such a departure should be justified with relevant supporting facts*".

Indeed the report states that "*surveys of existing developments similar to the proposal can also be undertaken and comparisons may be drawn*".

However, the document is widely used in NSW although its validity is sometimes called into question, particularly at Land and Environment Court cases, when developers often submit their own traffic count data.

Queensland

The Guidelines for Assessment of Road Impacts for Developments states at Section 4.3 that "*traffic generation can be forecast using trip generation rates established for particular land uses. These are available from a number of sources including Main Roads and local government. The use of locally derived trip generation rates is preferred to that applicable elsewhere*". This is then discussed in more detail at Appendix E of the guidelines which lists a number of traffic generation sources

- *Guide to Traffic Generating Developments* prepared by the Roads and Traffic Authority of NSW (may need to be modified for particular uses to suit the local situation);
- *Trip Generation* by the Institute of Transportation Engineers (ITE) (United States data – may need to be modified to suit Australian conditions);
- Main Roads' and local governments' databases; and
- Traffic / transport consultants' and surveyors' databases.

Victoria

The Guidelines for Preparation of Transport Impact Assessment Report document (which is part of the VicRoads Toolkit for managing access to Arterial Roads and Freeways) discusses the provision of traffic generation information but gives no indication as to where such trip generation information might be obtained.

Western Australia

The Western Australia document, which is issued for trial and evaluation, comprises a number of volumes giving guidance on transport assessments for developments. Volume 5 however contains some very old data suggesting that "*person-trip generation rates for residential land uses may be derived from household travel surveys such as the 1986 Perth Travel Surveys, the more recent TravelSmart surveys in particular suburbs and the current Perth and regions travel survey (PARTS). However, such person-trip generation data is often unavailable, particularly for other than residential land uses. In these cases it is usually sufficient to use vehicle-trip generation rates with adjustments as appropriate to reflect anticipated higher or lower non-car mode share for the particular development.*

The person and/or vehicle trip generation of a development can be estimated by:

- *surveying a comparable development in a similar location;*
- *using existing traffic data for a comparable development(s); and*
- *using typical rates for similar developments".*

With regard to trip generation, Volume 2 states that "*vehicle trip generation rates are to be based on surveys of comparable land uses or extracted from recognised land use traffic generation databases such as:*

- *Land Use Traffic Generation Guidelines, March 1987 - Director General of Transport, South Australia;*
- *Guide to Traffic Generating Developments Version 2.2, October 2002 – Roads and Traffic Authority, New South Wales;*
- *Trip Generation 7th edition, 2003 - Institute of Transportation Engineers, Washington, USA.*

South Australia

The 1987 South Australia document states that the 'trip rates' used in the document are appropriate for the 1980's and "*care should be taken in applying them after 1980*". It does however contain simplistic trip generation rates for a large number of land uses.

Summary

- Throughout Australia, the RTA guide seems to be the main source of traffic generation data
- The ITE books are used but in a limited way.
- TRICS and NZTDB appear to be used academically but not in detailed consideration of development impacts
- There are however concerns about the RTA data in so far as the age of the data and the relevance of the time of year at which the data surveys were undertaken
- Many practitioners use the RTA guide as a starting point but then do their own surveys to establish traffic generation characteristics at similar sites / land uses
- The RTA guide does not consider multi-modal travel.

In summary, although other documents are used, and many companies seem to undertake their own surveys to establish the traffic generating capabilities of a particular site, the RTA guide seems to be the first point of reference.

4.3 Other Countries

4.3.1 New Zealand

The former New Zealand Trips and Parking Database Bureau is now known at the Trips Database Bureau. The Bureau was formed in New Zealand in 2002 using an initial database of around 500 survey sites. The Bureau continues to collect surveys of trip rates, parking demand and travel information relative to different land uses from across the country. In addition to developing the trips and parking database the Bureau also undertakes government sponsored transportation research on travel profiles, trip generation and transportation assessment guidelines. Members of the Bureau include New Zealand organisations including Transit NZ, consultants and councils and recently some Australian councils and consultants.

4.3.2 USA

The Institution of Transportation Engineers (ITE) "Trip Generation" book consists of two data volumes with land use descriptions, trip generation rates, equations and data plots. Data is included from more than 4,800 sites and 162 land uses. The most recent (8th) edition was published in 2008. The USA document is produced in book format only which means it is not possible to select the most appropriate site data and it encourages the use of average values.

In addition, the Institution of Transportation Engineers (ITE) "Parking Generation" third edition has 91 land uses represented and it includes parking demand data by hour of day.

4.3.3 UK

TRICS

TRICS is the UK national standard trip generation database and is used as an integral and essential part of the Transport Assessment process. The system is marketed and managed by JMP Consultants Limited on behalf of the TRICS® Consortium of 6 County Councils: Surrey, Kent, East Sussex, West Sussex, Hampshire and Dorset. JMP regularly ask for input from consultants and local authorities with regards to the additional land uses that require additional information. It contains transport generation data for a wide variety of development types, across all regions of the UK and Ireland. The current annual data collection programme consists of 170 multi-modal surveys across all regions, plus another 100 traffic surveys. The database in which 5,600 days of survey data are held uses a flexible system of filtering, to allow users to interrogate trip rates for sites (including a very specialised range of land use categories) which meet their own compatibility criteria. Also, individual trip rates for a given time period for a number of surveys can be calculated and ranked, displaying the worst and best case scenarios.

Nevertheless, with the wide range of data, it is often the case that developers and development control officers fail to agree on the most relevant site data, this often leads to disagreements and is often the basis of planning appeals (the UK equivalent of Land & Environment Courts).

TRAVL

TRAVL (Trip Rate Assessment Valid for London) is a multi-modal trip generation database designed specifically for use in the capital. It is used by planners working on projects across Greater London to estimate the effect of proposed changes in land use on transport patterns and, in particular, on the amount of road traffic in an area. The TRAVL database contains surveys of over four hundred sites across the capital. There are several types of surveys provided for each site which cover all aspects of traffic and people movement at the specific sites.

Summary

It is clear that the TRAVL database is primarily used in city centre London which has heavily constrained traffic movements and very high levels of public transport accessibility. Consequently, it is not considered that it is a useful database in the context of this study. Elsewhere in the UK, TRICS is the accepted database for nearly all councils and traffic consultancies.

4.4 Interrogation of International Databases

Based on Hyder's international experience, which generally accords with the guidelines listed above, the databases that have been examined as part of this study are as follows

- RTA Guide to Traffic Generating Developments (2002)
- New Zealand Trips and Parking Database Bureau (NZTPDB)
- United States Institute of Transportation Engineers (ITE)
- Trip Rate Information Computer Systems (TRICS) UK

All of these databases treat parking and traffic generation as two separate discussion areas so the information contained in these documents has been studied in these two key areas.

4.5 Parking – National / International Data

4.5.1 RTA Guide to Traffic Generating Developments

The Road and Traffic Authority of New South Wales (RTA) Guide to Traffic Generating Developments 2002 suggests that as elderly residents have lower car ownership rates, there is less parking demand than for other development types. Parking demand rates are deemed to be 0.67 spaces per unit, plus 1.0 parking space per five units for visitors.

4.5.2 New Zealand Trips & Parking Database Bureau Inc. (NZTPDB)

The NZTPDB produced a "Technical & Practice Note series No. 08/05".

The NZTPDB database includes some sites having retirement parking demands for homes in the range of 0.3 – 0.8 per bed. At present it has no parking surveys for retirement villages.

This report concludes by saying that *"The levels of parking demand will vary during the day. Parking demand is likely to be at its greatest during the evening period as more residents are likely to be home or have visitors after the usual working period. The Review of Housing New Zealand Car Park Occupancy Survey of Elderly and Medium/High Density Accommodation: Auckland Area concluded that the average weekday evening utilisation is 0.37 spaces per unit, with a maximum of 0.58 spaces per unit. The levels of parking demand included in NZTPDB, ITE and the RTA are similar. Adopting the RTA standard of 0.67 parks per unit during the planning process would be a sensible approach at the outset. There may be good reasons for variations both above and below that standard.*

The New Zealand data tends to suggest that the demand is 0.37 spaces per unit but the provision is 0.58 parking spaces per unit.

4.5.3 Institute of Transportation Engineers

The Institute of Transportation Engineers (ITE) Parking Generation Manual (3rd Edition) splits the Elderly Persons housing category into a number of discrete land uses (Nos 251-255 inclusive).

The information contained in this document has been analysed and summarised in the table below.

Table 4-1 Parking Data Extracted from the ITE Document

Land Use	Range of Units	Parking Supply	Weekday peak generation	Weekend / peak generation	Description
251 Senior Adult Housing attached	NO INFORMATION AVAILABLE				
252 Senior Adult Housing Attached	46-91 units		0.33 – 0.50 spaces per dwelling unit	0.34 – 0.50 spaces per dwelling unit	This use generally incorporates individual Living Units. Residents are generally active with little or no care requirements and residents may or not be retired.
			Higher number of units has lesser parking demand	Higher number of units has lesser parking demand	
253 Congregate Care Facility	204 units		0.41 spaces per dwelling unit (9am- 10am)		Independent living units with elements of communal facility – dining, transportation etc
254 Assisted Living	Average 100 units	Parking supply 0.5 spaces per dwelling unit	Average 0.33 vehicles per dwelling unit	Average vehicles per dwelling unit 0.24 (Sat) 0.28 (Sun)	This provides a residential setting for physically / mentally impaired.
			Range 0.22-0.42	Range 0.13-0.33 (sat) 0.21-0.34 (sun)	
			Peak period 11am-2pm	No definitive peak period	
255 Continuing Care Retirement Community	178-247 units	Parking supply of 1.3 spaces per unit	PM peak hour parking demand 0.49 – 0.83 spaces per dwelling at 5PM -6PM Friday.		These contain multiple elements of senior adult living – They are usually self contained villages and include an element of special care etc.
			The parking demand was higher at the larger site.		
			Actual peak at 11am -12noon		

The above data shows a wide range of parking supply ranging from 0.5 to 1.3 spaces per dwelling whereas the demand appears to range from 0.2 to 0.83 spaces

The most appropriate of the comparable uses (Land use 252) which incorporates individual living units where residents are generally active with little or no care requirements and residents may or not be retired suggests a provision of between 0.33 and 0.5 spaces per dwelling.

4.5.4 TRICS

In terms of parking, the TRICS database has been examined to see what the parking provision was for the sites in the 'sheltered housing' and 'sheltered housing' land uses were.

The table below shows a wide range of parking supply varying from 0.1 spaces per dwelling unit to 1.0 space per dwelling unit. However, most are provided with around 0.5 spaces per unit and the average of the data analysed reveals a parking provision of 0.54 spaces per unit.

Table 4-2 Parking Provision at Accommodation in the UK

	No. of Parking Spaces	No of Residential Units	Ratio of spaces per unit
Sheltered Housing	12	30	0.4
	40	124	0.3
	100	114	0.9
	24	19	1.3
	10	35	0.3
	30	31	1
	30	35	0.9
	24	80	0.3
	34	44	0.8
	6	53	0.1
	24	39	0.6
	17	32	0.5
	21	55	0.4
	18	44	0.4
Retirement Flats	22	50	0.4
	20	35	0.6
	18	43	0.4
	18	47	0.4
	48	46	1
	31	66	0.5
	48	46	1
	25	52	0.5
	12	57	0.2
	14	33	0.4
	44	76	0.6
AVERAGE	690	1286	0.537

However, it should be stressed that parking guidance in the UK is generally specified in documents produced by either the Unitary or County Councils and this often differs from area to area depending on whether the site is located in an urban or rural council area.

4.5.5 Parking Summary

The parking provision in the international database information is quite variable (i.e. between 0.1 and 1.0 spaces per dwelling unit) but on average it appears that parking provision of between 0.33 and 0.7 parking spaces per dwelling unit with an average of around 0.5 parking spaces per unit is a typical provision.

This 2009 study shows the parking provision from contemporary surveys is on average 1.07 spaces per unit (range from 0.45 to 1.83). It should be noted that some of the sites provide low-care and high-care services.

Table 4-3 Summary Comparison of National & International Data

	Parking Provision / Demand
RTA Guide	0.67 spaces per unit + 1 space every 5 visitors PROVISION
ITE	0.33 spaces per unit DEMAND 0.58 spaces per unit PROVISION
TRICS	0.54 spaces per unit PROVISION
2009 Survey	1.07 spaces per unit PROVISION

4.6 Person Trip Generation - National / International Data

There is no information available in the New Zealand database or in the ITE database relating to person trips.

However the TRICS database includes weekday information about person trips (although no weekend information is available) which can be interrogated to establish person trips both for the sheltered housing and retirement flats uses (see **Appendix B**).

This shows that for sheltered housing, the daily number of person trips is 4.4 trips per unit with the range of peak hourly trips between 0.44 and 0.74.

For retirement flats, the daily number of person trips per one dwelling is 3.7 trips per unit, the range of peak hourly trips is between 0.32 and 0.61.

This 2009 study indicates a peak hour person trip rate of between 0.40 and 0.89 trips with an average of around 0.55.

This information can be compared more easily in the table below.

Table 4-4 Summary of Person Trip Comparison

	Peak Hour Person Trips	Daily Person Trips
Sheltered Housing (TRICS)	0.44 - 0.74	4.4
Retirement Flats (TRICS)	0.32 - 0.61	3.7
2009 Surveys	0.40 - 0.89	3.2

4.7 Vehicle Trip Generation - National / International Data

Given the density of some retirement developments, it is recognised that trips to and from retirement villages will typically be reliant on higher levels of motorised forms of transport.

4.7.1 RTA Guide to Traffic Generating Developments

The RTA state that 'Housing for the Aged' generates 1-2 daily vehicle trips per unit. Evening peak hour vehicle trips are stated as being at 0.1 – 0.2 trips per dwelling. The RTA points out that these rates depend on external factors such as proximity to public transport and the type of 'housing for the aged'.

4.7.2 New Zealand Trips & Parking Database Bureau Inc. (NZTPDB)

A technical paper (No 08/5) produced by NZTPDB entitled "Elderly Persons Housing" was issued in March 2008 which contained a number of tables showing information from such developments

Table 4-5 NZTPDB Daily Trip Generation for retirement villages

	Shona McFarlane	Homes Park	Hunterville Flats
Trips per unit per day	2.1	2.5	2.8

In addition, a daily trip generation for a 138 unit complex in Auckland was recorded in 2007 and this is summarised in Table 4.7.

Table 4-6 Weekly Trip Generation at an Auckland Retirement Complex

Survey Day	24 hour traffic count	Generation rate per unit per day
Wednesday	459	3.33
Thursday	481	3.49
Friday	474	3.43
Saturday	353	2.56
Sunday	364	2.64
Monday	411	2.98
Tuesday	399	2.89
Average		3.04
85%ile		3.44
Maximum		3.49
Minimum		2.56

This week long survey indicates an average trip rate of 3.04 trips per unit per day and an 85% rate of 3.44 trips per unit per day.

The modal split of people visiting the New Zealand sites is unknown.

4.7.3 Institute of Transportation Engineers

The Institute of Transportation Engineers (ITE) Trip Generation Manual (8th Edition 2008) again splits the Elderly Persons housing category into a number of discrete land uses (Nos 251-255 inclusive).

The information contained in this document has been analysed and summarised in the table below.

Table 4-7 Trip Generation of Elderly Persons Housing from ITE

	Range of Units	Weekday Daily Trip generation	WEEKDAY				WEEKEND			
			Network Peak		Generator Peak		Saturday		Sunday	
			AM	PM	AM	PM	Daily	Peak	Daily	Peak
251 Senior Adult Housing attached		3.71 trips per unit	0.22 trips per unit	0.27 trips per unit	0.29 trips per unit	0.34 trips per unit	2.77 trips per unit	0.23 trips per unit	2.33 trips per unit	0.21 trips per unit
		Range 2.90-5.70	Range 0.13-0.84	Range 0.17-0.95	Range 0.21-0.90	Range 0.20-1.01	Range 2.70-5.53	Range 0.19-0.27	Range 2.27-4.77	
252 Senior Adult Housing Attached		3.48 trips per unit	0.13 trips per unit	0. 16 trips per unit	0.06 trips per unit	0.11 trips per unit	2.51 trips per unit	0.30 trips per unit	2.70 trips per unit	0.55 trips per unit
			Range 0.02-0.27	Range 0.03-0.31	Range 0.02-0.37	Range 0.03-0.25				
253 Congregate Care Facility	Dwelling Units	2.02 trips per unit	0.06 trips per unit	0.17trips per unit	0.14 trips per unit	0.20 trips per unit				
		Range 1.63-2.15	Range 0.05-0.06	Range 0.16-0.19	Range 0.10-0.16	Range 0.15-0.21				
	Occupied Units	2.15 trips per unit	0.06 trips per unit	0.17trips per unit	0.15 trips per unit	0.21trips per unit				
		Range 2.12-2.15	Range 0.06-0.06	Range 0.16-0.21	Range 0.13-0.16	Range 0.21-0.21				

	Range of Units	Weekday Daily Trip generation	WEEKDAY				WEEKEND			
			Network Peak		Generator Peak		Saturday		Sunday	
			AM	PM	AM	PM	Daily	Peak	Daily	Peak
254 Assisted Living	Occupied Beds	2.74 trips per bed				0.38 trips per bed	2.20 trips per bed	0.36 trips per bed	2.44 trips per bed	0.42 trips per bed
		Range 1.88-4.14				Range 0.28-0.53	Range 1.45-3.53	Range 0.28-0.46	Range 1.67-3.73	Range 0.27-0.58
	Beds	2.66 trips per bed	0.14 trips per bed	0.22 trips per bed	0.18 trips per bed	0.35 trips per bed	2.20 trips per bed	0.33 trips per bed	2.44 trips per bed	0.38 trips per bed
		Range 1.86-4.14	Range 0.08-0.28	Range 0.11-0.30	Range 0.13-0.34	Range 0.16-0.87	Range 1.45-3.53	Range 0.17-0.46	Range 1.67-3.73	Range 0.13-0.58
	Employees	3.93 trips per employee				0.55 trips per employee	3.18 trips per employee	0.53 trips per employee	3.53 trips per employee	0.62 trips per employee
		Range 2.53-9.69				Range 0.30-1.09	Range 1.96-9.09	Range 1.34-1.11	Range 2.07-9.60	Range 0.34-1.34
255 Continuing Care Retirement Community	Occupied Unit	2.81 trips per unit	0.18 trips per unit	0.29 trips per unit						
		Range 1.98-4.71	Range 0.10-0.32	Range 0.20-0.45						

The modal split of people visiting the American sites is unknown.

4.7.4 Trip Rate Information Computer Systems (TRICS) London

Retirement homes and villages are contained within the residential land use. They are contained in two separate classifications.

- **03/F Sheltered Accommodation (GDO use class C3)**

  Sheltered accommodation for elderly people, is not to be confused with nursing homes. As described previously, trip rates can be calculated by site area, number of dwellings, or site / housing density.

Reference	Description	Area	Location	SITE AREA	DWELLS	DENSITY	Survey Type	Most Recent Survey
CB-03-F-01	SHELTERED HOUSING, CARLISLE	CUMBRIA	Suburban Area (PPS6	0.30	30		VEHICLES	28/10/03
DC-03-F-01	SHELTERED HOUS., FERNDOWN	DORSET	Edge of Town Centr	5.90	124		VEHICLES	06/05/98
DC-03-F-02	SHELTERED HOUSING, POOLE	DORSET	Suburban Area (PPS6	0.65	114	316.67	MULTI-MODAL	17/07/08
ER-03-F-01	SHELTERED HOUSING,N. MEARNS	EAST RENFREWSHIRE	Suburban Area (PPS6		19		VEHICLES	12/08/91
GM-03-F-01	SHELTERED HOUSING, HALE	GREATER MANCHESTER	Suburban Area (PPS6	1.00	70		VEHICLES	07/07/90
GM-03-F-02	SHELTERED HOUSING, SALE	GREATER MANCHESTER	Edge of Town	0.40	36		VEHICLES	14/07/90
GM-03-F-03	SHELTERED HOUSING, SALE	GREATER MANCHESTER	Edge of Town	0.60	52		VEHICLES	14/07/90
GM-03-F-04	SHELTERED HOUSING, OLDHAM	GREATER MANCHESTER	Neighbourhood Cent	0.30	35		VEHICLES	28/01/95
GM-03-F-05	SHELTERED HOUS., GOLBORNE	GREATER MANCHESTER	Neighbourhood Cent	0.40	31		VEHICLES	25/03/95
GM-03-F-06	SHELTERED HOUS., DROYLSDEN	GREATER MANCHESTER	Suburban Area (PPS6	0.40	35		VEHICLES	01/04/95
KC-03-F-01	SHELTERED HOUS., MAIDSTONE	KENT	Edge of Town Centr	0.40	81		VEHICLES	21/10/93
KC-03-F-02	SHELTERED HOUS., MAIDSTONE	KENT	Edge of Town Centr	0.40	80		MULTI-MODAL	14/06/01
KC-03-F-03	SHELTERED HOU.,NR MAIDSTONE	KENT	Edge of Town	1.10	44		MULTI-MODAL	21/11/03
LC-03-F-01	SHELTERED HOUSING, PRESTON	LANCASHIRE	Edge of Town Centr	0.30	53		MULTI-MODAL	18/06/03
RE-03-F-01	SHELTERED HOUS., NR READING	READING	Neighbourhood Cent	0.40	39		VEHICLES	02/12/91
RE-03-F-02	SHELTERED HOUSING	READING	Edge of Town	1.00	40		VEHICLES	16/12/92
SC-03-F-01	SHELTERED ACC., GUILDFORD	SURREY	Edge of Town	0.28	32	114.29	MULTI-MODAL	08/07/08
SF-03-F-01	SHELTERED HOUSING, IPSWICH	SUFFOLK	Edge of Town	1.10	55		VEHICLES	26/09/02
WG-03-F-01	SHELTERED HOUS., WOKINGHAM	WOKINGHAM	Suburban Area (PPS6	1.00	44		VEHICLES	08/12/92
WS-03-F-01	SHELTERED HOUS, CHICHESTER	WEST SUSSEX	Edge of Town	0.20	67		VEHICLES	11/11/89
WS-03-F-02	SHELTERED HOUSING, LINDFIELD	WEST SUSSEX	Suburban Area (PPS6	0.90	31		VEHICLES	01/11/90
WS-03-F-03	SHELTERED HOUS., L'HAMPTON	WEST SUSSEX	Neighbourhood Cent	0.60	35		VEHICLES	30/08/92
WS-03-F-04	SHELTERED HOUS., CHICHESTER	WEST SUSSEX	Edge of Town Centr	0.20	45		VEHICLES	25/07/93

- **03/N Retirement Flats (GDO use class C3)**

  The housing developments in this class are built specifically for the retired, where at least 75% of units are privately owned. Of the total number of units, 75% must also be flats (sum of flats in blocks and split houses), with no more than 25% of the total units being non-split houses. Trip rates can be calculated by site area, dwellings, housing / site density, or total bedrooms.

Geographic Map Copy Data Print Help Previous Screen 12 Sites Available Order Normal

Reference	Description	Area	Location	SITE AREA	DWELLS	DENSITY	TOTBED	Survey Type	Most Recent Survey
CA-03-N-01	RETIREMENT FLATS, P.BORO	CAMBRIDGESHIRE	Neighbourhood Cent	0.55	50	108.70	50	MULTI-MODAL	14/05/08
CF-03-N-02	RETIREMENT FLATS, CARDIFF	CARDIFF	Edge of Town	0.44	35	79.55	47	MULTI-MODAL	13/10/06
DH-03-N-01	RETIREMENT FLATS, DURHAM	DURHAM	Edge of Town Centr	0.20	43			VEHICLES	10/06/03
GC-03-N-01	RETIREMENT FLATS, GLASGOW	GLASGOW CITY	Suburban Area (PPS6	0.35	47	134.29	59	MULTI-MODAL	10/06/08
KC-03-N-01	RETIREMENT FLATS, GRAVESEND	KENT	Edge of Town Centr	0.25	46		77	VEHICLES	26/11/98
KC-03-N-02	RETIREMENT FLATS, GRAVESEND	KENT	Edge of Town Centr	0.30	66		110	VEHICLES	26/11/98
KC-03-N-03	RETIREMENT FLATS, GRAVESEND	KENT	Edge of Town Centr	0.25	66		110	VEHICLES	27/11/03
KC-03-N-04	RETIREMENT FLATS, GRAVESEND	KENT	Edge of Town Centr	0.25	46		77	VEHICLES	27/11/03
PS-03-N-01	RETIREMENT FLATS, BRECON	POWYS	Edge of Town Centr	0.46	52	346.67	84	MULTI-MODAL	05/09/08
SH-03-N-01	RETIREMNT FLATS,SHREWSBURY	SHROPSHIRE	Edge of Town Centr	0.60	57	95.00	73	VEHICLES	09/06/05
TW-03-N-01	RETIREMENT FLATS, N. SHIELDS	TYNE & WEAR	Edge of Town	0.30	33	110.00	72	MULTI-MODAL	30/10/06
WS-03-N-01	RETIREMENT FLATS, BOGNOR	WEST SUSSEX	Town Centre	0.40	76			VEHICLES	11/12/01

4.7.5 TRICS ANALYSIS - VEHICLE TRIPS

There is a considerable amount of data available in the TRICS database and there is an analysis process for interrogating the trip generation data. TRICS contains two land uses which contain elderly persons living – retirement flats and sheltered housing.

The process undertaken in analysing the data is summarised in **Appendix B** but a summary of the information extracted from the database is summarised in the table below.

Table 4-8 Summary of TRICS Analysis

	WEEKDAY				WEEKEND		
	Trip Rate per day	Site Peak Hour	Network peak Hour	Modal Split	Trip Rate per day	Site Peak Hour	Network peak Hour
Retirement Flats	1.557	0.18 - 0.43	0.1 - 0.26	Cars 66% Peds 30% Public Transport 4%	No Data Available		
Sheltered Housing	2.102	0.13 - 0.53	0.09-0.43	Cars 64% Peds 28% Public Transport 8% Cyclist 1%	1.367	0.233	

The TRICS data did record cycle activity but registered a trip generation rate of 0.005 cycle trips per dwelling in one single hour over 5 surveys. An examination of the raw data suggests that this equates to a single cycle site visit during the survey period.

One of the interesting characteristics to note is the lower proportion of car users in the UK surveys as opposed to the recent Australian surveys. The graphs at Section 3.3.3 show that the predominant mode of travel to the NSW sites is the car with many of the sites recording 100% vehicle trips and with the other recording above 90% vehicle trips. The UK figures show above 30% of non car use.

This suggests that the UK figures are probably some 30% lower in terms of vehicle trips when compared to the Australian figures.

4.7.6 Comparison of Databases – Vehicles Trip Generation

Table 4-9 Summary Vehicle Trip Generation Comparison

	WEEKDAY		WEEKEND	
	Peak Hour Trip Generation	Daily Trip Generation	Peak Hour Trip Generation	Daily Trip Generation
	(Vehicle Trips per unit)		(Vehicle Trips per unit)	
RTA Guide	0.1 to 0.2	1 to 2	-	-
NZTPDB	-	3.04	-	-
ITE	0.16	3.48	-	-
TRICS	0.32*	1.557*	0.23*	1.37*
Study Results	0.36	2.04	0.25	1.21

** Note that the TRICS data includes sites with a 60-70% modal split to cars which is much lower than the study figures*

4.8 Validity of comparison of Database Trip Rates

The planning environment and, in particular, the transport planning environment in each of the countries is different which has a direct effect on the number of vehicle trips generated by a particular site. In order to highlight a few of these differences, a very brief summary of the general policy direction of each of the countries is given below.

4.8.1 Australian Transport Planning Policy

The Australian Government is investing $26.7 billion on road and rail infrastructure through the Nation Building Program over the six year period from 2008-09 to 2013-14. This investment involves a range of road and rail programs to improve connections through urban areas, links to ports and airports, rail, road and intermodal connections.

In **New South Wales**, the aim of integrating land use and transport is to ensure that urban structures, building forms, land use locations, development designs, subdivision and street layouts achieve:

- improved access to housing, jobs and services by walking, cycling and public transport
- increased choice of available transport and reducing dependence on cars
- reduced travel demand including the number of trips generated by development and the distances travelled, especially by car
- support the efficient and viable operation of public transport services

Queensland Transport has also prepared Integrated Regional Transport Plans that will transform the transport network with more trains, trams and buses, and projects to 'unclog our road network' and take trucks off residential streets.

The **Victorian** Transport Plan delivers short, medium and long term projects for cities, regional centres, country towns and rural areas. This includes new metro trains, new low floor trams, train operational changes to increase peak capacity, new train carriages for the regional rail network, new rail links, a program or works to separate road and rail at key intersections, a program for outer suburban roads, a package for safer country roads, new bike lanes and a public bike hire scheme for Melbourne's CBD.

The Department of Planning and Infrastructure on behalf of **the Northern Territory** Government has a number of transport related reform areas including travel demand management issues.

ACT has a *Sustainable Transport Plan* provides the direction and actions to achieve a more sustainable transport system over the next 25 years.

However none of these planning policy documents suggest a sea change in attitude towards out of centre developments and it is likely that these will continue to occur as long as the developer provides the prescribed number of parking spaces, calculates the traffic generated and mitigates the impact of the traffic generated. Consequently, travel to these sites will be predominantly car based.

It is noted that some progressive councils have started to actively encourage travel demand management and are utilising maximum parking standards at developments rather than the minimum parking requirements historically used although these have tended to be in urban areas rather than edge of town areas.

4.8.2 New Zealand

New Zealand (NZ) transport policy is guided by the NZ Transport Strategy and the Government Policy Statement on Land Transport Funding; the former having a longer-term focus and ambitious stretch-targets, and the latter having a short to medium term outlook. These documents stress the need to undertake transport planning in a multimodal context, and to integrate it with land use planning to reduce the need to travel. This focus was first introduced in 2002 and has worked through all land transport planning since. It has also resulted in the national funding agent developing a hierarchy of interventions, where undertaking capital investment is the most reluctant measure. The recent election of a new government has resulted in the softening the focus on sustainability in favour of economic development, primarily through infrastructure improvement.

The new government also has a stronger focus on driving productivity growth at a national level and values the road network as supplying the needs of car users rather than public transport or rail to "*reflect the realities of how New Zealanders get around and how we transport our goods*". This is in part recognition of the geography of New Zealand and the relatively low density of distribution of the population within the islands, which produces conditions that are more economically amenable to more use of private vehicles and road-based freight transport.

NZ does not have centralised prescriptive planning policy. National planning is guided by the Resource Management Act, but there remain significant conflicts between district, regional, and national transport and land planning, whereby the ability to protect inter-regional transport routes over the medium to long-term is severely limited. Transport planning occurs at the regional level, guided by national legislation, and as such, there can be considerable variance in policies across the country.

There are no strong policies for developments occurring in non-urban areas, other than the negotiations that occur on a case by case basis with the respective territorial authorities, where transport infrastructure and services provision competes with other funding priorities. Central government offers financial assistance rates to local councils for partial funding of transport infrastructure and service provision, however the existence of parts of the fully-funded state highway road network within each region tends to see local councils focussed upon pushing for the continued development of this network, over the requirement for large local investments in the network.

Developments in urban areas, such as Auckland, do need to comply with regional policies and growth plans. Growth strategies introduced over the past 10 years have tended to focus on developing dense nodes of activity within a set metropolitan urban limit to avert sprawl, which are connected to each other and serviced by well-developed multi-modal transport corridors. However, there are no strong requirements for developers to include specific focus on alternatives to road improvements.

In summary, the dispersed nature of population and the use of roads to transport goods and people, means that in non urban areas developments would be totally dependent upon the use of cars.

4.8.3 USA

There is no an overall policy for the US and the approach is different in city centre and non metropolitan areas. Again, there appear to be no strong policies in non-urban areas and site negotiations occur on a site by site basis with the respective government authorities. Correspondence with the US publication The Urban Transportation Monitor suggests that "*there are only a handful of jurisdictions in the U.S. where parking maximums have been implemented ….and a few more where a lower minimum has been implemented*". The implication is that any such reductions have been applied in town/city centres and out of town/edge of town developments are still permitted to be developed as long as they provide the prescribed number of parking spaces, calculate the traffic generated and mitigate the impact of any traffic generated.

4.8.4 UK

UK transport policy has been very focussed over the last 10 years to achieving sustainable travel patterns with development applications needing to demonstrate that they are accessible by means other than the private car. Indeed, the UK planning policy is such that all development now needs to take place in 'centres' be they city, town or village. If the development is beyond the 'centre' boundaries there is a presumption that any development application will be refused. Furthermore, there is a requirement on all but the smallest sites for a 'green travel plan' to be submitted and implemented in any development application. These plans generally set targets for reducing single occupancy car use.

The result is that even 'edge of town' sites in the UK have some level of accessibility for non car modes of travel and as such the proportion of car trips is probably less than on a comparable Australian Site. This has been reflected in the surveys undertaken at elderly housing sites where the car modal split in Australia was nearly 100% whereas the UK site had car modal split of around 66%.

The UK data is therefore useful at establishing daily profiles over the day but with regard to trip rates, the number of vehicles generated per unit is probably significantly less than Australian sites.

4.9 Comparison between international data – previous studies

A report entitled "Trip Rate and Parking Databases in New Zealand and Australia" presented by Ian Clark (2007) reported some comparable peak hour flows between sites located in Australia, New Zealand and America.

The paper considered that these "indicate a reasonable amount of similarity" but it should be noted that the trip rate for New Zealand was above 40% more than Australia for 3 of the 5 land uses considered

	New Zealand	Australia	America
Dwelling houses	1.2 per dwelling	0.85 per dwelling	1.0 per dwelling
Medium density residential	0.8 per dwelling (*)	0.4 to 0.5 per dwelling	0.5 per dwelling
Commercial premises / offices	2 per 100m^2 GFA	2 per 100m^2 GFA	1.5 per 100m^2 GFA
Supermarkets	17.8 per 100m^2 GFA	15.5 per 100m^2 GLFA	12.3 per 100m^2 GFA
Shopping Centres over 30,000m^2	9.9 per 100m^2 GFA (*)	6 per 100m^2 GLFA	5 per 100m^2 GFA

Source: Table 6.1 of Transfund Report 209.

Similarly, a comparison between New Zealand and the UK shows that residential and educational trip rates are lower in the UK (where dwellings and schools are generally located much closer to the centre) as opposed to towns in NZ where space is not such an issue and there are no town planning obstacles to prevent development beyond the edge of town and where accessibility for cars cannot be easily achieved. However, this assumption cannot be made for bars & restaurants.

Table 3: Comparison of New Zealand and UK Peak Hour Trip Generation Rates

	New Zealand	TRICS UK
Residential dwellings	1.2	0.7
Education: preschools	19.0	13.8
Retail: Bar	9.6	14.2
Retail: Restaurant	12.6	15.2
Supermarket	15.2	14.4

Source: NZTPDB Research Report No 2/2005.

4.9.1 Summary

It appears that the New Zealand data is more clearly aligned with non metropolitan Australian sites as the planning policies in both countries are reasonably similar. The USA contains a large range of planning situations but its non metropolitan area data exhibits similar characteristics to New Zealand and Australia.

The planning policy in the UK is noticeably different from the other countries' studies in so far that it promotes non car based trips above all others with the result that trip generation is generally much less and public transport/cycle use/pedestrian numbers are higher than in the other countries considered. The travel profiles and characteristics of trip generation in the UK might be quite similar to these other countries but the actual number of trips per unit / unit area can be less.

In making comparisons, there is clearly a concern that these foreign databases use different land use classes to those being used in Australia and this can make direct comparisons between the databases difficult.

5 SUMMARY

Ten sites were selected to represent the whole of the state - five sites were selected in the Sydney Metropolitan Area and five sites were selected in Non-Metropolitan Area. The sites operated "independently" in traffic terms and all traffic movements (vehicles and pedestrians) were generated as a result of the proposed site use (i.e. the site was not shared with another use which also generated trips). The sites were surveyed in March 2009 which was outside of any school holidays or public holidays.

One problem encountered was that it was not possible to count the number of residents' vehicles parked on site in the parking survey element of the counts because many of the units had a lock up garage. This meant that it was not possible to do a parking accumulation on the sites.

Based upon information given to us by the site owners (and by reference to the overseas surveys described later in this report), the surveys were undertaken between 10am and 8pm. Even though the anecdotal evidence from the site owners and from abroad, was that the busiest weekday times for the elderly housing was towards midday, Hyder undertook a couple of check counts - one on a rural site and one on an urban site to check what the traffic generation characteristics were like in the traditional peak hour periods. This confirmed that at the traditional network peak, the trip generation rate from the sites was only 33% - 43% of the peak hour traffic generation.

In order to calculate trip rates, the most appropriate key variable was the number of units.

The surveys revealed that

- The weekday site peak hour trip generation rate varied from 0.23 vehicle trips per unit to 0.55 vehicle trips per unit with an average of 0.37 trips.
- The weekday daily trip rate varied from 1.35 vehicle trips per unit to 3.1 vehicle trips per unit with an average of 2.10 vehicle trips per unit.
- The network PM peak hours during weekdays are often between 3pm and 6pm while the network peak hour at the weekend was close to noon time.
- More trips were observed during the weekend network peak than the weekday network PM peak.
- The trip rates in Non-Metropolitan Area are generally higher than the sites in the Sydney Metropolitan Area. The average daily vehicle trip rates in towns in weekday and weekend are 25% and 13% higher than in Sydney respectively.
- The number of daily trips during weekdays is higher than the weekend. However, there is no constant ratio between the weekday and weekend volumes across all of the sites.

Using linear regression, both the 'site peak hour' trips and 'daily trips' have a reasonably high correlation with the number of occupied units. Confidence levels of 63% to 86% that trip behaviour can be explained by the number of units have been obtained. Neither the trips during 'network PM peak hour' in weekday nor 'network peak hour in weekend' have an acceptable correlation with the number of occupied units.

In terms of type of visit, it is clear that trips to elderly peoples housing are specific trips – very few are pass-by or multi purpose trips.

In terms of postcodes of visitors to the site, it is clear that most visitors come from areas which are relatively close to the site. Generally, people in Non-Metropolitan Areas are prepared to travel much longer distances than the people in Sydney.

In terms of modal split, the predominant mode of travel is the car with many of the sites recording 100% vehicle trips and with the other recording above 90% vehicle trips.

The parking survey revealed that the majority of sites recorded close to 100% of all parking occurring on site.

- The provision of parking spaces varies from 0.45 spaces per unit to 2.32 spaces per unit with an average of 1.07 spaces per unit.
- However, the car ownership only varies between 0.35 cars per unit and 1.04 cars per unit (with an average of 0.67). This suggests that car parking provision significantly exceeds demand on all of the sites.
- Higher car ownership was found in Non-Metropolitan sites compared with the Sydney Metropolitan sites. This may be because higher care services tend to be provided in the city whereas elderly housing in Non-Metropolitan Area appears to provide for more active

A review of existing traffic generation guides and databases, suggests that throughout Australia

- The RTA guide seems to be the main source of traffic generation data
- The ITE books are used but in a limited way.
- TRICS and NZTDP appear to be used academically but not in detailed consideration of development impacts
- There are however concerns about the RTA data in so far as the age of the data and the relevance of the time of year at which the data surveys were undertaken
- Many practitioners use the RTA guide as a starting point but then do their own surveys to establish traffic generation characteristics at similar sites / land uses
- The RTA guide does not consider multi-modal travel.

In summary, although other documents are used, and many companies seem to undertake their own surveys to establish the traffic generating capabilities of a particular site, the RTA guide seems to be the first point of reference.

International guides are available such as

- The New Zealand Trips Database Bureau.
- The Institution of Transportation Engineers (ITE) “Trip Generation” book
- UK - TRICS & TRAVL - TRICS is the UK national standard trip generation database and is used as an integral and essential part of the Transport Assessment process. TRAVL is primarily used in city centre London which has heavily constrained traffic movements and very high levels of public transport accessibility. Consequently, it is not considered that it is a useful database in the context of this study.

All of these databases treat parking and traffic generation as two separate discussion areas so the information contained in these documents has been studied in these two key areas.

A comparison of trip rates between these databases is summarised below

Table 5-1 Summary Comparison of National & International Data

	Parking Provision / Demand
RTA Guide	0.67 spaces per unit + 1 space every 5 visitors PROVISION
ITE	0.33 spaces per unit DEMAND 0.58 spaces per unit PROVISION
TRICS	0.54 spaces per unit PROVISION
2009 Survey	1.07 spaces per unit PROVISION

Table 5-2 Summary of Person Trip Comparison

	Peak Hour Person Trips	Daily Person Trips
Sheltered Housing (TRICS)	0.44 - 0.74	4.4
Retirement Flats (TRICS)	0.32 - 0.61	3.7
2009 Surveys	0.40 - 0.89	3.2

Table 5-3 Summary Vehicle Trip Generation Comparison

	WEEKDAY		WEEKEND	
	Peak Hour Trip Generation	Daily Trip Generation	Peak Hour Trip Generation	Daily Trip Generation
	(Vehicle Trips per unit)		(Vehicle Trips per unit)	
RTA Guide	0.1 to 0.2	1 to 2	-	-
NZTPDB	-	3.04	-	-
ITE	0.16	3.48	-	-
TRICS	0.32*	1.557*	0.23*	1.37*
Study Results	0.36	2.04	0.25	1.21

** Note that the TRICS data includes sites with a 60-70% modal split to cars which is much lower than the study figures*

In summary, the variation in trip rate can be attributed to many factors such as

- Degree of care in the health facility (i.e. acute or low care)
- Location of site in proximity to settlements

Whilst a general trip rate might give an estimate of trips likely to be generated by a senior living complex development site, a detailed study of similar site with similar characteristics of size, location, degree of health care etc, is likely to give a more accurate representation of the site's likely transport implications.

The validity of comparing trip rates from various databases is summarised below

- The planning environment and in particular the transport planning environment in each of the countries studied is different and this has a direct effect on the number of vehicle trips generated by a particular site.
- It appears that the New Zealand data is more clearly aligned with non metropolitan Australian sites as the planning policies in both countries are reasonably similar. The USA contains a large range of planning situations but it again the non metropolitan areas would exhibit similar characteristics to New Zealand and Australia.

- The planning policy in the UK is noticeably different from the other countries studies in so far that it promotes non car based trips above all others with the result that trip generation is generally much less and public transport/cycle use/pedestrian numbers are higher than in the other countries considered. The travel profiles and characteristics of trip generation in the UK might be quite similar to these other countries but the actual number of trips per unit / unit area can be less.
- There is clearly a concern that these different databases use different land use classes to those being used in Australia and this can make direct comparisons between the databases difficult.

Appendix A

Survey Results

Traffic Survey Results – SH1 to SH5 – Sydney Metropolitan Area

Site ID	SH1		SH2		SH3		SH4		SH5	
No. of Occupied Units (Total)	205		78		264		174		214	
	Trips	Period	Trips	Period	Trips	Period	Trips	Period	Trips	Period
Weekdays										
Person-based										
Daily Person Trips - Car-based	703	10 hours	116	10 hours	451	10 hours	405	10 hours	400	10 hours
Daily Person Trips - CV	11	10 hours	13	10 hours	33	10 hours	30	10 hours	101	10 hours
Daily Person Trips - All Veh	714	10 hours	129	10 hours	484	10 hours	435	10 hours	501	10 hours
Average Person Trips (per hour)	85	10 hours	16	10 hours	65	10 hours	48	10 hours	53	10 hours
Peak Person Trips (per hour)										
- Site Peak Hour	126	1130-1230	31	1015-1115	110	1015-1115	80	1330-1430	91	1400-1500
- Vehicle Network AM Peak	Network AM peak is outside of survey period									
- Vehicle Network PM Peak	116	1700-1800	8	1700-1800	23	1700-1800	56	1500-1600	44	1600-1700
- Vehicle Peak	87	1045-1145	16	1315-1415	110	1015-1115	80	1330-1430	91	1400-1500
Daily Total Person Trips	854	10 hours	163	10 hours	653	10 hours	481	10 hours	528	10 hours
Vehicle-based										
Peak Vehicle Trips (per hour)										
- Site Peak Hour	87	1045-1145	20	1315-1415	62	1015-1115	55	1330-1430	54	1400-1500
- Network AM Peak	Network AM peak is outside of survey period									
- Network PM Peak	74	1700-1800	5	1700-1800	12	1700-1800	41	1500-1600	36	1600-1700
Peak Parking Accumulation	33	1715-1815	45	1500-1600	55	1300-1400	57	1015-1115	33	1530-1630
Average Vehicle Occupancy	1.20	10 hours	1.23	10 hours	1.27	10 hours	1.40	10 hours	1.51	10 hours
Commercial Vehicle (CV) trips										
- Peak In	1	1300-1400	3	1430-1530	6	1030-1130	4	1245-1345	6	1400-1500
- Peak Out	2	1330-1430	3	1430-1530	3	1130-1230	3	1430-1530	7	1345-1445
Daily Total CV Trips	9	10 hours	10	10 hours	30	10 hours	26	10 hours	38	10 hours
Daily Total Car Trips	584	10 hours	95	10 hours	351	10 hours	285	10 hours	294	10 hours
Daily Total Vehicle Trips	593	10 hours	105	10 hours	381	10 hours	311	10 hours	332	10 hours
%CV of Daily Trips	1.5%	10 hours	9.5%	10 hours	7.9%	10 hours	8.4%	10 hours	11.4%	10 hours
Weekend										
Person-based										
Daily Person Trips - Car-based	116	10 hours	129	10 hours	509	10 hours	339	10 hours	449	10 hours
Daily Person Trips - CV	13	10 hours	2	10 hours	26	10 hours	8	10 hours	25	10 hours
Daily Person Trips - All Veh	129	10 hours	131	10 hours	535	10 hours	347	10 hours	474	10 hours
Average Person Trips (per hour)	16	10 hours	15	10 hours	62	10 hours	37	10 hours	48	10 hours
Peak Person Trips (per hour)										
- Site Peak Hour	31	1015-1115	29	1530-1630	95	1430-1530	73	1400-1500	89	1100-1200
- Vehicle Network Peak	13	1200-1300	16	1200-1300	76	1200-1300	44	1100-1200	47	1200-1300
- Vehicle Peak	16	1315-1415	18	1400-1500	94	1100-1200	73	1400-1500	89	1100-1200
Daily Total Person Trips	163	10 hours	151	10 hours	620	10 hours	373	10 hours	483	10 hours
Vehicle-based										
Peak Vehicle Trips (per hour)										
- Site Peak Hour	20	1315-1415	15	1400-1500	56	1100-1200	46	1400-1500	50	1100-1200
- Network Peak	9	1200-1300	11	1200-1300	45	1200-1300	30	1100-1200	31	1200-1300
Peak Parking Accumulation	45	1500-1600	34	1545-1645	59	1200-1300	33	1415-1515	28	1400-1500
Average Vehicle Occupancy	1.23	10 hours	1.35	10 hours	1.50	10 hours	1.40	10 hours	1.67	10 hours
Commercial Vehicle (CV) trips										
- Peak In	3	1415-1515	1	1430-1530	3	1200-1300	2	1215-1315	2	1345-1445
- Peak Out	3	1430-1530	1	1800-1900	3	1200-1300	1	1230-1330	2	1345-1445
Daily Total CV Trips	10	10 hours	2	10 hours	22	10 hours	7	10 hours	16	10 hours
Daily Total Car Trips	95	10 hours	95	10 hours	334	10 hours	241	10 hours	268	10 hours
Daily Total Vehicle Trips	105	10 hours	97	10 hours	356	10 hours	248	10 hours	284	10 hours
%CV of Daily Trips	9.5%	10 hours	2.1%	10 hours	6.2%	10 hours	2.8%	10 hours	5.6%	10 hours

Traffic Survey Results – SH6 to SH10 – Non-Metropolitan Area

Site ID	SH6		SH7		SH8		SH9		SH10	
No. of Occupied Units (Total)	240		71		70		38		81	
	Trips	Period	Trips	Period	Trips	Period	Trips	Period	Trips	Period
Weekdays										
Person-based										
Daily Person Trips - Car-based	889	10 hours	152	10 hours	209	10 hours	91	10 hours	258	10 hours
Daily Person Trips - CV	122	10 hours	15	10 hours	10	10 hours	33	10 hours	5	10 hours
Daily Person Trips - All Veh	1,011	10 hours	167	10 hours	219	10 hours	124	10 hours	263	10 hours
Average Person Trips (per hour)	104	10 hours	18	10 hours	23	10 hours	14	10 hours	27	10 hours
Peak Person Trips (per hour)										
- Site Peak Hour	149	1630-1730	31	1100-1200	39	1000-1100	34	1200-1300	44	1400-1500
- Vehicle Network AM Peak	Network AM peak is outside of survey period									
- Vehicle Network PM Peak	86	1500-1600	26	1500-1600	22	1600-1700	1	1700-1800	43	1500-1600
- Vehicle Peak	149	1630-1730	31	1100-1200	39	1000-1100	27	1000-1100	44	1400-1500
Daily Total Person Trips	1,037	10 hours	182	10 hours	225	10 hours	139	10 hours	269	10 hours
Vehicle-based										
Peak Vehicle Trips (per hour)										
- Site Peak Hour	105	1630-1730	20	1100-1200	27	1000-1100	21	1000-1100	37	1400-1500
- Network AM Peak	Network AM peak is outside of survey period									
- Network PM Peak	54	1500-1600	16	1500-1600	16	1600-1700	1	1700-1800	27	1500-1600
Peak Parking Accumulation	21	1545-1645	6	1800-1900	4	1900-2000	5	1515-1615	11	1745-1845
Average Vehicle Occupancy	1.36	10 hours	1.53	10 hours	1.44	10 hours	1.65	10 hours	1.26	10 hours
Commercial Vehicle (CV) trips										
- Peak In	9	1530-1630	3	1500-1600	2	1145-1245	2	1200-1300	1	1530-1630
- Peak Out	7	1545-1645	3	1445-1545	2	1200-1300	2	1130-1230	1	1530-1630
Daily Total CV Trips	59	10 hours	9	10 hours	6	10 hours	12	10 hours	5	10 hours
Daily Total Car Trips	685	10 hours	100	10 hours	146	10 hours	63	10 hours	204	10 hours
Daily Total Vehicle Trips	744	10 hours	109	10 hours	152	10 hours	75	10 hours	209	10 hours
%CV of Daily Trips	7.9%	10 hours	8.3%	10 hours	3.9%	10 hours	16.0%	10 hours	2.4%	10 hours
Weekend										
Person-based										
Daily Person Trips - Car-based	443	10 hours	88	10 hours	107	10 hours	100	10 hours	165	10 hours
Daily Person Trips - CV	5	10 hours	0	10 hours	0	10 hours	2	10 hours	3	10 hours
Daily Person Trips - All Veh	448	10 hours	88	10 hours	107	10 hours	102	10 hours	168	10 hours
Average Person Trips (per hour)	45	10 hours	12	10 hours	11	10 hours	11	10 hours	18	10 hours
Peak Person Trips (per hour)										
- Site Peak Hour	123	1100-1200	28	1100-1200	35	1100-1200	22	1700-1800	46	1115-1215
- Vehicle Network Peak	123	1100-1200	6	1200-1300	35	1100-1200	15	1100-1200	37	1100-1200
- Vehicle Peak	110	1130-1230	28	1100-1200	34	1045-1145	22	1700-1800	46	1115-1215
Daily Total Person Trips	452	10 hours	119	10 hours	111	10 hours	114	10 hours	182	10 hours
Vehicle-based										
Peak Vehicle Trips (per hour)										
- Site Peak Hour	85	1130-1230	15	1100-1200	20	1045-1145	11	1700-1800	33	1115-1215
- Network Peak	79	1100-1200	3	1200-1300	18	1100-1200	6	1100-1200	27	1100-1200
Peak Parking Accumulation	14	1015-1115	16	1715-2000	13	1445-1545	11	1900-2000	-3	1145-1245
Average Vehicle Occupancy	1.42	10 hours	1.57	10 hours	1.65	10 hours	1.70	10 hours	1.25	10 hours
Commercial Vehicle (CV) trips										
- Peak In	1	1500-1600	0	0	0	0	1	1045-1145	1	1430-1530
- Peak Out	1	1530-1630	0	0	0	0	1	1015-1115	1	1430-1530
Daily Total CV Trips	3	10 hours	0	10 hours	0	10 hours	2	10 hours	3	10 hours
Daily Total Car Trips	312	10 hours	56	10 hours	65	10 hours	58	10 hours	131	10 hours
Daily Total Vehicle Trips	315	10 hours	56	10 hours	65	10 hours	60	10 hours	134	10 hours
%CV of Daily Trips	1.0%	10 hours	0.0%	10 hours	0.0%	10 hours	3.3%	10 hours	2.2%	10 hours

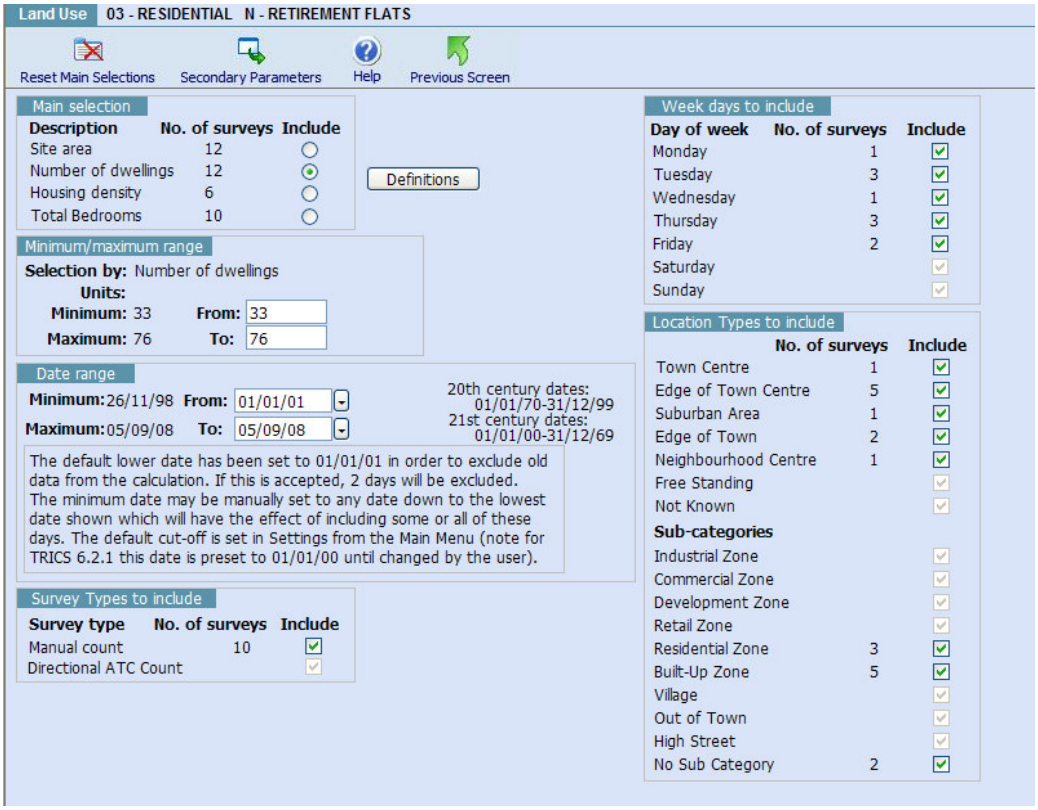
Appendix B

Detailed TRICS analysis

Vehicle Trips

Retirement Flats - WEEKDAY

Firstly, the retirement flats land use was interrogated for weekday surveys of retirement flats. The weekday option was selected and the surveys were based upon the number of dwellings rather than any of the other parameters (i.e. number of bedrooms, site area etc). The town centre location was removed and only weekday surveys were selected for analysis.



VEHICLES — Estimate TRIP rates

TRIP RATE VALUE PER 1 DWELLS	ARRIVALS Total rate: 0.780 Peak: 16:00-17:00			DEPARTURES Total rate: 0.777 Peak: 11:00-12:00			TOTALS Total rate: 1.557 Peak: 16:00-17:00		
	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00-01:00	0	0	0.000	0	0	0.000	0	0	0.000
01:00-02:00	0	0	0.000	0	0	0.000	0	0	0.000
02:00-03:00	0	0	0.000	0	0	0.000	0	0	0.000
03:00-04:00	0	0	0.000	0	0	0.000	0	0	0.000
04:00-05:00	0	0	0.000	0	0	0.000	0	0	0.000
05:00-06:00	0	0	0.000	0	0	0.000	0	0	0.000
06:00-07:00	0	0	0.000	0	0	0.000	0	0	0.000
07:00-08:00	9	48	0.033	9	48	0.033	9	48	0.066
08:00-09:00	9	48	0.030	9	48	0.054	9	48	0.084
09:00-10:00	9	48	0.056	9	48	0.051	9	48	0.107
10:00-11:00	9	48	0.079	9	48	0.072	9	48	0.151
11:00-12:00	9	48	0.082	9	48	0.086	9	48	0.168
12:00-13:00	9	48	0.082	9	48	0.082	9	48	0.164
13:00-14:00	9	48	0.068	9	48	0.075	9	48	0.143
14:00-15:00	9	48	0.056	9	48	0.077	9	48	0.133
15:00-16:00	9	48	0.075	9	48	0.072	9	48	0.147
16:00-17:00	9	48	0.112	9	48	0.068	9	48	0.180
17:00-18:00	9	48	0.056	9	48	0.056	9	48	0.112
18:00-19:00	9	48	0.051	9	48	0.051	9	48	0.102
19:00-20:00	0	0	0.000	0	0	0.000	0	0	0.000
20:00-21:00	0	0	0.000	0	0	0.000	0	0	0.000
21:00-22:00	0	0	0.000	0	0	0.000	0	0	0.000
22:00-23:00	0	0	0.000	0	0	0.000	0	0	0.000
23:00-24:00	0	0	0.000	0	0	0.000	0	0	0.000

The resulting trip data showed an average daily trip rate across the selected sites of 1.557 trips per dwelling per day. However, TRICS allows the user to 'rank' the sites to compare the trip generation of each of the sites used in the overall calculation.

Using the peak hour of traffic generation from each of the sites, the trip rate per dwelling varied between 0.18 and 0.43 vehicle trips per dwelling in the individual site's own peak hour. It is also noted that the peak hour period varied from 11AM to 12AM until 5PM to 7PM across the sites.

VEHICLES

Rank order for: **Number of dwellings**
Calculated on: **TOTALS** Time range: **Peak Hour***
Total: **9** **85th Percentile = no. 2
**15th Percentile = no. 8

Note
WARNING: Using 85th and 15th percentile highlighted trip rates in data sets of under 20 surveys is not recommended by TRICS, and may be misleading.

Sorted by Trip Rate
○ Arrivals
○ Departures
◉ Totals

* Note: List does not represent any given time period but shows trip rates for busiest arr/dep/total hour for each survey

								TRIP RATE		
Rank	Site Ref	Description	Area	DWELLS	Day	Date	Peak Hour	Arrivals	Departures	Totals
1	CF-03-N-02	RETIREMENT FLATS, CARDIFF	CARDIFF	35	Friday	13/10/06	13:00-14:00	0.200	0.257	0.429
2 **	TW-03-N-01	RETIREMENT FLATS, N. SHIELDS	TYNE & WEAR	33	Monday	30/10/06	12:00-13:00	0.182	0.182	0.364
3	KC-03-N-03	RETIREMENT FLATS, GRAVESEND	KENT	66	Thursday	27/11/03	15:00-16:00	0.121	0.152	0.273
4	CA-03-N-01	RETIREMENT FLATS, P.BORO	CAMBRIDGESHIRE	50	Wednesday	14/05/08	16:00-17:00	0.220	0.120	0.260
5	DH-03-N-01	RETIREMENT FLATS, DURHAM	DURHAM	43	Tuesday	10/06/03	10:00-11:00	0.140	0.116	0.256
6	GC-03-N-01	RETIREMENT FLATS, GLASGOW	GLASGOW CITY	47	Tuesday	10/06/08	16:00-17:00	0.149	0.128	0.234
7	PS-03-N-01	RETIREMENT FLATS, BRECON	POWYS	52	Friday	05/09/08	11:00-12:00	0.135	0.135	0.231
8 **	KC-03-N-04	RETIREMENT FLATS, GRAVESEND	KENT	46	Thursday	27/11/03	17:00-18:00	0.130	0.109	0.196
9	SH-03-N-01	RETIREMNT FLATS,SHREWSBURY	SHROPSHIRE	57	Thursday	09/06/05	14:00-15:00	0.088	0.105	0.175

However, the trip rate in the 1600-1700 period, which appeared to be the busiest period across the whole of the data in the use class, the variation in peak hour trip rate is less marked with the variation being between 0.10 and 0.26 peak hour vehicle trips per dwelling.

VEHICLES

Rank order for: **Number of dwellings**
Calculated on: **TOTALS** Time range: **16:00-17:00**
Total: **9** **85th Percentile = no. 2
**15th Percentile = no. 8

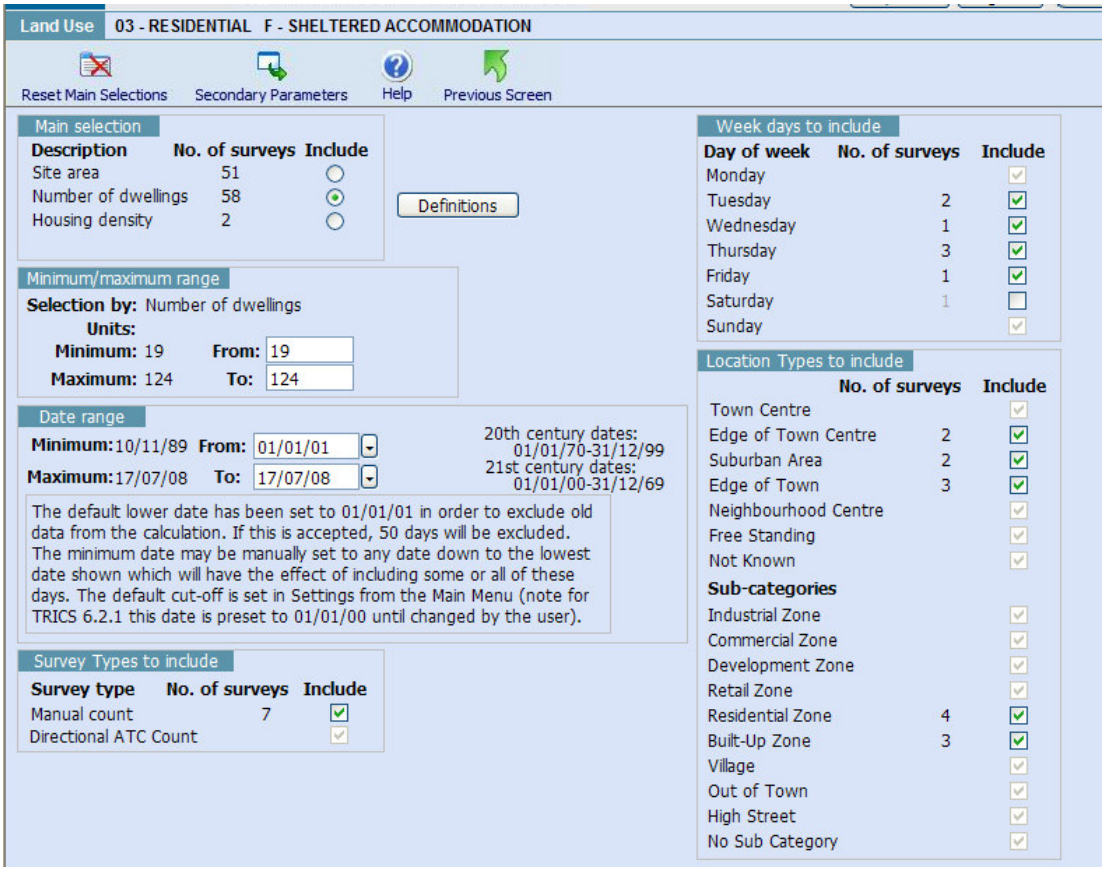
Note
WARNING: Using 85th and 15th percentile highlighted trip rates in data sets of under 20 surveys is not recommended by TRICS, and may be misleading.

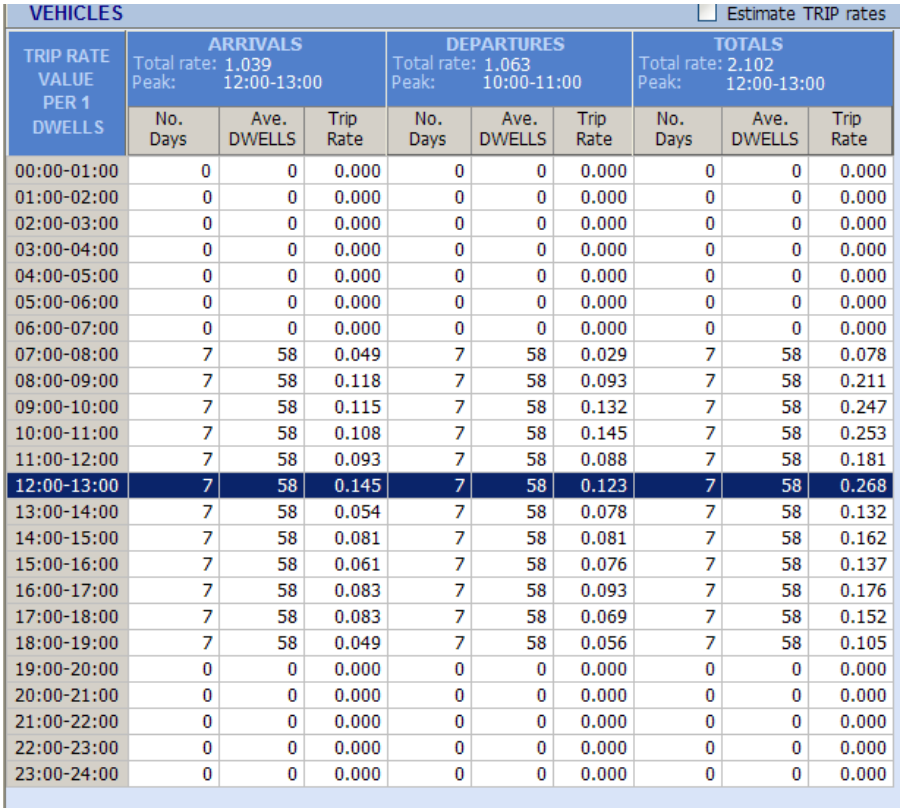
Sorted by Trip Rate
○ Arrivals
○ Departures
◉ Totals

							TRIP RATE		
Rank	Site Ref	Description	Area	DWELLS	Day	Date	Arrivals	Departures	Totals
1	CA-03-N-01	RETIREMENT FLATS, P.BORO	CAMBRIDGESHIRE	50	Wednesday	14/05/08	0.220	0.040	0.260
2 **	TW-03-N-01	RETIREMENT FLATS, N. SHIELDS	TYNE & WEAR	33	Monday	30/10/06	0.121	0.121	0.242
3	GC-03-N-01	RETIREMENT FLATS, GLASGOW	GLASGOW CITY	47	Tuesday	10/06/08	0.149	0.085	0.234
4	PS-03-N-01	RETIREMENT FLATS, BRECON	POWYS	52	Friday	05/09/08	0.135	0.096	0.231
5	KC-03-N-03	RETIREMENT FLATS, GRAVESEND	KENT	66	Thursday	27/11/03	0.121	0.061	0.182
6	KC-03-N-04	RETIREMENT FLATS, GRAVESEND	KENT	46	Thursday	27/11/03	0.087	0.043	0.130
7	DH-03-N-01	RETIREMENT FLATS, DURHAM	DURHAM	43	Tuesday	10/06/03	0.070	0.047	0.117
8 **	CF-03-N-02	RETIREMENT FLATS, CARDIFF	CARDIFF	35	Friday	13/10/06	0.057	0.057	0.114
9	SH-03-N-01	RETIREMNT FLATS,SHREWSBURY	SHROPSHIRE	57	Thursday	09/06/05	0.035	0.070	0.105

Sheltered Accommodation - Weekday

The sheltered accommodation land use was interrogated for weekday surveys using a similar interrogation process



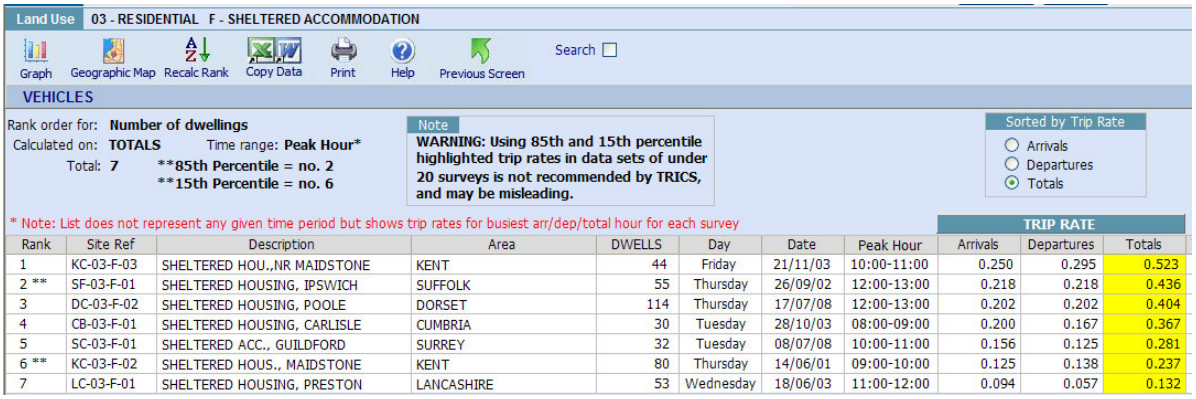


VEHICLES — Estimate TRIP rates

TRIP RATE VALUE PER 1 DWELLS	ARRIVALS Total rate: 1.039 Peak: 12:00-13:00			DEPARTURES Total rate: 1.063 Peak: 10:00-11:00			TOTALS Total rate: 2.102 Peak: 12:00-13:00		
	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00-01:00	0	0	0.000	0	0	0.000	0	0	0.000
01:00-02:00	0	0	0.000	0	0	0.000	0	0	0.000
02:00-03:00	0	0	0.000	0	0	0.000	0	0	0.000
03:00-04:00	0	0	0.000	0	0	0.000	0	0	0.000
04:00-05:00	0	0	0.000	0	0	0.000	0	0	0.000
05:00-06:00	0	0	0.000	0	0	0.000	0	0	0.000
06:00-07:00	0	0	0.000	0	0	0.000	0	0	0.000
07:00-08:00	7	58	0.049	7	58	0.029	7	58	0.078
08:00-09:00	7	58	0.118	7	58	0.093	7	58	0.211
09:00-10:00	7	58	0.115	7	58	0.132	7	58	0.247
10:00-11:00	7	58	0.108	7	58	0.145	7	58	0.253
11:00-12:00	7	58	0.093	7	58	0.088	7	58	0.181
12:00-13:00	7	58	0.145	7	58	0.123	7	58	0.268
13:00-14:00	7	58	0.054	7	58	0.078	7	58	0.132
14:00-15:00	7	58	0.081	7	58	0.081	7	58	0.162
15:00-16:00	7	58	0.061	7	58	0.076	7	58	0.137
16:00-17:00	7	58	0.083	7	58	0.093	7	58	0.176
17:00-18:00	7	58	0.083	7	58	0.069	7	58	0.152
18:00-19:00	7	58	0.049	7	58	0.056	7	58	0.105
19:00-20:00	0	0	0.000	0	0	0.000	0	0	0.000
20:00-21:00	0	0	0.000	0	0	0.000	0	0	0.000
21:00-22:00	0	0	0.000	0	0	0.000	0	0	0.000
22:00-23:00	0	0	0.000	0	0	0.000	0	0	0.000
23:00-24:00	0	0	0.000	0	0	0.000	0	0	0.000

A daily trip rate of 2.102 trips per dwelling per day was revealed but as explained earlier, it is possible to rank the sites to compare the trip generation of each of the sites used in the overall calculation.

Using the peak hour of traffic generation from each of the individual sites, the trip rate per dwelling varies between 0.13 and 0.53 trips per dwelling in the sites own peak hour. It is also noted that the peak hour period varied from 8AM to 9AM until 12 noon to 1PM.



Land Use 03 - RESIDENTIAL F - SHELTERED ACCOMMODATION

Graph | Geographic Map | Recalc Rank | Copy Data | Print | Help | Previous Screen | Search

VEHICLES

Rank order for: **Number of dwellings**
Calculated on: **TOTALS** Time range: **Peak Hour***
Total: **7** **85th Percentile = no. 2
**15th Percentile = no. 6

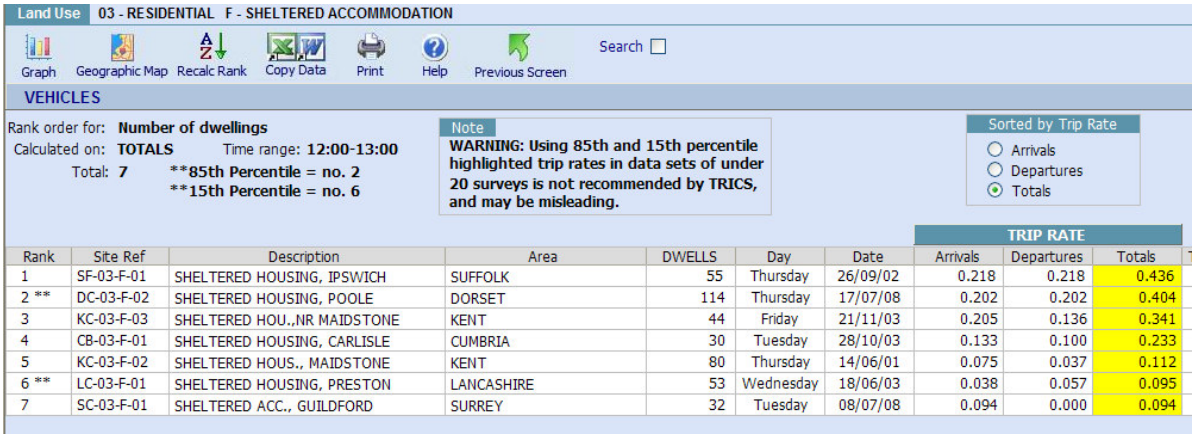
Note
WARNING: Using 85th and 15th percentile highlighted trip rates in data sets of under 20 surveys is not recommended by TRICS, and may be misleading.

Sorted by Trip Rate
- Arrivals
- Departures
- Totals

* Note: List does not represent any given time period but shows trip rates for busiest arr/dep/total hour for each survey

								TRIP RATE		
Rank	Site Ref	Description	Area	DWELLS	Day	Date	Peak Hour	Arrivals	Departures	Totals
1	KC-03-F-03	SHELTERED HOU.,NR MAIDSTONE	KENT	44	Friday	21/11/03	10:00-11:00	0.250	0.295	0.523
2 **	SF-03-F-01	SHELTERED HOUSING, IPSWICH	SUFFOLK	55	Thursday	26/09/02	12:00-13:00	0.218	0.218	0.436
3	DC-03-F-02	SHELTERED HOUSING, POOLE	DORSET	114	Thursday	17/07/08	12:00-13:00	0.202	0.202	0.404
4	CB-03-F-01	SHELTERED HOUSING, CARLISLE	CUMBRIA	30	Tuesday	28/10/03	08:00-09:00	0.200	0.167	0.367
5	SC-03-F-01	SHELTERED ACC., GUILDFORD	SURREY	32	Tuesday	08/07/08	10:00-11:00	0.156	0.125	0.281
6 **	KC-03-F-02	SHELTERED HOUS., MAIDSTONE	KENT	80	Thursday	14/06/01	09:00-10:00	0.125	0.138	0.237
7	LC-03-F-01	SHELTERED HOUSING, PRESTON	LANCASHIRE	53	Wednesday	18/06/03	11:00-12:00	0.094	0.057	0.132

However, the trip rate in the 1200-1300 period, which appeared to be the busiest period across the whole of the data in the use class, the variation in peak hour trip rate is slightly less marked with the variation being between 0.09 and 0.43.



Land Use 03 - RESIDENTIAL F - SHELTERED ACCOMMODATION

Graph | Geographic Map | Recalc Rank | Copy Data | Print | Help | Previous Screen | Search

VEHICLES

Rank order for: **Number of dwellings**
Calculated on: **TOTALS** Time range: **12:00-13:00**
Total: **7** **85th Percentile = no. 2
**15th Percentile = no. 6

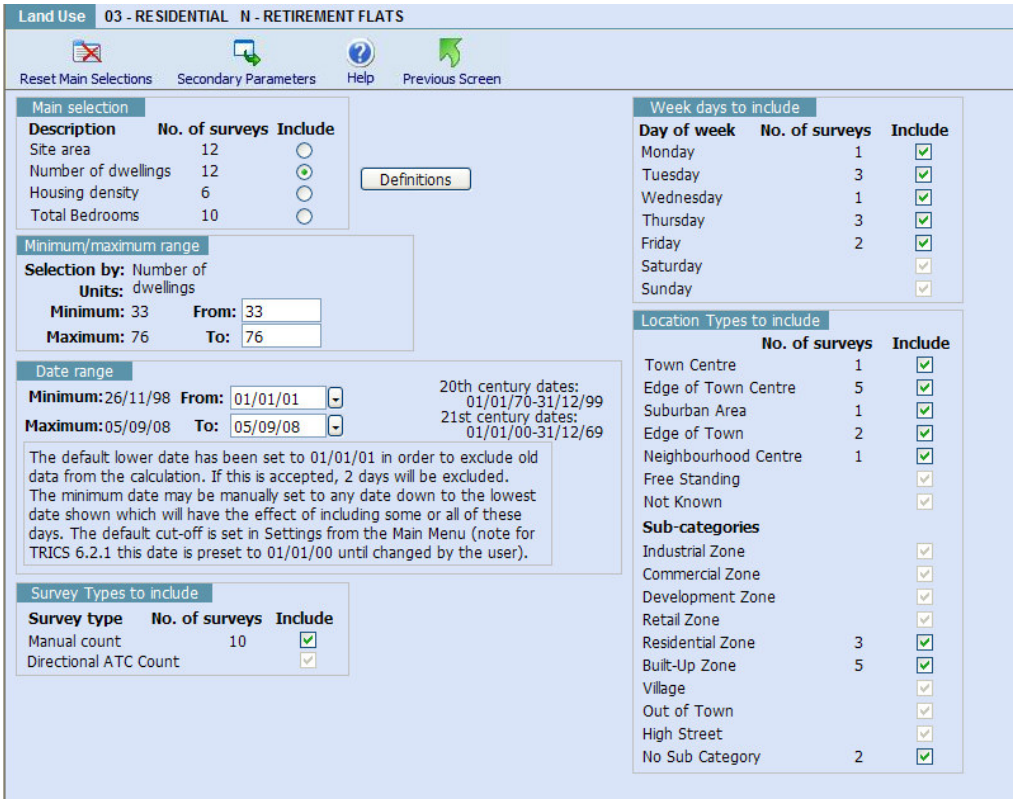
Note
WARNING: Using 85th and 15th percentile highlighted trip rates in data sets of under 20 surveys is not recommended by TRICS, and may be misleading.

Sorted by Trip Rate
- Arrivals
- Departures
- Totals

							TRIP RATE		
Rank	Site Ref	Description	Area	DWELLS	Day	Date	Arrivals	Departures	Totals
1	SF-03-F-01	SHELTERED HOUSING, IPSWICH	SUFFOLK	55	Thursday	26/09/02	0.218	0.218	0.436
2 **	DC-03-F-02	SHELTERED HOUSING, POOLE	DORSET	114	Thursday	17/07/08	0.202	0.202	0.404
3	KC-03-F-03	SHELTERED HOU.,NR MAIDSTONE	KENT	44	Friday	21/11/03	0.205	0.136	0.341
4	CB-03-F-01	SHELTERED HOUSING, CARLISLE	CUMBRIA	30	Tuesday	28/10/03	0.133	0.100	0.233
5	KC-03-F-02	SHELTERED HOUS., MAIDSTONE	KENT	80	Thursday	14/06/01	0.075	0.037	0.112
6 **	LC-03-F-01	SHELTERED HOUSING, PRESTON	LANCASHIRE	53	Wednesday	18/06/03	0.038	0.057	0.095
7	SC-03-F-01	SHELTERED ACC., GUILDFORD	SURREY	32	Tuesday	08/07/08	0.094	0.000	0.094

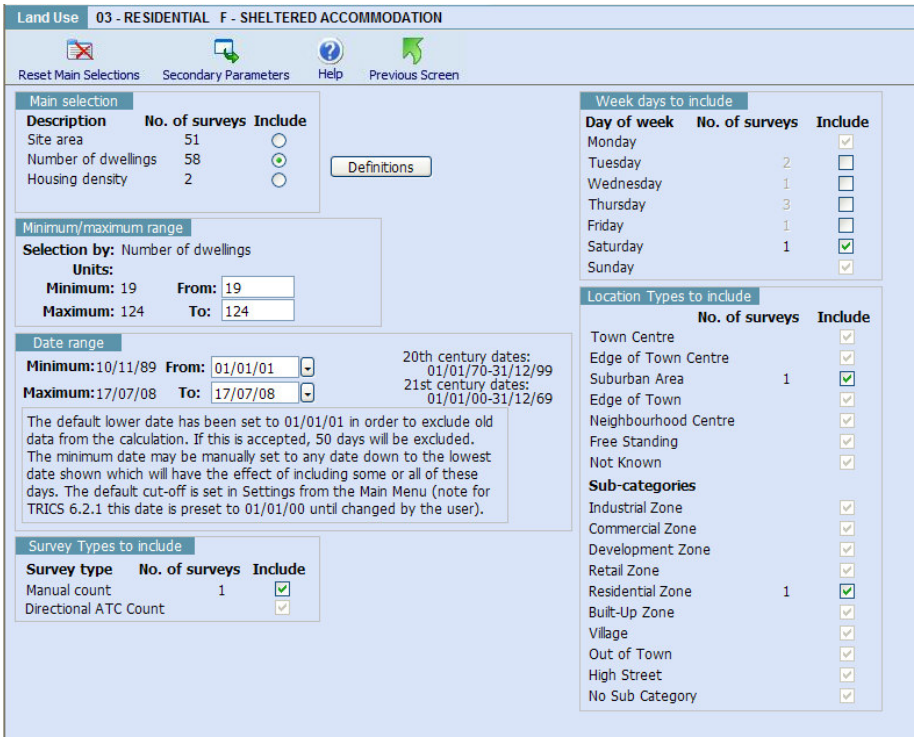
Retirement Flats - WEEKEND

There is no weekend data relating to retirement flats



Sheltered Accommodation

The sheltered accommodation land use does however have 1 Saturday survey.



The daily profile of the traffic at the site is summarised below

Land Use 03 - RESIDENTIAL F - SHELTERED ACCOMMODATION

Graph | Rank | Copy Data | Print | Selection | Help | Previous Screen

VEHICLES — Estimate TRIP rates

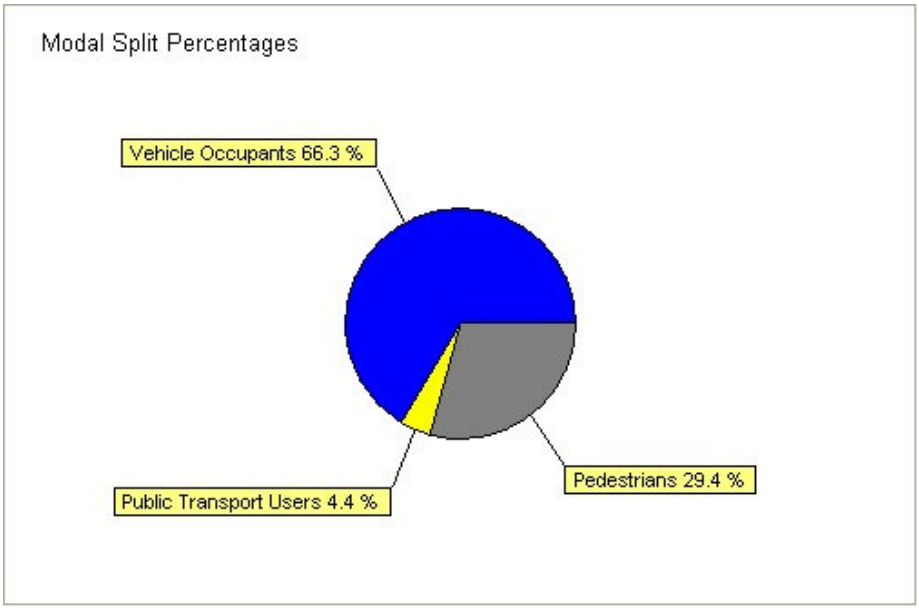
TRIP RATE VALUE PER 1 DWELLS	ARRIVALS Total rate: 0.667 Peak: 10:00-11:00			DEPARTURES Total rate: 0.700 Peak: 13:00-14:00			TOTALS Total rate: 1.367 Peak: 14:00-15:00		
	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00-01:00	0	0	0.000	0	0	0.000	0	0	0.000
01:00-02:00	0	0	0.000	0	0	0.000	0	0	0.000
02:00-03:00	0	0	0.000	0	0	0.000	0	0	0.000
03:00-04:00	0	0	0.000	0	0	0.000	0	0	0.000
04:00-05:00	0	0	0.000	0	0	0.000	0	0	0.000
05:00-06:00	0	0	0.000	0	0	0.000	0	0	0.000
06:00-07:00	0	0	0.000	0	0	0.000	0	0	0.000
07:00-08:00	1	30	0.000	1	30	0.000	1	30	0.000
08:00-09:00	1	30	0.033	1	30	0.000	1	30	0.033
09:00-10:00	1	30	0.067	1	30	0.067	1	30	0.134
10:00-11:00	1	30	0.100	1	30	0.000	1	30	0.100
11:00-12:00	1	30	0.000	1	30	0.067	1	30	0.067
12:00-13:00	1	30	0.100	1	30	0.067	1	30	0.167
13:00-14:00	1	30	0.067	1	30	0.133	1	30	0.200
14:00-15:00	1	30	0.100	1	30	0.133	1	30	0.233
15:00-16:00	1	30	0.100	1	30	0.100	1	30	0.200
16:00-17:00	1	30	0.067	1	30	0.067	1	30	0.134
17:00-18:00	1	30	0.033	1	30	0.033	1	30	0.066
18:00-19:00	1	30	0.000	1	30	0.033	1	30	0.033
19:00-20:00	0	0	0.000	0	0	0.000	0	0	0.000
20:00-21:00	0	0	0.000	0	0	0.000	0	0	0.000
21:00-22:00	0	0	0.000	0	0	0.000	0	0	0.000
22:00-23:00	0	0	0.000	0	0	0.000	0	0	0.000
23:00-24:00	0	0	0.000	0	0	0.000	0	0	0.000

This shows a daily trip rate of 1.667 trips per dwelling per day, with a peak hour traffic generation of 0.23 trips per dwelling between 2PM and 3PM.

TRICS ANALYSIS WEEKDAY - MULTIMODAL

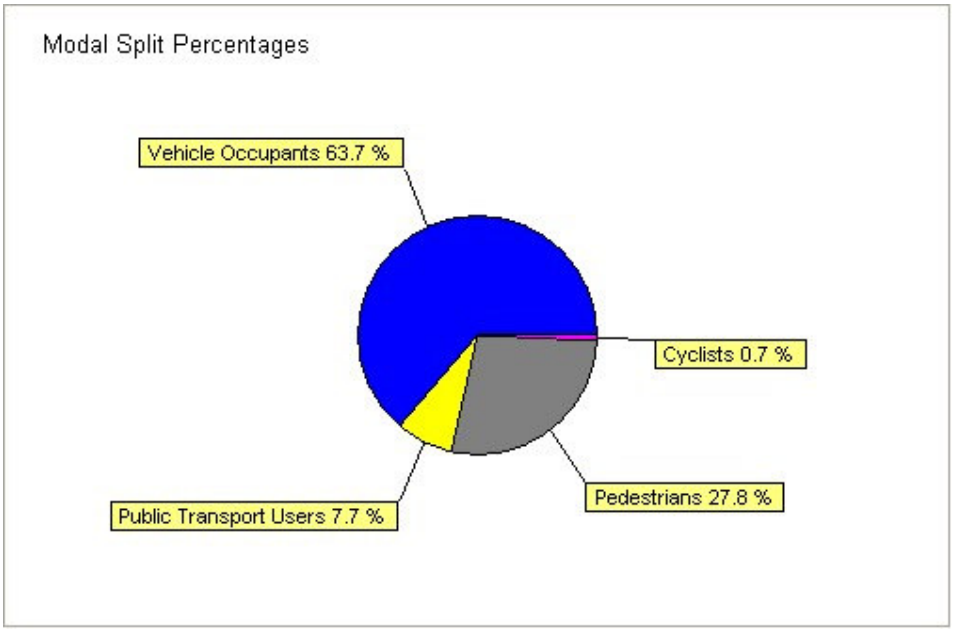
Retirement Flats

The TRICS database also includes a limited number of multimodal surveys and the data shows a surprisingly high volume of pedestrians (29.4%).

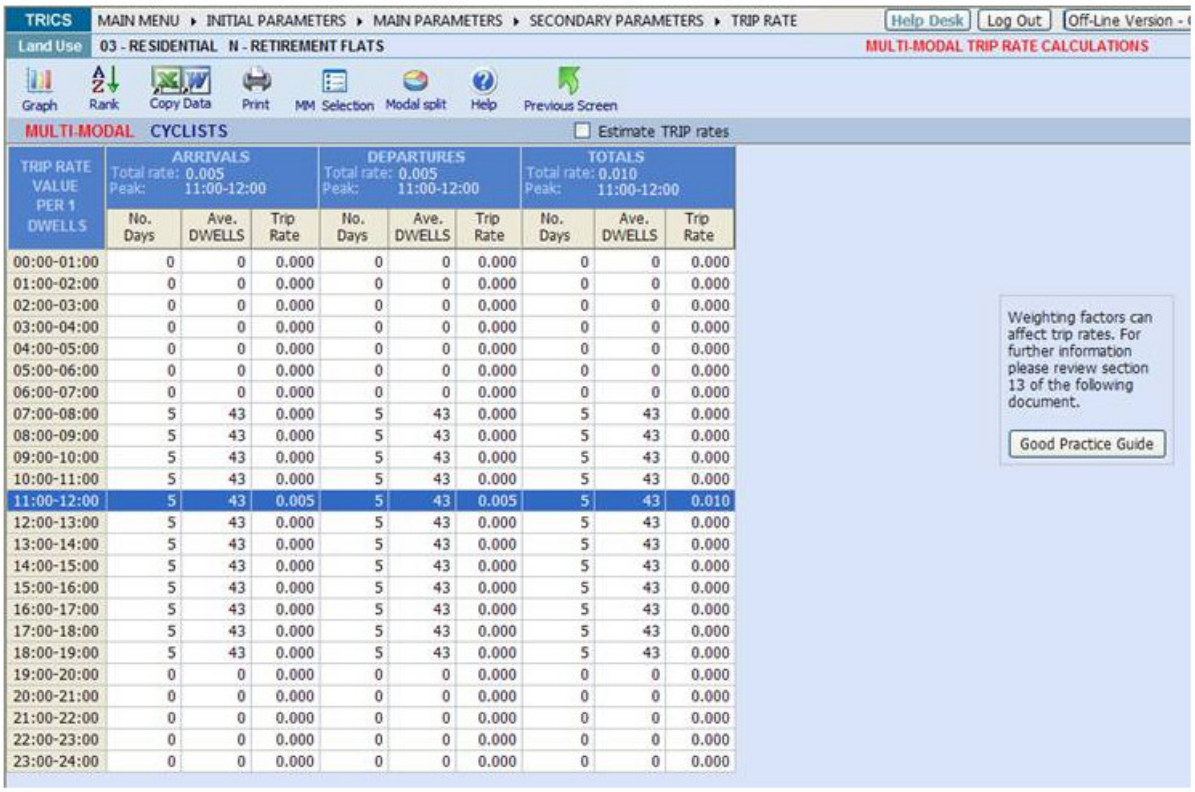


Sheltered Accommodation

This shows a similar high volume of pedestrians



In terms of cyclists, the cycle trip rate was calculated as 0.005 per dwelling in the only peak hour when cyclists were recorded. The first principles calculation suggests that this is a single cycle site visit during the survey period.

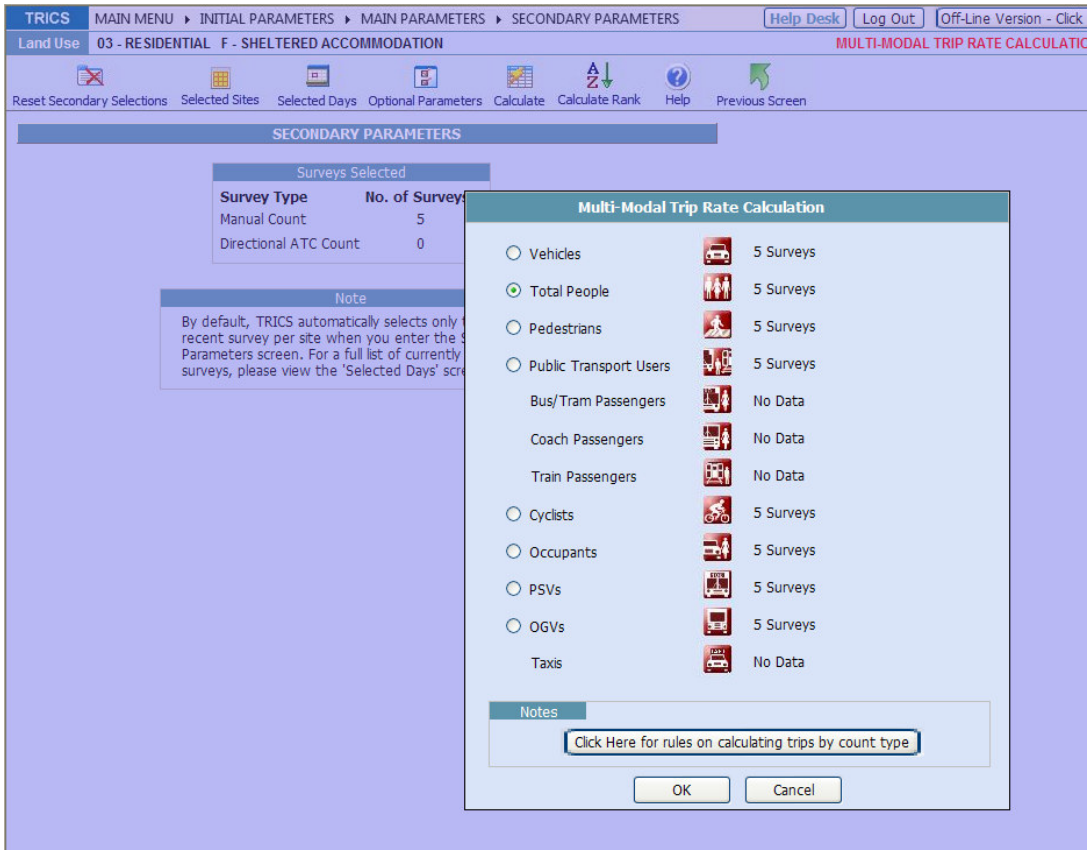


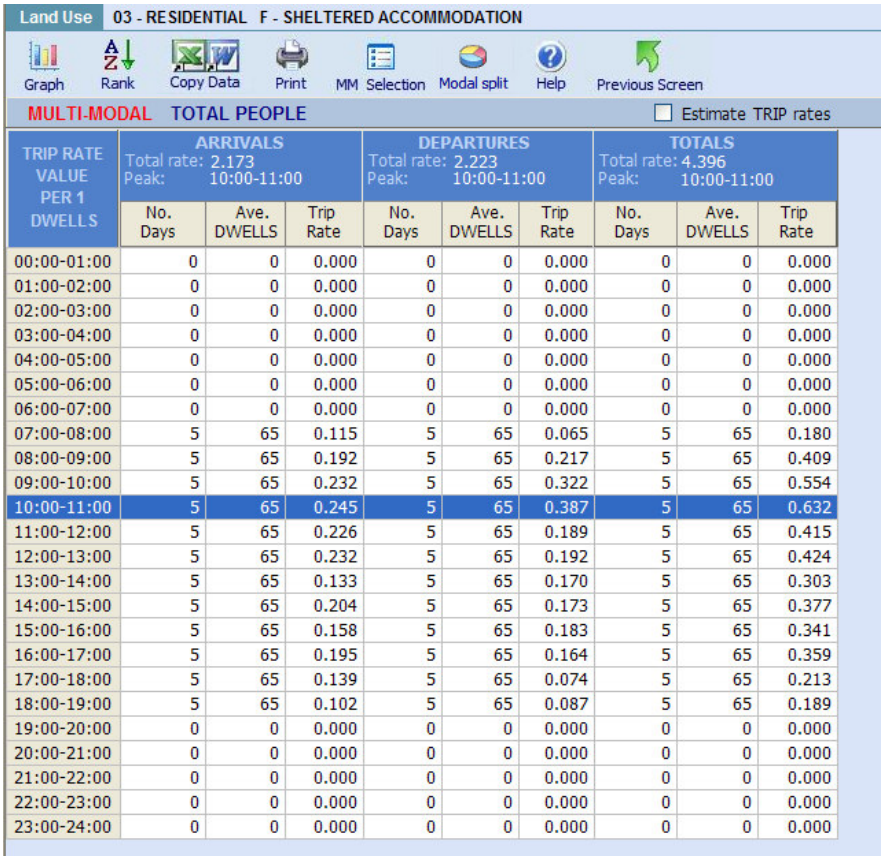
TRIP RATE VALUE PER 1 DWELLS	ARRIVALS Total rate: 0.005 Peak: 11:00-12:00			DEPARTURES Total rate: 0.005 Peak: 11:00-12:00			TOTALS Total rate: 0.010 Peak: 11:00-12:00		
	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00-01:00	0	0	0.000	0	0	0.000	0	0	0.000
01:00-02:00	0	0	0.000	0	0	0.000	0	0	0.000
02:00-03:00	0	0	0.000	0	0	0.000	0	0	0.000
03:00-04:00	0	0	0.000	0	0	0.000	0	0	0.000
04:00-05:00	0	0	0.000	0	0	0.000	0	0	0.000
05:00-06:00	0	0	0.000	0	0	0.000	0	0	0.000
06:00-07:00	0	0	0.000	0	0	0.000	0	0	0.000
07:00-08:00	5	43	0.000	5	43	0.000	5	43	0.000
08:00-09:00	5	43	0.000	5	43	0.000	5	43	0.000
09:00-10:00	5	43	0.000	5	43	0.000	5	43	0.000
10:00-11:00	5	43	0.000	5	43	0.000	5	43	0.000
11:00-12:00	5	43	0.005	5	43	0.005	5	43	0.010
12:00-13:00	5	43	0.000	5	43	0.000	5	43	0.000
13:00-14:00	5	43	0.000	5	43	0.000	5	43	0.000
14:00-15:00	5	43	0.000	5	43	0.000	5	43	0.000
15:00-16:00	5	43	0.000	5	43	0.000	5	43	0.000
16:00-17:00	5	43	0.000	5	43	0.000	5	43	0.000
17:00-18:00	5	43	0.000	5	43	0.000	5	43	0.000
18:00-19:00	5	43	0.000	5	43	0.000	5	43	0.000
19:00-20:00	0	0	0.000	0	0	0.000	0	0	0.000
20:00-21:00	0	0	0.000	0	0	0.000	0	0	0.000
21:00-22:00	0	0	0.000	0	0	0.000	0	0	0.000
22:00-23:00	0	0	0.000	0	0	0.000	0	0	0.000
23:00-24:00	0	0	0.000	0	0	0.000	0	0	0.000

Weighting factors can affect trip rates. For further information please review section 13 of the following document.

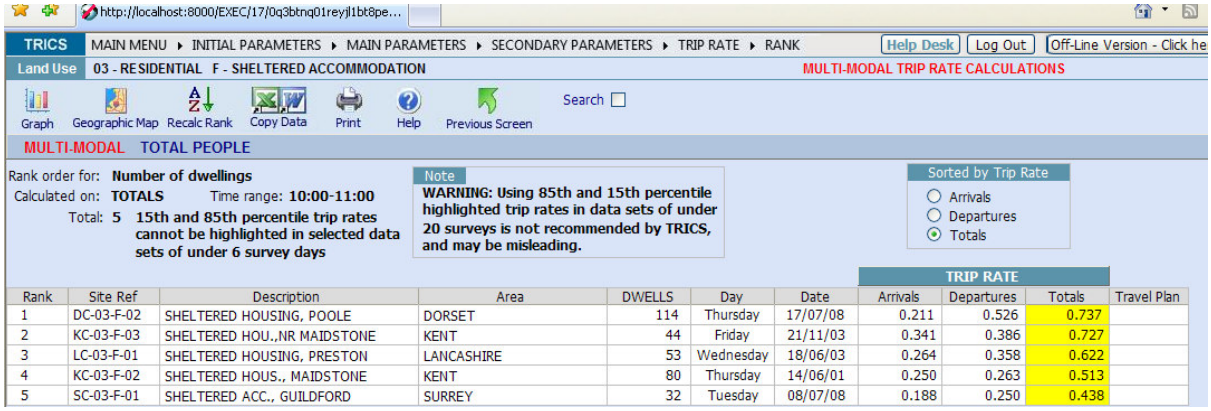
Good Practice Guide

Person trips - Sheltered Accommodation



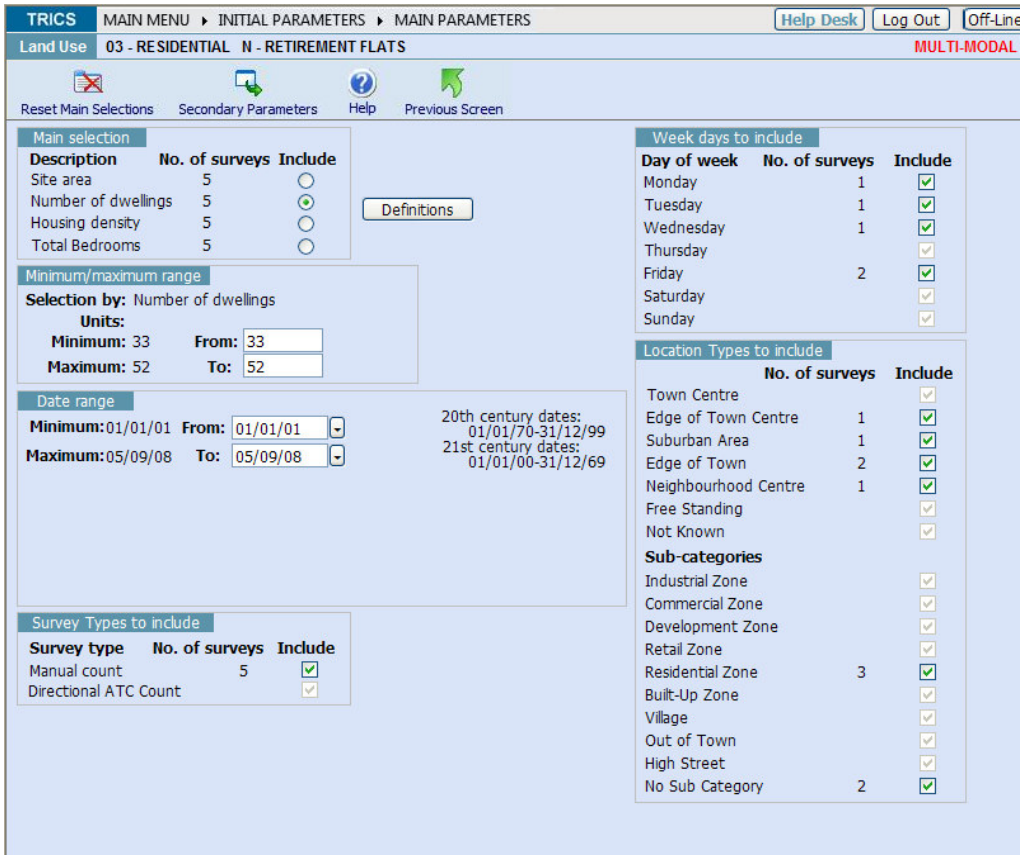


TRIP RATE VALUE PER 1 DWELLS	ARRIVALS Total rate: 2.173 Peak: 10:00-11:00			DEPARTURES Total rate: 2.223 Peak: 10:00-11:00			TOTALS Total rate: 4.396 Peak: 10:00-11:00		
	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00-01:00	0	0	0.000	0	0	0.000	0	0	0.000
01:00-02:00	0	0	0.000	0	0	0.000	0	0	0.000
02:00-03:00	0	0	0.000	0	0	0.000	0	0	0.000
03:00-04:00	0	0	0.000	0	0	0.000	0	0	0.000
04:00-05:00	0	0	0.000	0	0	0.000	0	0	0.000
05:00-06:00	0	0	0.000	0	0	0.000	0	0	0.000
06:00-07:00	0	0	0.000	0	0	0.000	0	0	0.000
07:00-08:00	5	65	0.115	5	65	0.065	5	65	0.180
08:00-09:00	5	65	0.192	5	65	0.217	5	65	0.409
09:00-10:00	5	65	0.232	5	65	0.322	5	65	0.554
10:00-11:00	5	65	0.245	5	65	0.387	5	65	0.632
11:00-12:00	5	65	0.226	5	65	0.189	5	65	0.415
12:00-13:00	5	65	0.232	5	65	0.192	5	65	0.424
13:00-14:00	5	65	0.133	5	65	0.170	5	65	0.303
14:00-15:00	5	65	0.204	5	65	0.173	5	65	0.377
15:00-16:00	5	65	0.158	5	65	0.183	5	65	0.341
16:00-17:00	5	65	0.195	5	65	0.164	5	65	0.359
17:00-18:00	5	65	0.139	5	65	0.074	5	65	0.213
18:00-19:00	5	65	0.102	5	65	0.087	5	65	0.189
19:00-20:00	0	0	0.000	0	0	0.000	0	0	0.000
20:00-21:00	0	0	0.000	0	0	0.000	0	0	0.000
21:00-22:00	0	0	0.000	0	0	0.000	0	0	0.000
22:00-23:00	0	0	0.000	0	0	0.000	0	0	0.000
23:00-24:00	0	0	0.000	0	0	0.000	0	0	0.000



This shows that whilst the daily number of person trips per one dwelling is 4.4 per unit the range of peak hourly trips varied between 0.44 and 0.74.

Person trips – Retirement Flats



TRICS ▸ MAIN MENU ▸ INITIAL PARAMETERS ▸ MAIN PARAMETERS ▸ SECONDARY PARAMETERS ▸ TRIP R

Land Use: 03 - RESIDENTIAL N - RETIREMENT FLATS

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MULTI-MODAL TOTAL PEOPLE — Estimate TRIP rates

TRIP RATE VALUE PER 1 DWELLS	ARRIVALS Total rate: 1.801 Peak: 13:00-14:00			DEPARTURES Total rate: 1.909 Peak: 11:00-12:00			TOTALS Total rate: 3.710 Peak: 11:00-12:00		
	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00-01:00	0	0	0.000	0	0	0.000	0	0	0.000
01:00-02:00	0	0	0.000	0	0	0.000	0	0	0.000
02:00-03:00	0	0	0.000	0	0	0.000	0	0	0.000
03:00-04:00	0	0	0.000	0	0	0.000	0	0	0.000
04:00-05:00	0	0	0.000	0	0	0.000	0	0	0.000
05:00-06:00	0	0	0.000	0	0	0.000	0	0	0.000
06:00-07:00	0	0	0.000	0	0	0.000	0	0	0.000
07:00-08:00	5	43	0.037	5	43	0.014	5	43	0.051
08:00-09:00	5	43	0.074	5	43	0.111	5	43	0.185
09:00-10:00	5	43	0.138	5	43	0.129	5	43	0.267
10:00-11:00	5	43	0.189	5	43	0.240	5	43	0.429
11:00-12:00	5	43	0.184	5	43	0.295	5	43	0.479
12:00-13:00	5	43	0.194	5	43	0.203	5	43	0.397
13:00-14:00	5	43	0.253	5	43	0.198	5	43	0.451
14:00-15:00	5	43	0.157	5	43	0.180	5	43	0.337
15:00-16:00	5	43	0.147	5	43	0.124	5	43	0.271
16:00-17:00	5	43	0.244	5	43	0.106	5	43	0.350
17:00-18:00	5	43	0.106	5	43	0.171	5	43	0.277
18:00-19:00	5	43	0.078	5	43	0.138	5	43	0.216
19:00-20:00	0	0	0.000	0	0	0.000	0	0	0.000
20:00-21:00	0	0	0.000	0	0	0.000	0	0	0.000
21:00-22:00	0	0	0.000	0	0	0.000	0	0	0.000
22:00-23:00	0	0	0.000	0	0	0.000	0	0	0.000
23:00-24:00	0	0	0.000	0	0	0.000	0	0	0.000

TRICS ▸ MAIN MENU ▸ INITIAL PARAMETERS ▸ MAIN PARAMETERS ▸ SECONDARY PARAMETERS ▸ TRIP RATE ▸ RANK | Help Desk | Log Out | Off-Line Version - Click here fo

Land Use: 03 - RESIDENTIAL N - RETIREMENT FLATS — MULTI-MODAL TRIP RATE CALCULATIONS

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MULTI-MODAL TOTAL PEOPLE

Rank order for: **Number of dwellings**
Calculated on: **TOTALS** Time range: **11:00-12:00**
Total: **5** **15th and 85th percentile trip rates cannot be highlighted in selected data sets of under 6 survey days**

Note: **WARNING: Using 85th and 15th percentile highlighted trip rates in data sets of under 20 surveys is not recommended by TRICS, and may be misleading.**

Sorted by Trip Rate: Arrivals / Departures / Totals

Rank	Site Ref	Description	Area	DWELLS	Day	Date	TRIP RATE Arrivals	Departures	Totals	Travel Plan
1	TW-03-N-01	RETIREMENT FLATS, N. SHIELDS	TYNE & WEAR	33	Monday	30/10/06	0.242	0.364	0.606	
2	PS-03-N-01	RETIREMENT FLATS, BRECON	POWYS	52	Friday	05/09/08	0.231	0.327	0.558	
3	CF-03-N-02	RETIREMENT FLATS, CARDIFF	CARDIFF	35	Friday	13/10/06	0.114	0.400	0.514	
4	CA-03-N-01	RETIREMENT FLATS, P.BORO	CAMBRIDGESHIRE	50	Wednesday	14/05/08	0.160	0.280	0.440	
5	GC-03-N-01	RETIREMENT FLATS, GLASGOW	GLASGOW CITY	47	Tuesday	10/06/08	0.170	0.149	0.319	

This shows that whilst the daily number of person trips per one dwelling is 3.7 trips per unit, the range of peak hourly trips varied between 0.32 and 0.61.