Trip Generation and Parking Demand Surveys of Shopping Centre

Analysis Report

September 2011

Prepared for

Roads and Traffic Authority

Halcrow

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This report has been issued and amended as follows:

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0	Draft for client review	23rd June 2011	KY	KJH
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1 Introduction

1.1 Study Brief/Outcomes

The RTA published its *Guide to Traffic Generating Developments* in the mid-1990s. As part of the studies supporting this, document, a number of shopping centres were the subject of detailed trip generation and parking studies in 1978 and again in 1990.

Since then there have been some recent changes to the type and operation of shopping centres and also ongoing societal and economic changes which collectively have the potential to impact on the relevance and reliability of the information in the *Guide to Traffic Generating Developments*. These include:

- Changes to retail trading hours in particular Sunday trading is now the norm rather than the exception;
- Changes to the size of the centres – many recent centres are much larger in terms of gross leasable floor area than their 1980's counterparts;
- Changing demographics – ageing population and smaller average household sizes;
- Changing uses in the shopping centre – many centres now include cinemas;
- Changing housing affordability – more expensive housing and rents causing some children to stay living in the family home for longer;
- Changes in car ownership as the real cost of new vehicles continues to fall and affluence generally increases;
- Recent evidence that higher fuel cost and the effect of tolls may be moderating the growth in vehicle travel; and
- Changing patterns of work and leisure, including the effects of flexible/extended working hours and part-time work, and the ongoing increase in the numbers of working women.

In response to these issues, RTA has sanctioned further trip generation and parking generation surveys within Sydney and NSW regional centres.

Consequently, Halcrow has been appointed to undertake a detailed analysis of shopping centres. The study includes new surveys to collect traffic characteristics relating to vehicles and person trips as well as interview surveys with visitors and staff to determine origin postcodes and travel mode.

The results from these surveys are then compared with similar data available from the other Australian road / planning agencies and various overseas organisations to assess the relevance and applicability of that data for use in the local context.

1.2 Approach

The approach to this generation study and the tasks involved are described below:

- Undertake detailed site assessments of shopping centre sites, contacting the development managers and occupiers to obtain comprehensive information including gross floor area (GFA), gross leasable floor area (GLFA) by retail categories, number of employees, access to public transport and trading hours;
- Arrange traffic surveys on Thursday, Friday, Saturday and Sunday at all sites. The surveys were generally undertaken from an hour before until the hour after the operating times of the main shopping centres (N.B some centres has supermarkets which remained open after the majority of the centre had closed). The survey data includes vehicle counts, person counts, parking accumulation counts and interview surveys.
- Where no existing/suitable RTA data was available, automatic traffic counters were placed on adjacent major roads to determine the network morning and evening peak hour periods.
- Undertake multiple linear regression analysis of a number of key variables as functions of various sub-categories of GLFA. Undertake linear regression analysis of the various visitation statistics as functions of single key variables.
- Compare these relationships with similar trip generation and parking demand information for this land use currently available from other sources, as a means of assessing the relevance of this data for use in the NSW context.
- Prepare an analysis report, which contains the analysis covering all of the calculations and comparisons.
- Prepare a data report, which contains the raw data from the surveys and other data such as site plans.

1.3 Report Structure

The remainder of this analysis report is set out as follows:

- Chapter 2 contains a description of the survey and the selected sites;
- Chapter 3 presents the survey results;
- Chapter 4 presents the regression analysis;
- Chapter 5 compares the NSW survey results with other country's databases such as TRICS (United Kingdom), NZTDB (New Zealand) and ITE (United States); and
- Chapter 6 presents the summary of this investigation.

2 Survey Methodology

2.1 Selected Sites

A total of ten shopping centres have been nominated by RTA to undertake the surveys. The selected sites have the following attributes:

- a range of construction dates;
- on-site parking provision;
- ease in isolating the site from other developments (office, residential, etc) for survey purposes and collecting the required trip information;
- reasonable geographic spread;
- a range of sizes; and
- a range of accessibility to public transport.

The list of selected sites is shown in Table 2.1.

Table 2.1 – Survey Site List

Site ID	Shopping Centre Name
SC1	Centro Roselands
SC2	Burwood Westfield
SC3	Liverpool Westfield
SC4	Penrith Plaza Westfield
SC5	Stockland Wetherill Park Shopping Centre (Prairiewood)
SC6	Rouse Hill Town Centre (GPT)
SC7	Centro Warriewood
SC8	Highlands Marketplace (Mittagong)
SC9	Stockland Shellharbour
SC10	Tuggerah Westfield

Site locations are also graphically presented in **Figure 2.1** and **Figure 2.2**, for Sydney and Regional sites, respectively.

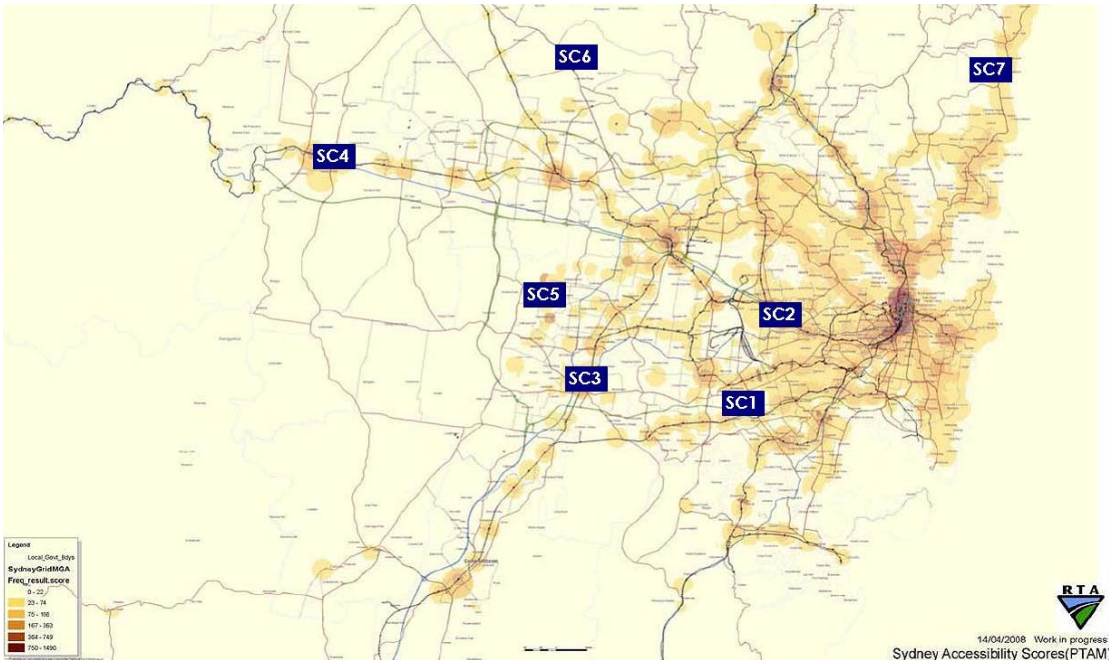

Figure 2.1 – Site Locations (Sydney Sites)

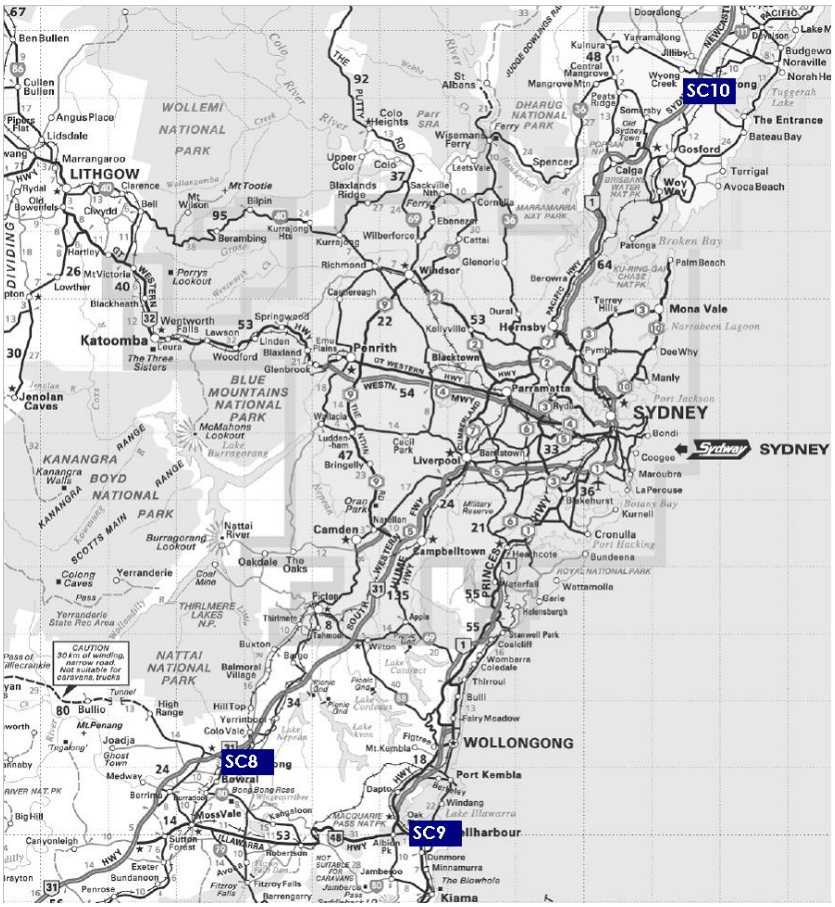

Figure 2.2 – Site Locations (Regional Sites)

The details of the selected sites are summarised in Table 2.2. It should be noted that the floor area is measured in Gross Leasable Floor Area (GLFA).

2.2 Survey Process

The surveys were undertaken between November 2010 and May 2011 outside of school holidays and public holidays. The surveys were conducted over four days, that is on a Thursday, Friday, Saturday and Sunday at all sites. The surveys were generally undertaken from an hour before until an hour after the opening hours of the shopping centres.

In general, the selected shopping centres have the following store opening hours:

- Monday, Tuesday, Wednesday and Friday – 9AM-5:30PM;
- Thursday – 9AM-9PM;
- Saturday – 9AM-5PM; and
- Sunday – 10AM-4PM.

Vehicle and pedestrian counts were undertaken around the perimeter of the shopping centres to record the number of vehicles, pedestrians and cyclists entering and exiting the site.

Interview surveys were also conducted throughout the store opening hours. The purpose of these interviews was to establish the following facts:

- Staff and customers' origin postcodes;
- Mode of travel;
- Proportion of persons who work in the centre versus customers; and
- Trip purpose such as sole purpose trip or linked trip.

Most of the shopping centre information, including the owner of the centre, principal tenants by area and parking spaces has been adopted from the *NSW/ACT Shopping Centre Directory 2009*. However, the centre management were also consulted for further information such as the employee numbers and the gross floor area of the centre.

Table 2.2 – Details of Selected Sites

Site ID	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Network Peak Hours										
Year	2008	2011	2008	2009	2011	2008	2008	2008	2000	2004
AM Peak - Weekdays	7-8AM	8-9AM	8-9AM	8-9AM	8-9AM	8-9AM	8-9AM	9-10AM	8-9AM	8-9AM
PM Peak - Weekdays	5-6PM	3-4PM	4-5PM	4-5PM	5-6PM	5-6PM	5-6PM	4-5PM	3-4PM	3-4PM
Peak - Weekends	1-2PM	10-11AM	1-2PM	12-1PM	12-1PM	12-1PM	12-1PM	1-2PM	11AM-12PM	11AM-12PM
Site Details - Shopping Centre										
Gross Leasable Floor Area (m^2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Year Constructed	1965	1966	1972	1971	1983	2008	1980	2007	1982	1995
Busy Peak Period	Saturday Midday	Saturday PM	Saturday Midday	Saturday Midday	Saturday Midday	Sunday Midday	Saturday Midday	Saturday Midday	Saturday Midday	Saturday Midday
Accessibility Score	40	233	268	200	96	184	64	22	67	105
Opening Hours										
Mon, Tue, Wed & Fri	9AM - 5:30PM	9AM - 5:30PM	9AM - 5:30PM	9AM - 5:30PM	9AM - 5:30PM	9AM - 5:30PM	9AM - 5:30PM	9AM - 5:30PM	9AM - 5:30PM	9AM - 5:30PM
Thu	9AM - 9PM	9AM - 9PM	9AM - 9PM	9AM - 9PM	9AM - 9PM	9AM - 9PM	9AM - 9PM	9AM - 9PM	9AM - 9PM	9AM - 9PM
Sat	9AM - 4PM	9AM - 5PM	9AM - 5PM	9AM - 5PM	9AM - 5PM	9AM - 5PM	9AM - 4PM	9AM - 5PM	9AM - 4PM	9AM - 5PM
Sun	10AM - 4PM	10AM - 5PM	10AM - 5PM	10AM - 4PM	10AM - 4PM	10AM - 5PM	10AM - 4PM	10AM - 4PM	10AM - 4PM	10AM - 4PM
Parking Spaces										
Customer	2,539	2,972	2,893	3,382	1,467	2,470	986	727	1,668	3,187
Disabled	67	38	78	60	35	75	18	16	44	66
Staff	140	-	514	-	369	553	-	5	-	-
Loading Bay/Reserved	90	23	29	110	15	38	20	16	12	4
Total	2,836	3,033	3,514	3,552	1,886	3,136	1,024	764	1,724	3,257
Survey Information										
Date of survey - Weekdays	25 & 26/11/10	24 & 25/03/11	19 & 20/05/11	7 & 8/04/11	28 & 29/04/11	17 & 18/03/11	3 & 4/03/11	10 & 11/03/11	5 & 6/05/11	12 & 13/05/11
- Weather	-	Sunny	Sunny	Sunny	Cloudy/Rain	Sunny/Cloudy	Sunny	Cloudy	Sunny	Sunny
Date of survey - Weekends	27 & 28/11/10	26 & 27/03/11	21 & 22/05/11	9 & 10/04/11	30/04 & 1/05/11	19 & 20/03/11	5 & 6/03/11	12 & 13/03/11	7 & 8/05/11	14 & 15/05/11
- Weather	-	Cloudy/Shower	Sunny	Sunny	Cloudy/Rain	Cloudy/Rain	Sunny	Cloudy/Rain	Sunny	Sunny

2.3 Data Recorded

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

- Number of vehicles parked on site at the commencement of the survey;
- Number of vehicles and the number of occupants in each vehicle entering and leaving the parking areas and loading docks;
- Number of pedestrians/cyclists entering and leaving via the pedestrian access points of the building;
- Customers/staff origin postcode (sample interview survey);
- Travel mode of customers/staff (sample interview survey);
- Number of customers or staff (sample interview survey);
- Trip purpose such as sole purpose or linked trips (sample interview survey); and
- Number of vehicles parked on site at the completion of the survey.

The collected information would help establish person trips, vehicle trips and parking accumulation.

Hourly traffic volumes on the principal frontage access road were also collected to determine background peak hours using either automatic traffic counters or existing RTA count station.

The survey data and key statistics and ratios for all survey sites are also presented in **Appendix A**.

3 Survey Analysis

3.1 Key Statistics

The survey data was analysed to determine the following key statistics:

Person-based:

- Daily Person Trips (ie inward trips + outgoing trips, 'Car-based' and 'Other');
- Average Person Trips;
- Peak Person Trips;
- Person Trips in the AM and PM peak (ie the number of person trips in the morning and afternoon 1-hour peak vehicle trip periods);
- Peak Vehicle-Hour Person Trips (ie the number of person trips in the overall hour of peak vehicle trips); and
- Mode split percentages from the sample questionnaire.

Vehicle-based:

Two distinct periods of traffic generation are considered, which are the peak activity time of the development itself; and the peak activity times of the adjacent road network serving the development.

- Daily Vehicle Trips (ie inward trips + outgoing trips);
- Peak Vehicle Trips;
- Peak Vehicle Trips in the AM and PM peak;
- Peak Parking Accumulation;
- Average Vehicle Occupancy of all cars which entered the building during the survey period (during both the AM and PM peak hours, and also averaged over the full survey period); and
- Bicycle Parking Accumulation.

3.2 Key Variables

The trip and parking generation rates could be derived from the following key variables:

- Gross Leasable Floor Area (GLFA);
- Gross Floor Area (GFA);
- Number of employees;
- Number of parking spaces; and
- Accessibility Score.

3.2.1 Gross Leasable Floor Area (GLFA)

The gross leasable floor area (GLFA) is considered to be the most reliable variable to choose since this information is well documented in *NSW/ACT Shopping Centre Directory* and reviewed/updated by the Property Council of Australia.

According to the RTA's *Guide to Traffic Generating Developments*, the division of the floor area into retail categories improves the accuracy of prediction.

Five retail categories were adopted in the RTA's Guide including A(S) slow trade, A(F) faster trade, A(SM) supermarket, A(SS) specialty shops/secondary retail and A(OM) office/medical.

However in light of this new trip generation study, it is considered necessary to update the previously adopted retail categories. After discussions with RTA Project Manager, it has been agreed to include a new category, A(C) cinemas, which is an integral part of the modern shopping centres. A detailed description of the revised retail categories is listed below:

- A(S): Slow trade includes major department stores such as David Jones and Myer, furniture, electrical and whitegood stores.
- A(F): Faster trade includes discount department stores such as K-Mart and Target, together with larger specialist stores, eg Lowes, Lincraft, etc.
- A(SM): Supermarket includes stores such as Woolworths, Coles, IGA, Franklins and large fruit markets.

- A(SS): Specialty shops / Secondary retail / Automobile services includes smaller retail outlets (eg clothing, jewellery, hairdressers, footwear, fast food, delicatessens, newsagents, sports stores, chemists, service stations, etc)
- A(OM): Office / Medical / Child care / Other including medical centres, general business offices, child care, library, etc.
- A(C): Cinemas

The GLFA's for six retail categories described above is used as functions of the multiple principal independent variables in multiple regression analysis.

3.2.2 Gross Floor Area (GFA)

Gross floor area by definition is the sum of the areas of each floor where the area of each floor is taken to be the area within the outer face of the external enclosing walls excluding columns, lifts, machinery/plant rooms, storages and etc.

However, this information was not readily available from the centre management and hence only a few centre managers provided this information.

3.2.3 Number of employees

The number of staff generally relates to popularity of the shopping centre. However, this information was not readily available from the centre management as it has no control over the number of staff for the individual tenants. Some rough estimates of employee numbers were provided by the centre managers.

3.2.4 Number of parking spaces

In most cases, the number of parking spaces provided on a site would have been determined at development application stage and invariably, this is based upon the floor area of the shopping centre.

3.2.5 Accessibility Score

The Accessibility Score has two components – a public transport proximity score and a centre proximity score. It can be used to determine the extent to which parking supply can be modified for a particular land use.

3.3 Trip Rates

The summary of the survey data for each of the selected sites is shown in the Table 3.1 to Table 3.4 for Thursdays to Sundays. The results indicated that the peak parking demand at some of the sites exceeded its parking provision (i.e. percentage parking capacity of more than 100%). This effect is probably caused by vehicles circulating within the shopping centre car park.

Using the trips summarised in Table 3.1 to Table 3.4 and the gross leasable floor area (GLFA) for each site, the trip generation rates for each selected sites are derived.

Table 3.5 to Table 3.8 present the person and vehicle based trip generation rates per $100m^2$ GLFA for Thursdays to Sundays.

Table 3.9 and Table 3.10 show the comparison of trip rates for all four surveyed days for person and vehicle trips, respectively. The trip rates summary showing the minimum, maximum and average person and vehicle trip rates separated into two groups, that is Sydney Metropolitan and Regional sites are also presented in Table 3.11.

The following figures show the trip variances over the four surveyed days at each site:

- Figure 3.1 – Comparison of Daily Person Trips/$100m^2$ GLFA;
- Figure 3.2 – Comparison of Daily Vehicle Trips/$100m^2$ GLFA;
- Figure 3.3 – Comparison of Peak Hour Person Trips/$100m^2$ GLFA; and
- Figure 3.4 – Comparison of Peak Hour Vehicle Trips/$100m^2$ GLFA.

Table 3.12 also presents the trip generation rates per parking space provided at each of the shopping centres.

Table 3.1 – Survey Results Summary (Thursday)

Site ID	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Total GLFA (m^2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Person-based Trips										
Daily Person Trips										
- Car-based	38,931	31,525	43,304	52,254	41,868	41,708	17,523	13,535	35,066	50,093
- Other	4,679	35,546	43,923	41,321	6,003	4,808	1,039	697	1,855	3,131
- Total	43,610	67,071	87,227	93,575	47,871	46,516	18,562	14,232	36,921	53,224
Average Person Trips	3,355	4,791	6,231	6,684	3,419	3,323	1,326	1,017	2,840	3,802
Peak Person Trips	4,082	6,317	7,744	8,708	4,137	5,231	1,968	1,526	3,447	4,800
Peak Vehicle-Hour Person Trips	4,082	5,515	7,198	8,708	4,137	5,231	1,968	1,522	3,109	4,508
Peak Network Hour Person Trips										
- AM Peak	1,692	1,934	3,616	5,635	2,188	1,469	689	904	2,431	2,258
- PM Peak	3,823	4,892	6,606	8,414	4,048	4,769	1,683	1,465	3,171	4,508
Mode Split (%)										
- Car as Driver	73%	41%	61%	55%	65%	75%	80%	82%	76%	64%
- Car as Passenger	13%	10%	19%	28%	14%	12%	9%	10%	15%	22%
- Train	1%	17%	3%	14%	1%	0%	2%	1%	0%	2%
- Bus	6%	16%	5%	1%	7%	8%	4%	0%	5%	12%
- Cycle	0%	0%	1%	1%	1%	0%	1%	0%	0%	1%
- On Foot	8%	16%	11%	1%	13%	5%	3%	8%	4%	0%
Vehicle-based Trips										
Daily Vehicle Trips	26,877	21,574	26,890	34,320	30,031	29,130	13,197	9,435	22,568	33,924
Peak Vehicle Trips	2,396	1,964	2,466	3,246	2,598	3,034	1,330	966	2,155	3,044
Peak Network Hour Vehicle Trips										
- AM Peak	1,133	611	922	2,127	1,439	986	495	635	1,667	1,632
- PM Peak	2,285	1,628	2,020	3,140	2,476	2,879	1,150	897	2,021	2,884
Peak Parking Accumulation	2,340	1,744	2,721	3,560	1,875	2,433	864	494	1,926	3,510
- % Parking Capacity	82%	57%	77%	100%	99%	77%	80%	65%	112%	108%
Average Vehicle Occupancy										
- AM Peak	1.27	1.21	1.30	1.38	1.20	1.17	1.21	1.37	1.42	1.35
- PM Peak	1.53	1.35	1.58	1.48	1.56	1.51	1.38	1.60	1.50	1.48
- Average over the Day	1.44	1.47	1.58	1.41	1.43	1.43	1.32	1.43	1.54	1.48
Bicycle Parking Accumulation	5	0	6	0	3	9	10	4	10	2

Table 3.2 – Survey Results Summary (Friday)

Site ID	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Total GLFA (m^2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Person-based Trips										
Daily Person Trips										
- Car-based	28,711	21,202	29,177	33,532	30,769	26,988	15,167	12,139	27,355	39,747
- Other	3,819	25,833	31,648	28,505	4,651	3,098	766	587	1,246	2,014
- Total	32,530	47,035	60,825	62,037	35,420	30,086	15,933	12,726	28,601	41,761
Average Person Trips	3,253	4,704	6,083	6,204	3,542	3,009	1,448	1,229	2,820	3,796
Peak Person Trips	3,972	6,293	8,146	8,822	4,756	3,950	1,922	1,621	3,603	4,696
Peak Vehicle-Hour Person Trips	3,937	6,293	6,889	8,822	4,568	3,950	1,763	1,621	3,175	4,525
Peak Network Hour Person Trips										
- AM Peak	1,582	2,214	3,088	4,511	1,757	1,391	720	1,016	1,486	2,044
- PM Peak	2,651	5,245	5,517	7,005	4,619	3,928	1,328	1,599	3,296	4,690
Mode Split (%)										
- Car as Driver	89%	48%	56%	56%	65%	68%	84%	86%	76%	71%
- Car as Passenger	3%	8%	7%	26%	21%	15%	11%	8%	11%	18%
- Train	0%	21%	14%	14%	0%	1%	0%	2%	1%	2%
- Bus	5%	12%	14%	3%	6%	10%	3%	2%	5%	5%
- Cycle	0%	1%	0%	0%	0%	2%	0%	2%	0%	0%
- On Foot	2%	10%	9%	1%	8%	4%	3%	1%	7%	4%
Vehicle-based Trips										
Daily Vehicle Trips	20,550	15,043	19,467	23,827	22,549	19,984	11,275	8,628	18,898	27,938
Peak Vehicle Trips	2,461	1,951	2,587	3,268	2,851	2,507	1,306	1,044	2,361	3,076
Peak Network Hour Vehicle Trips										
- AM Peak	1,011	624	945	1,542	933	944	535	730	1,070	1,482
- PM Peak	1,650	1,688	1,777	2,734	2,738	2,488	885	997	2,138	3,076
Peak Parking Accumulation	2,172	1,782	2,459	2,737	1,855	2,258	829	493	1,910	3,266
- % Parking Capacity	76%	59%	70%	77%	98%	71%	77%	65%	111%	100%
Average Vehicle Occupancy										
- AM Peak	1.26	1.25	1.27	1.40	1.26	1.18	1.24	1.37	1.33	1.31
- PM Peak	1.43	1.41	1.44	1.41	1.56	1.47	1.35	1.54	1.52	1.44
- Average over the Day	1.38	1.44	1.47	1.40	1.38	1.34	1.35	1.42	1.46	1.42
Bicycle Parking Accumulation	5	0	1	4	3	9	5	1	15	4

Table 3.3 – Survey Results Summary (Saturday)

Site ID	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Total GLFA (m^2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Person-based Trips										
Daily Person Trips										
- Car-based	36,474	31,738	39,843	44,515	37,208	45,136	17,745	13,466	34,198	46,085
- Other	5,140	27,297	30,675	24,591	3,193	3,106	712	885	1,274	1,859
- Total	41,614	59,035	70,518	69,106	40,401	48,242	18,457	14,351	35,472	47,944
Average Person Trips	4,161	5,904	7,052	6,282	4,040	4,824	2,051	1,435	3,941	4,359
Peak Person Trips	5,669	8,035	9,838	9,829	5,189	6,929	2,715	2,181	5,302	6,268
Peak Vehicle-Hour Person Trips	5,669	7,316	9,495	9,511	5,189	6,929	2,715	2,181	5,276	6,170
Peak Network Hour Person Trips	5,059	5,402	9,490	9,348	5,189	6,929	2,708	1,988	5,195	5,964
Mode Split (%)										
- Car as Driver	83%	52%	58%	71%	72%	74%	67%	88%	77%	68%
- Car as Passenger	8%	15%	13%	10%	20%	10%	17%	8%	14%	23%
- Train	0%	12%	20%	8%	0%	0%	1%	1%	0%	4%
- Bus	2%	7%	2%	9%	4%	9%	10%	0%	1%	2%
- Cycle	0%	0%	0%	1%	0%	0%	1%	0%	0%	0%
- On Foot	7%	14%	7%	2%	4%	8%	4%	3%	8%	2%
Vehicle-based Trips										
Daily Vehicle Trips	22,849	18,441	21,846	26,122	23,388	27,167	10,986	7,804	19,941	26,431
Peak Vehicle Trips	3,107	2,391	2,878	3,567	2,911	3,864	1,551	1,163	2,888	3,356
Peak Network Hour Vehicle Trips	2,723	1,886	2,770	3,435	2,911	3,864	1,534	1,071	2,867	3,282
Peak Parking Accumulation	2,182	2,326	3,020	3,126	2,314	3,468	1,167	581	1,934	3,280
- % Parking Capacity	77%	77%	86%	88%	123%	110%	108%	76%	112%	101%
Average Vehicle Occupancy										
- Peak Hour	1.66	1.73	1.94	1.72	1.75	1.71	1.68	1.78	1.75	1.81
- Average over the Day	1.57	1.74	1.81	1.70	1.62	1.63	1.60	1.75	1.71	1.75
Bicycle Parking Accumulation	5	1	1	2	12	14	7	2	8	5

Table 3.4 – Survey Results Summary (Sunday)

Site ID	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Total GLFA (m^2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Person-based Trips										
Daily Person Trips										
- Car-based	31,934	32,264	32,889	33,515	29,378	42,087	14,195	10,668	18,917	39,239
- Other	1,775	21,165	23,315	15,505	2,410	2,999	812	818	684	1,086
- Total	33,709	53,429	56,204	49,020	31,788	45,086	15,007	11,486	19,601	40,325
Average Person Trips	4,214	5,937	6,245	5,447	3,532	5,010	1,876	1,436	2,450	4,033
Peak Person Trips	5,285	7,892	8,903	8,044	4,823	7,010	2,433	1,942	3,216	6,199
Peak Vehicle-Hour Person Trips	5,232	7,892	8,903	8,044	4,823	7,001	2,433	1,942	3,093	6,123
Peak Network Hour Person Trips	5,232	5,629	8,888	8,034	4,640	6,187	2,110	1,671	3,208	5,464
Mode Split (%)										
- Car as Driver	92%	58%	67%	69%	71%	72%	74%	82%	83%	75%
- Car as Passenger	0%	19%	11%	13%	17%	17%	15%	11%	13%	23%
- Train	0%	7%	3%	7%	0%	1%	0%	1%	0%	2%
- Bus	1%	4%	10%	3%	3%	4%	4%	0%	1%	0%
- Cycle	0%	0%	1%	0%	0%	1%	1%	1%	0%	0%
- On Foot	7%	12%	8%	8%	8%	5%	6%	4%	4%	0%
Vehicle-based Trips										
Daily Vehicle Trips	18,829	17,119	16,631	19,239	17,319	22,609	8,732	6,186	10,300	21,548
Peak Vehicle Trips	2,945	2,587	2,564	3,134	2,535	3,453	1,385	1,027	1,675	3,277
Peak Network Hour Vehicle Trips	2,945	1,922	2,522	3,041	2,478	2,969	1,236	875	1,675	2,888
Peak Parking Accumulation	2,016	2,392	2,654	2,667	2,146	2,770	875	436	1,143	2,900
- % Parking Capacity	71%	79%	76%	75%	114%	88%	81%	57%	66%	89%
Average Vehicle Occupancy										
- Peak Hour	1.71	1.89	2.11	1.77	1.78	1.83	1.58	1.82	1.90	1.86
- Average over the Day	1.64	1.88	1.96	1.76	1.74	1.82	1.60	1.78	1.84	1.83
Bicycle Parking Accumulation	6	0	5	0	4	7	9	2	9	6

Table 3.5 – Trip Rates per 100m^2 GLFA (Thursday)

Trips/100m^2 GLFA	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Person-based Trips										
Daily Person Trips										
- Car-based	63.38	49.72	47.53	52.18	83.91	60.45	79.14	87.03	85.44	57.47
- Other	7.62	56.06	48.21	41.27	12.03	6.97	4.69	4.48	4.52	3.59
- Total	71.00	105.78	95.73	93.45	95.94	67.41	83.83	91.51	89.96	61.06
Average Person Trips (per Hour)	5.46	7.56	6.84	6.68	6.85	4.82	5.99	6.54	6.92	4.36
Peak Person Trips (per Hour)	6.65	9.96	8.50	8.70	8.29	7.58	8.89	9.81	8.40	5.51
Peak Vehicle-Hour Person Trips	6.65	8.70	7.90	8.70	8.29	7.58	8.89	9.79	7.58	5.17
Peak Network Hour Person Trips										
- AM Peak	2.75	3.05	3.97	5.63	4.38	2.13	3.11	5.81	5.92	2.59
- PM Peak	6.22	7.72	7.25	8.40	8.11	6.91	7.60	9.42	7.73	5.17
Vehicle-based Trips										
Daily Vehicle Trips	43.76	34.03	29.51	34.27	60.18	42.22	59.60	60.67	54.99	38.92
Peak Vehicle Trips (per Hour)	3.90	3.10	2.71	3.24	5.21	4.40	6.01	6.21	5.25	3.49
Peak Network Hour Vehicle Trips										
- AM Peak	1.84	0.96	1.01	2.12	2.88	1.43	2.24	4.08	4.06	1.87
- PM Peak	3.72	2.57	2.22	3.14	4.96	4.17	5.19	5.77	4.92	3.31

Table 3.6 – Trip Rates per 100m^2 GLFA (Friday)

Trips/100m^2 GLFA	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Person-based Trips										
Daily Person Trips										
- Car-based	46.74	33.44	32.02	33.49	61.66	39.11	68.50	78.05	66.65	45.60
- Other	6.22	40.74	34.73	28.47	9.32	4.49	3.46	3.77	3.04	2.31
- Total	52.96	74.18	66.76	61.95	70.98	43.60	71.96	81.83	69.69	47.91
Average Person Trips (per Hour)	5.30	7.42	6.68	6.20	7.10	4.36	6.54	7.90	6.87	4.36
Peak Person Trips (per Hour)	6.47	9.93	8.94	8.81	9.53	5.72	8.68	10.42	8.78	5.39
Peak Vehicle-Hour Person Trips	6.41	9.93	7.56	8.81	9.15	5.72	7.96	10.42	7.74	5.19
Peak Network Hour Person Trips										
- AM Peak	2.58	3.49	3.39	4.50	3.52	2.02	3.25	6.53	3.62	2.35
- PM Peak	4.32	8.27	6.05	7.00	9.26	5.69	6.00	10.28	8.03	5.38
Vehicle-based Trips										
Daily Vehicle Trips	33.46	23.73	21.37	23.80	45.19	28.96	50.92	55.48	46.05	32.05
Peak Vehicle Trips (per Hour)	4.01	3.08	2.84	3.26	5.71	3.63	5.90	6.71	5.75	3.53
Peak Network Hour Vehicle Trips										
- AM Peak	1.65	0.98	1.04	1.54	1.87	1.37	2.42	4.69	2.61	1.70
- PM Peak	2.69	2.66	1.95	2.73	5.49	3.61	4.00	6.41	5.21	3.53

Table 3.7 – Trip Rates per 100m^2 GLFA (Saturday)

Trips/100m^2 GLFA	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Person-based Trips										
Daily Person Trips										
- Car-based	59.38	50.06	43.73	44.46	74.57	65.41	80.14	86.59	83.33	52.87
- Other	8.37	43.05	33.67	24.56	6.40	4.50	3.22	5.69	3.10	2.13
- Total	67.75	93.11	77.39	69.01	80.97	69.92	83.35	92.28	86.43	55.01
Average Person Trips (per Hour)	6.77	9.31	7.74	6.27	8.10	6.99	9.26	9.23	9.60	5.00
Peak Person Trips (per Hour)	9.23	12.67	10.80	9.82	10.40	10.04	12.26	14.02	12.92	7.19
Peak Vehicle-Hour Person Trips	9.23	11.54	10.42	9.50	10.40	10.04	12.26	14.02	12.86	7.08
Peak Network Hour Person Trips	8.24	8.52	10.42	9.34	10.40	10.04	12.23	12.78	12.66	6.84
Vehicle-based Trips										
Daily Vehicle Trips	37.20	29.08	23.98	26.09	46.87	39.37	49.61	50.18	48.59	30.32
Peak Vehicle Trips (per Hour)	5.06	3.77	3.16	3.56	5.83	5.60	7.00	7.48	7.04	3.85
Peak Network Hour Vehicle Trips	4.43	2.97	3.04	3.43	5.83	5.60	6.93	6.89	6.99	3.77

Table 3.8 – Trip Rates per 100m^2 GLFA (Sunday)

Trips/100m^2 GLFA	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Person-based Trips										
Daily Person Trips										
- Car-based	51.99	50.89	36.10	33.47	58.88	61.00	64.11	68.60	46.09	45.02
- Other	2.89	33.38	25.59	15.48	4.83	4.35	3.67	5.26	1.67	1.25
- Total	54.88	84.27	61.68	48.95	63.71	65.34	67.77	73.86	47.76	46.26
Average Person Trips (per Hour)	6.86	9.36	6.85	5.44	7.08	7.26	8.47	9.23	5.97	4.63
Peak Person Trips (per Hour)	8.60	12.45	9.77	8.03	9.67	10.16	10.99	12.49	7.84	7.11
Peak Vehicle-Hour Person Trips	8.52	12.45	9.77	8.03	9.67	10.15	10.99	12.49	7.54	7.02
Peak Network Hour Person Trips	8.52	8.88	9.75	8.02	9.30	8.97	9.53	10.74	7.82	6.27
Vehicle-based Trips										
Daily Vehicle Trips	30.65	27.00	18.25	19.21	34.71	32.77	39.43	39.78	25.10	24.72
Peak Vehicle Trips (per Hour)	4.79	4.08	2.81	3.13	5.08	5.00	6.25	6.60	4.08	3.76
Peak Network Hour Vehicle Trips	4.79	3.03	2.77	3.04	4.97	4.30	5.58	5.63	4.08	3.31

Table 3.9 – Person Trip Rates per 100m^2 GLFA

Trips/100m^2 GLFA	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Total GLFA (m2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Thursday										
Daily Person Trips	71.00	105.78	95.73	93.45	95.94	67.41	83.83	91.51	89.96	61.06
Peak Person Trips (per Hour)	6.65	9.96	8.50	8.70	8.29	7.58	8.89	9.81	8.40	5.51
Peak Network Hour Person Trips										
- AM Peak	2.75	3.05	3.97	5.63	4.38	2.13	3.11	5.81	5.92	2.59
- PM Peak	6.22	7.72	7.25	8.40	8.11	6.91	7.60	9.42	7.73	5.17
Friday										
Daily Person Trips	52.96	74.18	66.76	61.95	70.98	43.60	71.96	81.83	69.69	47.91
Peak Person Trips (per Hour)	6.47	9.93	8.94	8.81	9.53	5.72	8.68	10.42	8.78	5.39
Peak Network Hour Person Trips										
- AM Peak	2.58	3.49	3.39	4.50	3.52	2.02	3.25	6.53	3.62	2.35
- PM Peak	4.32	8.27	6.05	7.00	9.26	5.69	6.00	10.28	8.03	5.38
Saturday										
Daily Person Trips	67.75	93.11	77.39	69.01	80.97	69.92	83.35	92.28	86.43	55.01
Peak Person Trips (per Hour)	9.23	12.67	10.80	9.82	10.40	10.04	12.26	14.02	12.92	7.19
Peak Network Hour Person Trips	8.24	8.52	10.42	9.34	10.40	10.04	12.23	12.78	12.66	6.84
Sunday										
Daily Person Trips	54.88	84.27	61.68	48.95	63.71	65.34	67.77	73.86	47.76	46.26
Peak Person Trips (per Hour)	8.60	12.45	9.77	8.03	9.67	10.16	10.99	12.49	7.84	7.11
Peak Network Hour Person Trips	8.52	8.88	9.75	8.02	9.30	8.97	9.53	10.74	7.82	6.27

Table 3.10 – Vehicle Trip Rates per 100m^2 GLFA

Trips/100m^2 GLFA	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Total GLFA (m2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Thursday										
Daily Vehicle Trips	43.76	34.03	29.51	34.27	60.18	42.22	59.60	60.67	54.99	38.92
Peak Vehicle Trips (per Hour)	3.90	3.10	2.71	3.24	5.21	4.40	6.01	6.21	5.25	3.49
Peak Network Hour Vehicle Trips										
- AM Peak	1.84	0.96	1.01	2.12	2.88	1.43	2.24	4.08	4.06	1.87
- PM Peak	3.72	2.57	2.22	3.14	4.96	4.17	5.19	5.77	4.92	3.31
Friday										
Daily Vehicle Trips	33.46	23.73	21.37	23.80	45.19	28.96	50.92	55.48	46.05	32.05
Peak Vehicle Trips (per Hour)	4.01	3.08	2.84	3.26	5.71	3.63	5.90	6.71	5.75	3.53
Peak Network Hour Vehicle Trips										
- AM Peak	1.65	0.98	1.04	1.54	1.87	1.37	2.42	4.69	2.61	1.70
- PM Peak	2.69	2.66	1.95	2.73	5.49	3.61	4.00	6.41	5.21	3.53
Saturday										
Daily Vehicle Trips	37.20	29.08	23.98	26.09	46.87	39.37	49.61	50.18	48.59	30.32
Peak Vehicle Trips (per Hour)	5.06	3.77	3.16	3.56	5.83	5.60	7.00	7.48	7.04	3.85
Peak Network Hour Vehicle Trips	4.43	2.97	3.04	3.43	5.83	5.60	6.93	6.89	6.99	3.77
Sunday										
Daily Vehicle Trips	30.65	27.00	18.25	19.21	34.71	32.77	39.43	39.78	25.10	24.72
Peak Vehicle Trips (per Hour)	4.79	4.08	2.81	3.13	5.08	5.00	6.25	6.60	4.08	3.76
Peak Network Hour Vehicle Trips	4.79	3.03	2.77	3.04	4.97	4.30	5.58	5.63	4.08	3.31

Table 3.11 – Trip Rates Summary

Trips/100m^2 GLFA	Sydney Metropolitan Area SC1 to SC7			Regional Area SC8 to SC10			All Surveyed Sites SC1 to SC10		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Thursday									
Person-based Trips									
Daily Person Trips	67.41	105.78	87.59	61.06	91.51	80.85	61.06	105.78	85.57
Site Peak Hour Person Trips	6.65	9.96	8.37	5.51	9.81	7.91	5.51	9.96	8.23
Peak Network Hour Person Trips									
- AM Peak	2.13	5.63	3.58	2.59	5.92	4.78	2.13	5.92	3.94
- PM Peak	6.22	8.40	7.46	5.17	9.42	7.44	5.17	9.42	7.45
Vehicle-based Trips									
Daily Vehicle Trips	29.51	60.18	43.37	38.92	60.67	51.53	29.51	60.67	45.81
Site Peak Hour Vehicle Trips	2.71	6.01	4.08	3.49	6.21	4.98	2.71	6.21	4.35
Peak Network Hour Vehicle Trips									
- AM Peak	0.96	2.88	1.78	1.87	4.08	3.34	0.96	4.08	2.25
- PM Peak	2.22	5.19	3.71	3.31	5.77	4.67	2.22	5.77	4.00
Friday									
Person-based Trips									
Daily Person Trips	43.60	74.18	63.20	47.91	81.83	66.48	43.60	81.83	64.18
Site Peak Hour Person Trips	5.72	9.93	8.30	5.39	10.42	8.20	5.39	10.42	8.27
Peak Network Hour Person Trips									
- AM Peak	2.02	4.50	3.25	2.35	6.53	4.17	2.02	6.53	3.52
- PM Peak	4.32	9.26	6.66	5.38	10.28	7.90	4.32	10.28	7.03
Vehicle-based Trips									
Daily Vehicle Trips	21.37	50.92	32.49	32.05	55.48	44.53	21.37	55.48	36.10
Site Peak Hour Vehicle Trips	2.84	5.90	4.06	3.53	6.71	5.33	2.84	6.71	4.44
Peak Network Hour Vehicle Trips									
- AM Peak	0.98	2.42	1.55	1.70	4.69	3.00	0.98	4.69	1.99
- PM Peak	1.95	5.49	3.30	3.53	6.41	5.05	1.95	6.41	3.83
Saturday									
Person-based Trips									
Daily Person Trips	67.75	93.11	77.36	55.01	92.28	77.91	55.01	93.11	77.52
Site Peak Hour Person Trips	9.23	12.67	10.75	7.19	14.02	11.38	7.19	14.02	10.94
Peak Network Hour Person Trips	8.24	12.23	9.88	6.84	12.78	10.76	6.84	12.78	10.15
Vehicle-based Trips									
Daily Vehicle Trips	23.98	49.61	36.03	30.32	50.18	43.03	23.98	50.18	38.13
Site Peak Hour Vehicle Trips	3.16	7.00	4.86	3.85	7.48	6.12	3.16	7.48	5.24
Peak Network Hour Vehicle Trips	2.97	6.93	4.61	3.77	6.99	5.88	2.97	6.99	4.99
Sunday									
Person-based Trips									
Daily Person Trips	48.95	84.27	63.80	46.26	73.86	55.96	46.26	84.27	61.45
Site Peak Hour Person Trips	8.03	12.45	9.95	7.11	12.49	9.15	7.11	12.49	9.71
Peak Network Hour Person Trips	8.02	9.75	9.00	6.27	10.74	8.28	6.27	10.74	8.78
Vehicle-based Trips									
Daily Vehicle Trips	18.25	39.43	28.86	24.72	39.78	29.87	18.25	39.78	29.16
Site Peak Hour Vehicle Trips	2.81	6.25	4.45	3.76	6.60	4.81	2.81	6.60	4.56
Peak Network Hour Vehicle Trips	2.77	5.58	4.07	3.31	5.63	4.34	2.77	5.63	4.15

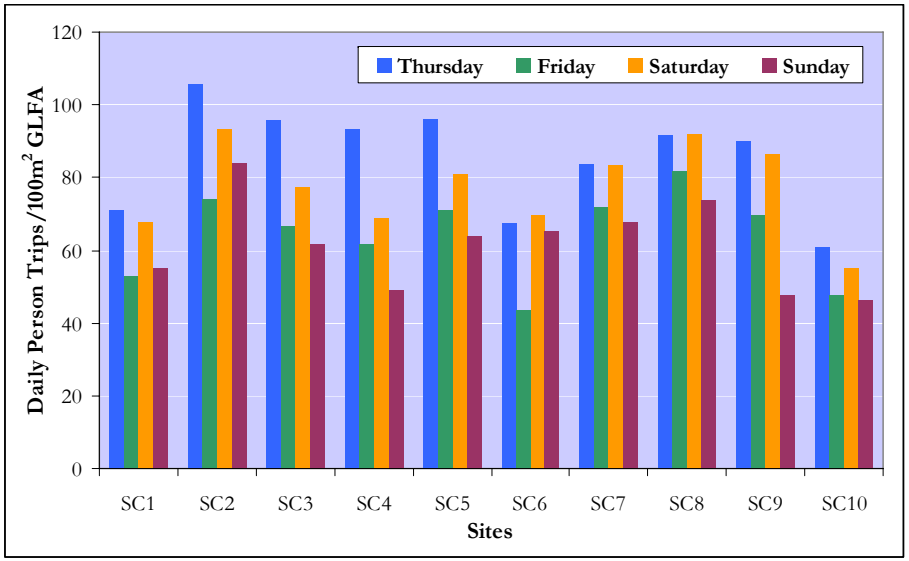

Figure 3.1 – Comparison of Daily Person Trips/100m² GLFA

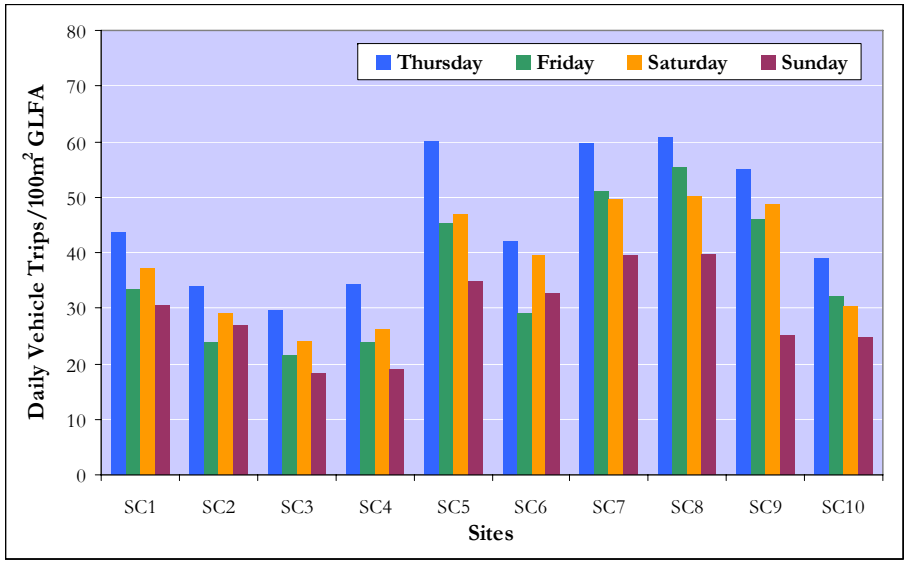

Figure 3.2 – Comparison of Daily Vehicle Trips/100m² GLFA

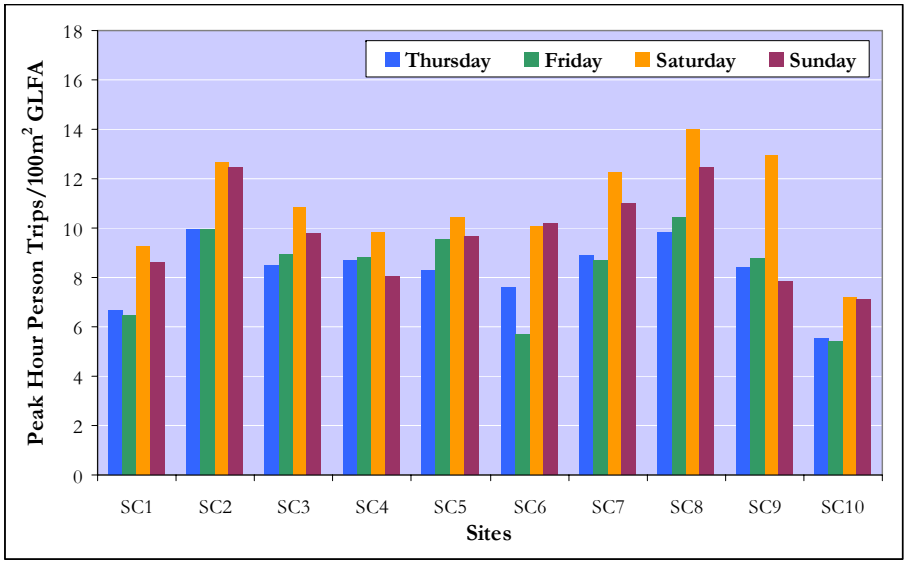

Figure 3.3 – Comparison of Peak Hour Person Trips/100m² GLFA

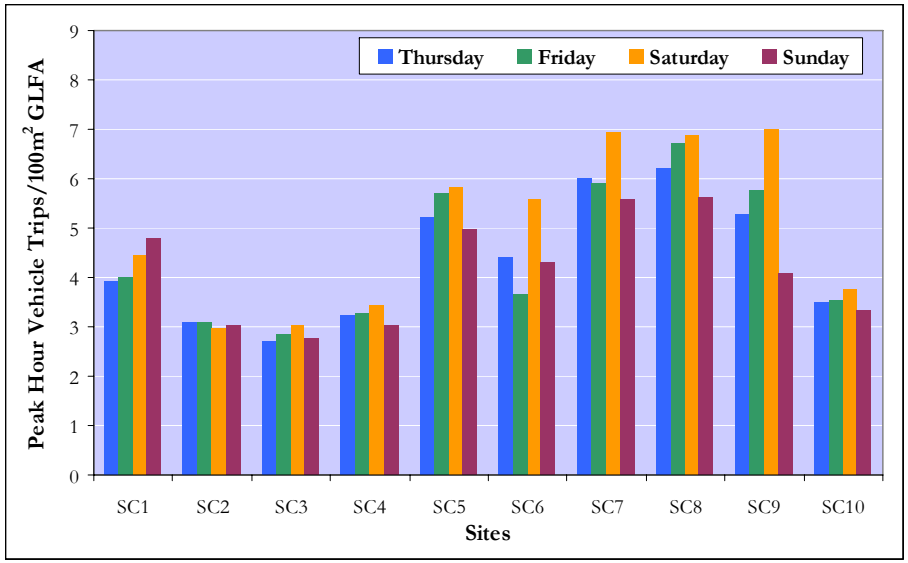

Figure 3.4 – Comparison of Peak Hour Vehicle Trips/100m² GLFA

Table 3.12 – Vehicle Trip Rates per Parking Space

Trips/ Parking Space	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Total Parking Space	2,841	3,034	3,514	3,569	2,020	3,161	1,080	764	1,727	3,257
Thursday										
Daily Vehicle Trips	9.46	7.11	7.65	9.62	14.87	9.22	12.22	12.35	13.07	10.42
Peak Vehicle Trips (per Hour)	0.84	0.65	0.70	0.91	1.29	0.96	1.23	1.26	1.25	0.93
Peak Network Hour Vehicle Trips										
- AM Peak	0.40	0.20	0.26	0.60	0.71	0.31	0.46	0.83	0.97	0.50
- PM Peak	0.80	0.54	0.57	0.88	1.23	0.91	1.06	1.17	1.17	0.89
Friday										
Daily Vehicle Trips	7.23	4.96	5.54	6.68	11.16	6.32	10.44	11.29	10.94	8.58
Peak Vehicle Trips (per Hour)	0.87	0.64	0.74	0.92	1.41	0.79	1.21	1.37	1.37	0.94
Peak Network Hour Vehicle Trips										
- AM Peak	0.36	0.21	0.27	0.43	0.46	0.30	0.50	0.96	0.62	0.46
- PM Peak	0.58	0.56	0.51	0.77	1.36	0.79	0.82	1.30	1.24	0.94
Saturday										
Daily Vehicle Trips	8.04	6.08	6.22	7.32	11.58	8.59	10.17	10.21	11.55	8.12
Peak Vehicle Trips (per Hour)	1.09	0.79	0.82	1.00	1.44	1.22	1.44	1.52	1.67	1.03
Peak Network Hour Vehicle Trips	0.96	0.62	0.79	0.96	1.44	1.22	1.42	1.40	1.66	1.01
Sunday										
Daily Vehicle Trips	6.63	5.64	4.73	5.39	8.57	7.15	8.09	8.10	5.96	6.62
Peak Vehicle Trips (per Hour)	1.04	0.85	0.73	0.88	1.25	1.09	1.28	1.34	0.97	1.01
Peak Network Hour Vehicle Trips	1.04	0.63	0.72	0.85	1.23	0.94	1.14	1.15	0.97	0.89

A review of the data reveals a number of observations:

- The surveys were undertaken on a range of GLFA from 22,143 to 100,134 m^2;
- Thursday daily trip generation rate varied from 29.51 to 60.67 vehicles per $100m^2$ GLFA with an average of 45.81 trips;
- Friday daily trip generation rate varied from 21.37 to 55.48 vehicles per $100m^2$ GLFA with an average of 36.10 trips;
- Saturday daily trip generation rate varied from 23.98 to 50.18 vehicles per $100m^2$ GLFA with an average of 38.13 trips;
- Sunday daily trip generation rate varied from 18.25 to 39.78 vehicles per $100m^2$ GLFA with an average of 29.16 trips;
- Thursday site peak hour trip generation rate varied from 2.71 to 6.21 vehicles per $100m^2$ GLFA with an average of 4.35 trips;
- Friday site peak hour trip generation rate varied from 2.84 to 6.71 vehicles per $100m^2$ GLFA with an average of 4.44 trips;
- Saturday site peak hour trip generation rate varied from 3.16 to 7.48 vehicles per $100m^2$ GLFA with an average of 5.24 trips;
- Sunday site peak hour trip generation rate varied from 2.81 to 6.60 vehicles per $100m^2$ GLFA with an average of 4.56 trips;
- Average daily trip generation rate per parking space is 10.6, 8.3, 8.8 and 6.7 vehicles for Thursday, Friday, Saturday and Sunday, respectively;
- Average peak hour trip generation rate per parking space is around 1.0 vehicle per space for all surveyed days expect for Saturday, which is 1.2 vehicles per space;
- The regional sites generally had higher vehicle trip rates than the Sydney Metropolitan sites;
- Higher trip rates were recorded in PM network peak hour than AM network peak hour;
- Trip variance over the four surveyed days indicates that Thursday is generally the busiest trading day with the Saturday being the busiest peak hour.

Figure 3.5 and Figure 3.6 show the minimum, maximum and average trip rates for daily and site peak hour vehicle trips, respectively.

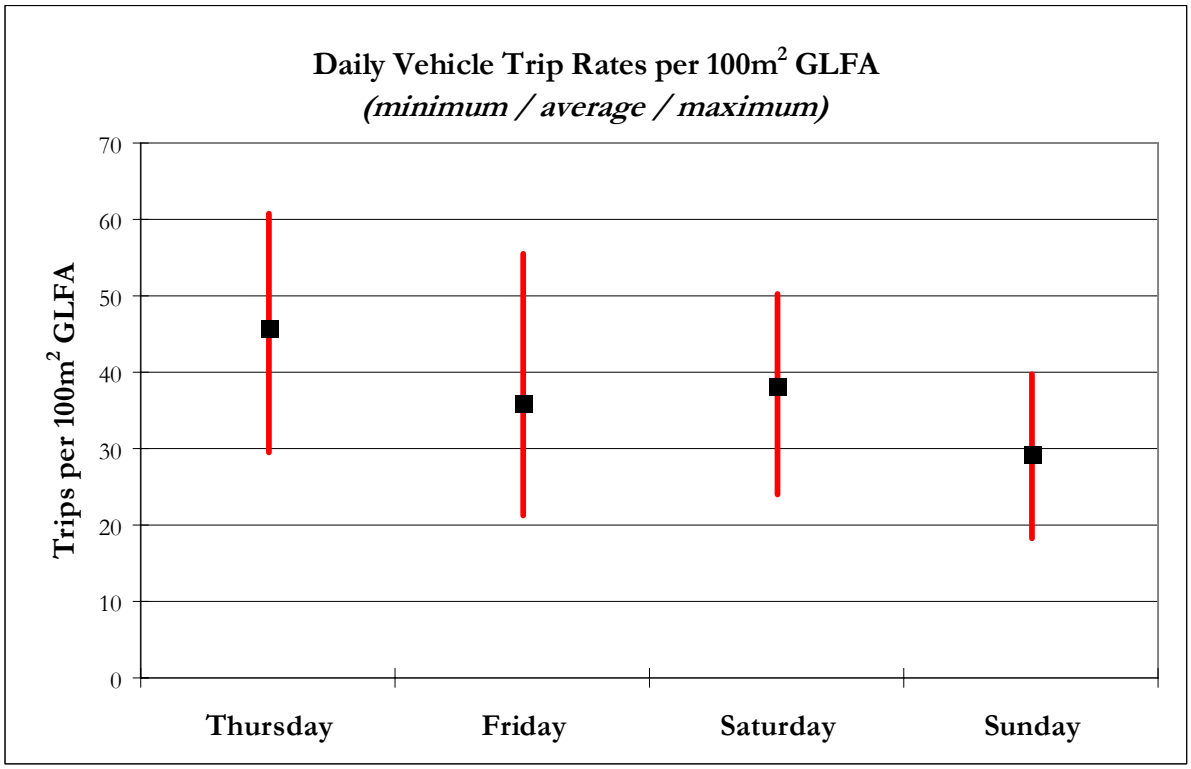

Figure 3.5 – Daily Vehicle Trip Rates over Four Surveyed Days

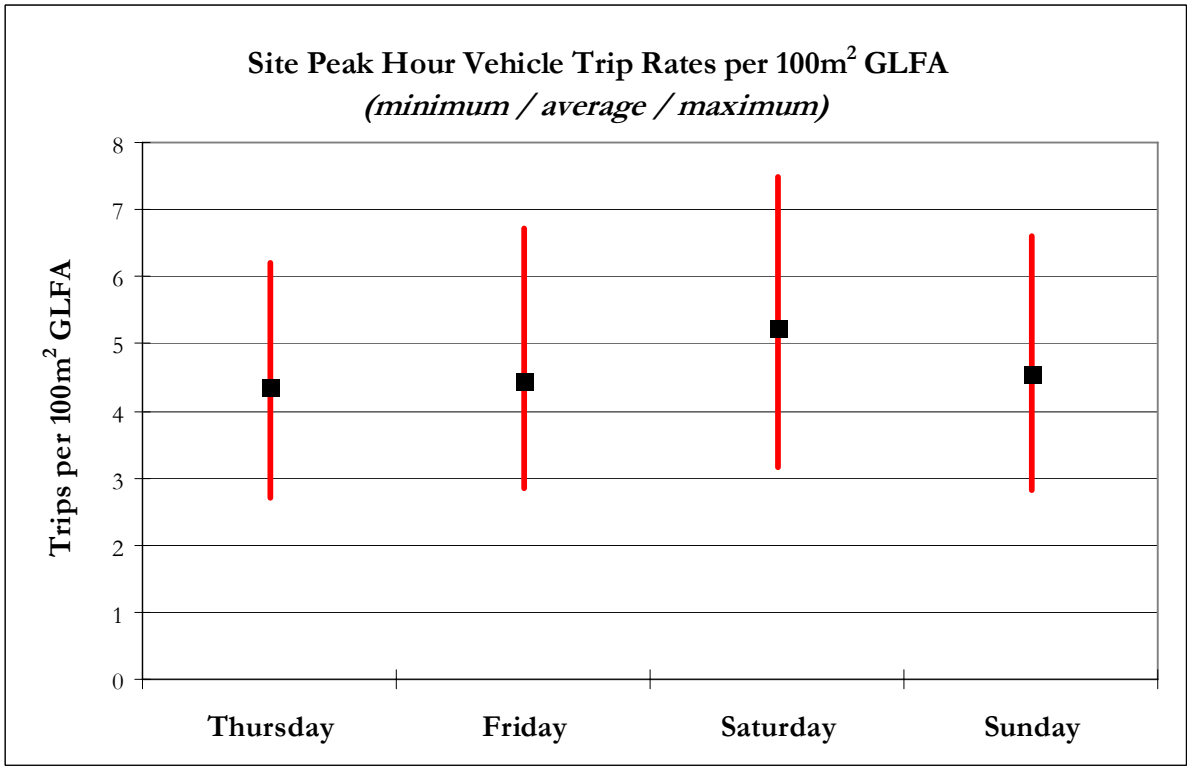

Figure 3.6 – Site Peak Hour Vehicle Trip Rates over Four Surveyed Days

3.4 Interview Survey Results

Interview surveys were conducted throughout the store opening hours. The purpose of these interviews was to establish the following facts:

- Proportion of person who works in the centre versus customers;
- Trip purpose such as sole purpose trip or linked trip;
- Mode of travel; and
- Staff and customers' origin postcodes.

Detailed interview survey results are also presented in the Data Report.

3.4.1 Staff/Customer

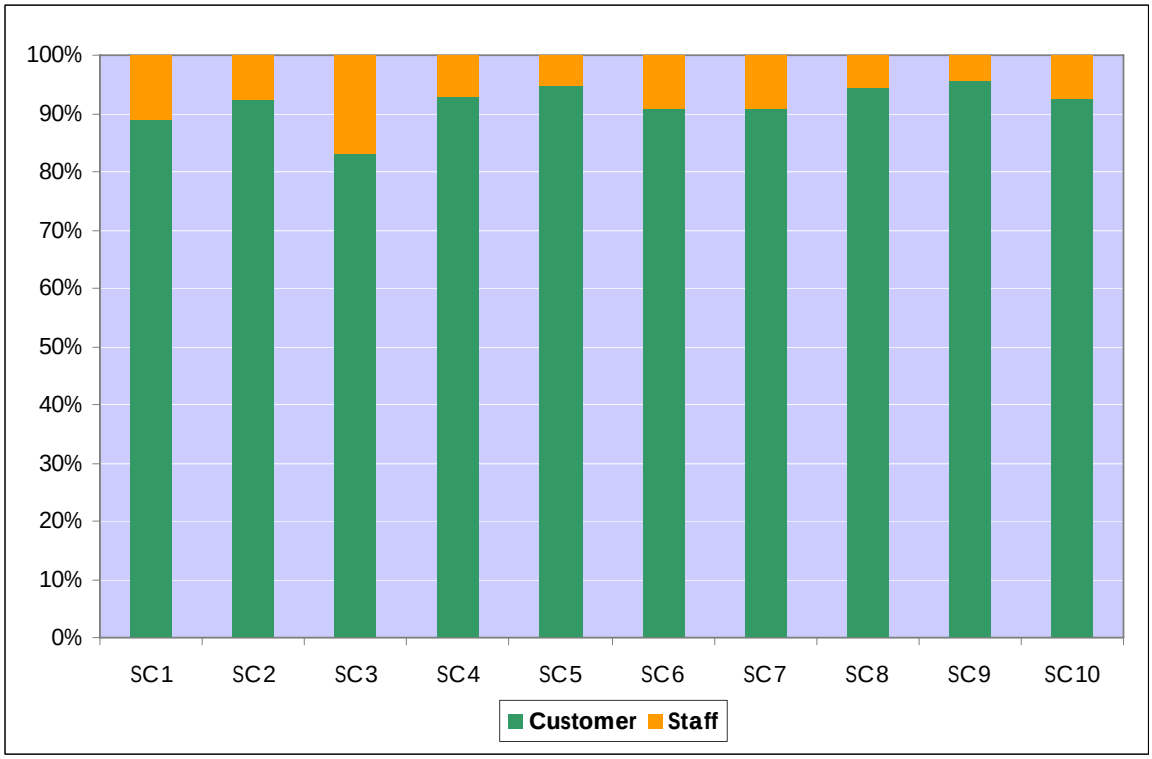

Figure 3.7 – Staff/Customer (average over four surveyed days)

The majority of the respondents (i.e. about 90%) were customers and about 10% of the respondents were staff working at the shopping centre.

The variations in staff/customer proportion over four surveyed days are negligible.

3.4.2 Sole Purpose Trips/Linked Trips

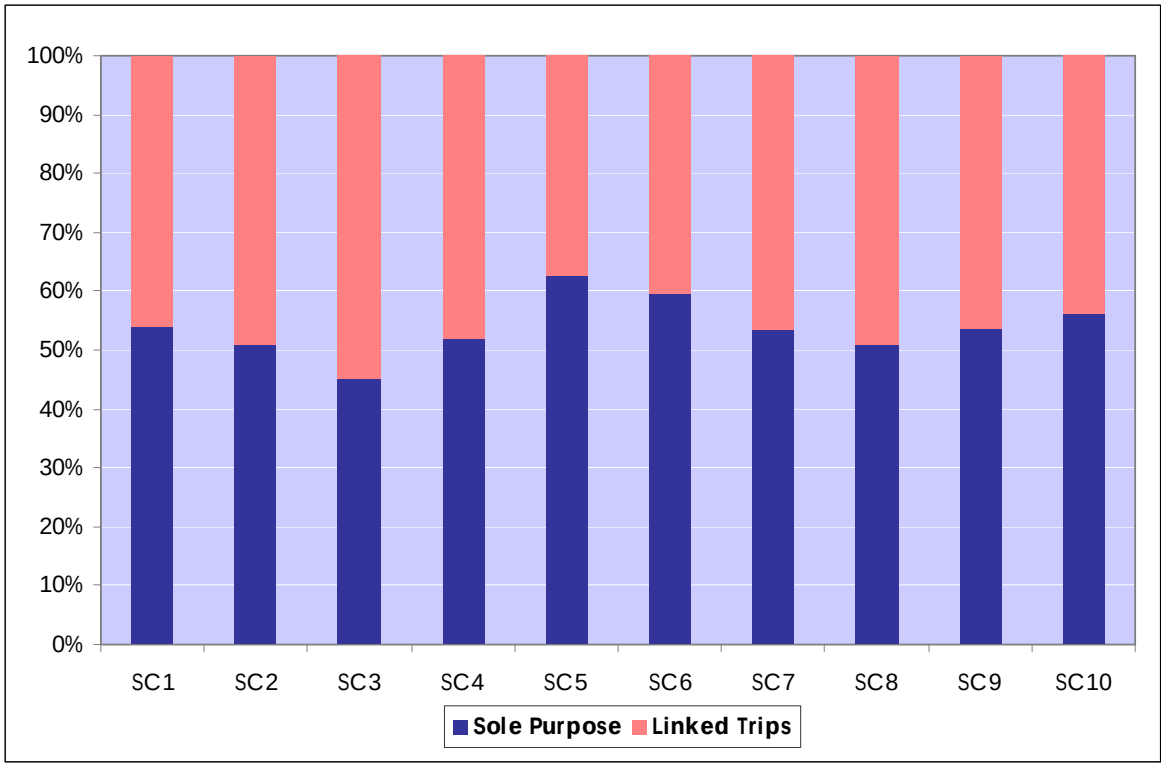

Figure 3.8 – Trip Purpose (average over four surveyed days)

Approximately 54% of the respondents indicated that their trip to the shopping centre was the sole purpose trip and 46% indicated that it was a linked trip (i.e. respondents visited another location prior to arriving at the shopping centre and/or plan to visit another location before returning home).

The differences in trip purposes over four surveyed days are minor.

3.4.3 Mode of Travel

Table 3.13 summarises the average travel mode for all sites for Thursday, Friday, Saturday and Sunday.

Table 3.13 – Mode of Travel

Travel Mode	Thursday	Friday	Saturday	Sunday	Average
Car as Driver	67%	70%	71%	74%	71%
Car as Passenger	15%	13%	14%	14%	14%
Train	4%	5%	5%	2%	4%
Bus	6%	7%	5%	3%	5%
Cycle	0%	0%	0%	0%	0%
On Foot	7%	5%	6%	6%	6%

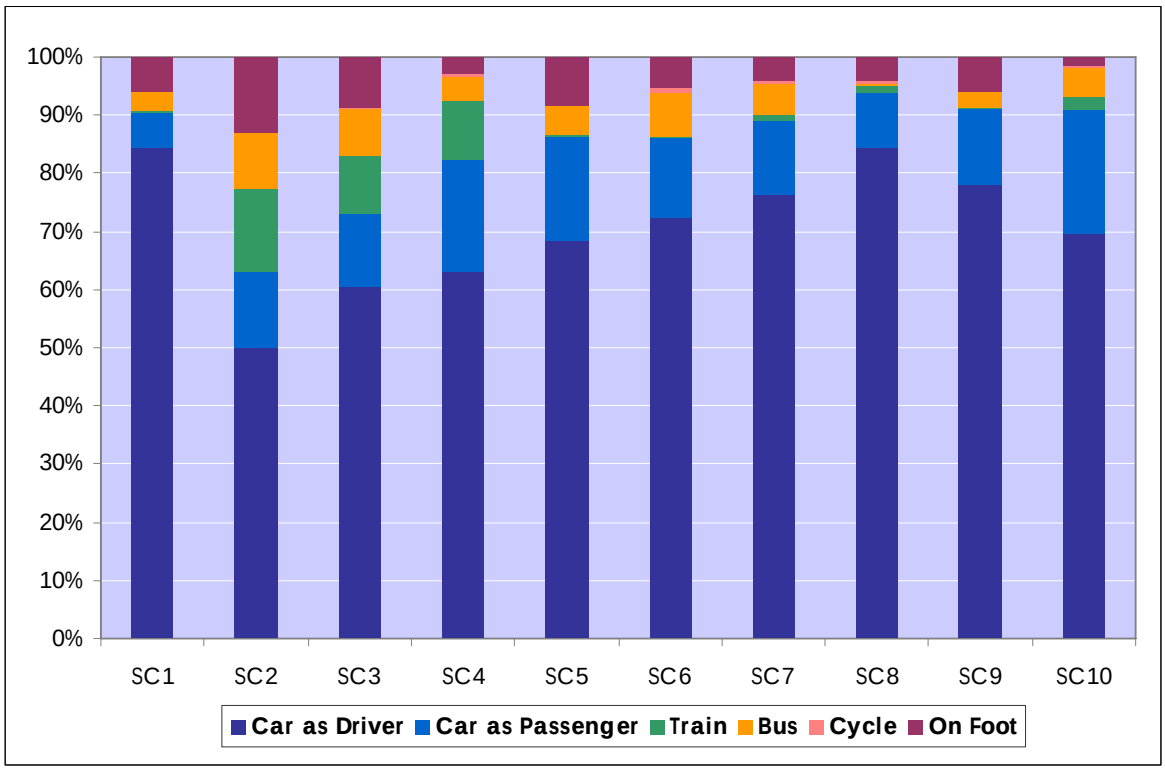

Figure 3.9 – Mode of Travel (average over four surveyed days)

The interview survey results indicated that in average about 71% of respondents arrive at the shopping centre as "car driver", 14% as "car passenger", 4% via train, 5% via bus and 6% walked to the centre. The percentage of respondents cycling to the centre is negligible.

The variations in travel mode over four surveyed days are relatively minor. However, the results indicated that the non car-based modes are slightly higher during the weekdays than the weekends.

3.4.4 Origin Postcode

The following figures show the origin of the staff/ customers for each of the surveyed shopping centres.

The figures represent the sum of origin postcodes over four surveyed days. Separate plots for Thursday, Friday, Saturday and Sunday are included in the Data Report.

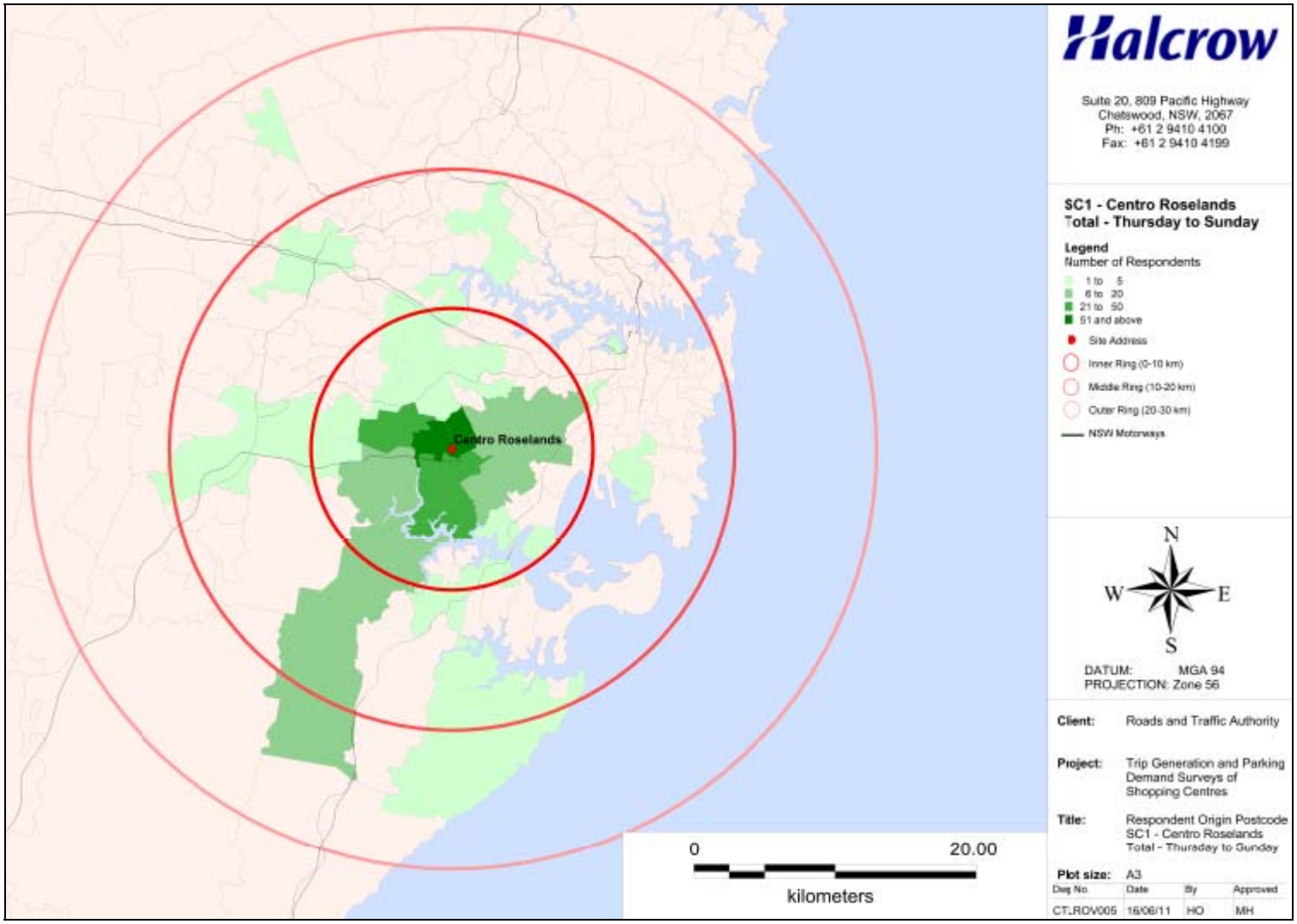

Figure 3.10 – SC1 Origin Postcode

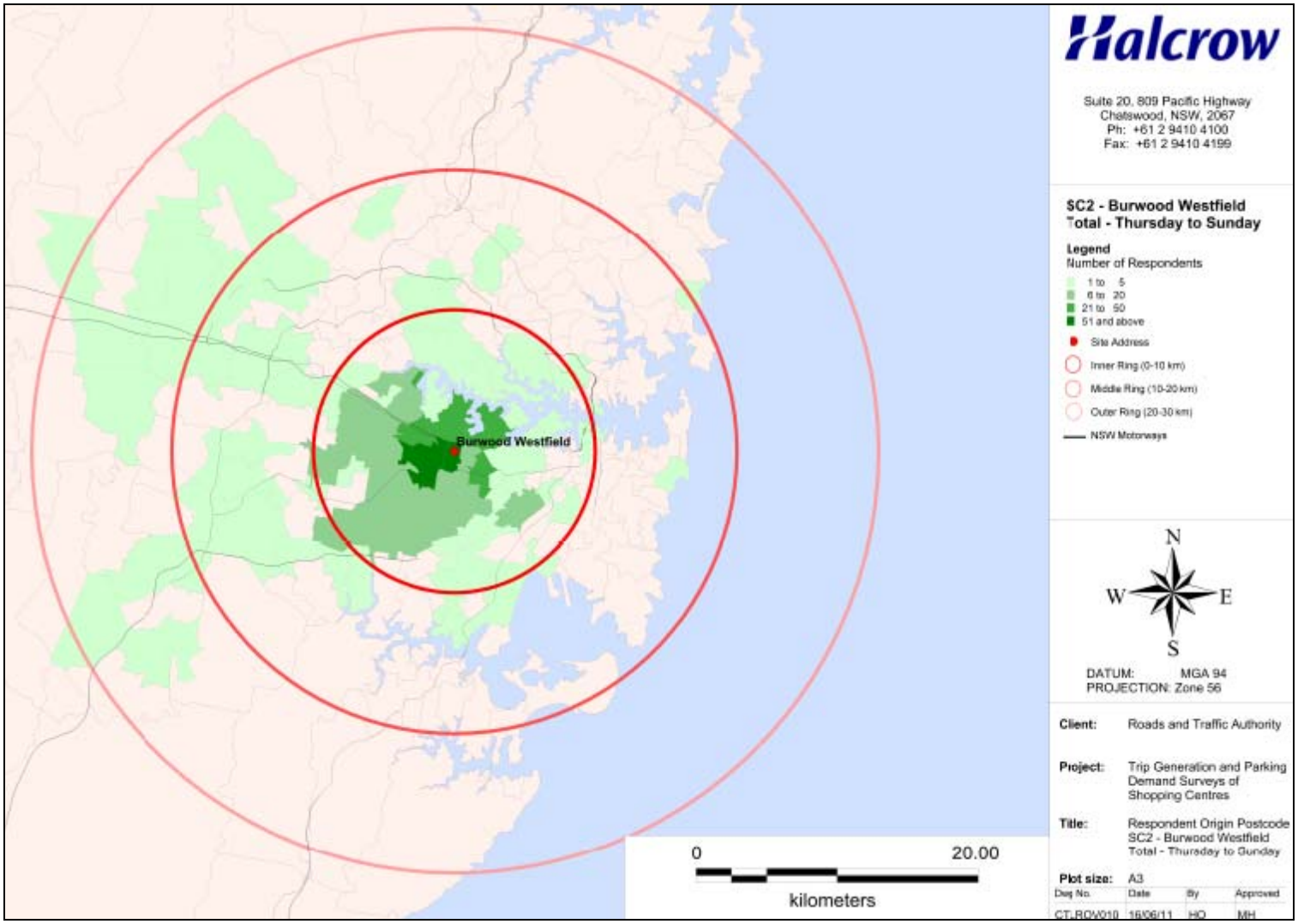

Figure 3.11 – SC2 Origin Postcode

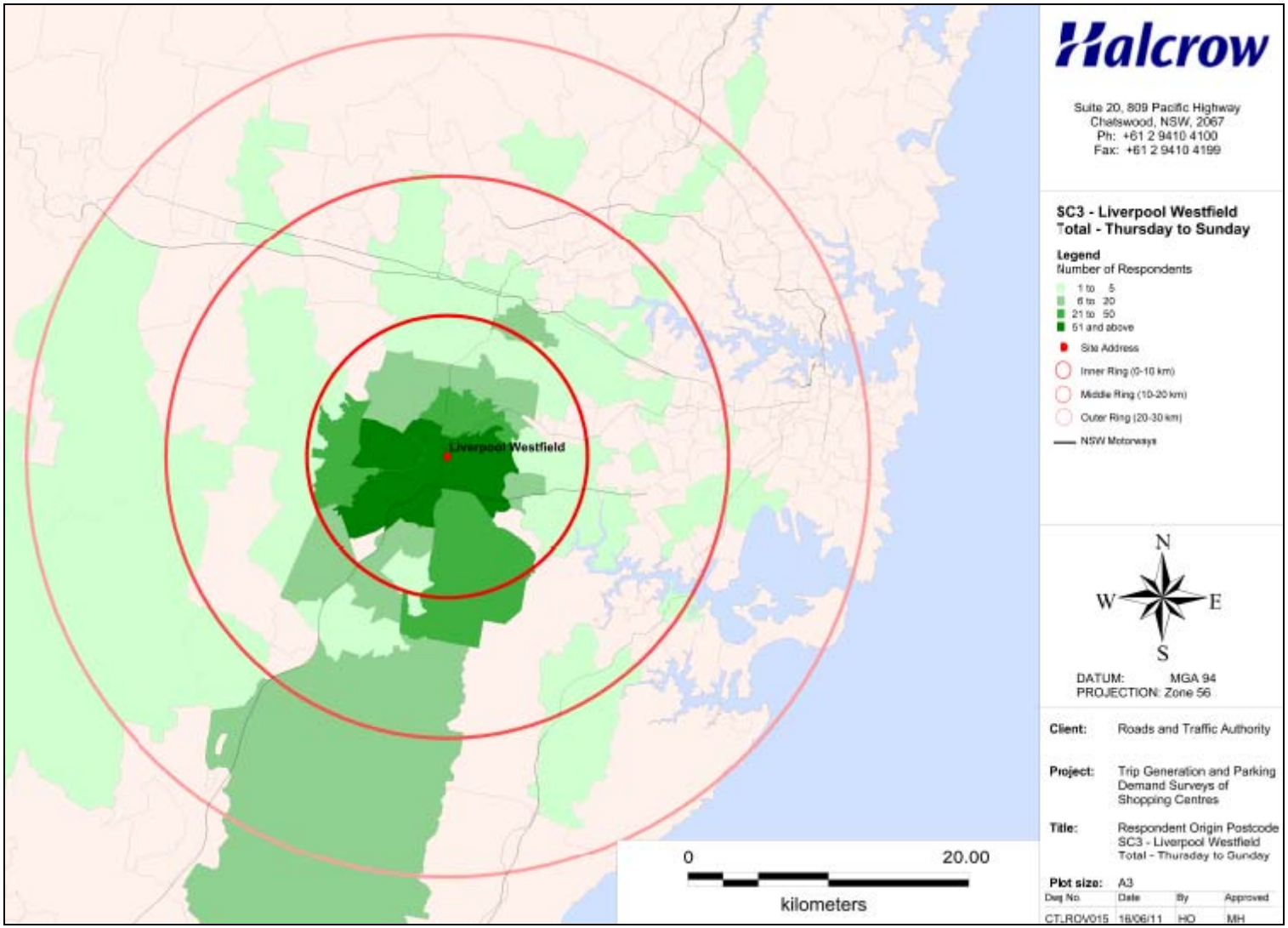

Figure 3.12 – SC3 Origin Postcode

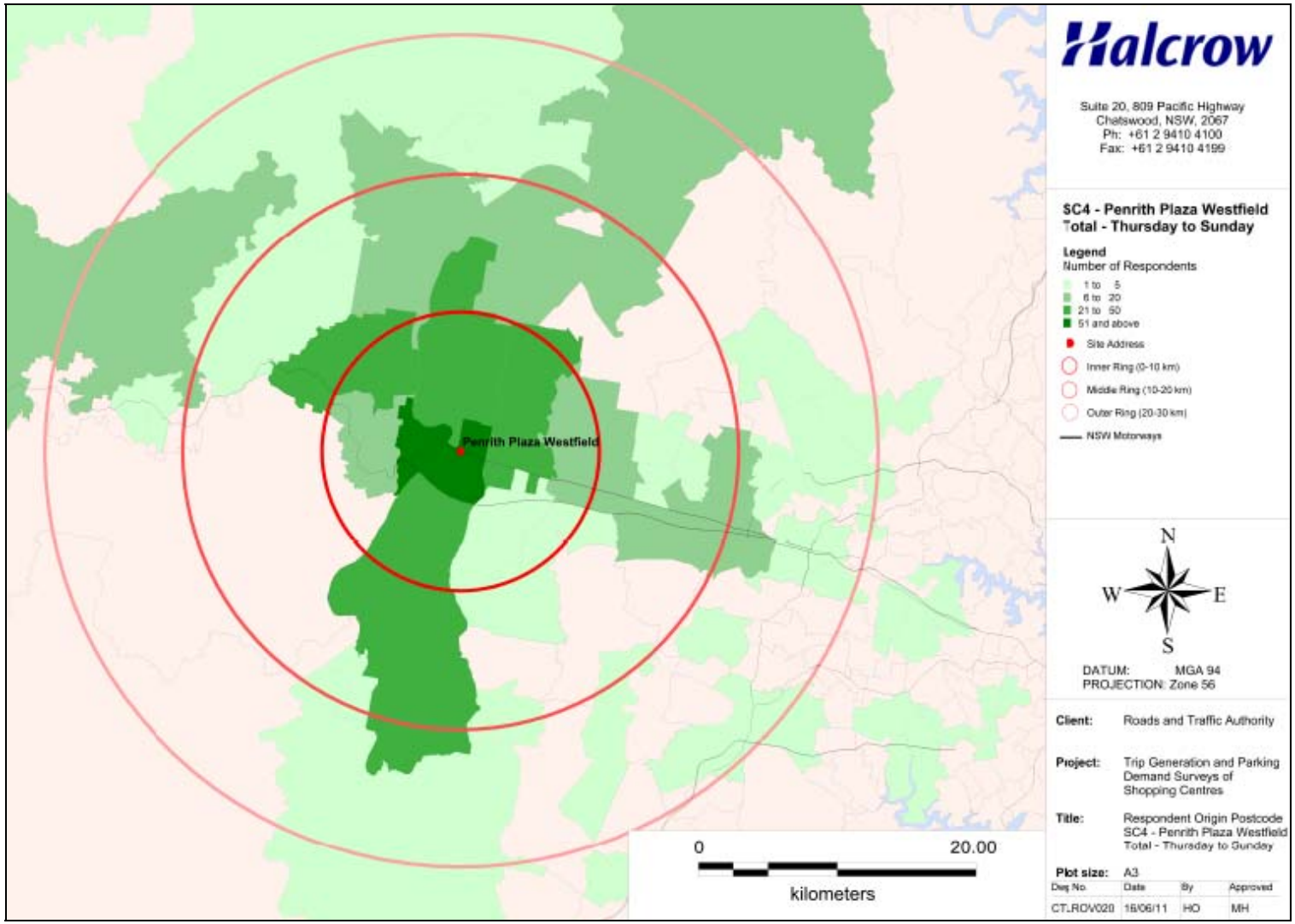

Figure 3.13 – SC4 Origin Postcode

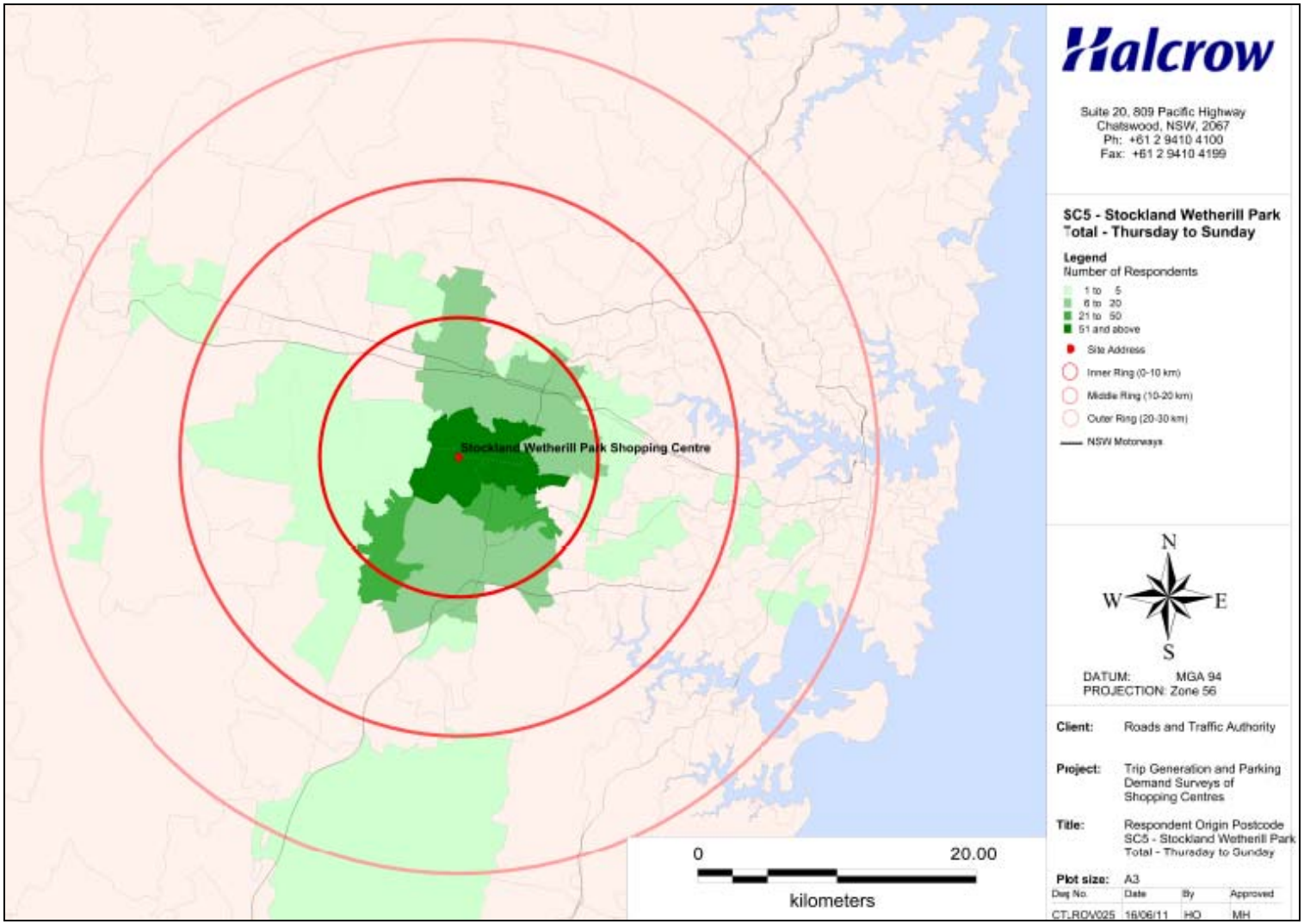

Figure 3.14 – SC5 Origin Postcode

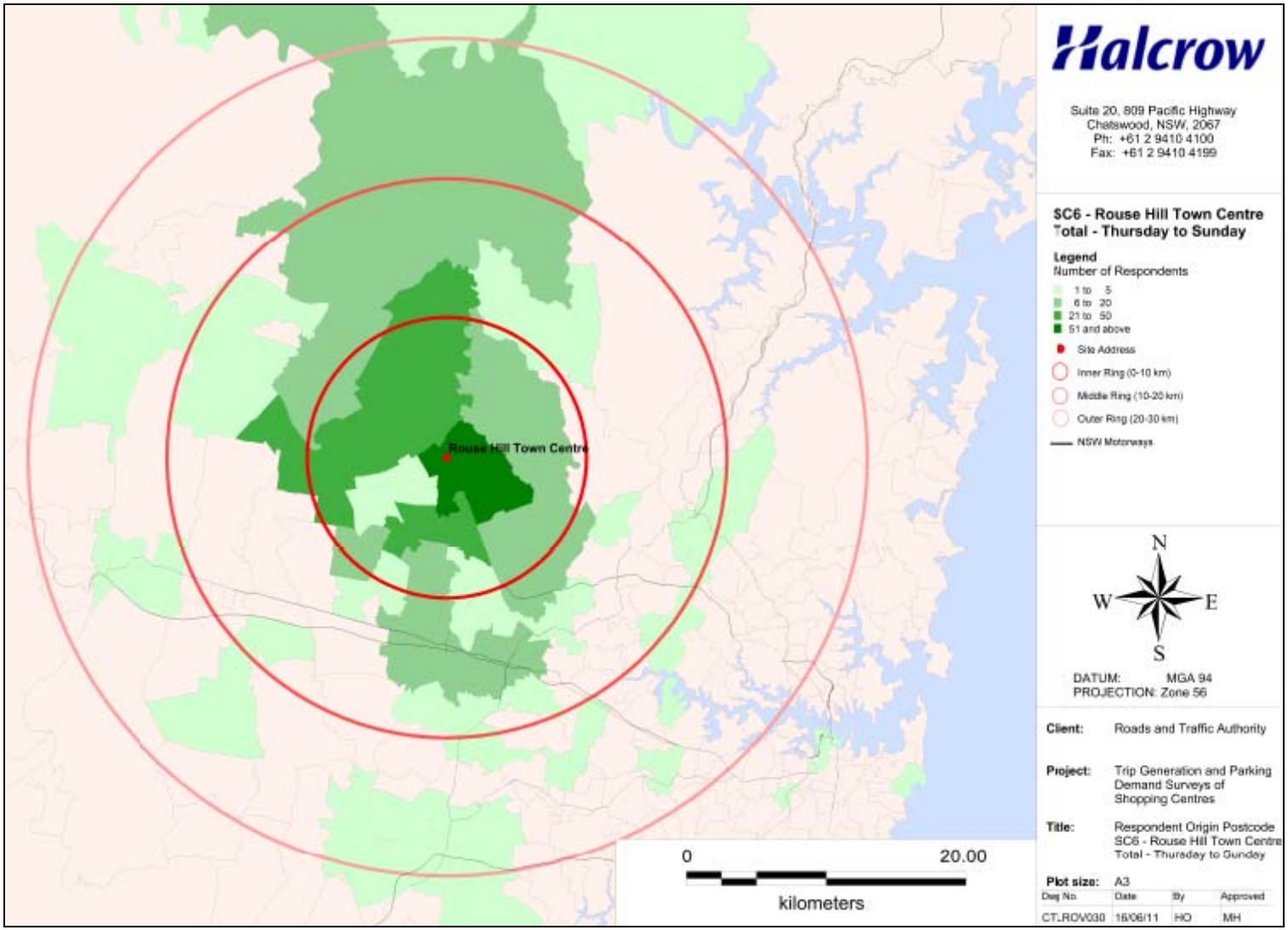

Figure 3.15 – SC6 Origin Postcode

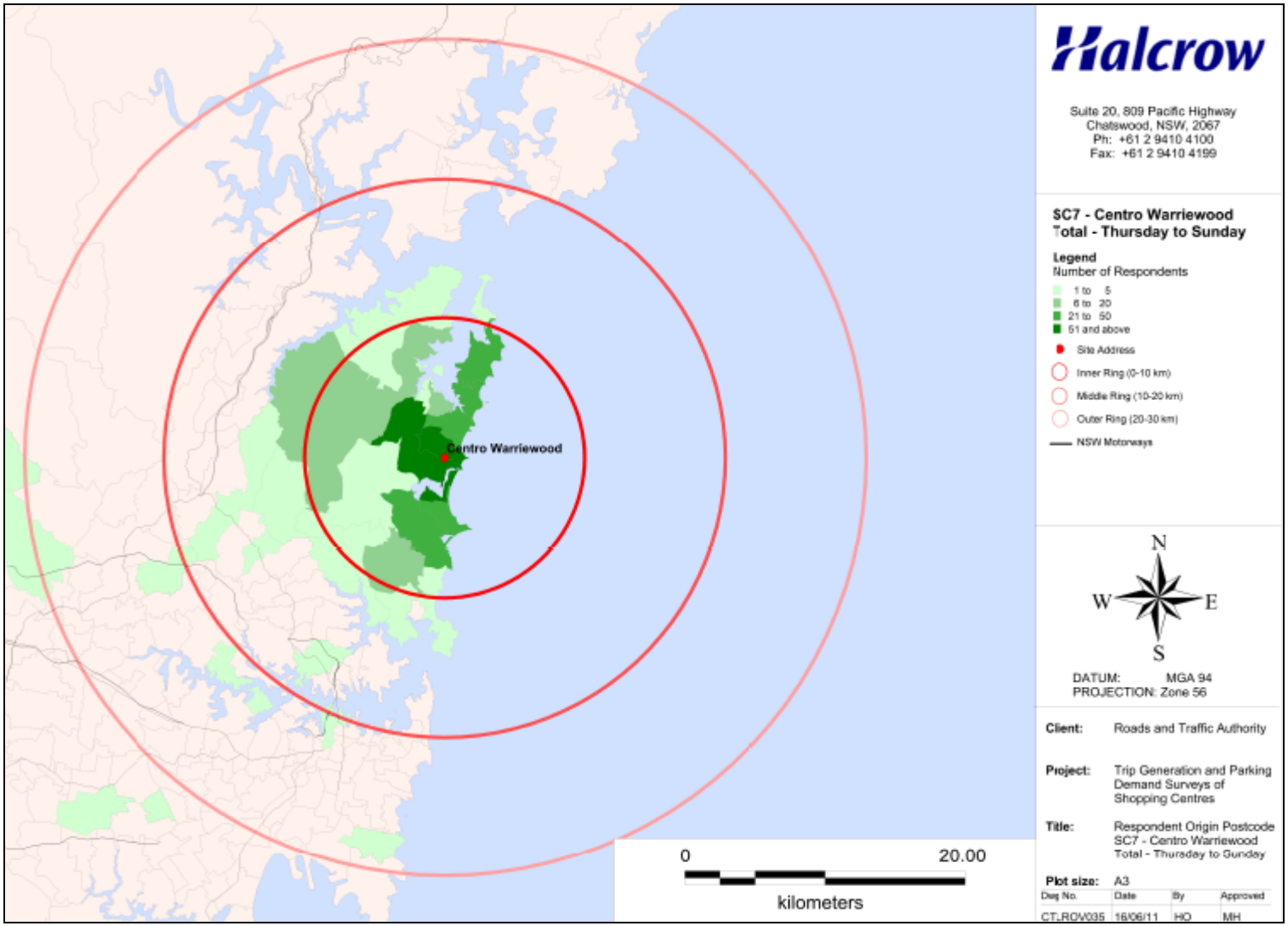

Figure 3.16 – SC7 Origin Postcode

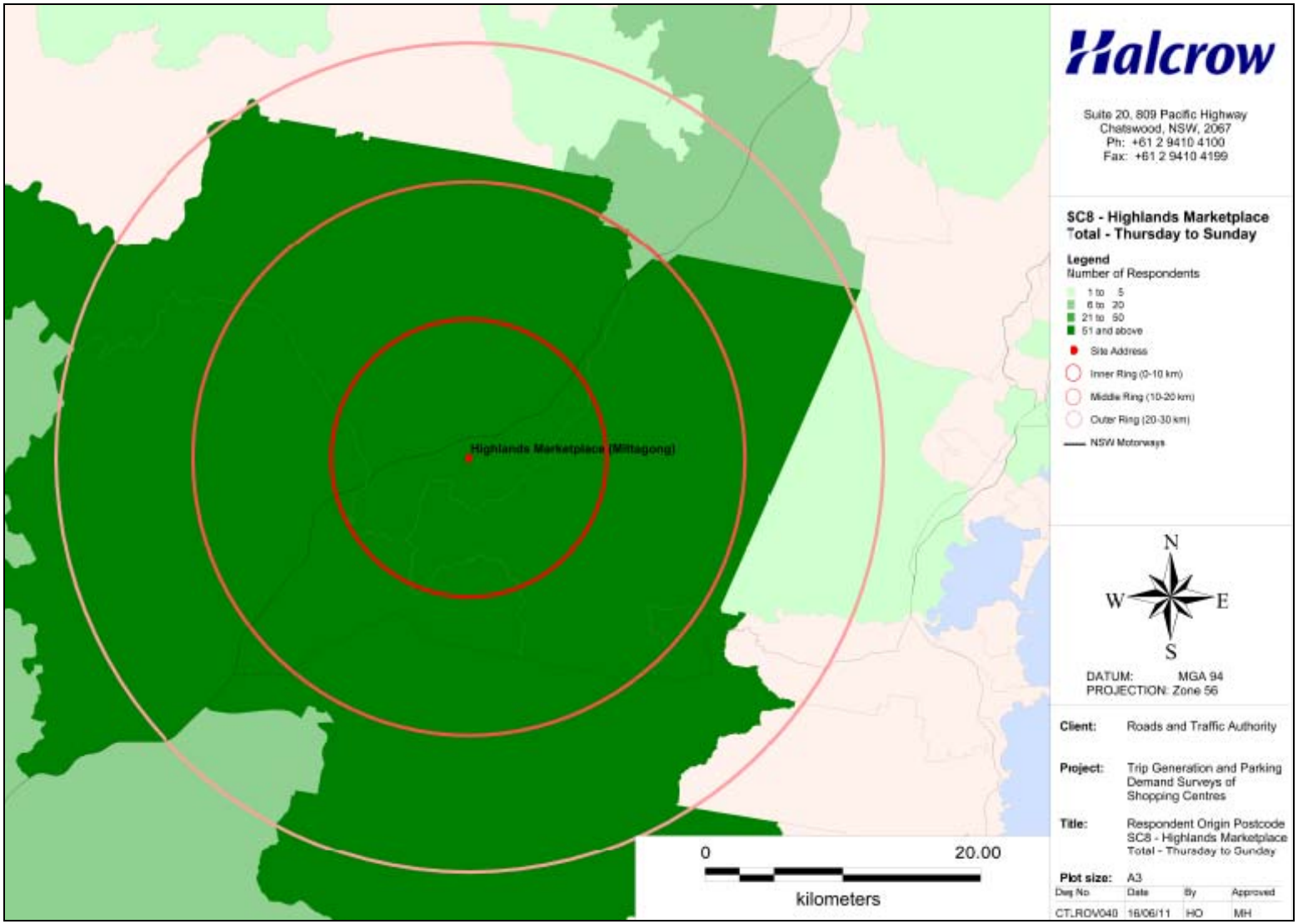

Figure 3.17 – SC8 Origin Postcode

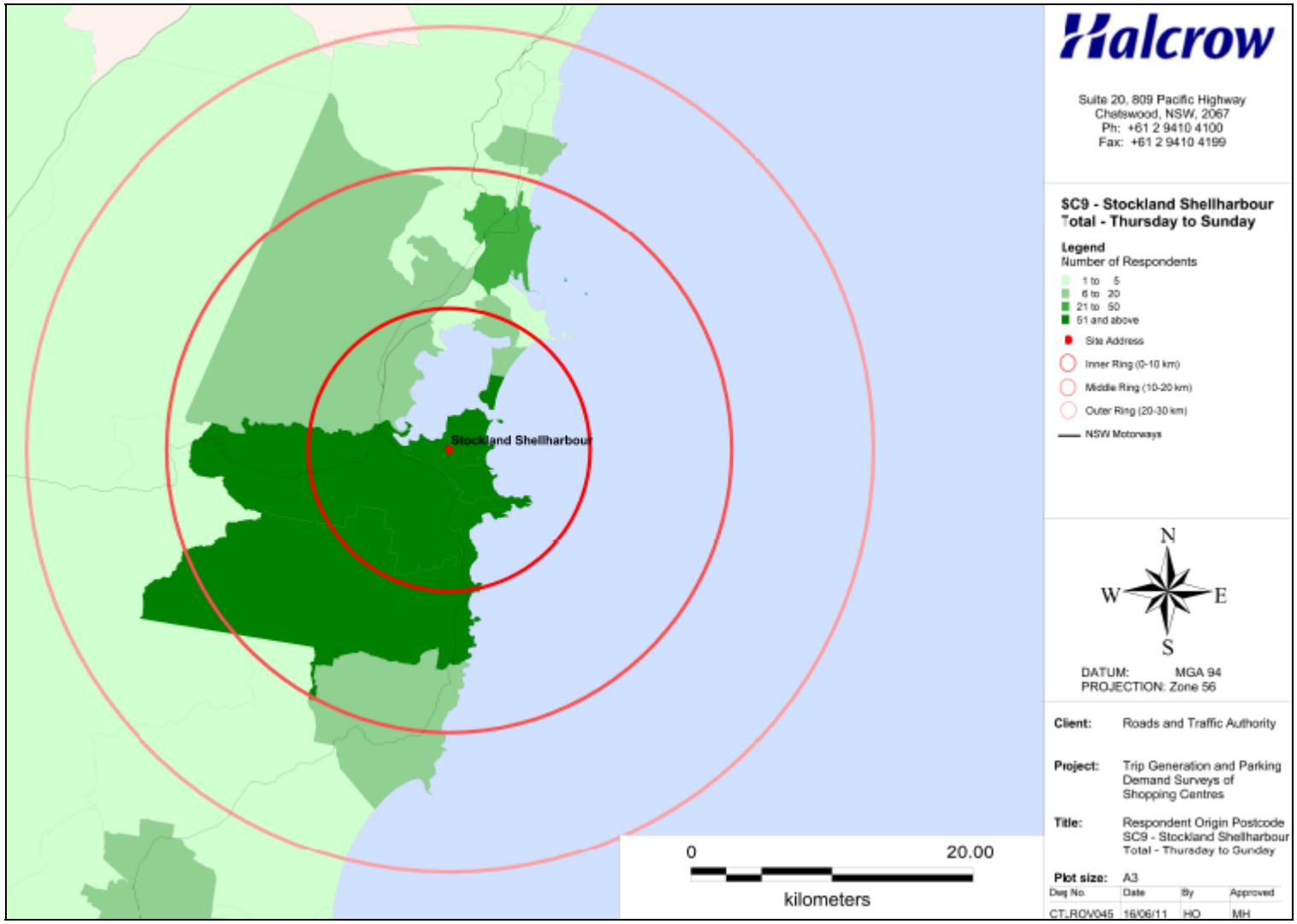

Figure 3.18 – SC9 Origin Postcode

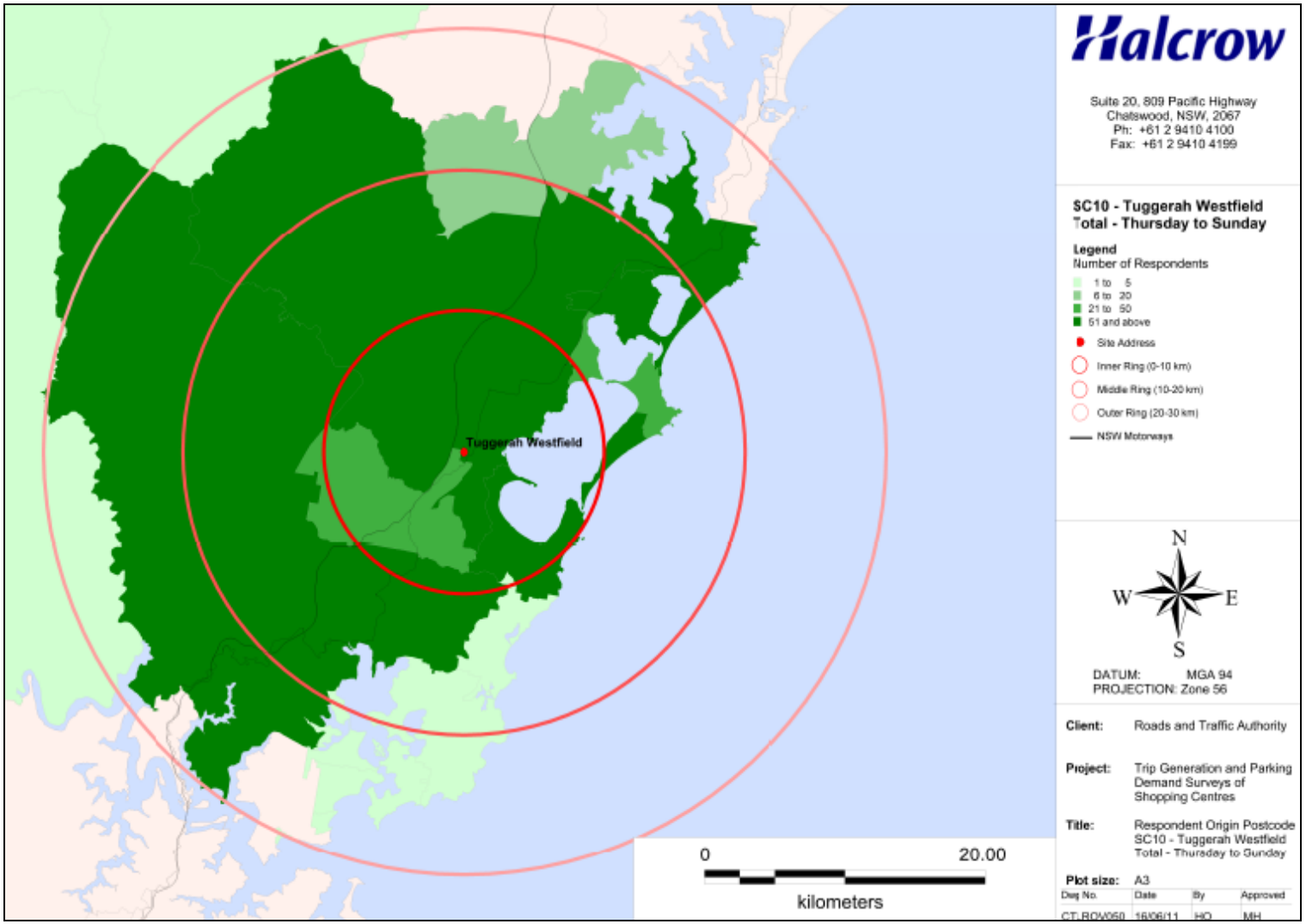

Figure 3.19 – SC10 Origin Postcode

3.5 Seasonal Economic Effects

In order to consider the seasonal economic effects on the number of vehicle trips generated by these sites, Halcrow contacted all of the centre managers regarding its visitor entries on a daily or weekly variation, which would indicate retail activity over the course of a year/ number of years.

While most of the operators were unwilling to issue such data presumably because of the commercial sensitivities of such information, the monthly variation in visitor flows has been supplied by some of the centre managers.

Table 3.14 presents the monthly variations for the recent 2009/2010 data for shopping centres grouped by with and without slow trade stores. A copy of the monthly variations included in the *RTA Guide to Traffic Generating Developments, 2002* is also shown in the table for comparison.

Table 3.14 – Monthly Variations

	2002 RTA Guide (1993 Data)	2009/2010 Data	
		With Slow Trade	Without Slow Trade
January	0.89	1.03	1.03
February	0.87	0.91	0.91
March	0.97	0.77	1.00
April	0.96	0.97	0.93
May	1.01	0.98	0.99
June	0.97	0.95	0.92
July	1.03	1.05	0.99
August	1.01	0.96	0.93
September	0.96	1.01	0.96
October	0.98	1.02	1.02
November	1.08	1.02	1.02
December	1.28	1.33	1.29

3.6 Seasonally Adjusted Trip Rates

Using the monthly variation factors shown in Table 3.14, the person and vehicle trip generation rates shown in Table 3.9 and Table 3.10 are adjusted.

Table 3.15 and Table 3.16 show the comparison of trip rates for all four surveyed days for seasonally adjusted person and vehicle trips, respectively. The seasonally adjusted trip rates summary showing the minimum, maximum and average trip rates separated into Sydney Metropolitan and Regional sites are also presented in Table 3.17.

Table 3.15 – Seasonally Adjusted Person Trip Rates per 100m^2 GLFA

Trips/100m^2 GLFA	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Total GLFA (m2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Thursday										
Daily Person Trips	69.61	137.38	97.69	96.34	103.16	67.41	83.83	91.51	90.87	62.31
Peak Person Trips (per Hour)	6.52	12.94	8.67	8.97	8.91	7.58	8.89	9.81	8.48	5.62
Peak Network Hour Person Trips										
- AM Peak	2.70	3.96	4.05	5.80	4.71	2.13	3.11	5.81	5.98	2.64
- PM Peak	6.10	10.02	7.40	8.66	8.72	6.91	7.60	9.42	7.80	5.28
Friday										
Daily Person Trips	51.92	96.34	68.12	63.87	76.33	43.60	71.96	81.83	70.39	48.89
Peak Person Trips (per Hour)	6.34	12.89	9.12	9.08	10.25	5.72	8.68	10.42	8.87	5.50
Peak Network Hour Person Trips										
- AM Peak	2.53	4.53	3.46	4.64	3.79	2.02	3.25	6.53	3.66	2.39
- PM Peak	4.23	10.74	6.18	7.21	9.95	5.69	6.00	10.28	8.11	5.49
Saturday										
Daily Person Trips	66.42	120.92	78.97	71.15	87.06	69.92	83.35	92.28	87.31	56.13
Peak Person Trips (per Hour)	9.05	16.46	11.02	10.12	11.18	10.04	12.26	14.02	13.05	7.34
Peak Network Hour Person Trips	8.07	11.06	10.63	9.62	11.18	10.04	12.23	12.78	12.79	6.98
Sunday										
Daily Person Trips	53.80	109.44	62.94	50.47	68.50	65.34	67.77	73.86	48.24	47.21
Peak Person Trips (per Hour)	8.44	16.17	9.97	8.28	10.39	10.16	10.99	12.49	7.92	7.26
Peak Network Hour Person Trips	8.35	11.53	9.95	8.27	10.00	8.97	9.53	10.74	7.90	6.40

Table 3.16 – Seasonally Adjusted Vehicle Trip Rates per 100m^2 GLFA

Trips/100m^2 GLFA	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Total GLFA (m2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Thursday										
Daily Vehicle Trips	42.90	44.19	30.11	35.33	64.71	42.22	59.60	60.67	55.55	39.71
Peak Vehicle Trips (per Hour)	3.82	4.02	2.76	3.34	5.60	4.40	6.01	6.21	5.30	3.56
Peak Network Hour Vehicle Trips										
- AM Peak	1.81	1.25	1.03	2.19	3.10	1.43	2.24	4.08	4.10	1.91
- PM Peak	3.65	3.33	2.26	3.23	5.34	4.17	5.19	5.77	4.97	3.38
Friday										
Daily Vehicle Trips	32.80	30.81	21.80	24.53	48.59	28.96	50.92	55.48	46.51	32.71
Peak Vehicle Trips (per Hour)	3.93	4.00	2.90	3.36	6.14	3.63	5.90	6.71	5.81	3.60
Peak Network Hour Vehicle Trips										
- AM Peak	1.61	1.28	1.06	1.59	2.01	1.37	2.42	4.69	2.63	1.73
- PM Peak	2.63	3.46	1.99	2.81	5.90	3.61	4.00	6.41	5.26	3.60
Saturday										
Daily Vehicle Trips	36.47	37.77	24.47	26.89	50.40	39.37	49.61	50.18	49.08	30.94
Peak Vehicle Trips (per Hour)	4.96	4.90	3.22	3.67	6.27	5.60	7.00	7.48	7.11	3.93
Peak Network Hour Vehicle Trips	4.35	3.86	3.10	3.54	6.27	5.60	6.93	6.89	7.06	3.84
Sunday										
Daily Vehicle Trips	30.05	35.06	18.63	19.81	37.32	32.77	39.43	39.78	25.35	25.23
Peak Vehicle Trips (per Hour)	4.70	5.30	2.87	3.23	5.46	5.00	6.25	6.60	4.12	3.84
Peak Network Hour Vehicle Trips	4.70	3.94	2.82	3.13	5.34	4.30	5.58	5.63	4.12	3.38

Table 3.17 – Trip Rates Summary (Seasonally Adjusted)

Trips/100m^2 GLFA	Sydney Metropolitan Area SC1 to SC7			Regional Area SC8 to SC10			All Surveyed Sites SC1 to SC10		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Thursday									
Person-based Trips									
Daily Person Trips	67.41	137.38	93.63	62.31	91.51	81.56	62.31	137.38	90.01
Site Peak Hour Person Trips	6.52	12.94	8.93	5.62	9.81	7.97	5.62	12.94	8.64
Peak Network Hour Person Trips									
- AM Peak	2.13	5.80	3.78	2.64	5.98	4.81	2.13	5.98	4.09
- PM Peak	6.10	10.02	7.92	5.28	9.42	7.50	5.28	10.02	7.79
Vehicle-based Trips									
Daily Vehicle Trips	30.11	64.71	45.58	39.71	60.67	51.98	30.11	64.71	47.50
Site Peak Hour Vehicle Trips	2.76	6.01	4.28	3.56	6.21	5.03	2.76	6.21	4.50
Peak Network Hour Vehicle Trips									
- AM Peak	1.03	3.10	1.86	1.91	4.10	3.37	1.03	4.10	2.31
- PM Peak	2.26	5.34	3.88	3.38	5.77	4.71	2.26	5.77	4.13
Friday									
Person-based Trips									
Daily Person Trips	43.60	96.34	67.45	48.89	81.83	67.04	43.60	96.34	67.33
Site Peak Hour Person Trips	5.72	12.89	8.87	5.50	10.42	8.26	5.50	12.89	8.69
Peak Network Hour Person Trips									
- AM Peak	2.02	4.64	3.46	2.39	6.53	4.19	2.02	6.53	3.68
- PM Peak	4.23	10.74	7.14	5.49	10.28	7.96	4.23	10.74	7.39
Vehicle-based Trips									
Daily Vehicle Trips	21.80	50.92	34.06	32.71	55.48	44.90	21.80	55.48	37.31
Site Peak Hour Vehicle Trips	2.90	6.14	4.27	3.60	6.71	5.38	2.90	6.71	4.60
Peak Network Hour Vehicle Trips									
- AM Peak	1.06	2.42	1.62	1.73	4.69	3.02	1.06	4.69	2.04
- PM Peak	1.99	5.90	3.49	3.60	6.41	5.09	1.99	6.41	3.97
Saturday									
Person-based Trips									
Daily Person Trips	66.42	120.92	82.54	56.13	92.28	78.57	56.13	120.92	81.35
Site Peak Hour Person Trips	9.05	16.46	11.45	7.34	14.02	11.47	7.34	16.46	11.45
Peak Network Hour Person Trips	8.07	12.23	10.41	6.98	12.79	10.85	6.98	12.79	10.54
Vehicle-based Trips									
Daily Vehicle Trips	24.47	50.40	37.86	30.94	50.18	43.40	24.47	50.40	39.52
Site Peak Hour Vehicle Trips	3.22	7.00	5.09	3.93	7.48	6.17	3.22	7.48	5.41
Peak Network Hour Vehicle Trips	3.10	6.93	4.81	3.84	7.06	5.93	3.10	7.06	5.14
Sunday									
Person-based Trips									
Daily Person Trips	50.47	109.44	68.32	47.21	73.86	56.44	47.21	109.44	64.76
Site Peak Hour Person Trips	8.28	16.17	10.63	7.26	12.49	9.22	7.26	16.17	10.21
Peak Network Hour Person Trips	8.27	11.53	9.51	6.40	10.74	8.35	6.40	11.53	9.16
Vehicle-based Trips									
Daily Vehicle Trips	18.63	39.43	30.44	25.23	39.78	30.12	18.63	39.78	30.34
Site Peak Hour Vehicle Trips	2.87	6.25	4.69	3.84	6.60	4.85	2.87	6.60	4.74
Peak Network Hour Vehicle Trips	2.82	5.58	4.26	3.38	5.63	4.38	2.82	5.63	4.29

Table 3.18, Table 3.19 and Table 3.20 show the average vehicle trip rates per 100m^2 GLFA grouped by the shopping centre area ranges for daily, site peak hour and network peak hour, respectively. These tables below present the seasonally adjusted trip generation rates.

Table 3.18 – Daily Traffic Generation Rates (Average Rates)

Range in Total Floor Area (GLFA - m^2)	Daily Generation Rates (vehicles per 100m^2 GLFA)			
	Thursday	Friday	Saturday	Sunday
0 - 20,000	61	55	50	40
20,000 - 40,000	60	51	50	39
40,000 - 60,000	60	48	50	31
60,000 - 80,000	43	31	38	33
Above 80,000	35	26	27	21

Table 3.19 – Site Peak Hour Traffic Generation Rates (Average Rates)

Range in Total Floor Area (GLFA - m^2)	Site Peak Hour Generation Rates (vehicles per 100m^2 GLFA)			
	Thursday	Friday	Saturday	Sunday
0 - 20,000	6.2	6.7	7.5	6.6
20,000 - 40,000	6.0	5.9	7.0	6.3
40,000 - 60,000	5.5	6.0	6.7	4.8
60,000 - 80,000	4.1	3.9	5.2	5.0
Above 80,000	3.2	3.3	3.6	3.3

Table 3.20 – Network Peak Hour Traffic Generation Rates (Average Rates)

Range in Total Floor Area (GLFA - m^2)	Network Peak Hour Generation Rates (vehicles per 100m^2 GLFA)			
	Thursday	Friday	Saturday	Sunday
0 - 20,000	5.8	6.4	6.9	5.6
20,000 - 40,000	5.2	4.0	6.9	5.6
40,000 - 60,000	5.2	5.6	6.7	4.7
60,000 - 80,000	3.7	3.2	4.6	4.3
Above 80,000	3.0	2.8	3.5	3.1

NOTE: Network peak hour for Thursday and Friday is for the PM peak hour.

3.7 Parking Demand and Provision

Using the number of parking spaces recorded during the survey, the parking provision rate per 100m^2 GLFA can be calculated.

Table 3.21 shows separate parking provision rates for customer, disabled, staff and loading bay/reserved parking spaces. The seasonally adjusted parking provision rates are shown in Table 3.22.

The analysis results indicate the following:

- The number of parking spaces provide varied from 3.6 to 4.9 spaces per 100m^2 GLFA.
- The peak parking demand from the survey indicated that it varied from 2.7 to 5.3 spaces per 100m^2 GLFA. Generally, Saturday had the highest parking demand, followed by Thursday, Sunday and then Friday.
- The seasonally adjusted parking demand varied from 2.8 to 5.3 spaces per 100m^2 GLFA.
- The surveys at sites SC4, SC5, SC6, SC7, SC9 and SC10 indicated that its parking demand had exceeded the parking supply during the peak periods.

Table 3.21 – Parking Provision Summary

Site ID	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
GLFA (m^2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Parking Spaces										
- Customer	2,539	2,972	2,893	3,382	1,467	2,470	986	727	1,668	3,187
- Disabled	67	38	78	60	35	75	18	16	44	66
- Staff	140	-	514	-	369	553	-	5	-	-
- Loading Bay	90	23	29	110	15	38	20	16	12	4
- Total	2,836	3,033	3,514	3,552	1,886	3,136	1,024	764	1,724	3,257
Space/100m^2 GLFA (Provision)										
- Customer	4.13	4.69	3.18	3.38	2.94	3.58	4.45	4.67	4.06	3.66
- Disabled	0.11	0.06	0.09	0.06	0.07	0.11	0.08	0.10	0.11	0.08
- Staff	0.23	-	0.56	-	0.74	0.80	-	0.03	-	-
- Loading Bay/Reserved	0.15	0.04	0.03	0.11	0.03	0.06	0.09	0.10	0.03	0.00
- Total	4.62	4.78	3.86	3.55	3.78	4.54	4.62	4.91	4.20	3.74
Peak Parking Accumulation										
- Thursday	2,340	1,744	2,721	3,560	1,875	2,433	864	494	1,926	3,510
- % Occupied	82%	57%	77%	100%	99%	77%	80%	65%	112%	108%
- Friday	2,172	1,782	2,459	2,737	1,855	2,258	829	493	1,910	3,266
- % Occupied	76%	59%	70%	77%	98%	71%	77%	65%	111%	100%
- Saturday	2,182	2,326	3,020	3,126	2,314	3,468	1,167	581	1,934	3,280
- % Occupied	77%	77%	86%	88%	123%	110%	108%	76%	112%	101%
- Sunday	2,016	2,392	2,654	2,667	2,146	2,770	875	436	1,143	2,900
- % Occupied	71%	79%	76%	75%	114%	88%	81%	57%	66%	89%

Table 3.22 – Seasonally Adjusted Parking Provision Summary

Site ID	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
GLFA (m^2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Parking Spaces										
- Customer	2,539	2,972	2,893	3,382	1,467	2,470	986	727	1,668	3,187
- Disabled	67	38	78	60	35	75	18	16	44	66
- Staff	140	-	514	-	369	553	-	5	-	-
- Loading Bay	90	23	29	110	15	38	20	16	12	4
- Total	2,836	3,033	3,514	3,552	1,886	3,136	1,024	764	1,724	3,257
Space/100m^2 GLFA (Provision)										
- Customer	4.13	4.69	3.18	3.38	2.94	3.58	4.45	4.67	4.06	3.66
- Disabled	0.11	0.06	0.09	0.06	0.07	0.11	0.08	0.10	0.11	0.08
- Staff	0.23	-	0.56	-	0.74	0.80	-	0.03	-	-
- Loading Bay/Reserved	0.15	0.04	0.03	0.11	0.03	0.06	0.09	0.10	0.03	0.00
- Total	4.62	4.78	3.86	3.55	3.78	4.54	4.62	4.91	4.20	3.74
Peak Parking Accumulation										
- Thursday	2,294	2,265	2,777	3,670	2,016	2,433	864	494	1,945	3,582
- % Occupied	81%	75%	79%	103%	107%	77%	80%	65%	113%	110%
- Friday	2,129	2,314	2,509	2,822	1,995	2,258	829	493	1,929	3,333
- % Occupied	75%	76%	71%	79%	106%	71%	77%	65%	112%	102%
- Saturday	2,139	3,021	3,082	3,223	2,488	3,468	1,167	581	1,954	3,347
- % Occupied	75%	100%	88%	90%	132%	110%	108%	76%	113%	103%
- Sunday	1,976	3,106	2,708	2,749	2,308	2,770	875	436	1,155	2,959
- % Occupied	70%	102%	77%	77%	122%	88%	81%	57%	67%	91%

Table 3.23 shows the average parking provision rates grouped into GLFA ranges.

Table 3.23 – Parking Provision Rates

Range in Total Floor Area (GLFA - m^2)	Car Parking Spaces per $100m^2$ GLFA
0 - 20,000	4.9
20,000 - 40,000	4.6
40,000 - 60,000	4.0
60,000 - 80,000	4.6
Above 80,000	3.7

Table 3.24 shows the average parking demand rates per $100m^2$ GLFA grouped by the area ranges. The seasonally adjusted parking provision rates are also shown in Table 3.25.

Table 3.24 – Parking Demand Rates

Range in Total Floor Area	Car Parking Spaces per $100m^2$ GLFA			
(GLFA - m^2)	Thursday	Friday	Saturday	Sunday
0 - 20,000	3.2	3.2	3.7	2.8
20,000 - 40,000	3.9	3.7	5.3	4.0
40,000 - 60,000	4.2	4.2	4.7	3.5
60,000 - 80,000	3.4	3.2	4.1	3.7
Above 80,000	3.5	3.1	3.4	3.0

Table 3.25 – Seasonally Adjusted Parking Demand Rates

Range in Total Floor Area	Car Parking Spaces per $100m^2$ GLFA			
(GLFA - m^2)	Thursday	Friday	Saturday	Sunday
0 - 20,000	3.2	3.2	3.7	2.8
20,000 - 40,000	3.9	3.7	5.3	4.0
40,000 - 60,000	4.4	4.3	4.9	3.7
60,000 - 80,000	3.6	3.5	4.4	4.0
Above 80,000	3.6	3.1	3.5	3.0

4 Regression Analysis

4.1 Multiple Regression Analysis

Multiple linear regression methods, measuring trip behaviour as a function of several independent variables, have been used in the previous studies and are considered to be superior than using the simple linear regression method for this particular land use type.

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 GLFA) 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 3.2.1, the gross leasable floor area (GLFA) is used as the key independent variable for this regression analysis. The trip behaviour is calculated against the following unit:

- Daily total trips;
- Site peak hour trips;
- Peak network hour trips;
- Peak parking accumulation

A detail description of the revised retail categories are listed below:

- A(S): Slow trade includes major department stores such as David Jones and Myer, furniture, electrical and whitegood stores.
- A(F): Faster trade includes discount department stores such as K-Mart and Target, together with larger specialist stores, eg Lowes, Lincraft, etc.
- A(SM): Supermarket includes stores such as Woolworths, Coles, IGA, Franklins and large fruit markets.

- A(SS): Specialty shops / Secondary retail / Automobile services includes smaller retail outlets (eg clothing, jewellery, hairdressers, footwear, fast food, delicatessens, newsagents, sports stores, chemists, service stations, etc)
- A(OM): Office / Medical / Child care / Other including medical centres, general business offices, child care, library, etc.
- A(C): Cinemas

The proportion of GLFA for the six retail categories for each selected sites are shown in Figure 4.1.

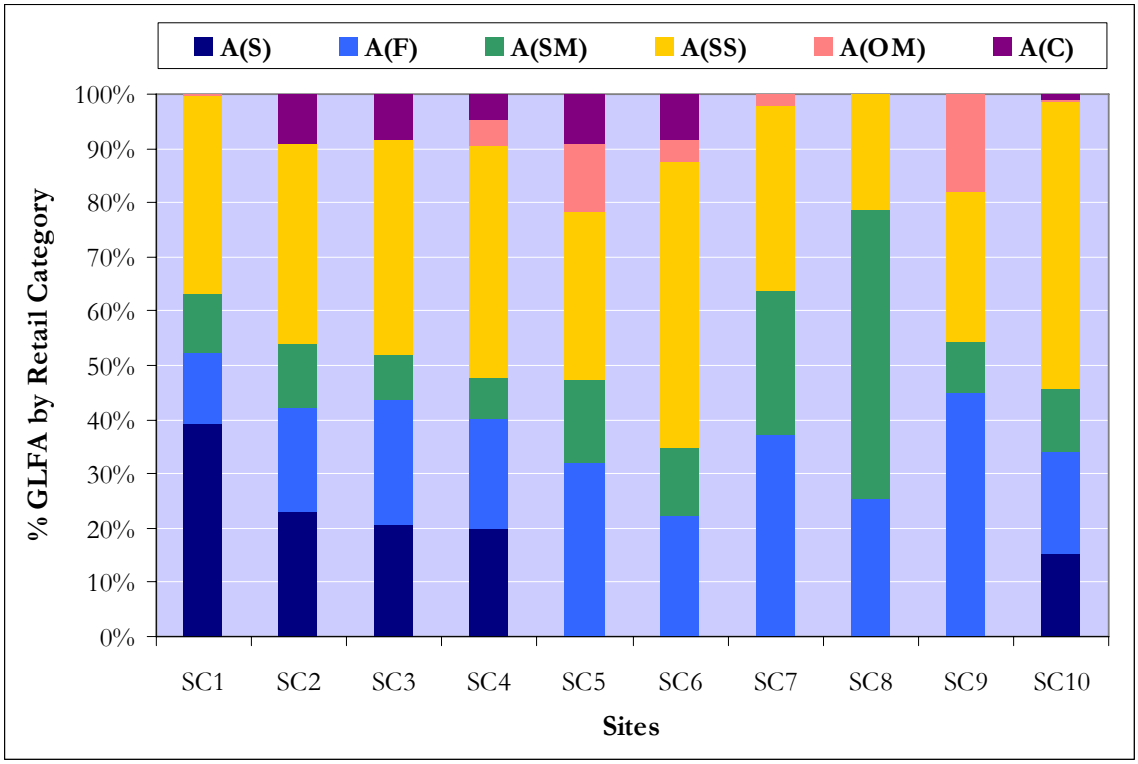

Figure 4.1 – Proportion of GLFA by Six Retail Categories

The GLFA's for six retail categories described above is used as functions of the multiple principal independent variables in multiple regression analysis.

The data analysis tool in Microsoft Excel has been used to perform the multiple regression analysis but a number of the sites were also checked using the Statistical Package for the Social Sciences package (SPSS).

More detailed regression analysis results including the standard error and t-Stat, as well as the coefficients for the retail category areas are included in **Appendix B**.

The summary of the multiple regression outputs are listed below.

4.1.1 Daily Total Trips

Daily Person Trips

Thursday:

DPT = 1.449 A(S) + 1.472 A(F) + 0.573 A(SM) + 0.002 A(SS) + 1.143 A(OM) + 3.5 A(C)

$R^2 = 0.99$

Friday:

DPT = 0.984 A(S) + 1.434 A(F) + 0.718 A(SM) – 0.122 A(SS) + 0.224 A(OM) + 1.682 A(C)

$R^2 = 1.00$

Saturday:

DPT = 0.981 A(S) + 1.253 A(F) + 1.205 A(SM) + 0.014 A(SS) + 0.633 A(OM) + 2.473 A(C)

$R^2 = 1.00$

Sunday:

DPT = 0.619 A(S) + 0.468 A(F) + 1.574 A(SM) + 0.134 A(SS) + 2.82 A(C)

$R^2 = 0.99$

Daily Vehicle Trips

Thursday:

DVT = 0.288 A(S) + 0.074 A(F) + 1.455 A(SM) + 0.288 A(SS) + 1.787 A(OM) – 0.167 A(C)

$R^2 = 0.99$

Friday:

DVT = 0.175 A(S) + 0.327 A(F) + 1.171 A(SM) + 0.165 A(SS) + 0.975 A(OM) – 0.702 A(C)

$R^2 = 0.99$

Saturday:

DVT = 0.185 A(S) + 0.06 A(F) + 1.258 A(SM) + 0.234 A(SS) + 1.43 A(OM) – 0.063 A(C)

$R^2 = 0.99$

Sunday:

DVT = 0.063 A(S) + 0.189 A(F) + 1.064 A(SM) + 0.183 A(SS) + 0.078 A(C)

$R^2 = 0.97$

4.1.2 Site Peak Hour Trips

Site Peak Hour Person Trips

Thursday:

PPT = 0.116 A(S) + 0.09 A(F) + 0.096 A(SM) + 0.017 A(SS) + 0.147 A(OM) + 0.34 A(C)

$R^2 = 0.99$

Friday:

PPT = 0.145 A(S) + 0.154 A(F) + 0.08 A(SM) – 0.021 A(SS) + 0.12 A(OM) + 0.333 A(C)

$R^2 = 0.99$

Saturday:

PPT = 0.133 A(S) + 0.194 A(F) + 0.152 A(SM) – 0.002 A(SS) + 0.083 A(OM) + 0.331 A(C)

$R^2 = 0.99$

Sunday:

PPT = 0.098 A(S) + 0.089 A(F) + 0.226 A(SM) + 0.022 A(SS) + 0.408 A(C)

$R^2 = 0.99$

Site Peak Hour Vehicle Trips

Thursday:

PVT = 0.017 A(S) + 0.003 A(F) + 0.137 A(SM) + 0.032 A(SS) + 0.164 A(OM) – 0.011 A(C)

$R^2 = 0.99$

Friday:

PVT = 0.031 A(S) + 0.032 A(F) + 0.134 A(SM) + 0.016 A(SS) + 0.158 A(OM) – 0.033 A(C)

$R^2 = 1.00$

Saturday:

PVT = 0.023 A(S) + 0.01 A(F) + 0.17 A(SM) + 0.031 A(SS) + 0.201 A(OM) – 0.019 A(C)

$R^2 = 0.98$

Sunday:

PVT = 0.013 A(S) + 0.034 A(F) + 0.16 A(SM) + 0.027 A(SS) – 0.002 A(C)

$R^2 = 0.97$

4.1.3 Peak Network Hour Trips

Peak Network Hour Vehicle Trips

Thursday (PM):

PVT(P) = 0.016 A(S) – 0.026 A(F) + 0.135 A(SM) + 0.04 A(SS) + 0.21 A(OM) – 0.025 A(C)

$R^2 = 0.99$

Friday (PM):

PVT(P) = – 0.001 A(S) – 0.006 A(F) + 0.133 A(SM) + 0.034 A(SS) + 0.186 A(OM) – 0.034 A(C)

$R^2 = 0.99$

Saturday:

PVT = 0.005 A(S) + 0.019 A(F) + 0.144 A(SM) + 0.038 A(SS) + 0.19 A(OM) – 0.033 A(C)

$R^2 = 0.98$

Sunday:

PVT = 0.021 A(S) + 0.055 A(F) + 0.122 A(SM) + 0.019 A(SS) – 0.029 A(C)

$R^2 = 0.97$

4.1.4 Peak Parking Accumulation

Peak Parking Demand

Thursday:

PPD = 0.027 A(S) + 0.034 A(F) + 0.032 A(SM) + 0.049 A(SS) + 0.087 A(OM) – 0.071 A(C)

$R^2 = 1.00$

Friday:

PPD = 0.018 A(S) + 0.051 A(F) + 0.049 A(SM) + 0.035 A(SS) + 0.044 A(OM) – 0.071 A(C)

$R^2 = 0.99$

Saturday:

PPD = 0.001 A(S) + 0.028 A(F) + 0.082 A(SM) + 0.044 A(SS) + 0.064 A(OM) + 0.036 A(C)

$R^2 = 0.99$

Sunday:

PPD = 0.01 A(S) + 0.024 A(F) + 0.081 A(SM) + 0.032 A(SS) + 0.067 A(C)

$R^2 = 0.99$

4.2 Linear Regression Analysis

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.

As stated in Section 3.2.1, the gross leasable floor area (GLFA) is used as the key independent variable for this regression analysis. The trip behaviour is plotted against the following unit:

- Daily total trips;
- Site peak hour trips;
- Network peak hour trips (i.e. AM & PM);
- Daily trip rates (i.e. trips/100m^2 GLFA);
- Site peak hour trip rates (i.e. trips/100m^2 GLFA);
- Network peak hour trip rates (i.e. trips/100m^2 GLFA);and
- Total parking space and peak parking accumulation.

4.2.1 Daily Total Trips

Table 4.1 presents the summary of correlation coefficients for daily trips regression models.

Table 4.1 – Summary of Correlation Coefficient (R^2) for Daily Trips

	Person Trips	Vehicle Trips
Thursday	0.83	0.75
Friday	0.84	0.62
Saturday	0.87	0.69
Sunday	0.79	0.68

- For the person trips, R^2 is generally above 0.8 except for Sundays.
- For the vehicle trips, R^2 is between 0.6 and 0.75.
- R^2 for the person trips for all surveyed days is reasonably acceptable.

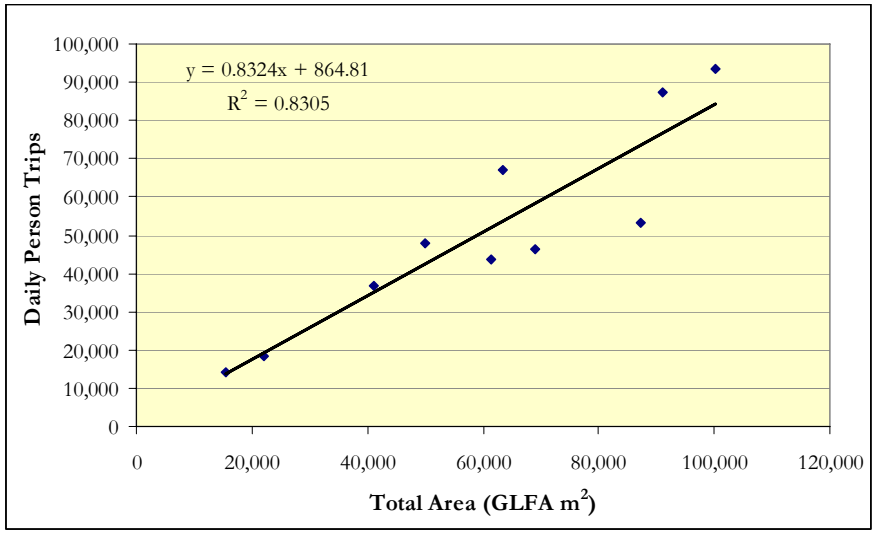

Figure 4.2 – Daily Person Trips/GLFA (Thursday)

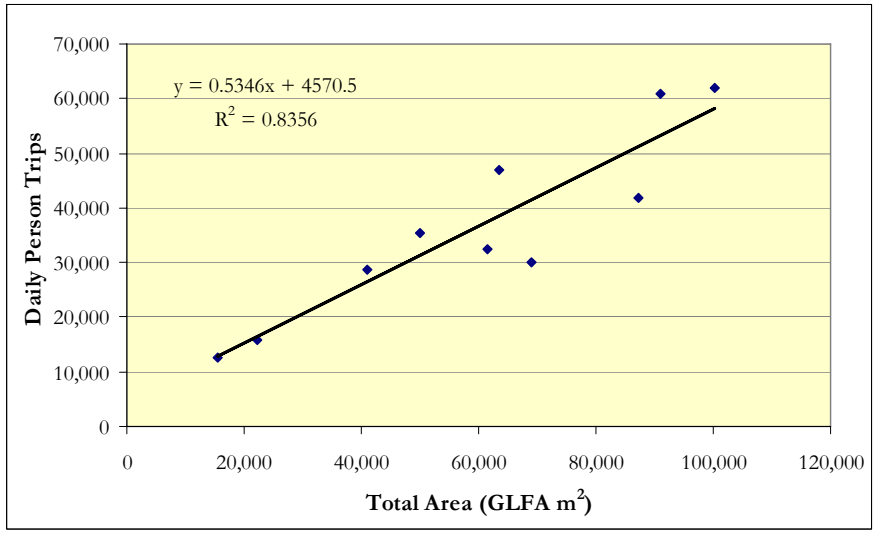

Figure 4.3 – Daily Person Trips/GLFA (Friday)

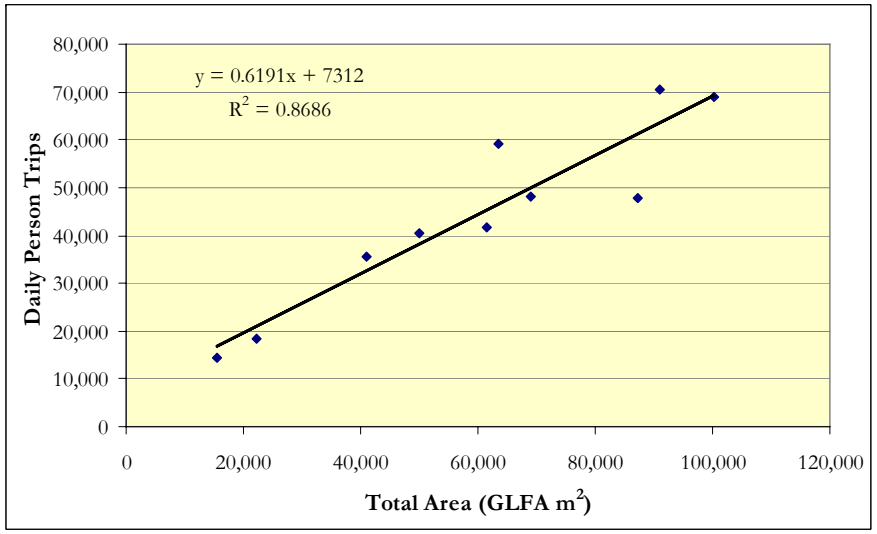

Figure 4.4 – Daily Person Trips/GLFA (Saturday)

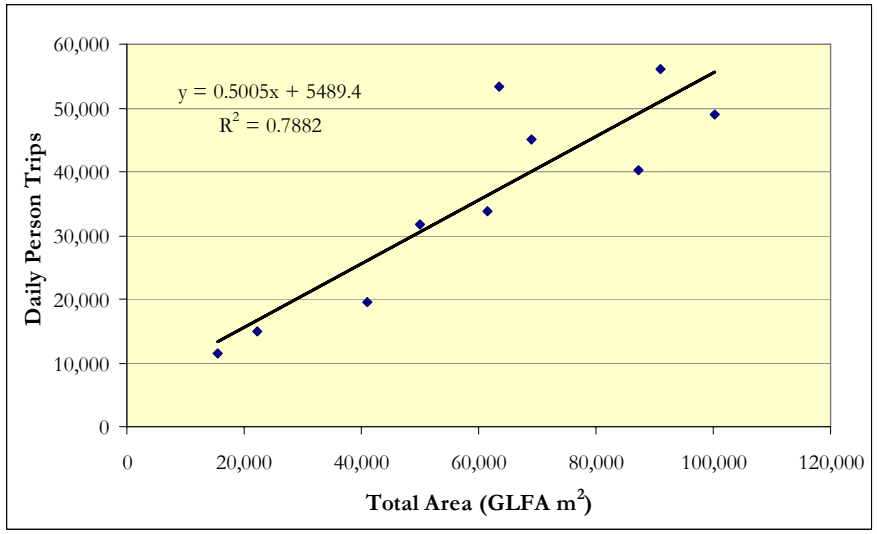

Figure 4.5 – Daily Person Trips/GLFA (Sunday)

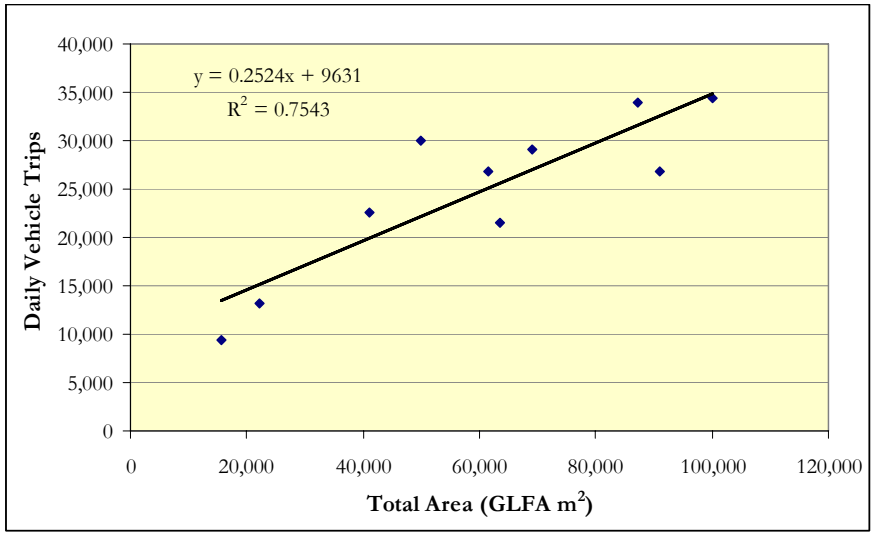

Figure 4.6 – Daily Vehicle Trips/GLFA (Thursday)

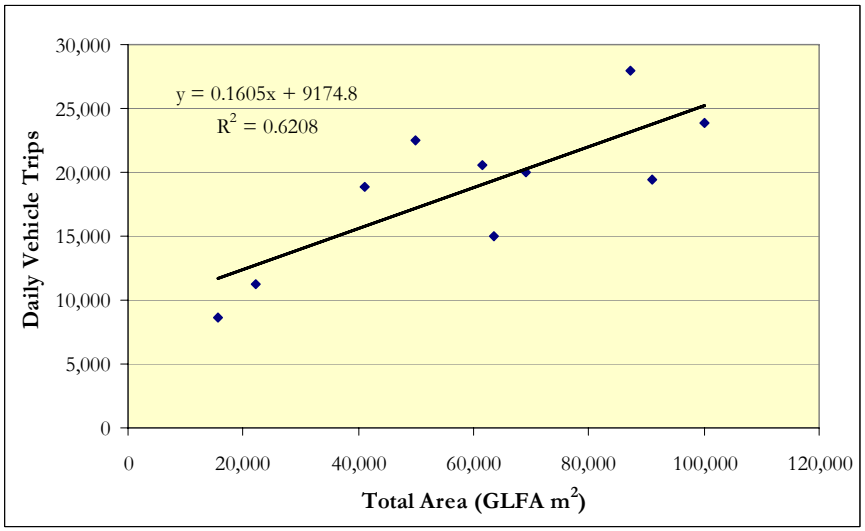

Figure 4.7 – Daily Vehicle Trips/GLFA (Friday)

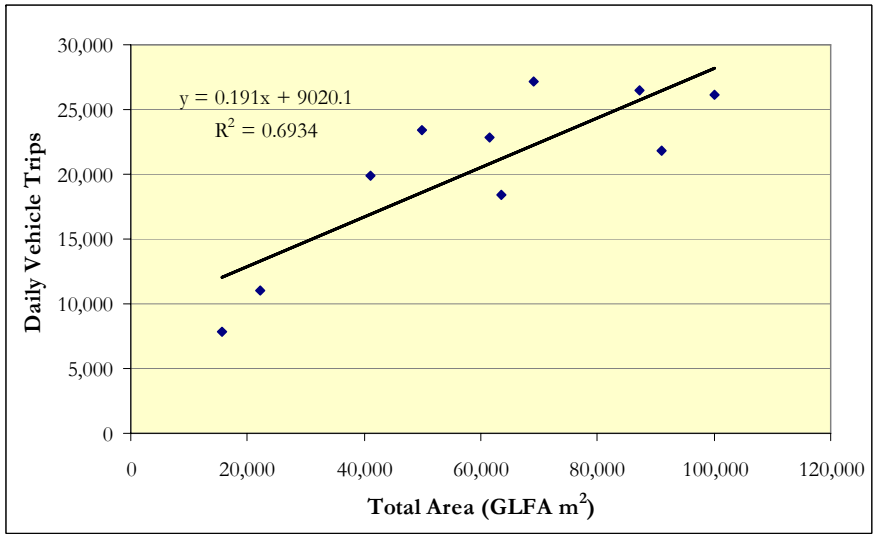

Figure 4.8 – Daily Vehicle Trips/GLFA (Saturday)

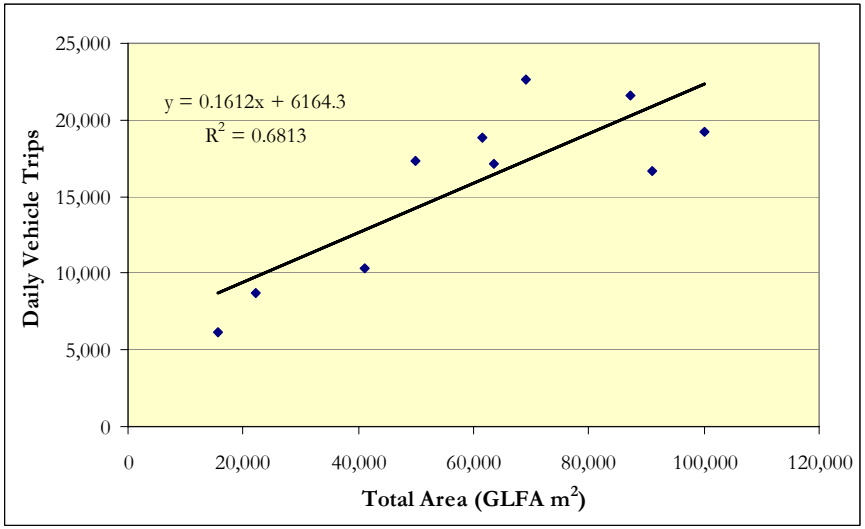

Figure 4.9 – Daily Vehicle Trips/GLFA (Sunday)

4.2.2 Site Peak Hour Trips

Table 4.2 presents the summary of correlation coefficients for site peak hour trip regression models.

Table 4.2 – Summary of Correlation Coefficient (R^2) for Site Peak Hour Trips

	Person Trips	Vehicle Trips
Thursday	0.84	0.75
Friday	0.77	0.72
Saturday	0.84	0.64
Sunday	0.83	0.73

- For the person trips, R^2 is generally above 0.8 except for Fridays.
- For the vehicle trips, R^2 is between 0.6 and 0.75.
- R^2 for the person trips for all surveyed days is reasonably acceptable.

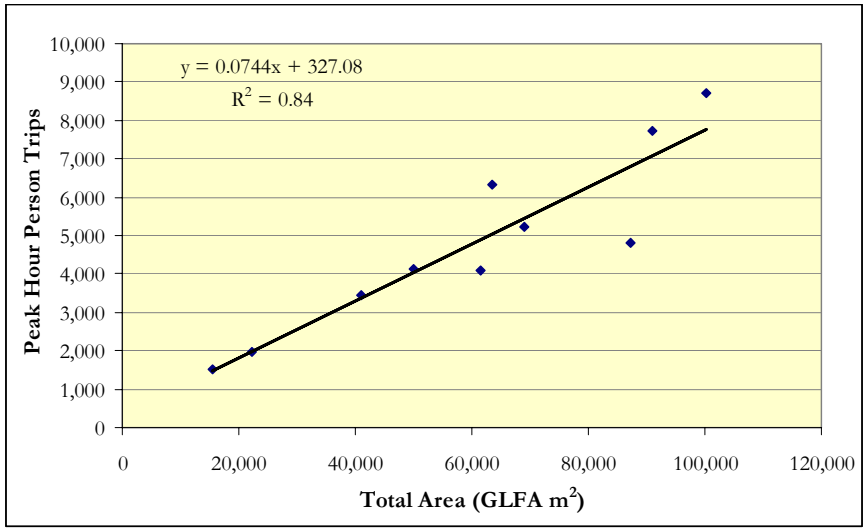

Figure 4.10 – Site Peak Hour Person Trips/GLFA (Thursday)

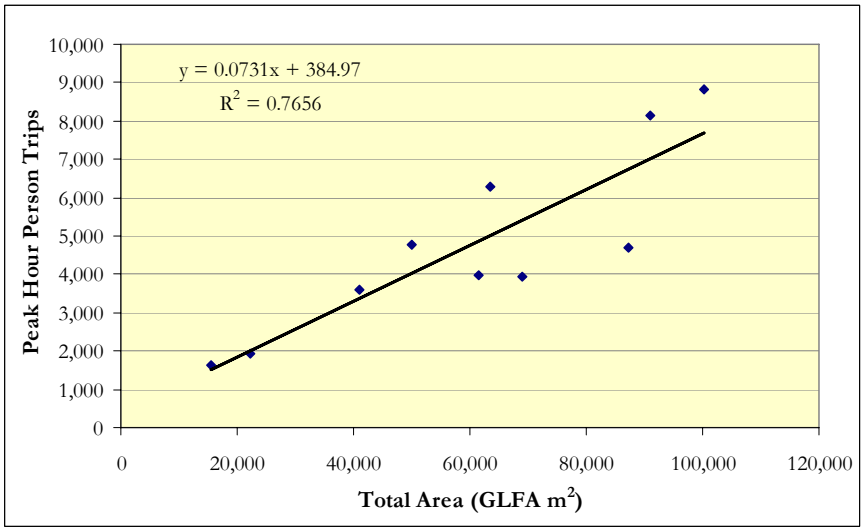

Figure 4.11 – Site Peak Hour Person Trips/GLFA (Friday)

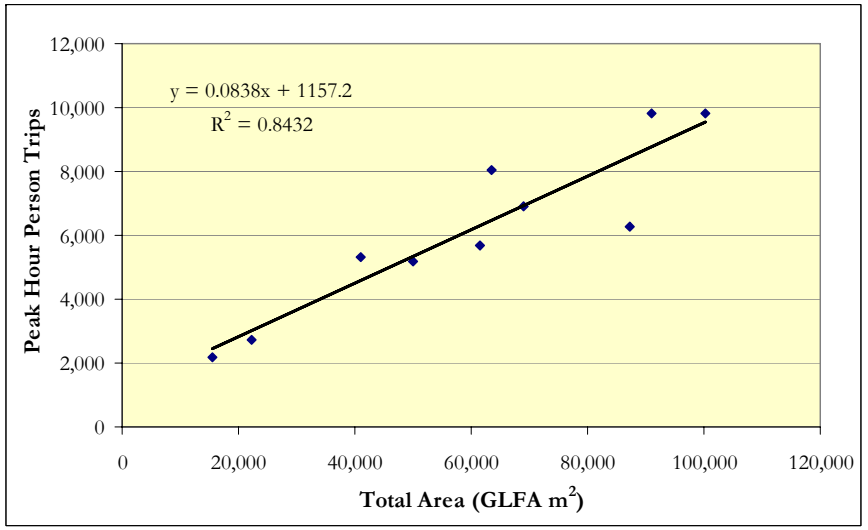

Figure 4.12 – Site Peak Hour Person Trips/GLFA (Saturday)

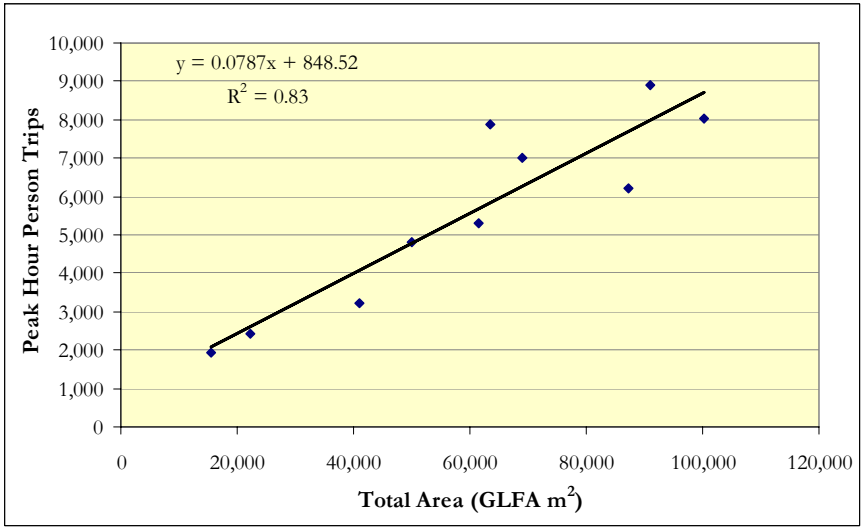

Figure 4.13 – Site Peak Hour Person Trips/GLFA (Sunday)

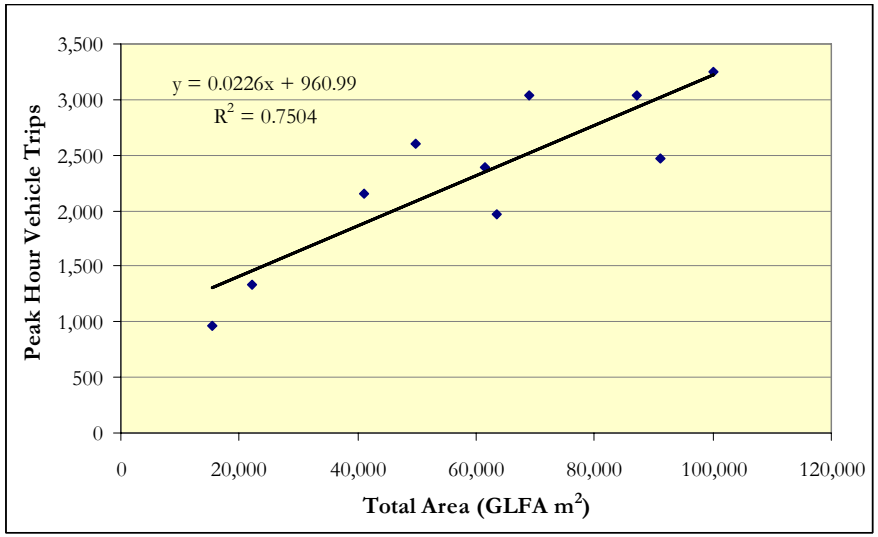

Figure 4.14 – Site Peak Hour Vehicle Trips/GLFA (Thursday)

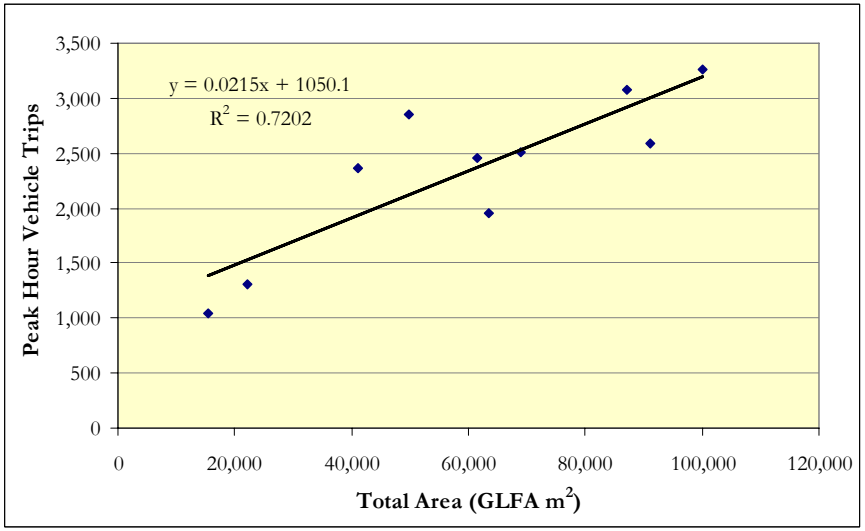

Figure 4.15 – Site Peak Hour Vehicle Trips/GLFA (Friday)

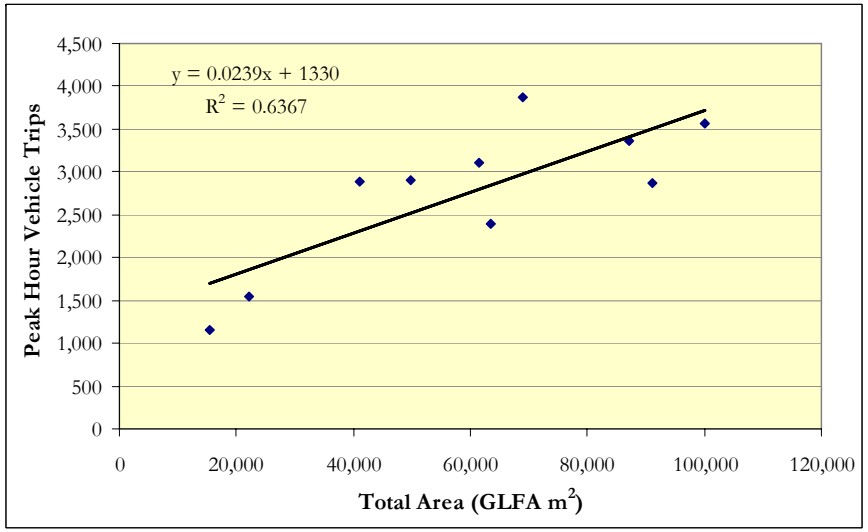

Figure 4.16 – Site Peak Hour Vehicle Trips/GLFA (Saturday)

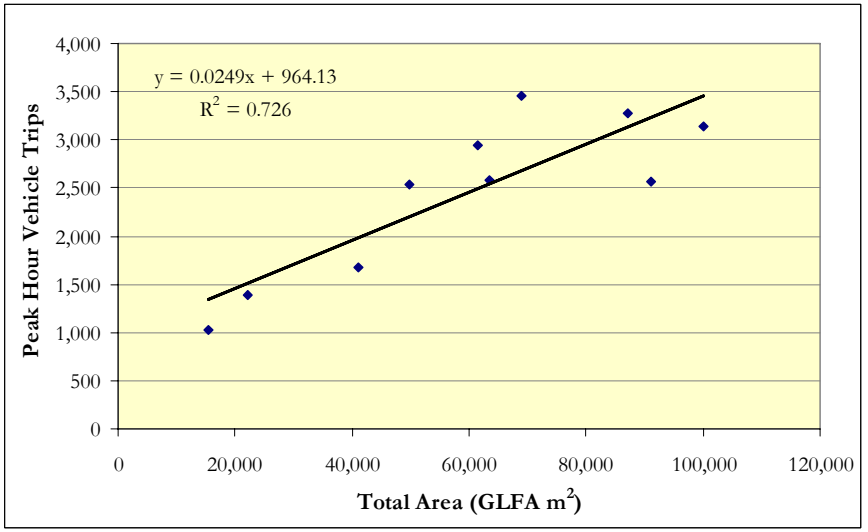

Figure 4.17 – Site Peak Hour Vehicle Trips/GLFA (Sunday)

4.2.3 Network Peak Hour Vehicle Trips

Table 4.3 presents the summary of correlation coefficients for network peak hour vehicle trips regression models.

Table 4.3 – Summary of Correlation Coefficient (R^2) for Network Peak Hour Vehicle Trips

	AM Network Vehicle Trips	PM Network Vehicle Trips
Thursday	0.31	0.64
Friday	0.52	0.47
	Network Vehicle Trips	
Saturday	0.55	
Sunday	0.74	

- For the network peak hour vehicle trips, R^2 is low except for Thursday and Sunday network peak hour vehicle trips.

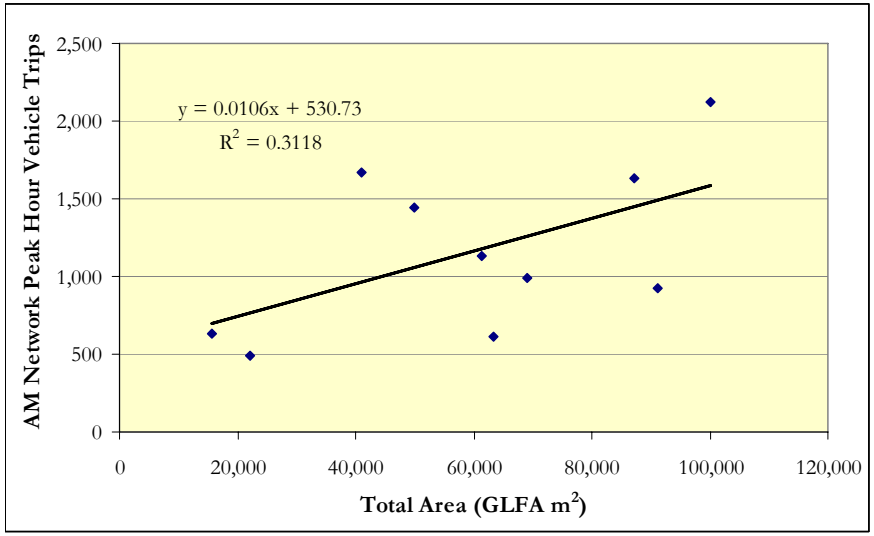

Figure 4.18 – Network AM Peak Hour Vehicle Trips/GLFA (Thursday)

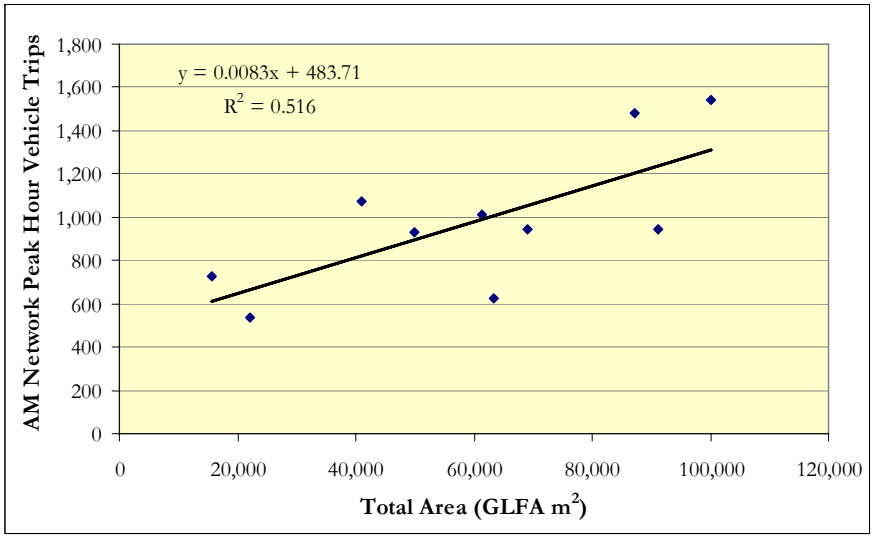

Figure 4.19 – Network AM Peak Hour Vehicle Trips/GLFA (Friday)

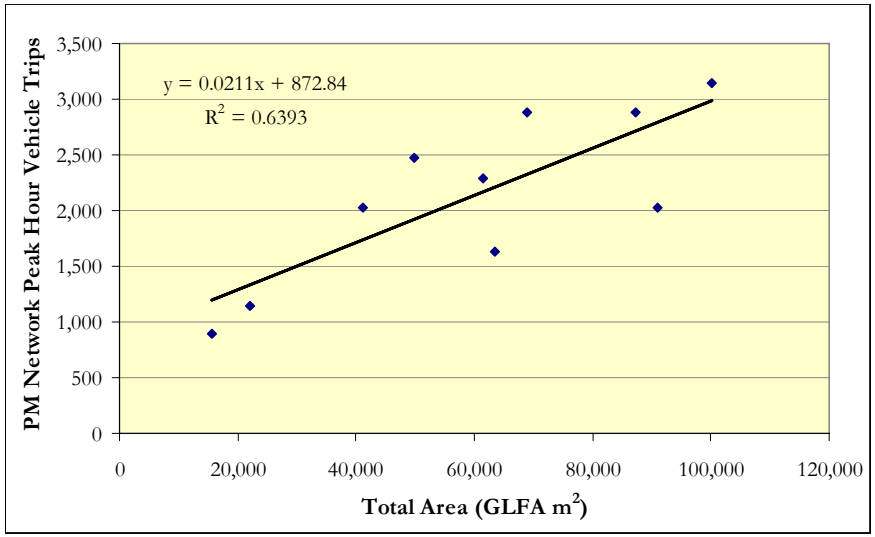

Figure 4.20 – Network PM Peak Hour Vehicle Trips/GLFA (Thursday)

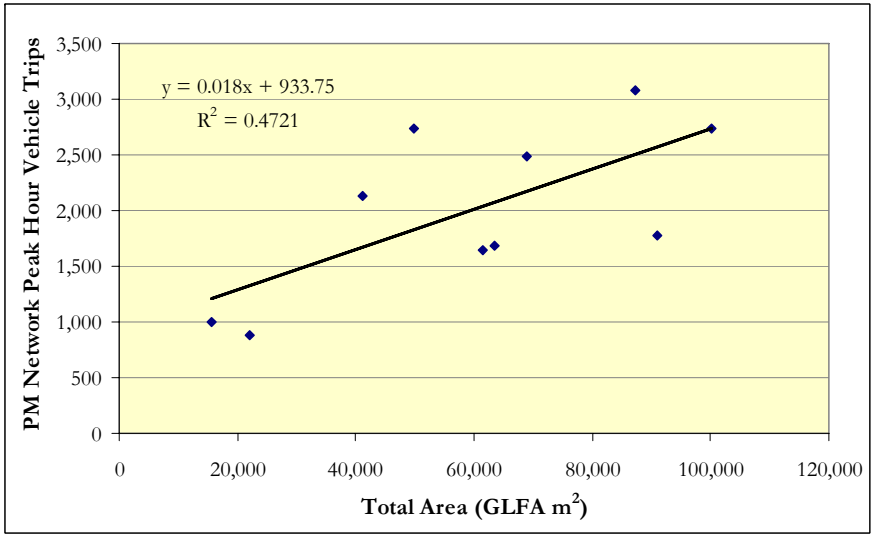

Figure 4.21 – Network PM Peak Hour Vehicle Trips/GLFA (Friday)

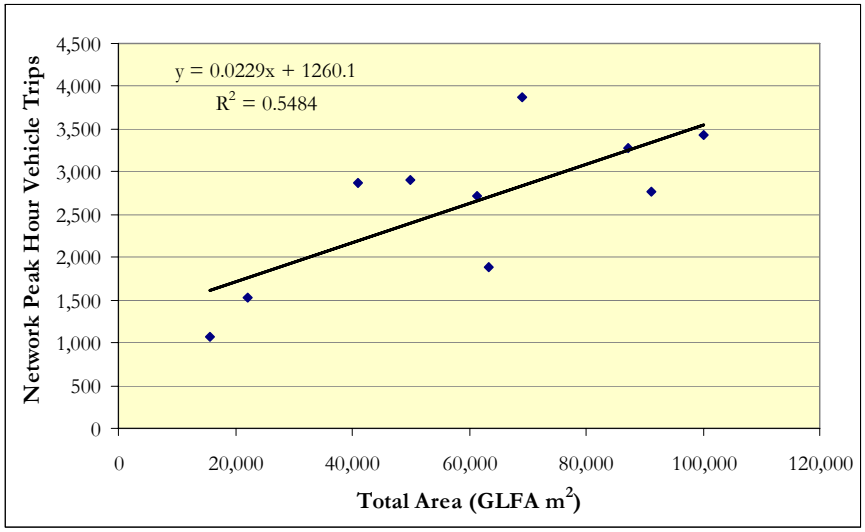

Figure 4.22 – Network Peak Hour Vehicle Trips/GLFA (Saturday)

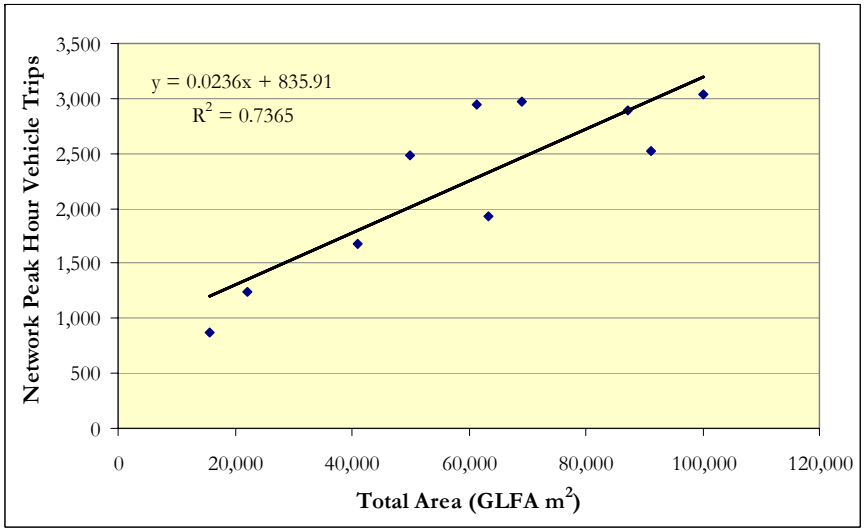

Figure 4.23 – Network Peak Hour Vehicle Trips/GLFA (Sunday)

4.2.4 Daily Trip Rates (Trips/100m² GLFA)

Table 4.4 presents the summary of correlation coefficients for daily trip rate regression models.

Table 4.4 – Summary of Correlation Coefficient (R^2) for Daily Trip Rates

	Person Trips/100m² GLFA	Vehicle Trip/100m² GLFA
Thursday	0.02	0.79
Friday	0.35	0.83
Saturday	0.44	0.84
Sunday	0.19	0.73

- For the person trip rates, R^2 is considerably low.
- For the vehicle trip rates, R^2 is generally above 0.7.
- R^2 for the vehicle trip rates is reasonably acceptable.

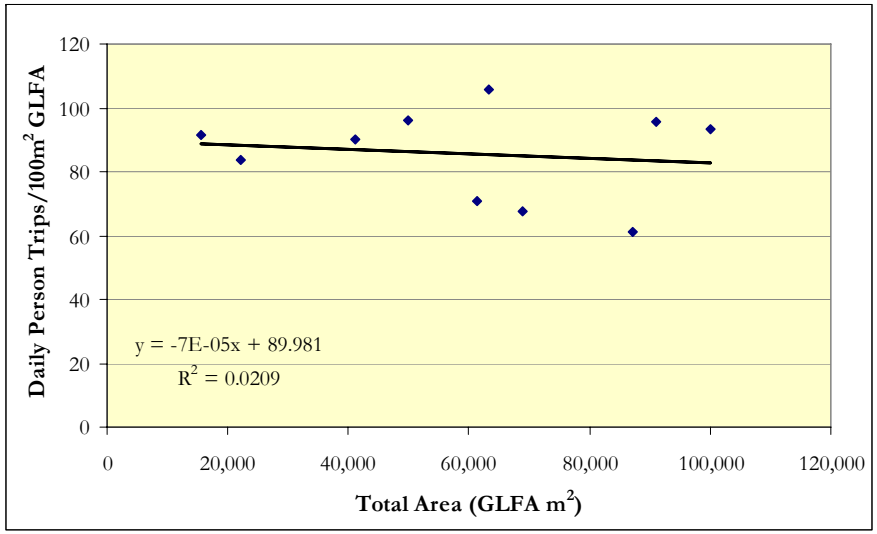

Figure 4.24 – Daily Person Trip Rates/GLFA (Thursday)

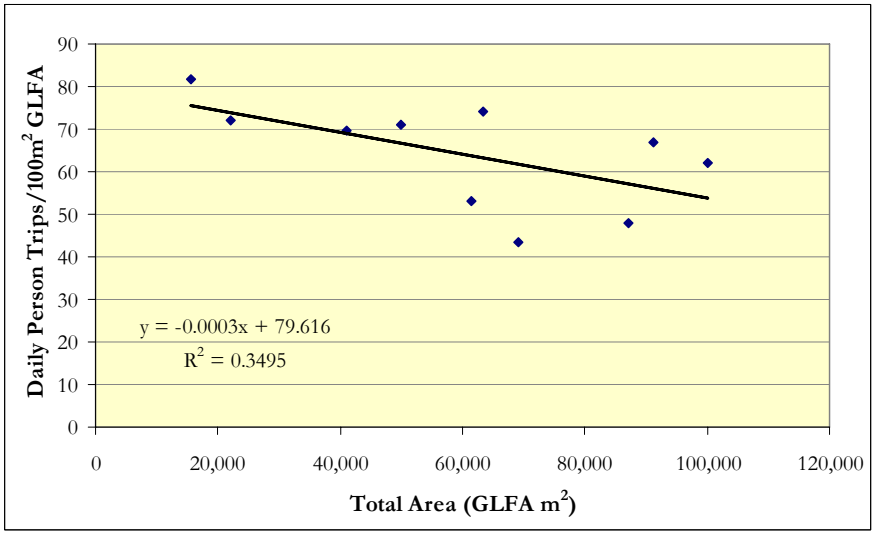

Figure 4.25 – Daily Person Trip Rates/GLFA (Friday)

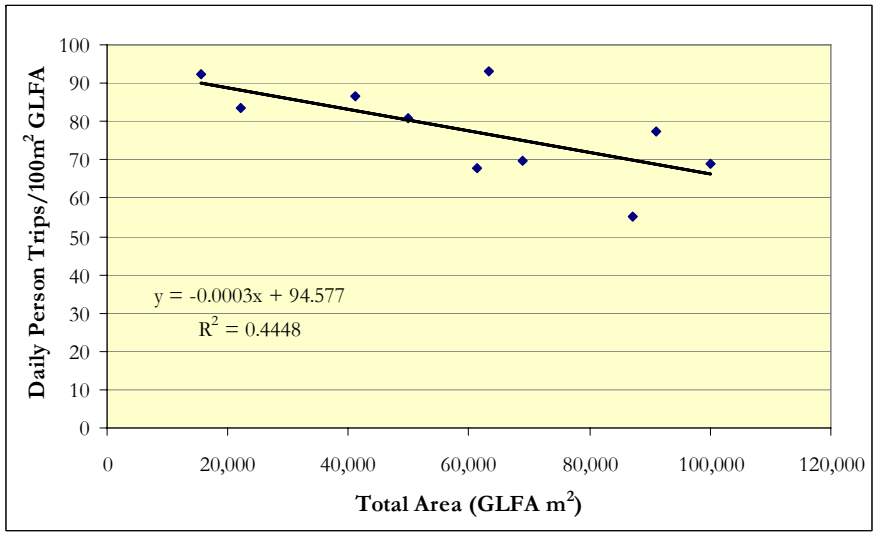

Figure 4.26 – Daily Person Trip Rates/GLFA (Saturday)

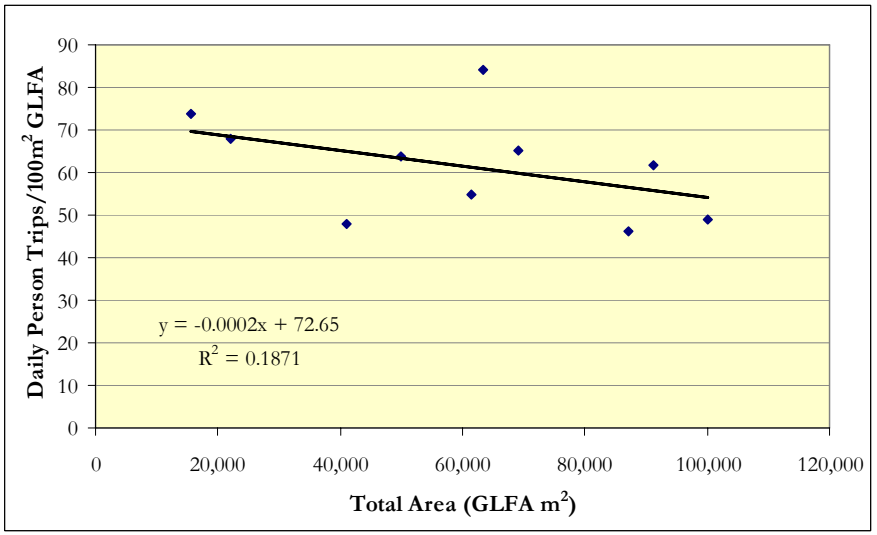

Figure 4.27 – Daily Person Trip Rates/GLFA (Sunday)

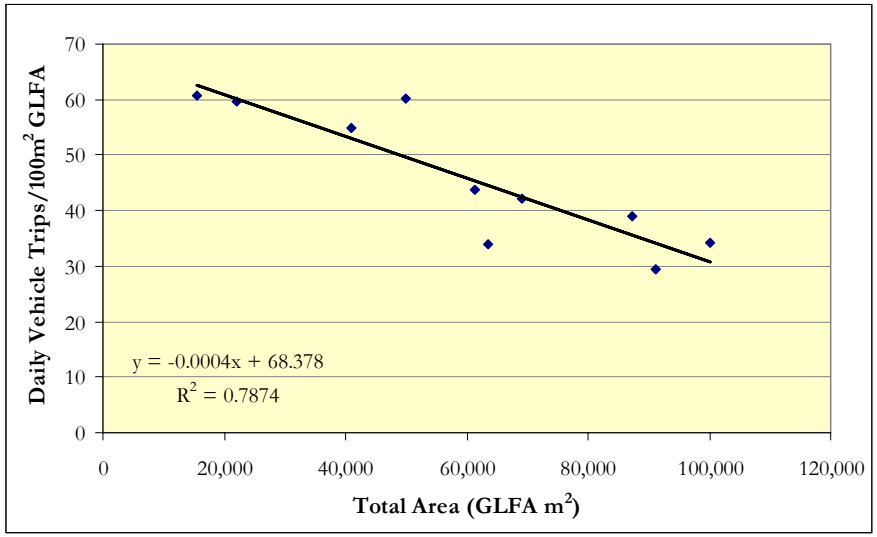

Figure 4.28 – Daily Vehicle Trip Rates/GLFA (Thursday)

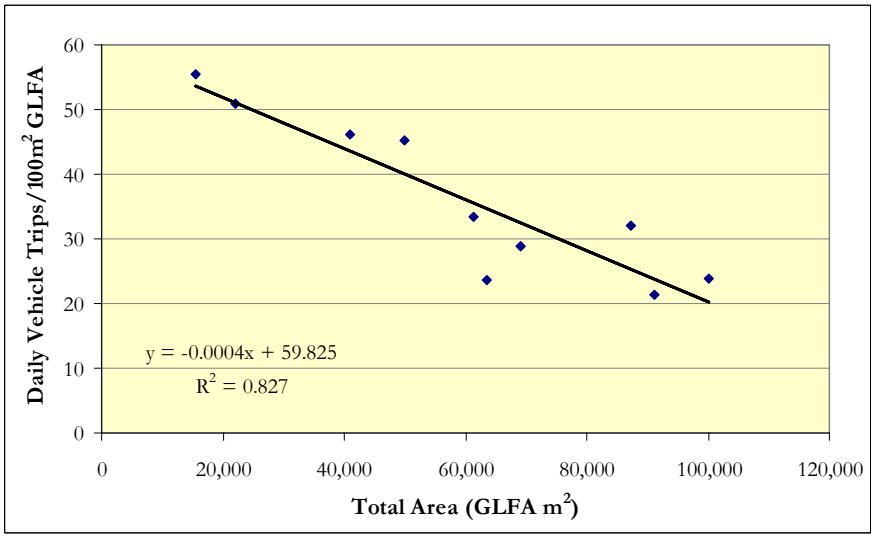

Figure 4.29 – Daily Vehicle Trip Rates/GLFA (Friday)

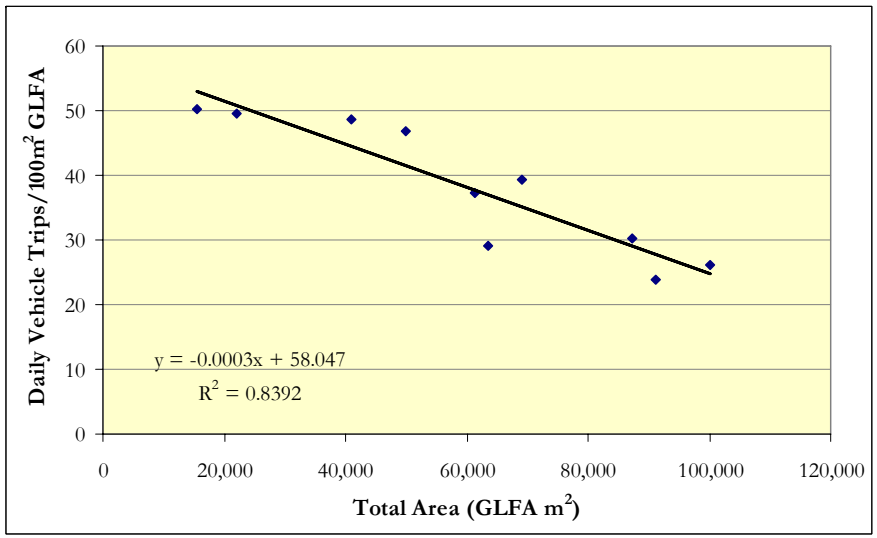

Figure 4.30 – Daily Vehicle Trip Rates/GLFA (Saturday)

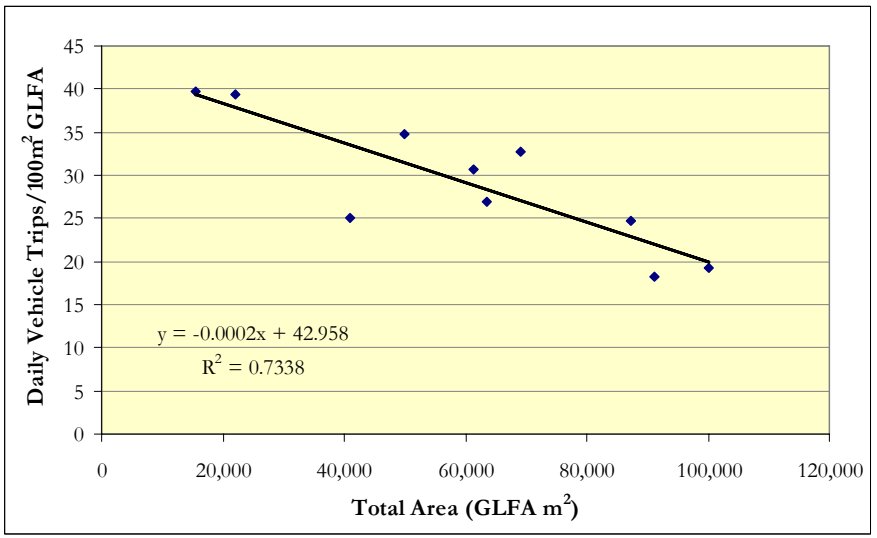

Figure 4.31 – Daily Vehicle Trip Rates/GLFA (Sunday)

4.2.5 Site Peak Hour Trip Rates (Trips/100m² GLFA)

Table 4.5 presents the summary of correlation coefficients for site peak hour trip rate regression models.

Table 4.5 – Summary of Correlation Coefficient (R^2) for Site Peak Hour Trip Rates

	Person Trips/100m² GLFA	Vehicle Trips/100m² GLFA
Thursday	0.18	0.84
Friday	0.17	0.82
Saturday	0.51	0.85
Sunday	0.30	0.79

- For the person trip rates, R^2 is low.
- For the vehicle trip rates, R^2 is generally above 0.8.
- R^2 for the vehicle trip rates is reasonably acceptable.

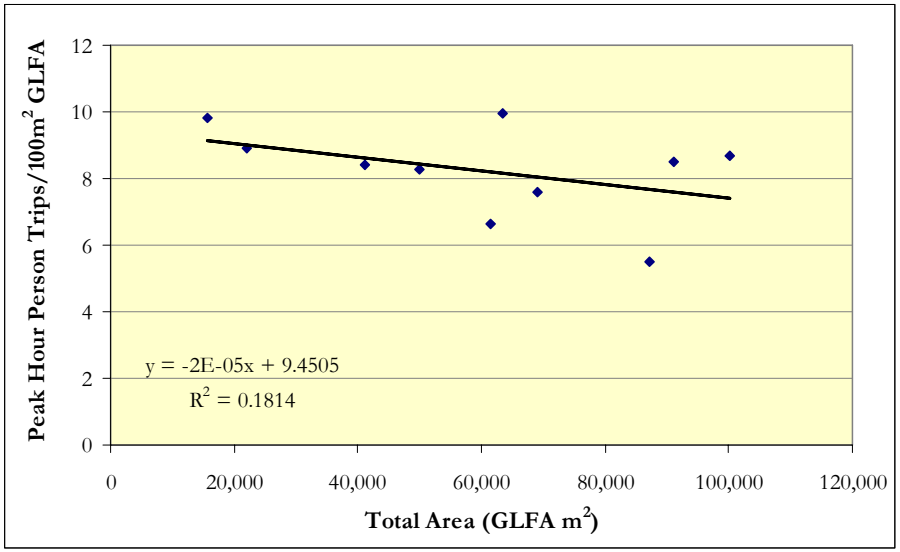

Figure 4.32 – Site Peak Hour Person Trip Rates/GLFA (Thursday)

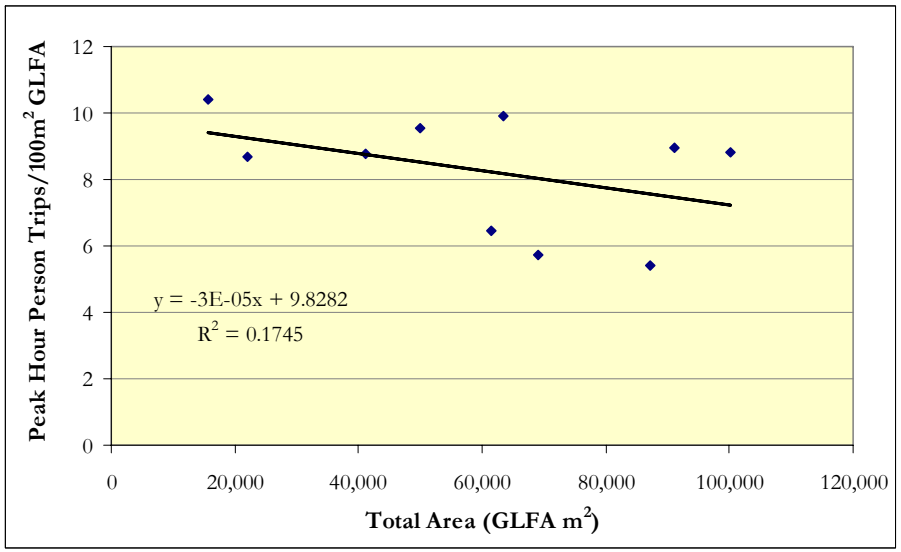

Figure 4.33 – Site Peak Hour Person Trip Rates/GLFA (Friday)

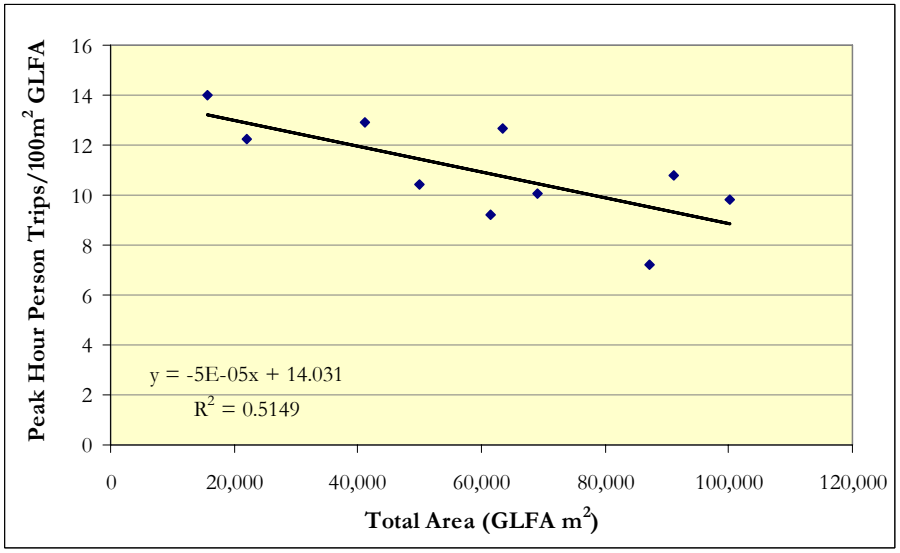

Figure 4.34 – Site Peak Hour Person Trip Rates/GLFA (Saturday)

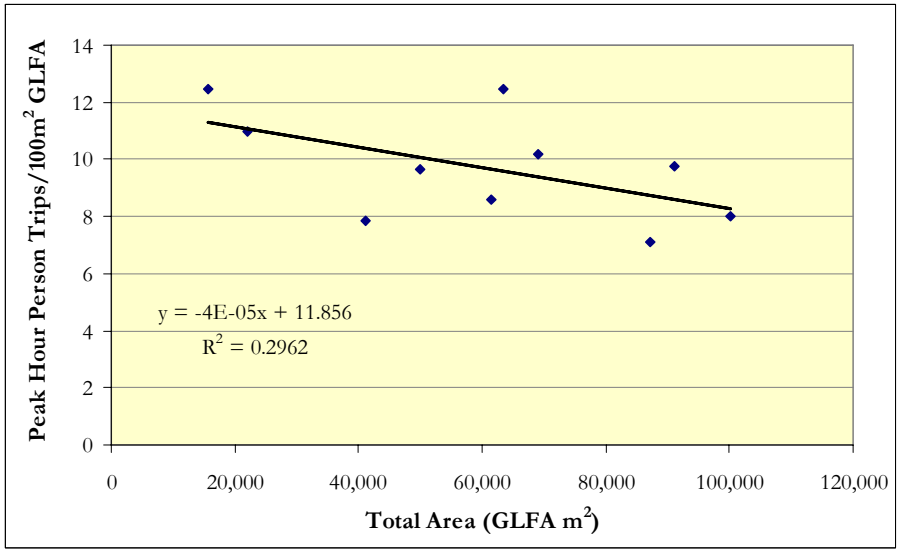

Figure 4.35 – Site Peak Hour Person Trip Rates/GLFA (Sunday)

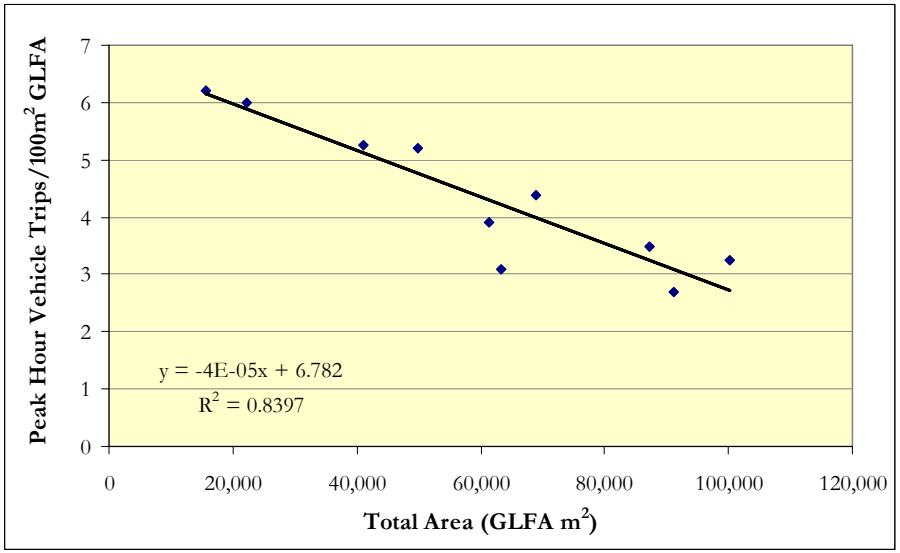

Figure 4.36 – Site Peak Hour Vehicle Trip Rates/GLFA (Thursday)

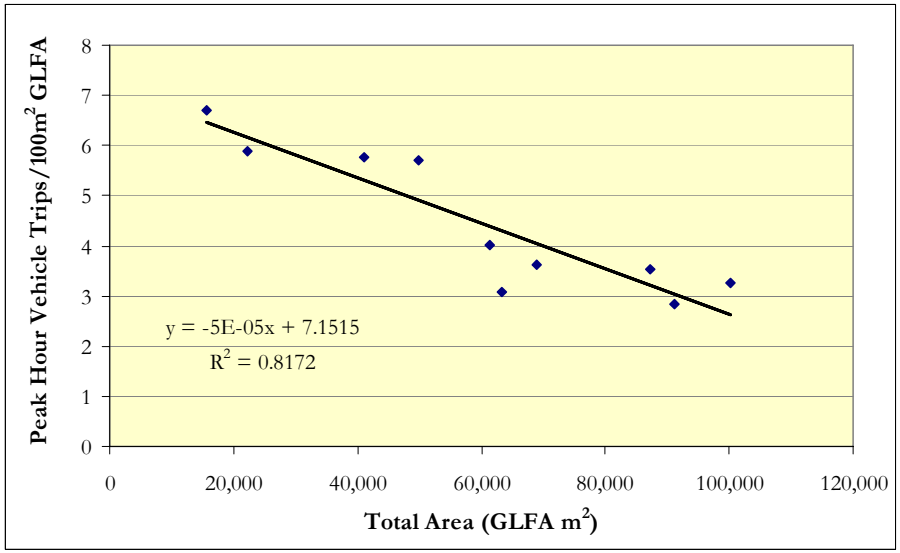

Figure 4.37 – Site Peak Hour Vehicle Trip Rates/GLFA (Friday)

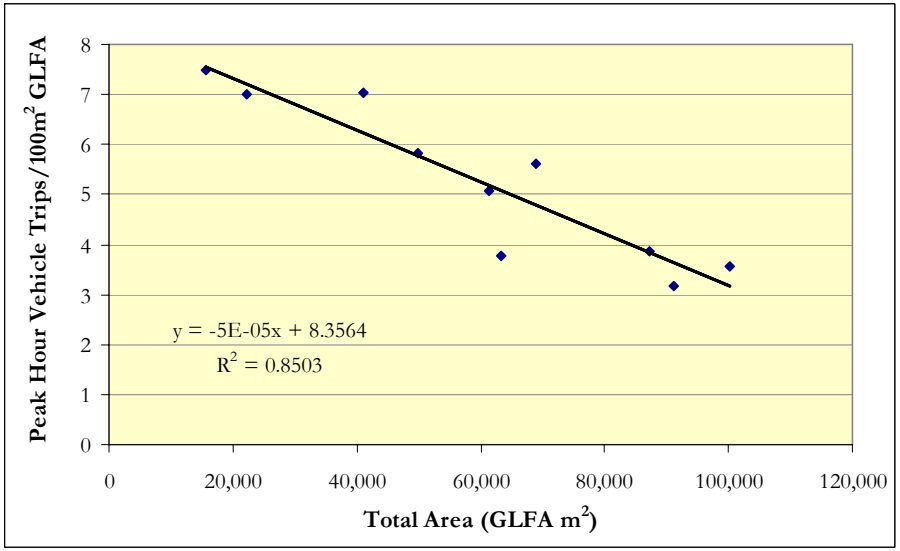

Figure 4.38 – Site Peak Hour Vehicle Trip Rates/GLFA (Saturday)

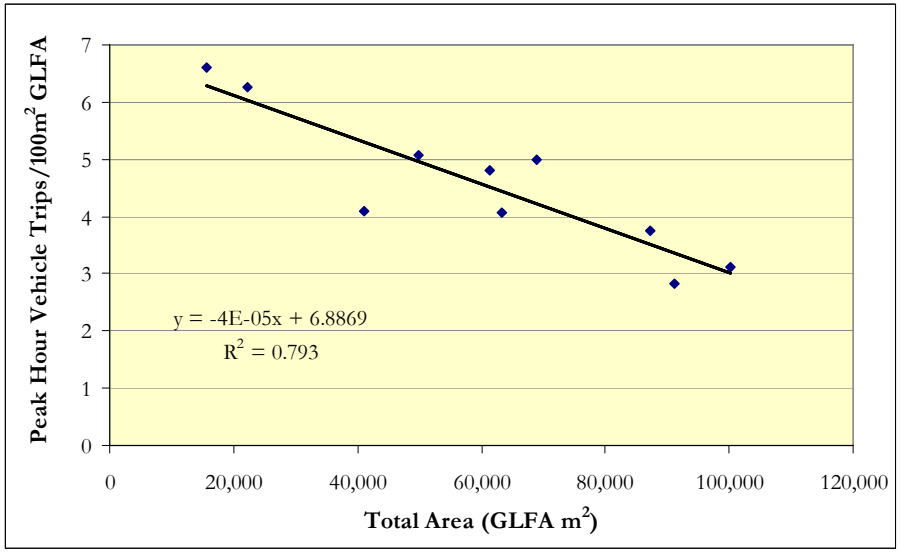

Figure 4.39 – Site Peak Hour Vehicle Trip Rates/GLFA (Sunday)

4.2.6 Network Peak Hour Trip Rates (Trips/100m² GLFA)

Table 4.6 presents the summary of correlation coefficients for network peak hour vehicle trip rate regression models.

Table 4.6 – Summary of Correlation Coefficient (R^2) for Network Peak Hour Vehicle Trip Rates

	PM Network Vehicle Trips/100m² GLFA
Thursday	0.74
Friday	0.58
	Network Vehicle Trips/100m² GLFA
Saturday	0.74
Sunday	0.75

- For the network peak hour vehicle trip rates, R^2 is generally above 0.7.
- R^2 is reasonably acceptable except for Fridays.

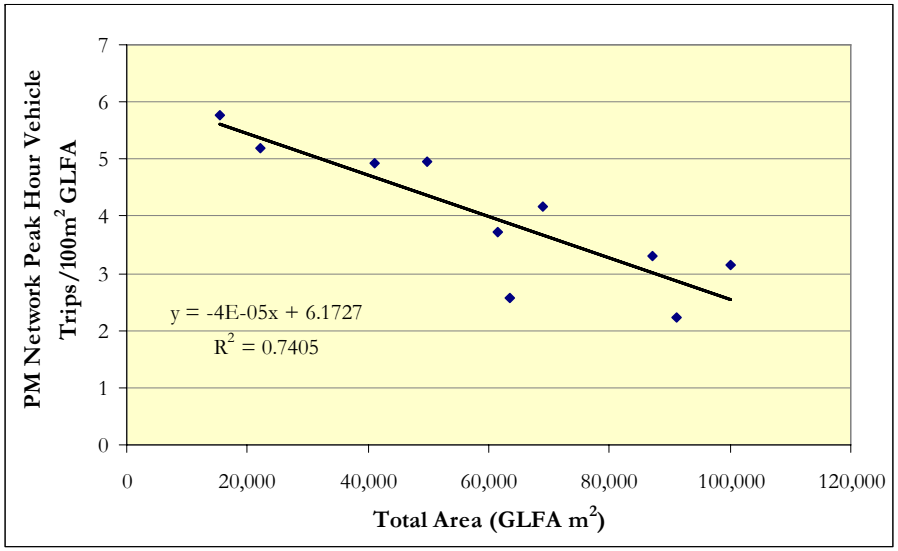

Figure 4.40 – Network PM Peak Hour Vehicle Trip Rates/GLFA (Thursday)

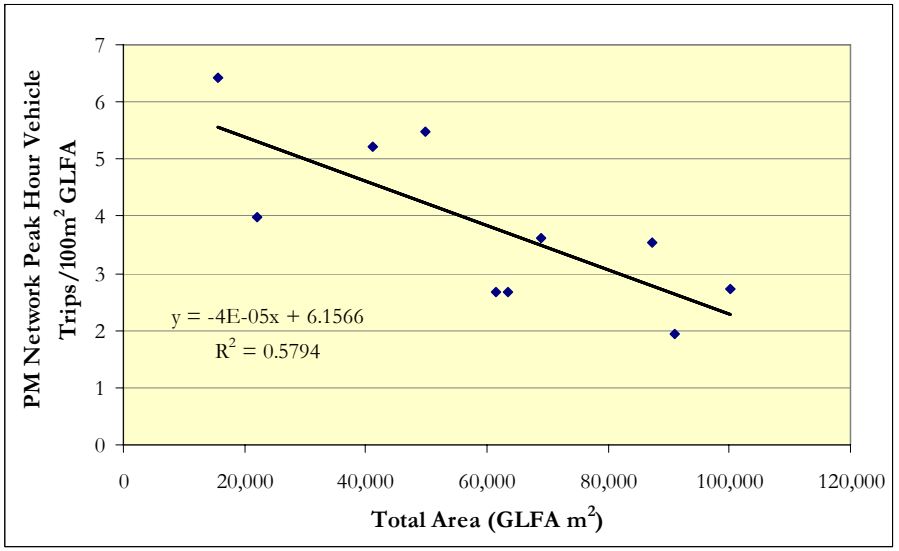

Figure 4.41 – Network PM Peak Hour Vehicle Trip Rates/GLFA (Friday)

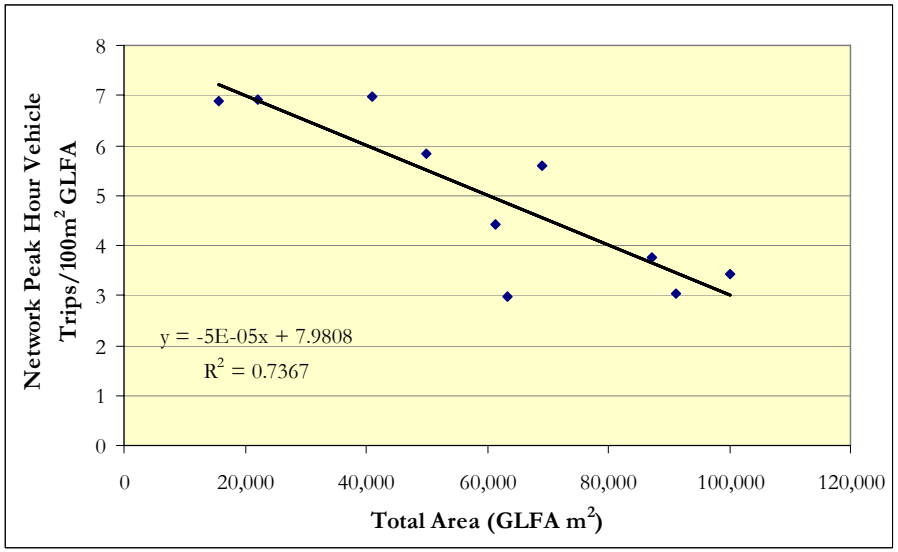

Figure 4.42 – Network Peak Hour Vehicle Trip Rates/GLFA (Saturday)

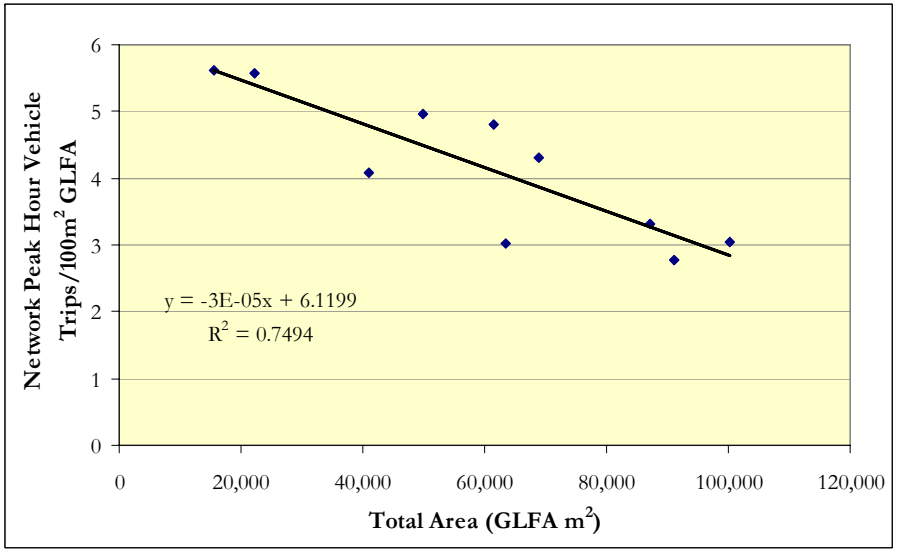

Figure 4.43 – Network Peak Hour Vehicle Trip Rates/GLFA (Sunday)

4.2.7 Parking Spaces

Table 4.7 presents the summary of correlation coefficients for parking provision and demand regression models.

Table 4.7 – Summary of Correlation Coefficient (R^2) for Parking Spaces

	Total Parking Spaces (Provision)	Peak Parking Accumulation (Demand)
Thursday	0.93	0.90
Friday	0.93	0.84
Saturday	0.93	0.83
Sunday	0.93	0.85

- For the parking provision, R^2 is 0.93.
- For the peak parking demand, R^2 is above 0.8.
- R^2 for the parking provision and demand is acceptable.

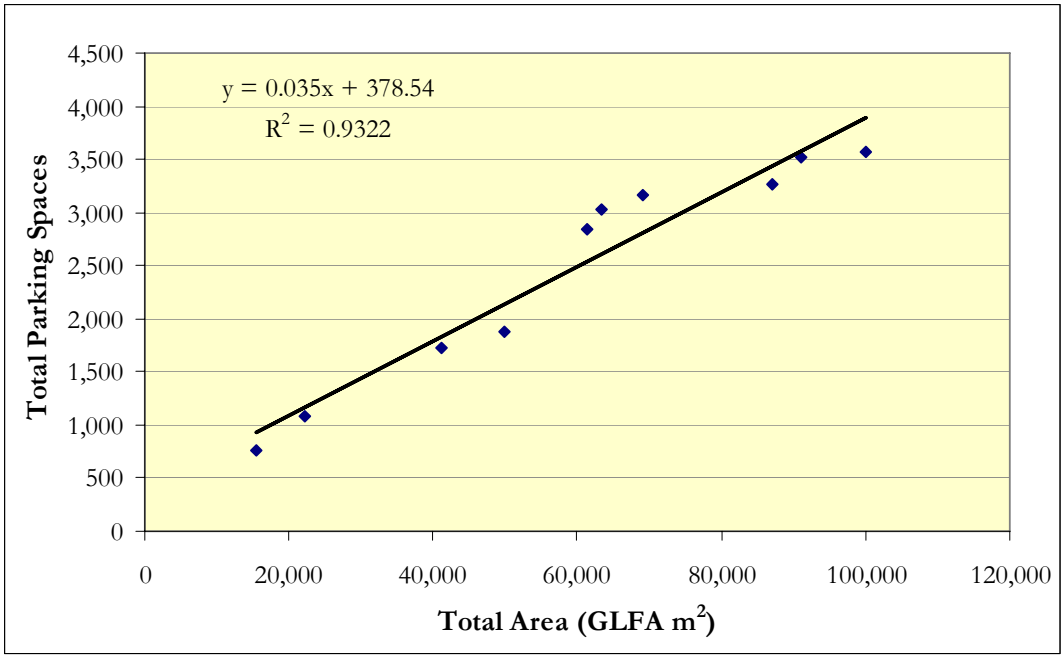

Figure 4.44 – Total Parking Space/GLFA

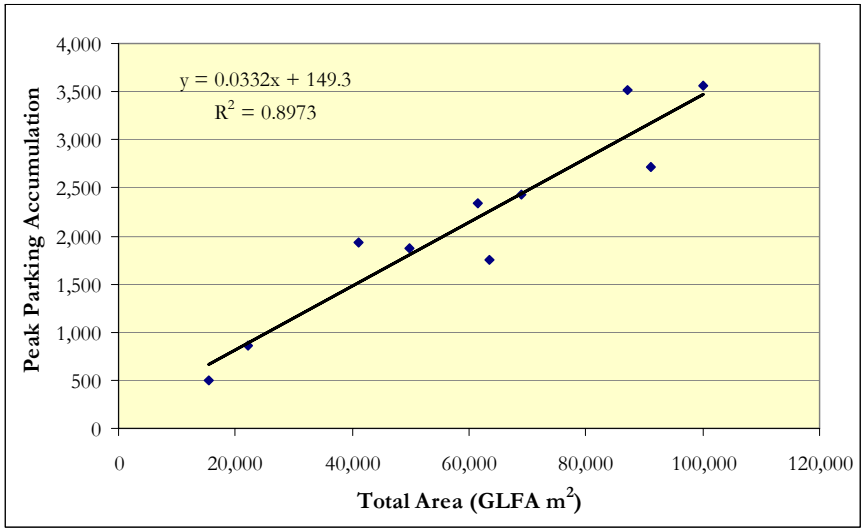

Figure 4.45 – Peak Parking Accumulation/GLFA (Thursday)

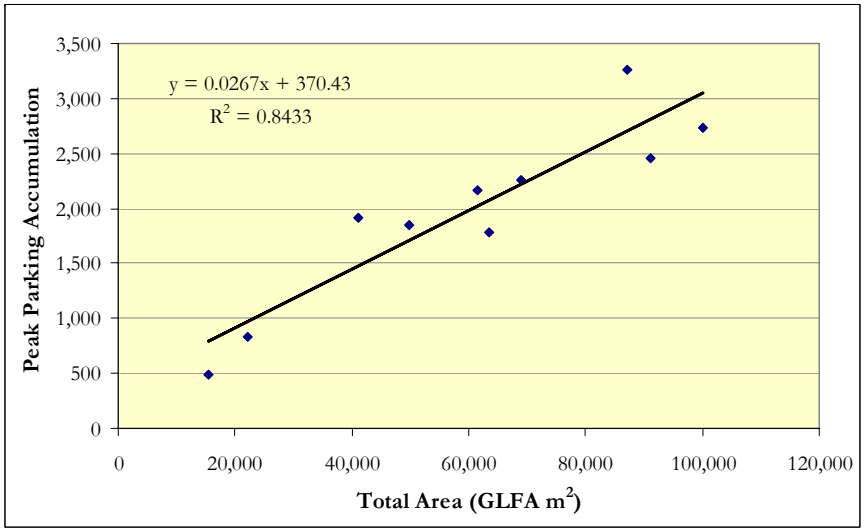

Figure 4.46 – Peak Parking Accumulation/GLFA (Friday)

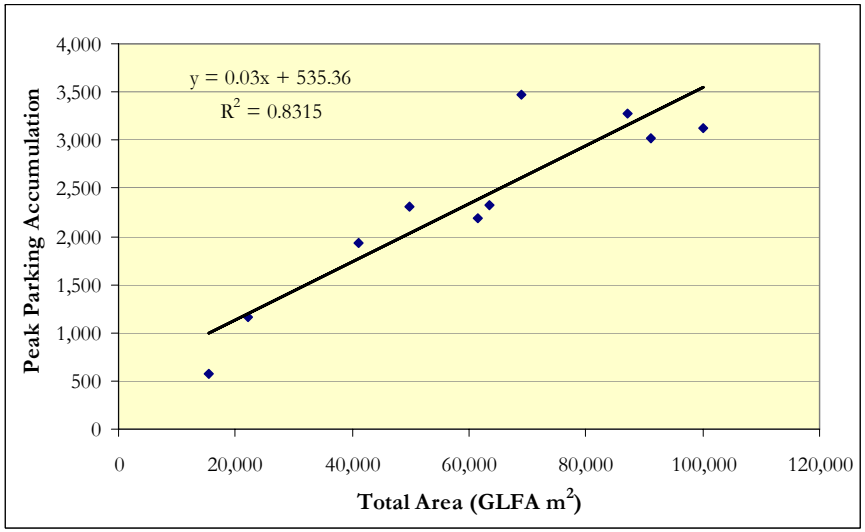

Figure 4.47 – Peak Parking Accumulation/GLFA (Saturday)

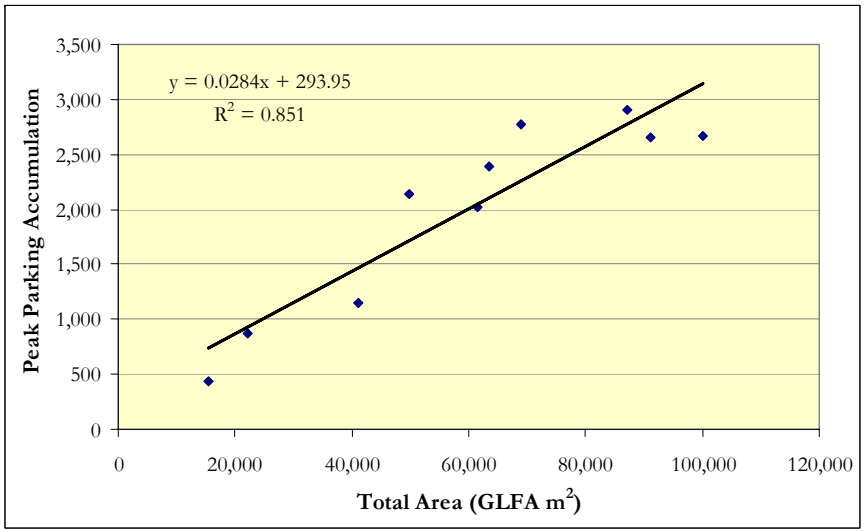

Figure 4.48 – Peak Parking Accumulation/GLFA (Sunday)

4.2.8 Accessibility Score

In addition, regression analyses are performed as functions of the Accessibility Score. The following relationships are examined:

- Daily trip rates (i.e. trips/100m^2 GLFA); and
- Percentage of all persons arriving by car.

Table 4.8 presents the accessibility score for weekdays as well as for Saturdays and Sundays for all selected sites. For Saturdays and Sundays, the selected 2 hour peak period is between 11AM and 1PM.

Table 4.8 – Accessibility Scores

	Weekdays (2 Hour AM Peak)	**Saturdays (11AM – 1PM)**	**Sundays (11AM – 1PM)**
SC1	40	27	18
SC2	233	184	173
SC3	268	194	179
SC4	200	169	165
SC5	96	67	60
SC6	184	77	77
SC7	64	16	16
SC8	22	22	20
SC9	67	62	60
SC10	105	90	88

The summary of correlation coefficient, R^2 for the Accessibility Score regressions are shown in Table 4.9.

Table 4.9 – Summary of Correlation Coefficient (R^2) for Accessibility Score Regressions

	Daily Vehicle Trips/100m² GLFA	% of Car Based Mode
Thursday	0.67	0.76
Friday	0.73	0.75
Saturday	0.74	0.82
Sunday	0.65	0.82

- For the daily vehicle trip rates, R^2 is between 0.6 and 0.8.
- For the percentage of car based mode, R^2 is above 0.75.
- R^2 for the percentage of car based mode is reasonably acceptable.

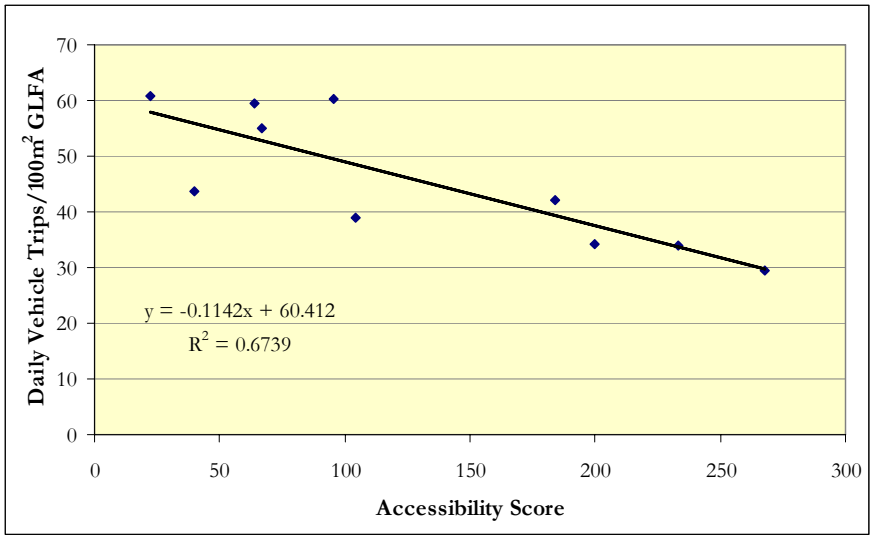

Figure 4.49 – Daily Vehicle Trip Rates/Accessibility Score (Thursday)

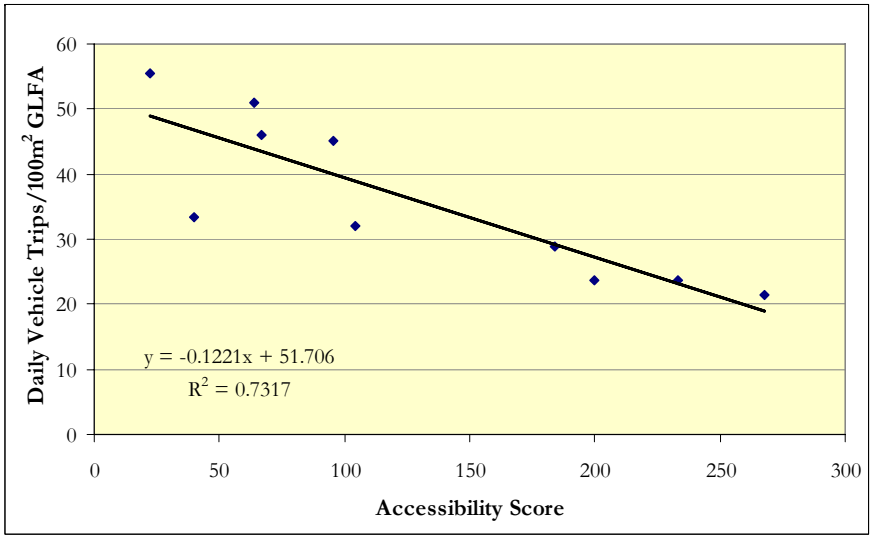

Figure 4.50 – Daily Vehicle Trip Rates/Accessibility Score (Friday)

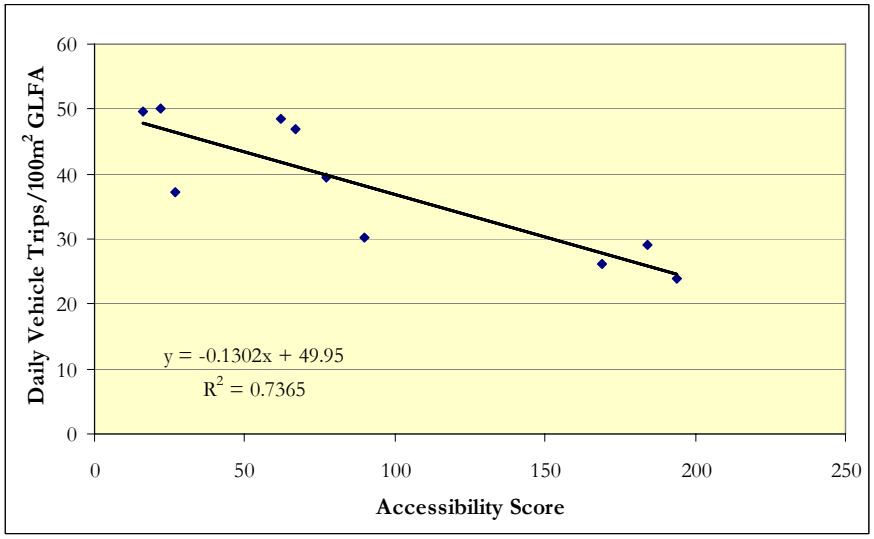

Figure 4.51 – Daily Vehicle Trip Rates/Accessibility Score (Saturday)

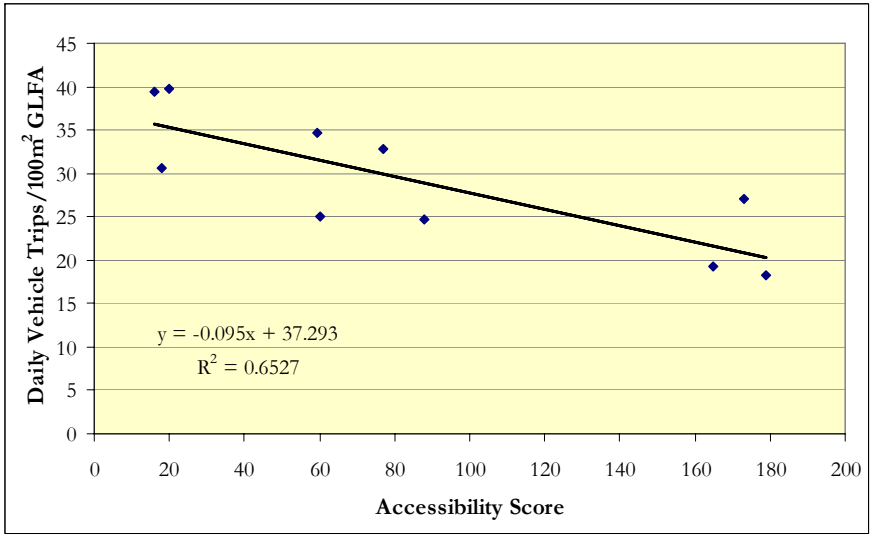

Figure 4.52 – Daily Vehicle Trip Rates/Accessibility Score (Sunday)

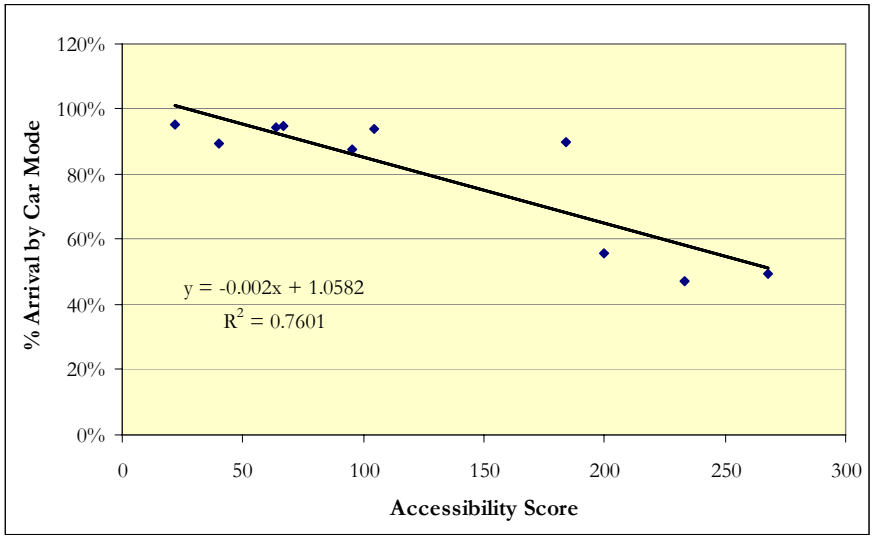

Figure 4.53 – % Arrival by Car Mode/Accessibility Score (Thursday)

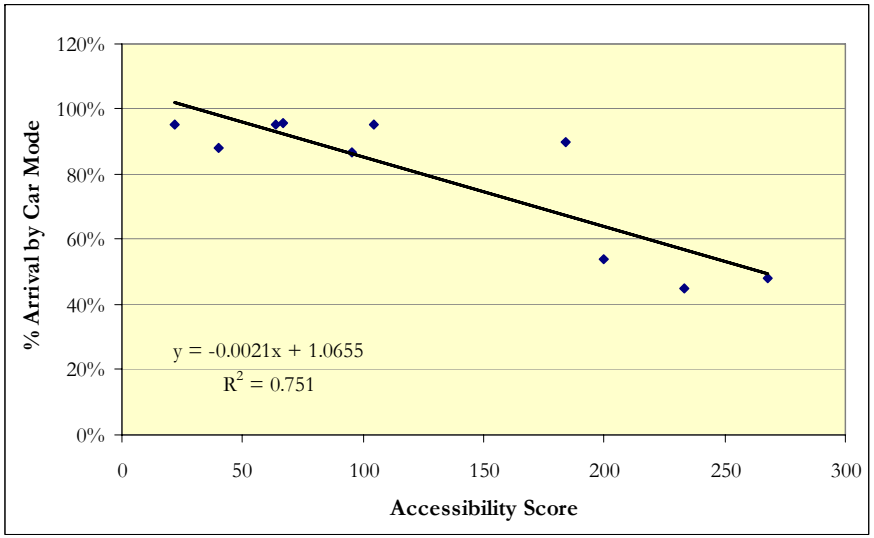

Figure 4.54 – % Arrival by Car Mode/Accessibility Score (Friday)

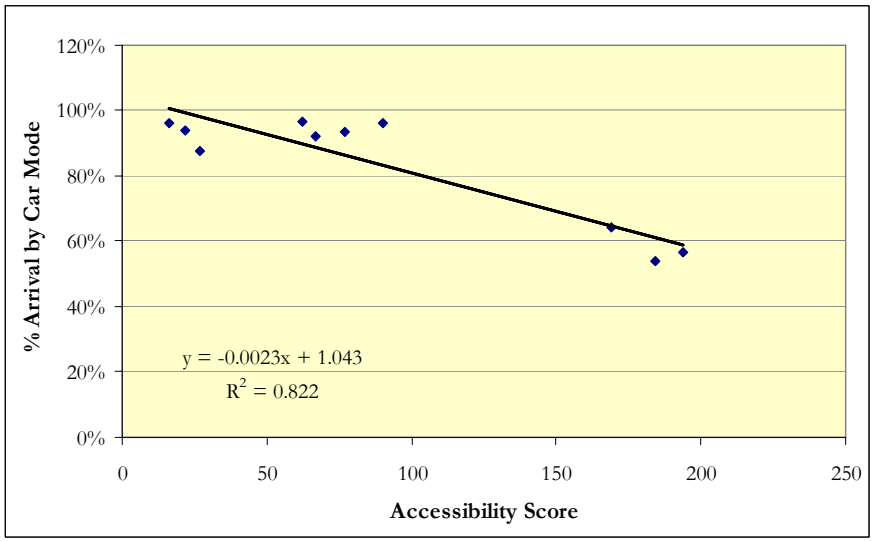

Figure 4.55 – % Arrival by Car Mode/Accessibility Score (Saturday)

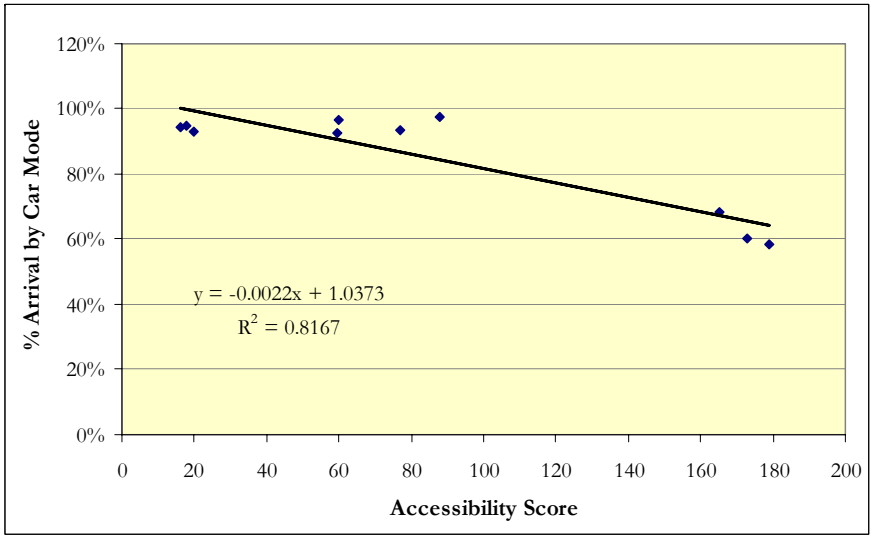

Figure 4.56 – % Arrival by Car Mode/Accessibility Score (Sunday)

4.2.9 Additional Models

Furthermore, the following additional relationships are examined:

- Site peak hour vehicle trips as a function of daily vehicle trips;
- Network peak hour vehicle trips as a function of daily vehicle trips; and
- Peak parking accumulation as a function of network peak hour vehicle trips.

The ratio of the site peak hour vehicle trips to daily vehicle trips are presented in Table 4.10.

Table 4.10 – Site Peak Hour Vehicle Trips to Daily Vehicle Trips Ratio

	Thursday	Friday	Saturday	Sunday
SC1	0.09	0.12	0.14	0.16
SC2	0.09	0.13	0.13	0.15
SC3	0.09	0.13	0.13	0.15
SC4	0.09	0.14	0.14	0.16
SC5	0.09	0.13	0.12	0.15
SC6	0.10	0.13	0.14	0.15
SC7	0.10	0.12	0.14	0.16
SC8	0.10	0.12	0.15	0.17
SC9	0.10	0.12	0.14	0.16
SC10	0.09	0.11	0.13	0.15
Average	0.09	0.12	0.14	0.16

The ratio of the network peak hour vehicle trips to daily vehicle trips are presented in Table 4.11.

Table 4.11 – Network Peak Hour Vehicle Trips to Daily Vehicle Trips Ratio

	Thursday	Friday	Saturday	Sunday
SC1	0.09	0.08	0.12	0.16
SC2	0.08	0.11	0.10	0.11
SC3	0.08	0.09	0.13	0.15
SC4	0.09	0.11	0.13	0.16
SC5	0.08	0.12	0.12	0.14
SC6	0.10	0.12	0.14	0.13
SC7	0.09	0.08	0.14	0.14
SC8	0.10	0.12	0.14	0.14
SC9	0.09	0.11	0.14	0.16
SC10	0.09	0.11	0.12	0.13
Average	0.09	0.11	0.13	0.14

NOTE: PM Network peak hour is used for Thursday and Friday

The summary of correlation coefficient, R^2 for the additional models are shown in Table 4.12.

Table 4.12 – Summary of Correlation Coefficient (R^2) for Network Peak Hour Vehicle Trip to Daily Vehicle Trips & Peak Parking Accumulation

	Daily Vehicle Trips	Peak Parking Accumulation
Thursday	0.93	0.81
Friday	0.85	0.70
Saturday	0.92	0.81
Sunday	0.90	0.80

- For the daily vehicle trips, R^2 is generally above 0.85.
- For the peak parking accumulation, R^2 is generally above 0.8 except for Fridays.
- The above R^2 is reasonably acceptable.

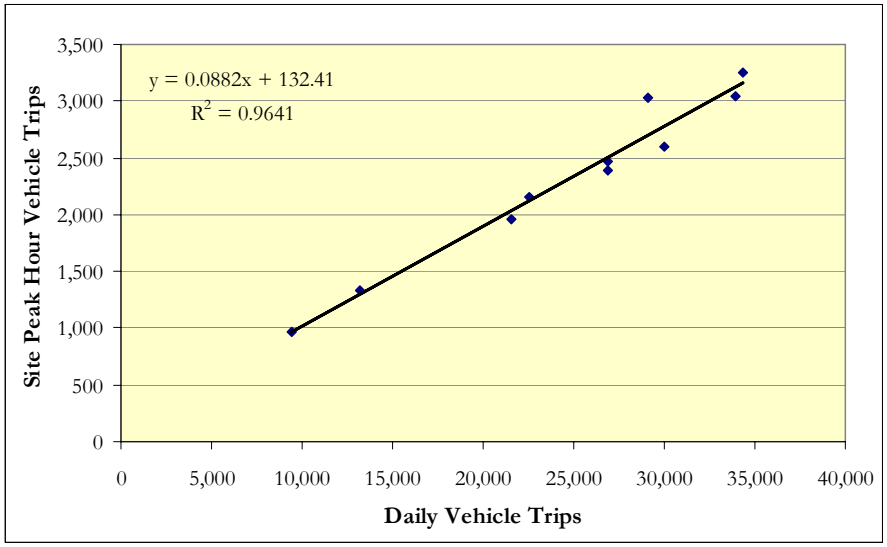

Figure 4.57 – Site Peak Hour / Daily Vehicle Trips (Thursday)

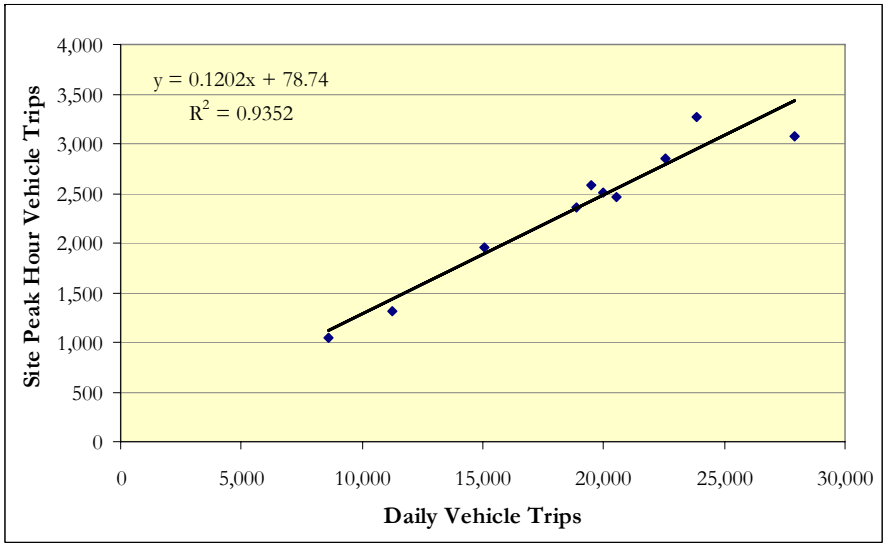

Figure 4.58 – Site Peak Hour / Daily Vehicle Trips (Friday)

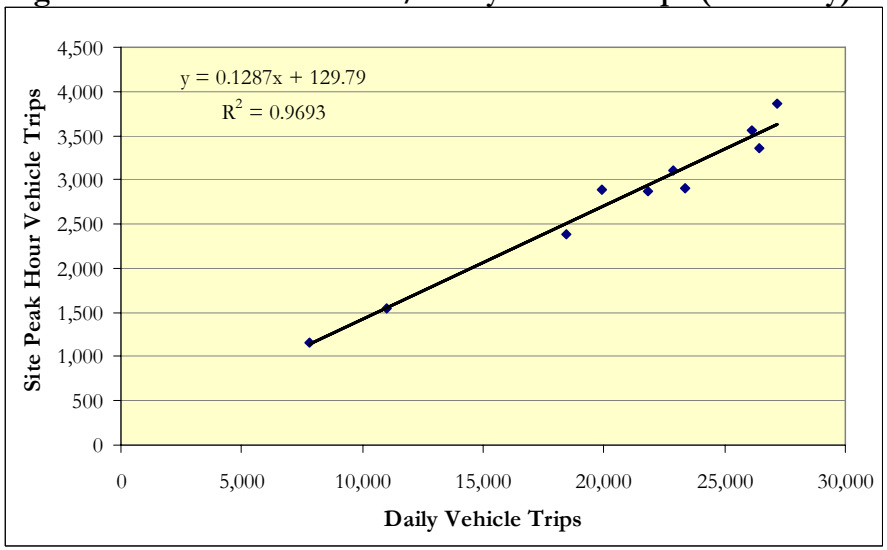

Figure 4.59 – Site Peak Hour / Daily Vehicle Trips (Saturday)

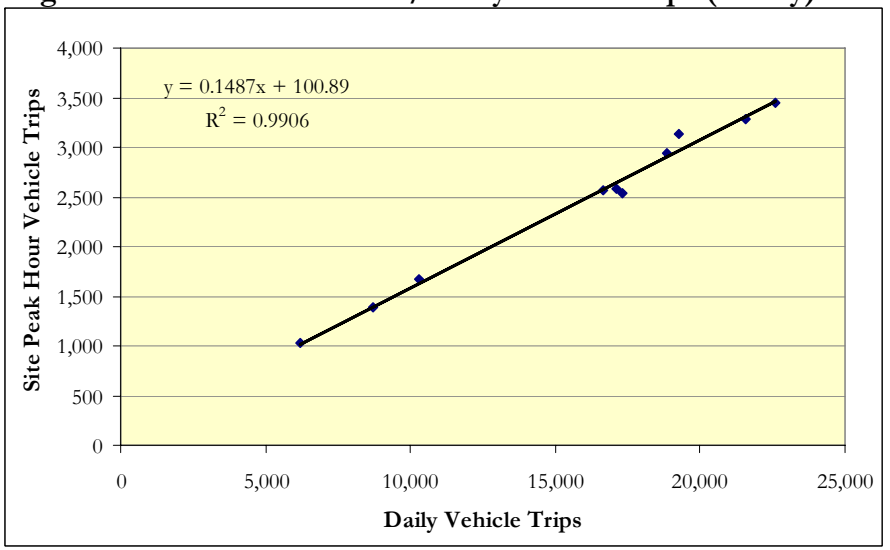

Figure 4.60 – Site Peak Hour / Daily Vehicle Trips (Sunday)

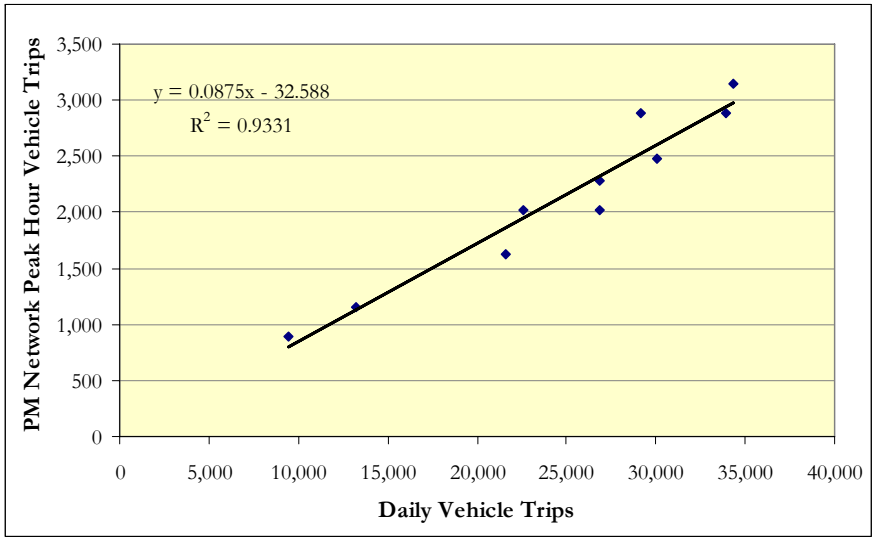

Figure 4.61 – PM Network Peak Hour / Daily Vehicle Trips (Thursday)

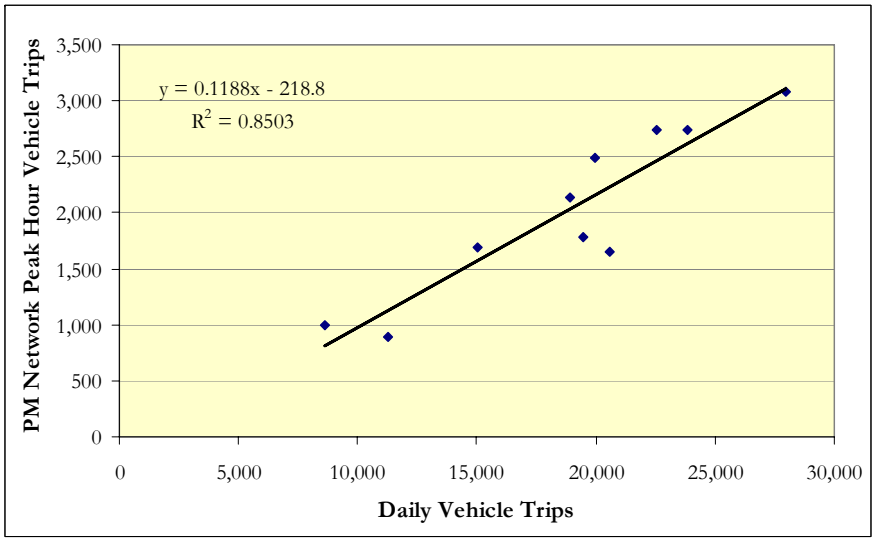

Figure 4.62 – PM Network Peak Hour / Daily Vehicle Trips (Friday)

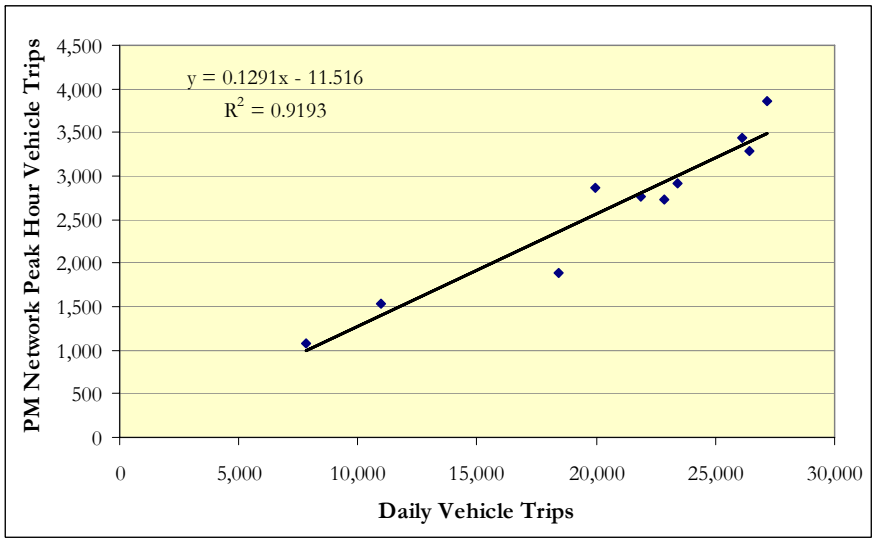

Figure 4.63 – Network Peak Hour / Daily Vehicle Trips (Saturday)

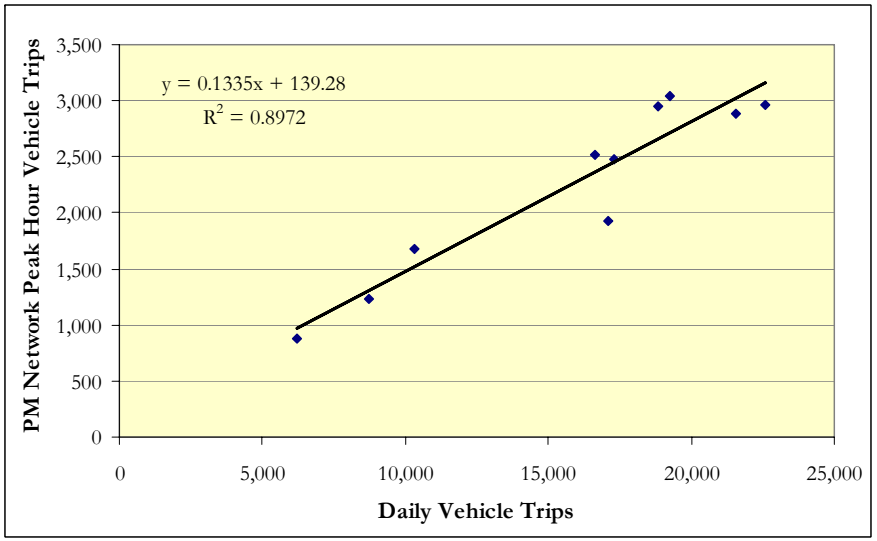

Figure 4.64 – Network Peak Hour / Daily Vehicle Trips (Sunday)

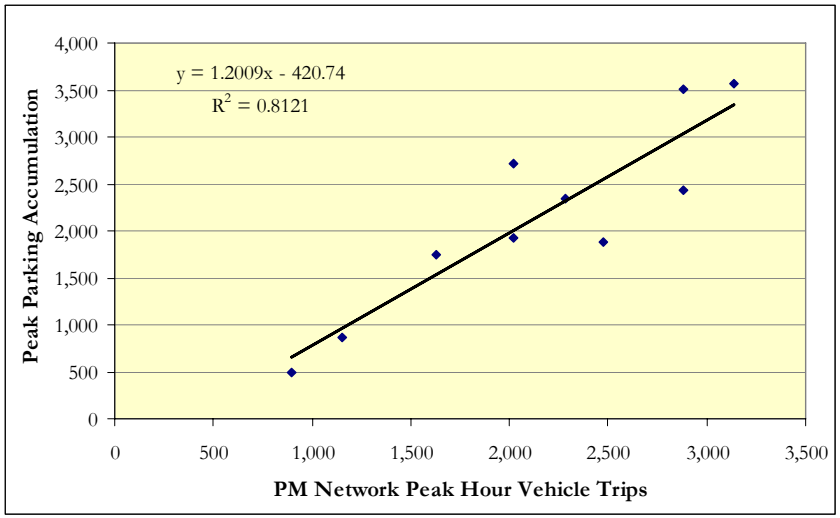

Figure 4.65 – Peak Parking Accumulation/PM Network Peak Hour Vehicle Trips (Thursday)

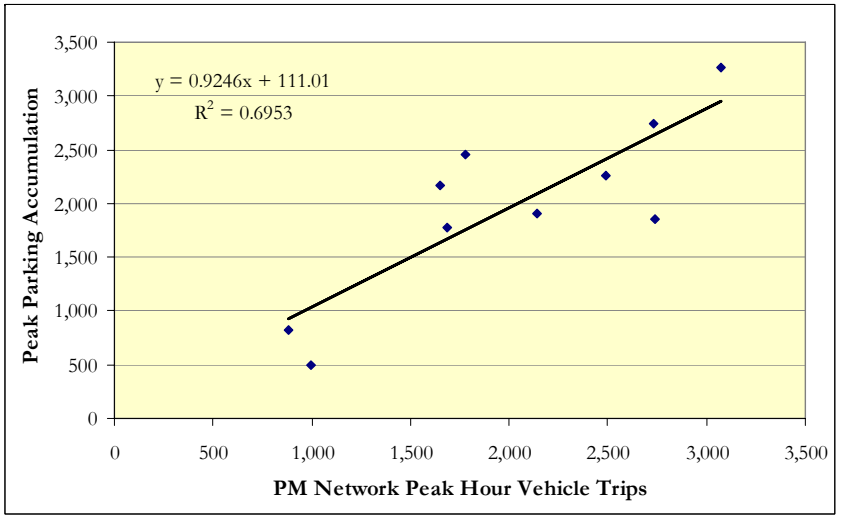

Figure 4.66 – Peak Parking Accumulation/PM Network Peak Hour Vehicle Trips (Friday)

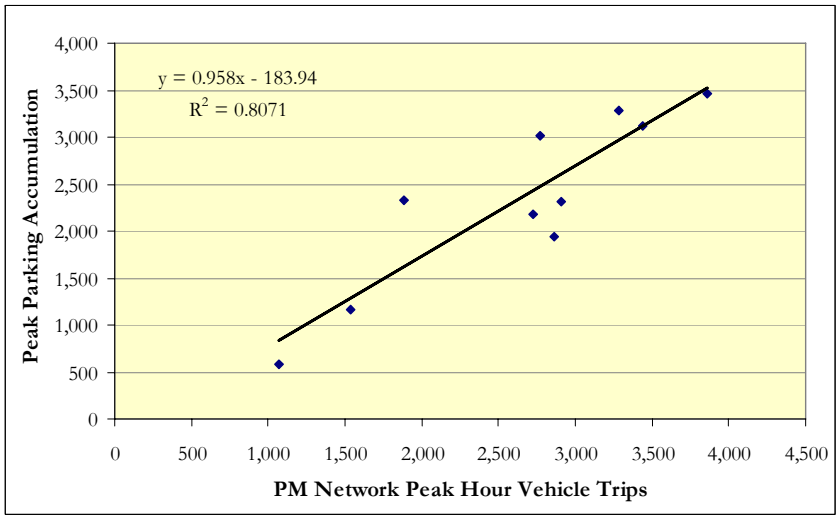

Figure 4.67 – Peak Parking Accumulation/ Network Peak Hour Vehicle Trips (Saturday)

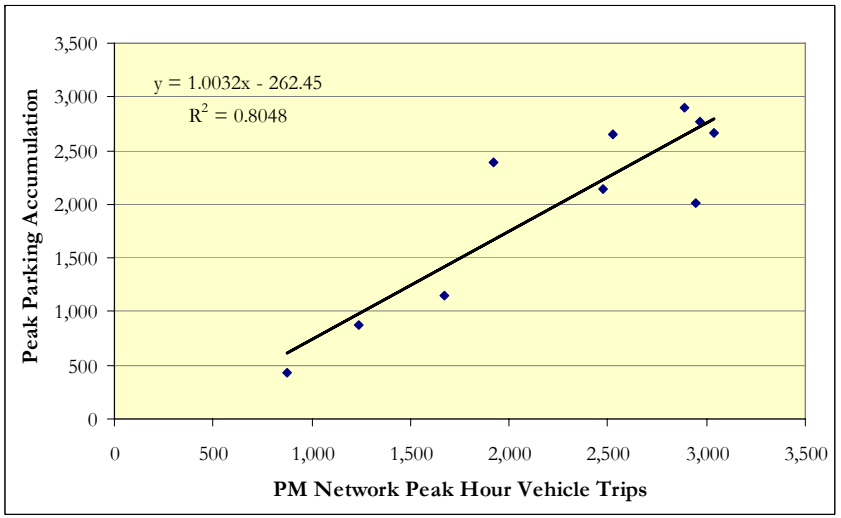

Figure 4.68 – Peak Parking Accumulation/ Network Peak Hour Vehicle Trips (Sunday)

5 Comparison of NSW Findings with Other Databases

A number of Australian and international guidance documents and traffic generation databases have been examined to understand their comparability to the results established from this study. These are examined below.

5.1 Australian Documents

5.1.1 National Documents

Austroads document, "*The Guide to Traffic Management Part 12: Traffic Impacts of Development*" identifies and manages the impacts on the road system arising from land use developments. The aim of this document is to ensure consistency in the assessment and treatment of traffic impacts.

This document provides:

- land use and transport planning context for traffic impact assessment, including travel demand, safety, parking and access management issues;
- guidance on the need and criteria for impact assessments;
- a detailed procedure for identifying and assessing the traffic impacts and mitigating their effects; and
- assessment of safety, infrastructure and environmental effects.

5.1.2 State Documents

Most of the Australian states have produced 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 in Table 5.1 for each of the states.

Table 5.1 – 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 uses 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 as shown in Table 5.1 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 recommends where practitioners should obtain trip rate information.

Table 5.2 – 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)

For details of sources, see footnotes to Table 1

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.

For shopping centres, traffic generation and parking rates are provided by five retail categories to improve accuracy of prediction. The guide also includes a table showing varying traffic generation and parking rates according to the size of the centre.

The guide includes prediction methods using both divided floor area categories and using total floor area ranges.

It also states that *"as with most land uses, it is preferable to base a traffic generation estimate for a shopping centre on a similar development"*.

For traffic generation, the factors are provided for variation of daily traffic flows over the week as well as the monthly variation.

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 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.

It also confirms that the level of detail in these sources varies from 'raw data to rates only with some containing parking demand etc'. It also notes that the most reliable source is from an actual development or a similar one in a similar location, preferably in close proximity to the subject site.

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 a*s:

- *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.*

In Part B – Derivation of Technical Data of Volume 5, the document states that for retail/shopping centres (with significant food retail component), the following trip generation has been adopted:

- 10 trips per 100m^2 GFA during the PM peak hour with 50/50 in/out split; and
- 2.5 trips per 100m^2 GFA during the AM peak hour with 80/20 in/out split.

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.

The document presents daily and peak hour traffic generation rates for shopping centres by varying size of the centre. Table below shows the peak hour traffic generation rates for Thursday PM peak hour and Saturday AM peak hour.

Size of Centre (Gross Leasable Area)	Thursday (4.30 - 5.30 p.m.)	Saturday (10.30 - 11.30 am)
2,000m^2	400	500
4,000m^2	580	860
6,000m^2	800	1,150
8,000m^2	1,000	1,440
10,000m^2	1,160	1,690
15,000m^2	1,500	2,200
20,000m^2	1,850	2,650
30,000m^2	2,500	3,400
40,000m^2	3,200	4,100
50,000m^2	3,800	4,800
60,000m^2	4,550	5,450

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 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; and
- 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.

5.2 Other Countries

5.2.1 New Zealand

The former New Zealand Trips and Parking Database Bureau is now known as the Trips Database Bureau (TDB). 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. RTA is also a member of NZ TDB.

5.2.2 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" fourth edition has 91 land uses represented and it includes parking demand data by hour of day.

5.2.3 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 regard 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 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 which in turn often leads to disagreements and this often forms the basis of planning appeals (which are 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.

5.3 Interrogation of International Databases

Based on our international experience, and the examination of data in Section 5 of the traffic generation data available in Australia, the following databases that have been examined as part of this study are as follows:

- RTA Guide to Traffic Generating Developments (2002)
- New Zealand Trips Database Bureau (NZTDB)
- 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.

5.4 Vehicle Trip Generation

5.4.1 RTA Guide to Traffic Generating Developments

The 1990 shopping centre survey data that informed the RTA's Guide to Traffic Generating Developments 2002, indicated that, "the division of floor area into retail categories improves the accuracy of the prediction". Accordingly, the RTA's guide identifies the following retail categories.

A(S): Slow Trade gross leasable floor area (Gross Leasable Floor Area in square metres) includes major department stores such as David Jones and Grace Bros., furniture, electrical and whitegoods stores.

A(F): Faster Trade GLFA - includes discount department stores such as K-Mart and Target, together with larger specialist stores such as Fosseys.

A(SM): Supermarket GLFA - includes stores such as Franklins and large fruit markets.

A(SS): Specialty shops, secondary retail GLFA - includes specialty shops and take-away stores such as McDonalds. These stores are grouped as they tend to not be primary attractors to the centre.

A(OM): Office, medical GLFA: includes medical centres and general business offices.

Using these categories, the RTA developed the following multi-use regression models for Thursday, Friday and Saturday peak period traffic generation.

Models.

For Thursdays and Fridays, the models are for the vehicle trips in the evening peak hour - V(P) - where this period has been taken as 4.30-5.30 pm.

For Saturday morning, the peak vehicle hour has been used - PVT. This is typically 11.00 am-12.00 pm. Localised variations in these peak hours can occur.

Thursday:

$V(P) = 0.02\ A(S) + 0.051\ A(F) + 0.155\ A(SM) + 0.046\ A(SS) + 0.022\ A(OM)$

(vehicle trips per m^2)

Friday:

$V(P) = 0.011\ A(S) + 0.023\ A(F) + 0.138\ A(SM) + 0.056\ A(SS) + 0.005\ A(OM)$

(vehicle trips per m^2)

Saturday:

$PVT = 0.038\ A(S) + 0.013\ A(F) + 0.147\ A(SM) + 0.107\ A(SS)$

(vehicle trips per m^2)

However, it was recognised that total retail floor area could also be used for traffic generation; however, rates would vary according to the size of the shopping centre. The following presents the average peak hour traffic generation rates recommended by the RTA's guide when using total retail floor area.

Peak hour traffic generation rate

Range in Total Floor Area. (GLFA - m^2).	Peak Hour Generation Rate. (vehicles per $100m^2$ GLFA)		
	Thursday. (V(P)/A)	Friday. (V(P)/A)	Saturday PVT(A)
0 - 10,000	12.3	12.5	16.3
10,000 - 20,000	7.6	6.2	7.5
20,000 - 30,000	5.9	5.6	7.5
30,000 - 40,000	4.6	3.7	6.1

5.4.2 New Zealand Trips Database Bureau (NZTDB)

About 180 shopping centre surveys were available in latest (August 2010) version of the NZTDB database. It should be noted that the NZTDB defines trip rates on the basis of GFA, not GLFA. In order to compare the surveys, we have applied the RTA's guide GLFA equates to about 75% GFA.

From these surveys it was possible to determine the following average peak hour trip rates for shopping centres in the NZ.

Table 5.3 – TDB Average Peak Hour Trip Rates by Day

	Thursday	Friday	Saturday	Sunday
Trip Rate per $100m^2$ GLFA	7.90	8.37	6.15	15.68

5.4.3 US Institute of Transportation Engineers (ITE)

The Institute of Transportation Engineers (ITE) Trip Generation Manual (8th Edition 2008) defines its land use Category 820 as Shopping Centres. The information contained in this document has been analysed and Table 5.4 presents the relevant ITE average peak hour trip rates.

Table 5.4 – ITE Average Peak Hour Trip Rates by Day

	Weekday	Saturday	Sunday
veh/1000 ft² GLFA	3.73	4.89	3.12
veh/100 m² GLFA	4.08	5.34	3.41

The handbook also provided a breakdown of the daily variation in Shopping Centre Traffic as a percentage of the average weekday volume and by size of shopping centre. This daily variation for Thursday – Sunday is shown on Table 5.5.

Table 5.5 – ITE Daily and Building Size Variation as a Percentage of Weekday Average

Building Area (GLFA)				Thursday	Friday	Saturday	Sunday
in ft²	0	<	100,000	98.2%	118.9%	128.5%	45.2%
in ft²	100,000	to	300,000	85.3%	108.7%	113.4%	65.4%
in ft²	300,000	<	Max	97.1%	115.4%	128.0%	77.4%

5.4.4 Trip Rate Information Computer Systems (TRICS) London

There is a considerable amount of data available in the TRICS database and there is a specific analysis process for interrogating the trip generation data. Unlike NZ TDB and US ITE, TRICS does not contain a land use category that directly matches the NSW definition of shopping centre. This is not totally surprising as the UK places stronger emphasis on maintaining the traditional High Street retail strip as opposed to the US style shopping centres prevalent in NSW.

Notwithstanding the above, within its general 01-Retail land use category, it lists five sub-land use categories which contain multi-store retail developments; these are:

- 01/I – Shopping Centres – Local Shops;
- 01/J – Retail Park (Including Food);
- 01/K – Retail Park (Excluding Food);
- 01/M – Mixed Shopping Malls (generally smaller than NSW shopping centres); and
- 01/N – Factory Outlet Centres.

Within these five sub-land use categories, there were 40 sites providing 44 survey days. From these surveys it was possible to determine the following average peak hour trip rates for Shopping Centre type development in the UK.

Table 5.6 – TRICS Average Peak Hour Trip Rates by Day

	Thursday	Friday	Saturday	Sunday
Trip Rate per 100m² GLFA	4.61	5.78	7.47	9.12

5.4.5 Comparison of Databases – Vehicle Trip Generation

Table 5.7 provides a comparison of the average NSW trip generation rates calculated by this study, with the NZ, US and UK trip generation rates tabled above.

Table 5.7 – Summary Trip Generation Comparison

	Weekday	Thursday	Friday	Saturday	Sunday
NSW	-	3.72	3.43	4.07	3.5
NZ TDB	-	7.90	8.37	6.15	15.68
US ITE	4.08	-	-	5.34	3.41
UK TRICS	-	4.61	5.78	7.47	9.12

5.5 Parking

5.5.1 RTA Guide to Traffic Generating Developments

The Road and Traffic Authority of New South Wales (RTA) Guide to Traffic Generating Developments 2002 indicates the following minimum recommended level of off-street parking.

Table 5.2
Off Street Parking

Gross leasable floor area (GLFA) m^2	Car Parking Spaces per $100m^2$ of GLFA
0-10,000	6.1
10,000-20,000	5.6
20,000-30,000	4.3
Over 30,000	4.1

The above car parking provisions reflect the mean results of the surveyed centres. The provision based on the 85th percentile parking demand is shown below with floor area divided into sub-categories:

Peak Parking Demand = 24 A(S) + 40 A(F) + 42 A(SM) + 45 A(SS) + 9 A(OM) (per 1,000m^2).

where:

A(S): Slow Trade GLFA, includes major Department stores such as David Jones and Grace Brothers, furniture, electrical and utility goods stores.

A(F): Faster Trade GLFA, includes discount department stores such as K-Mart and Target, together with larger specialist stores such as Fosseys.

A(SM): Supermarket GLFA, includes stores such as Franklins and large fruit markets.

A(SS): Speciality Shops and Secondary retail GLFA, includes speciality shops and take-away stores such as McDonalds. These stores are grouped since they tend not be primary attractors to the centre.

A(OM): Offices, medical GLFA.

5.5.2 New Zealand Trips Database Bureau (NZTDB)

The same surveys analysed for the trip rate comparative assessment have been analysed for the parking assessment. Where available, the NZTDB surveys provided information about surveyed parking demand as well as the parking provision of the subject shopping centre. The following Table 5.8 presents the average peak parking demand by day and Table 5.9 presents the average parking supply by centre size.

Table 5.8 – TDB Average Peak Parking Demand by Day

	Thursday	Friday	Saturday	Sunday
Parking Spaces per 100m² GLFA	2.95	3.06	3.13	4.17

Table 5.9 – TDB Average Parking Supply by Centre Size

GLFA (m²)	Parking Supply per 100 m² of GLFA
0-10,000	4.51
10,000-20,000	2.60
20,000-30,000	3.23
Over 30,000	0.55

5.5.3 US Institute of Transportation Engineers (ITE)

The Institute of Transportation Engineers (ITE) Parking Generation Manual (Fourth Edition) covers parking for the ITE land use 820, Shopping Centres. The information

contained in this document has been analysed and Table 5.10 presents the relevant ITE average parking demand rates.

Table 5.10 – ITE Average Peak Parking Demand by Day

	Non-Friday Weekday	Friday	Saturday	Sunday
spaces/1000 ft² GLFA	2.55	2.94	2.87	2.04
spaces/100 m² GLFA	2.74	3.16	3.09	2.20

The handbook groups shopping centres in to the following five categories based on size:

- Strip GLFA < 30,000 ft^2 (or GLFA < 2,800 m^2)
- Neighbourhood GLFA 30,000-100,000 ft^2 (or GLFA 2,800-9,300 m^2)
- Community GLFA 100,000-400,000 ft^2 (or GLFA 9,300-37,200 m^2)
- Regional GLFA 400,000-800,000 ft^2 (or GLFA 37,200-74,300 m^2)
- Super Regional GLFA > 800,000 ft^2 (or GLFA > 74,300 m^2)

The handbook also identified the average parking supply for shopping centres that fell within the size categories listed above. These parking supply rates are presented in Table 5.11.

Table 5.11 – ITE Parking Supply by Centre Size

	Strip	Neighbourhood	Community	Regional	Super Regional
spaces /1000 ft² GLFA	4.1	4.7	4.9	5.5	5.1
spaces /100 m² GLFA	4.5	5.1	5.4	6.0	5.6

5.5.4 Trip Rate Information Computer Systems (TRICS) London

The same surveys analysed for the trip rate comparative assessment have been analysed for the parking assessment. By accessing the raw survey data stored within TRICS, it was possible to calculate average parking demand rates and supply rates. The following Table 5.12 presents the average peak parking demand by day and Table 5.13 presents the average parking supply by centre size.

Table 5.12 – TRICS Average Peak Parking Demand by Day

	Thursday	Friday	Saturday	Sunday
Parking Spaces per 100m² GLFA	2.34	4.44	4.45	3.53

Table 5.13 – TRICS Average Parking Supply by Centre Size

GLFA (m²)	Parking Supply per 100 m² of GLFA
10,000-20,000	5.24
20,000-30,000	4.53

TRICS did not contain sufficient parking supply data for shopping centres above 30,000 m^2 of GLFA.

5.5.5 Comparison of Databases – Parking

Table 5.14 provides a comparison of the average NSW parking demand rates calculated by this study, with the NZ, US and UK parking demand rates tabled above.

Table 5.14 – Summary Comparison of Parking Demand Rates

	Weekday (non-Friday)	Thursday	Friday	Saturday	Sunday
NSW	-	3.72	3.43	4.07	3.50
NZ TDB	-	2.95	3.06	3.13	4.17
US ITE	2.74	-	3.16	3.09	2.20
UK TRICS	-	2.34	4.44	4.45	3.53

Table 5.15 provides a comparison of the average NSW parking demand rates calculated by this study, with the NZ, US and UK parking demand rates tabled above.

Table 5.15 – Summary Comparison of Parking Supply Rates

STORE SIZE	NSW	NZ TDB	UK TRICS	US ITE
0-10,000	4.9	4.5	-	4.5-5.1
10,000-20,000		2.6	5.2	5.4
20,000-30,000	4.6	3.2	4.5	
30,000-40,000		0.6	-	
40,000-50,000	4.0		-	6.0
50,000-60,000			-	
60,000-70,000	4.6		-	
70,000-80,000			-	5.6
Above 80,000	3.7		-	
			-	

5.6 Comparison of Databases – Person Trips

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

5.6.1 Trip Rate Information Computer Systems (TRICS) London

A number of the TRICS surveys used for the trip rate and parking comparative assessments above were multi-modal surveys. These multi-modal surveys have been analysed for the person trips. By accessing the raw survey data stored within TRICS, it was possible to determine the following average peak hour person trip rates for Shopping Centre type development in the UK.

Table 5.16 – TRICS Average Peak Hour Person Trip Rates by Day

	Thursday	Friday	Saturday	Sunday
Person Trip Rate per 100m² GFA	13.56	28.95	17.57	-

Table 5.17 – TRICS Average Peak Hour Person Trip Rates by Centre Size

Gross Leasable Floor Area (GLFA) m²	Peak Hour Trips per 100m² of GLFA
0-10,000	19.49
10,000-20,000	15.65
20,000-30,000	13.28

5.7 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 planning policy direction of each of the countries is given below.

5.7.1 Australian Transport Planning Policy

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. 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.

5.7.2 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.

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.

5.7.3 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.

5.7.4 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.

5.7.5 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.

5.7.6 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. However, there are a number of planning uses, such as out of town shopping centres / outlet centres, where customers will predominantly travel by car in case they buy bulky goods or hardware which would be difficult to transport by other modes. Nevertheless, not many UK shopping centre sites are as large as those in Australia.

In making comparisons, there is also 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.

In particular:

- 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 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. However, there are a number of planning uses, such as bulky goods / hardware, where customers will predominantly travel by car in case they buy bulky goods or hardware which would be difficult to transport by other modes.
- 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.

6 Summary

Since RTA published its *Guide to Traffic Generating Developments* in the mid-1990s, there have been some recent changes to the operation of the shopping centres and also ongoing societal and economic changes which collectively have the potential to impact on the relevance and reliability of the information in the Guide.

A total of ten shopping centres have been nominated by RTA to undertake the surveys. 7 sites are located in Sydney Metropolitan area, whilst 3 sites are in NSW Regional areas.

The surveys were undertaken between November 2010 and May 2011 outside of school holidays and public holidays. The surveys were conducted over four days between Thursdays and Sundays at all sites. The surveys were generally undertaken from an hour before until an hour after the opening hours of the shopping centres.

Vehicle and pedestrian counts were undertaken around the perimeter of the shopping centres to record the number of vehicles, pedestrians and cyclists entering and exiting the site.

Interview surveys also established the proportion of staff/customers, respondent's origin postcodes, mode of travel and trip purpose.

The trip and parking generation calculation used a number of key variables such as Gross Leasable Floor Area (GLFA), number of parking spaces and Accessibility Score. GLFA was the variable chosen for the trip and parking rate calculations and considered to be the most reliable variable.

A review of the data reveals a number of observations:

- The surveys were undertaken on a range of GLFA from 22,143 to 100,134 m^2;
- Thursday daily trip generation rate varied from 30 to 61 vehicles per 100m^2 GLFA with an average of 46 trips;

- Saturday daily trip generation rate varied from 24 to 50 vehicles per 100m^2 GLFA with an average of 38 trips;
- Thursday site peak hour trip generation rate varied from 2.7 to 6.2 vehicles per 100m^2 GLFA with an average of 4.4 trips;
- Saturday site peak hour trip generation rate varied from 3.2 to 7.5 vehicles per 100m^2 GLFA with an average of 5.2 trips;
- Average daily trip generation rate per parking space is 10.6, 8.3, 8.8 and 6.7 vehicles for Thursday, Friday, Saturday and Sunday, respectively;
- Average peak hour trip generation rate per parking space is around 1.0 vehicle for all surveyed days expect for Saturday, which is 1.2 vehicles per space;
- The regional sites generally had higher vehicle trip rates than the Sydney Metropolitan sites;
- Higher trip rates were recorded in PM network peak hour than AM network peak hour; and
- Trip variance over the four surveyed days indicates that Thursday is generally the busiest trading day with the Saturday being the busiest peak hour.

The analysis results indicate the following for parking:

- The number of parking spaces provide varied from 3.6 to 4.9 spaces per 100m^2 GLFA;
- The peak parking demand from the survey indicated that it varied from 2.7 to 5.3 spaces per 100m^2 GLFA. Generally, Saturday had the highest parking demand, followed by Thursday, Sunday and then Friday; and
- The surveys at sites SC4, SC5, SC6, SC7, SC9 and SC10 indicated that its parking demand had exceeded the parking supply during the peak periods. This effect is probably caused by vehicles circulating within the shopping centre car park.

The previously adopted five retail categories in the RTA Guide have been revised to include an additional retail category, which is the cinema. This is considered to an integral part of the modern shopping centres.

The GLFA's for the six separate retail categories are used as the functions of the multiple principal independent variables in multiple regression analysis. The trip

behaviour is calculated against the daily, site peak hour and network peak hour trips as well as peak parking demand.

The coefficient of determination (R^2) for the multiple regression analysis indicated that all of the R^2 values are close to 1.0, which has high degree of correlation.

Linear regression analysis was also performed using GLFA as the key independent variable. The trip behaviour was also plotted against daily, site peak hour and network peak hour trips as well as trip rates (i.e. trips/100m^2 GLFA), parking provision and peak parking demand.

The regression analysis indicated that correlation for the daily and site peak hour vehicle trip rates against the GLFA is reasonably acceptable.

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 6.1 – Summary Trip Generation Comparison

	Weekday	Thursday	Friday	Saturday	Sunday
NSW	-	3.72	3.43	4.07	3.5
NZ TDB	-	7.90	8.37	6.15	15.68
US ITE	4.08	-	-	5.34	3.41
UK TRICS	-	4.61	5.78	7.47	9.12

Table 6.2 – Summary Comparison of Parking Demand Rates

	Weekday (non-Friday)	Thursday	Friday	Saturday	Sunday
NSW	-	3.72	3.43	4.07	3.50
NZ TDB	-	2.95	3.06	3.13	4.17
US ITE	2.74	-	3.16	3.09	2.20
UK TRICS	-	2.34	4.44	4.45	3.53

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 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.
- 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 Summary Table of Key Statistics and Ratios for All Surveyed Sites

Appendix A - Summary Table of Key Statistics and Ratios of All Surveyed Sites

Site ID	Sydney Metropolitan Area							Regional Area		
	SC1 Roselands	SC2 Burwood	SC3 Liverpool	SC4 Penrith	SC5 Prairiewood	SC6 Rouse Hill	SC7 Warriewood	SC8 Mittagong	SC9 Shellharbour	SC10 Tuggerah
Area Characteristics:										
Owner	Centro Properties Group	Westfield Group	Westfield /AMP Capital Investors	Westfield Group The GPT Group	Stockland	The GPT Group	Centro Properties Group	Fabcot Pty Ltd	Stockland	Westfield Group
Major tenant(s)	Myer, Target	David Jones, Kmart, Target	Myer, Target, Big W	Myer, Big W, Target	Big W, Target	Big W, Target	Kmart, Coles	Big W, Woolworths	Kmart, Target	David Jones, Target, Big W
Indicative Public Transport Accessibility Score	40	233	268	200	96	184	64	22	67	105
Year built / expanded	1965	1966	1972	1971	1983	2008	1980	2007	1982	1995
Number of shops	154	267	330	325	139	232	83	37	120	264
Gross leasable floor area (GLFA-m^2)	61,424	63,404	91,115	100,134	49,898	69,000	22,143	15,552	41,040	87,162
Total car spaces	2841	3034	3514	3569	1886	3161	1080	764	1727	3257
Day/Date of survey	25 - 28/11/10	24 - 27/03/11	19 - 22/05/11	7 - 10/04/11	28/04 - 1/05/11	17 - 20/03/11	3 - 6/03/11	10 - 13/03/11	5 - 8/05/11	12 - 15/05/11
Duration of survey										
- Thursday	13 hours	14 hours	14 hours	14 hours	14 hours	14 hours	14 hours	14 hours	14 hours	14 hours
- Friday	10 hours	10 hours	10 hours	10 hours	10 hours	10 hours	11 hours	10.5 hours	10.5 hours	11 hours
- Saturday	10 hours	10 hours	10 hours	11 hours	10 hours	10 hours	9 hours	10 hours	9 hours	11 hours
- Sunday	8 hours	9 hours	9 hours	9 hours	9 hours	9 hours	9 hours	8 hours	8 hours	10 hours
Principal adjacent road - Weekday AM peak period	7-8AM	8-9AM	8-9AM	8-9AM	8-9AM	8-9AM	8-9AM	9-10AM	8-9AM	8-9AM
Principal adjacent road - Weekday PM peak period	5-6PM	3-4PM	4-5PM	4-5PM	5-6PM	5-6PM	5-6PM	4-5PM	3-4PM	3-4PM
Principal adjacent road - Weekend period	1-2PM	10-11AM	1-2PM	12-1PM	12-1PM	12-1PM	12-1PM	1-2PM	11AM-12PM	11AM-12PM
Person Trips:										
o Peak 1-hour person-trips	3,972 - 5,669	6,293 - 8,035	7,744 - 9,838	8,044 - 9,829	4,137 - 5,189	3,950 - 7,010	1,922 - 2,715	1,526 - 2,181	3,216 - 5,302	4,696 - 6,268
o Time of peak 1-hour person-trips										
- Thursday	3:15-4:15PM	3:15-4:15PM	2:45-3:45PM	5:30-6:30PM	5:30-6:30PM	5:30-6:30PM	4-5PM	4:15-5:15PM	11AM-12PM	5:15-6:15PM
- Friday	3:15-4:15PM	3:15-4:15PM	12-1PM	1-2PM	2:30-3:30PM	3:15-4:15PM	3:15-4:15PM	3:30-4:30PM	10:45-11:45AM	11:30AM-12:30PM
- Saturday	10:45-11:45AM	1:45-2:45PM	11:45AM-12:45PM	10:45-11:45AM	12-1PM	12-1PM	11:45AM-12:45PM	11AM-12PM	11:30AM-12:30PM	12:15-1:15PM
- Sunday	1:15-2:15PM	12:30-1:30PM	12:30-1:30PM	11:30AM-12:30PM	12:30-1:30PM	12:15-1:15PM	11:45AM-12:45PM	11:45AM-12:45PM	11:30AM-12:30PM	12:30-1:30PM
o Peak person-trips per 100m2 GLFA	6.5 - 9.2	9.9 - 12.7	8.5 - 10.8	8.0 - 9.8	8.3 - 10.4	5.7 - 10.2	8.7 - 12.3	9.8 - 14.0	7.8 - 12.9	5.4 - 7.2
o Total daily person-trips	32,530 - 43,610	47,035 - 67,071	56,204 - 87,227	49,020 - 93,575	31,788 - 47,871	30,086 - 48,242	15,007 - 18,562	11,486 - 14,351	19,601 - 36,921	40,325 - 53,224
o Total daily person-trips per 100m2 GLFA	53 - 71	74 - 106	62 - 96	49 - 93	64 - 96	44 - 70	68 - 84	74 - 92	48 - 90	46 - 61
o Person-trips in adjacent road Weekday AM peak	1,582 - 1,692	1,934 - 2,214	3,088 - 3,616	4,511 - 5,635	1,757 - 2,188	1,391 - 1,469	689 - 720	904 - 1,016	1,486 - 2,431	2,044 - 2,258
o Person-trips in adjacent road Weekday PM peak	2,651 - 3,823	4,892 - 5,245	5,517 - 6,606	7,005 - 8,414	4,048 - 4,619	3,928 - 4,769	1,328 - 1,683	1,465 - 1,599	3,171 - 3,296	4,508 - 4,690
o Person-trips in adjacent road Weekend peak	5,059 - 5,232	5,402 - 5,629	8,888 - 9,490	8,034 - 9,348	4,640 - 5,189	6,187 - 6,929	2,110 - 2,708	1,671 - 1,988	3,208 - 5,195	5,464 - 5,964
Vehicle Trips:										
o Peak 1-hour vehicle-trips	2,396 - 3,107	1,951 - 2,587	2,466 - 2,878	3,134 - 3,567	2,535 - 2,911	2,507 - 3,864	1,306 - 1,551	0,966 - 1,163	1,675 - 2,888	3,044 - 3,356
o Time of peak 1-hour vehicle-trips										
- Thursday	3:15-4:15PM	6:45-7:45PM	5:45-6:45PM	5:30-6:30PM	11:15AM-12:15PM	5:30-6:30PM	4-5PM	3:45-4:45PM	11AM-12PM	4:45-5:45PM
- Friday	11AM-12PM	12:15-1:15PM	11:15AM-12:15PM	1-2PM	3:15-4:15PM	3:15-4:15PM	12-1PM	3:30-4:30PM	10:30-11:30AM	3-4PM
- Saturday	10:45-11:45AM	1:45-2:45PM	12:30-1:30PM	11:15AM-12:15PM	12-1PM	12-1PM	11:45AM-12:45PM	11AM-12PM	11:30AM-12:30PM	12:15-1:15PM
- Sunday	12-1PM	12:15-1:15PM	12:30-1:30PM	11:30AM-12:30PM	12:30-1:30PM	12:30-1:30PM	11:45AM-12:45PM	11:45AM-12:45PM	11AM-12PM	12:30-1:30PM
o Peak vehicle-trips per 100m2 GLFA	3.9 - 5.1	3.1 - 4.1	2.7 - 3.2	3.1 - 3.6	5.1 - 5.8	3.6 - 5.6	5.9 - 7.0	6.2 - 7.5	4.1 - 7.0	3.5 - 3.9
o Total daily vehicle-trips	18,829 - 26,877	15,043 - 21,574	16,631 - 26,890	19,239 - 34,320	17,319 - 30,031	19,984 - 29,130	8,732 - 13,197	6,186 - 9,435	10,300 - 22,568	21,548 - 33,924
o Total daily vehicle-trips per 100m2 GLFA	31 - 44	24 - 34	18 - 30	19 - 34	35 - 60	29 - 42	39 - 60	40 - 61	25 - 55	25 - 39
o Vehicle-trips in adjacent road Weekday AM peak	1,011 - 1,133	611 - 624	922 - 945	1,542 - 2,127	933 - 1,439	944 - 986	495 - 535	635 - 730	1,070 - 1,667	1,482 - 1,632
o Vehicle-trips in adjacent road Weekday PM peak	1,650 - 2,285	1,628 - 1,688	1,777 - 2,020	2,734 - 3,140	2,476 - 2,738	2,488 - 2,879	885 - 1,150	897 - 997	2,021 - 2,138	2,884 - 3,076
o Vehicle-trips in adjacent road Weekend peak	2,723 - 2,945	1,886 - 1,922	2,522 - 2,770	3,041 - 3,435	2,478 - 2,911	2,969 - 3,864	1,236 - 1,534	0,875 - 1,071	1,675 - 2,867	2,888 - 3,282
o Car Occupancy (average over survey period)	1.38-1.64	1.44-1.88	1.47-1.96	1.40-1.76	1.38-1.74	1.34-1.82	1.32-1.60	1.42-1.78	1.46-1.84	1.42-1.83
% of total trips by mode:										
o % Car (as driver)	73% - 92%	41% - 58%	56% - 67%	55% - 71%	65% - 72%	68% - 75%	67% - 84%	82% - 88%	76% - 83%	64% - 75%
o % Car (as passenger)	0% - 13%	8% - 19%	7% - 19%	10% - 28%	14% - 21%	10% - 17%	9% - 17%	8% - 11%	11% - 15%	18% - 23%
o % Train	0% - 1%	7% - 21%	3% - 20%	7% - 14%	0% - 1%	0% - 1%	0% - 2%	1% - 2%	0% - 1%	2% - 4%
o % Bus	1% - 6%	4% - 16%	2% - 14%	1% - 9%	3% - 7%	4% - 10%	3% - 10%	0% - 2%	1% - 5%	0% - 12%
o % Cycle	0%	0% - 1%	0% - 1%	0% - 1%	0% - 1%	0% - 2%	0% - 1%	0% - 2%	0%	0% - 1%
o % On foot	2% - 8%	10% - 16%	7% - 11%	1% - 8%	4% - 13%	4% - 8%	3% - 6%	1% - 8%	4% - 8%	0% - 4%

Appendix B Detail Multiple Regression Analysis Results

Daily Person Trips

Thursday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.996909964
R Square	0.993829476
Adjusted R Square	0.736116322
Standard Error	7021.968698
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	31766372099	5294395350	107.373866	0.001372905
Residual	4	197232177.6	49308044.4		
Total	10	31963604277			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	1.449058342	0.321811798	4.50281298	0.010799268	0.55556555	2.342551134	0.55556555	2.342551134
X Variable 2	1.471741688	0.834648038	1.763308151	0.15262644	-0.845612771	3.789096147	-0.845612771	3.789096147
X Variable 3	0.572717016	0.829961578	0.690052445	0.528110521	-1.731625745	2.877059776	-1.731625745	2.877059776
X Variable 4	0.002150807	0.291774683	0.007371465	0.994471464	-0.807945584	0.812247198	-0.807945584	0.812247198
X Variable 5	1.142864508	1.43114694	0.798565455	0.469269982	-2.830636408	5.116365423	-2.830636408	5.116365423
X Variable 6	3.500262827	1.006541804	3.477513614	0.025409347	0.705654762	6.294870892	0.705654762	6.294870892

Daily Person Trips

Friday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99753149
R Square	0.995069074
Adjusted R Square	0.738905416
Standard Error	4435.070839
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	15877636389	2646272731	134.5344413	0.000981375
Residual	4	78679413.39	19669853.35		
Total	10	15956315802			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.984406933	0.203256121	4.843184681	0.008380705	0.42007747	1.548736397	0.42007747	1.548736397
X Variable 2	1.433870064	0.527163155	2.719973978	0.052988288	-0.029769497	2.897509625	-0.029769497	2.897509625
X Variable 3	0.717508741	0.52420319	1.36876073	0.242906395	-0.73791264	2.172930122	-0.73791264	2.172930122
X Variable 4	-0.12181235	0.184284699	-0.66100087	0.544742011	-0.633468698	0.389844004	-0.633468698	0.389844004
X Variable 5	0.223898231	0.903911472	0.247699292	0.816562526	-2.285762349	2.733558812	-2.285762349	2.733558812
X Variable 6	1.682452737	0.635731145	2.646484681	0.057191392	-0.082619889	3.447525364	-0.082619889	3.447525364

Daily Person Trips

Saturday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99825901
R Square	0.99652105
Adjusted R Square	0.742172364
Standard Error	4475.331077
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	22948202763	3824700460	190.9620594	0.000582032
Residual	4	80114353.01	20028588.25		
Total	10	23028317116			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.980830355	0.205101219	4.782177103	0.008761557	0.411378078	1.550282631	0.411378078	1.550282631
X Variable 2	1.252729669	0.531948583	2.35498262	0.078089299	-0.224196372	2.72965571	-0.224196372	2.72965571
X Variable 3	1.205328378	0.528961749	2.278668318	0.084911215	-0.26330488	2.673961637	-0.26330488	2.673961637
X Variable 4	0.013749484	0.18595758	0.073938822	0.944608952	-0.502551529	0.530050498	-0.502551529	0.530050498
X Variable 5	0.633064029	0.912116908	0.694060184	0.52584498	-1.899378495	3.165506553	-1.899378495	3.165506553
X Variable 6	2.473063661	0.641502121	3.855113768	0.01822296	0.691968236	4.254159086	0.691968236	4.254159086

Daily Person Trips

Sunday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.995533137
R Square	0.991086226
Adjusted R Square	0.783955207
Standard Error	5164.900956
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	14830091140	2966018228	111.1859267	0.000221678
Residual	5	133381009.4	26676201.88		
Total	10	14963472149			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.618888471	0.217985256	2.839129956	0.036283492	0.058539531	1.179237412	0.058539531	1.179237412
X Variable 2	0.467550915	0.347231871	1.346509218	0.235954152	-0.425037024	1.360138853	-0.425037024	1.360138853
X Variable 3	1.574197644	0.569646929	2.763462003	0.039671484	0.109873596	3.038521692	0.109873596	3.038521692
X Variable 4	0.133763217	0.203496571	0.657324183	0.540021885	-0.389341371	0.656867806	-0.389341371	0.656867806
X Variable 5	2.81965875	0.703008202	4.010847586	0.010212941	1.012518636	4.626798865	1.012518636	4.626798865

Daily Vehicle Trips

Thursday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.996367211
R Square	0.992747619
Adjusted R Square	0.733682142
Standard Error	3501.57807
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	6713451204	1118908534	91.2571621	0.001748354
Residual	4	49044195.91	12261048.98		
Total	10	6762495400			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.288216015	0.160474816	1.796020223	0.146917269	-0.157333503	0.733765532	-0.157333503	0.733765532
X Variable 2	0.073940507	0.416205966	0.177653646	0.867628645	-1.081632509	1.229513524	-1.081632509	1.229513524
X Variable 3	1.454973102	0.413869014	3.515540071	0.024548704	0.305888504	2.6040577	0.305888504	2.6040577
X Variable 4	0.288087881	0.145496495	1.980033137	0.118797093	-0.11587515	0.692050911	-0.11587515	0.692050911
X Variable 5	1.787184062	0.713656377	2.504264125	0.066463084	-0.194243692	3.768611815	-0.194243692	3.768611815
X Variable 6	-0.16667983	0.501922589	-0.33208275	0.756499192	-1.560240348	1.226880682	-1.560240348	1.226880682

Daily Vehicle Trips

Friday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.995500619
R Square	0.991021483
Adjusted R Square	0.729798337
Standard Error	2936.770352
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	3807837801	634639633.4	73.58464792	0.002406122
Residual	4	34498480.39	8624620.099		
Total	10	3842336281			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.174512724	0.134590083	1.296623947	0.264502777	-0.199169252	0.548194701	-0.199169252	0.548194701
X Variable 2	0.326797907	0.349071566	0.936191711	0.402176378	-0.642380134	1.295975948	-0.642380134	1.295975948
X Variable 3	1.171306027	0.347111567	3.374436751	0.027928788	0.207569817	2.135042237	0.207569817	2.135042237
X Variable 4	0.165436898	0.122027778	1.355731458	0.246675037	-0.17336653	0.504240325	-0.17336653	0.504240325
X Variable 5	0.975283533	0.598542956	1.629429473	0.178554749	-0.686538127	2.637105193	-0.686538127	2.637105193
X Variable 6	-0.70208405	0.42096202	-1.66780852	0.170679746	-1.870861985	0.466693895	-1.870861985	0.466693895

Daily Vehicle Trips

Saturday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.993265961
R Square	0.98657727
Adjusted R Square	0.719798858
Standard Error	3922.317749
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	4523095863	753849310.5	49.00032896	0.00438777
Residual	4	61538306.09	15384576.52		
Total	10	4584634169			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.184572216	0.179757014	1.026787284	0.362553982	-0.314513266	0.683657699	-0.314513266	0.683657699
X Variable 2	0.059901728	0.466216093	0.1284849	0.903966313	-1.234521661	1.354325118	-1.234521661	1.354325118
X Variable 3	1.257723473	0.463598339	2.712959401	0.053373709	-0.029431867	2.544878814	-0.029431867	2.544878814
X Variable 4	0.233564183	0.16297894	1.433094252	0.225117798	-0.218937899	0.686066264	-0.218937899	0.686066264
X Variable 5	1.429563815	0.799407301	1.788279659	0.148247344	-0.789946672	3.649074302	-0.789946672	3.649074302
X Variable 6	-0.06256932	0.562232182	-0.11128733	0.916749158	-1.62357611	1.498437469	-1.62357611	1.498437469

Daily Vehicle Trips

Sunday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.985670794
R Square	0.971546914
Adjusted R Square	0.748784446
Standard Error	3984.827211
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	2710961811	542192362.1	34.14557313	0.002240576
Residual	5	79394239.49	15878847.9		
Total	10	2790356050			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.063264287	0.168180104	0.376169863	0.722223773	-0.369056434	0.495585008	-0.369056434	0.495585008
X Variable 2	0.18908332	0.267896523	0.705807295	0.51182569	-0.499566615	0.877733255	-0.499566615	0.877733255
X Variable 3	1.064199986	0.43949431	2.421419257	0.060012246	-0.065556104	2.193956077	-0.065556104	2.193956077
X Variable 4	0.182702957	0.157001786	1.163699866	0.297052901	-0.220882981	0.586288895	-0.220882981	0.586288895
X Variable 5	0.077617346	0.542385273	0.143103713	0.891796556	-1.316628383	1.471863076	-1.316628383	1.471863076

Site Peak Hour Person Trips

Thursday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.995913536
R Square	0.991843772
Adjusted R Square	0.731648486
Standard Error	752.8558345
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	275700484.4	45950080.73	81.07046011	0.002084176
Residual	4	2267167.63	566791.9075		
Total	10	277967652			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.115952148	0.034502844	3.360654804	0.028287658	0.020156896	0.2117474	0.020156896	0.2117474
X Variable 2	0.090200489	0.08948625	1.007981547	0.370487949	-0.158253172	0.338654149	-0.158253172	0.338654149
X Variable 3	0.096077055	0.088983794	1.079714077	0.341026104	-0.150981564	0.343135674	-0.150981564	0.343135674
X Variable 4	0.017263336	0.031282434	0.551853993	0.610428445	-0.069590625	0.104117297	-0.069590625	0.104117297
X Variable 5	0.147465623	0.153439494	0.961066927	0.39094291	-0.278550709	0.573481955	-0.278550709	0.573481955
X Variable 6	0.339815122	0.107915729	3.148893364	0.034550765	0.040193025	0.639437219	0.040193025	0.639437219

Site Peak Hour Person Trips

Friday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.995405538
R Square	0.990832186
Adjusted R Square	0.729372419
Standard Error	799.8619564
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	276582302.4	46097050.4	72.05150473	0.002482366
Residual	4	2559116.597	639779.1493		
Total	10	279141419			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.145040851	0.036657101	3.956691808	0.016723924	0.043264422	0.246817279	0.043264422	0.246817279
X Variable 2	0.153645105	0.09507351	1.616066392	0.181384813	-0.110321277	0.417611486	-0.110321277	0.417611486
X Variable 3	0.079648744	0.094539683	0.842490074	0.446941029	-0.182835495	0.342132983	-0.182835495	0.342132983
X Variable 4	-0.02117377	0.033235618	-0.63708082	0.558709098	-0.113450643	0.071103094	-0.113450643	0.071103094
X Variable 5	0.120283589	0.163019808	0.737846466	0.501552215	-0.332331959	0.572899138	-0.332331959	0.572899138
X Variable 6	0.333173663	0.114653672	2.905913578	0.043857254	0.014844036	0.651503289	0.014844036	0.651503289

Site Peak Hour Person Trips

Saturday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.996733613
R Square	0.993477896
Adjusted R Square	0.735325266
Standard Error	851.3891451
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	441658593.1	73609765.52	101.5498337	0.00149162
Residual	4	2899453.905	724863.4764		
Total	10	444558047			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.13250386	0.039018555	3.39591921	0.027380103	0.024170984	0.240836736	0.024170984	0.240836736
X Variable 2	0.194143225	0.101198155	1.918446279	0.127499381	-0.086827898	0.475114348	-0.086827898	0.475114348
X Variable 3	0.151552918	0.100629939	1.506042044	0.206520479	-0.127840582	0.430946418	-0.127840582	0.430946418
X Variable 4	-0.00164246	0.03537666	-0.0464279	0.9651947	-0.099863818	0.09657889	-0.099863818	0.09657889
X Variable 5	0.083112188	0.173521561	0.478973262	0.656965303	-0.398660901	0.564885277	-0.398660901	0.564885277
X Variable 6	0.331187028	0.122039673	2.713765281	0.053329265	-0.007649425	0.670023482	-0.007649425	0.670023482

Site Peak Hour Person Trips

Sunday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.997167632
R Square	0.994343286
Adjusted R Square	0.789817915
Standard Error	642.6453524
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	362981807.8	72596361.55	175.7810737	8.93921E-05
Residual	5	2064965.244	412993.0489		
Total	10	365046773			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.097885853	0.027122923	3.608971362	0.015397082	0.028164159	0.167607547	0.028164159	0.167607547
X Variable 2	0.089194441	0.043204497	2.064471231	0.093897562	-0.021866254	0.200255136	-0.021866254	0.200255136
X Variable 3	0.226173063	0.0708786	3.190992227	0.024238064	0.04397382	0.408372306	0.04397382	0.408372306
X Variable 4	0.021786776	0.025320161	0.860451692	0.428860384	-0.043300771	0.086874322	-0.043300771	0.086874322
X Variable 5	0.407826098	0.087472143	4.662354038	0.005520391	0.182971797	0.632680399	0.182971797	0.632680399

Site Peak Hour Vehicle Trips

Thursday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.997102081
R Square	0.994212561
Adjusted R Square	0.736978261
Standard Error	291.6335509
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	58442360.49	9740393.415	114.5253234	0.001247312
Residual	4	340200.512	85050.128		
Total	10	58782561			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.017078711	0.013365357	1.277834269	0.270427649	-0.020029469	0.054186891	-0.020029469	0.054186891
X Variable 2	0.003059654	0.034664263	0.088265357	0.933908209	-0.09318377	0.099303077	-0.09318377	0.099303077
X Variable 3	0.137293573	0.034469627	3.983030426	0.016359705	0.041590546	0.232996601	0.041590546	0.232996601
X Variable 4	0.031841562	0.012117868	2.627653888	0.058329399	-0.001803032	0.065486156	-0.001803032	0.065486156
X Variable 5	0.164051959	0.059437813	2.760060468	0.050846465	-0.000973867	0.329077784	-0.000973867	0.329077784
X Variable 6	-0.01113231	0.041803285	-0.26630229	0.803170211	-0.127196837	0.104932216	-0.127196837	0.104932216

Site Peak Hour Vehicle Trips

Friday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.997977678
R Square	0.995959445
Adjusted R Square	0.740908752
Standard Error	245.1189145
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	59239900.87	9873316.812	164.3271879	0.000728296
Residual	4	240333.129	60083.28224		
Total	10	59480234			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.03066155	0.011233624	2.729444093	0.052473036	-0.000527992	0.061851091	-0.000527992	0.061851091
X Variable 2	0.032251767	0.029135422	1.106960689	0.330397237	-0.048641133	0.113144666	-0.048641133	0.113144666
X Variable 3	0.134497923	0.02897183	4.64236896	0.009716758	0.054059228	0.214936617	0.054059228	0.214936617
X Variable 4	0.015517429	0.010185106	1.523541301	0.20229556	-0.012760958	0.043795816	-0.012760958	0.043795816
X Variable 5	0.15786744	0.049957668	3.160024171	0.034183264	0.019162716	0.296572164	0.019162716	0.296572164
X Variable 6	-0.03310113	0.035135792	-0.94209134	0.399487665	-0.130653725	0.064451473	-0.130653725	0.064451473

Site Peak Hour Vehicle Trips

Saturday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.991649927
R Square	0.983369578
Adjusted R Square	0.712581551
Standard Error	587.9404729
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	81759874	13626645.67	39.42051089	0.006040761
Residual	4	1382695.999	345673.9997		
Total	10	83142570			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.02263922	0.026944891	0.840204542	0.448081643	-0.052171791	0.09745023	-0.052171791	0.09745023
X Variable 2	0.009787879	0.069884014	0.140058905	0.895382914	-0.184241251	0.203817008	-0.184241251	0.203817008
X Variable 3	0.170258754	0.069491623	2.450061557	0.070440614	-0.022680923	0.363198431	-0.022680923	0.363198431
X Variable 4	0.03142312	0.024429922	1.286255474	0.267756559	-0.036405216	0.099251457	-0.036405216	0.099251457
X Variable 5	0.200654429	0.119828106	1.67451891	0.169340564	-0.132041729	0.533350587	-0.132041729	0.533350587
X Variable 6	-0.0186115	0.08427646	-0.22083865	0.836032593	-0.252600465	0.215377465	-0.252600465	0.215377465

Site Peak Hour Vehicle Trips

Sunday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.987420626
R Square	0.974999493
Adjusted R Square	0.754999087
Standard Error	577.1903517
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	64962644.49	12992528.9	38.9991881	0.001732306
Residual	5	1665743.51	333148.7021		
Total	10	66628388			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.013084787	0.024360387	0.537133767	0.6142074	-0.049535582	0.075705155	-0.049535582	0.075705155
X Variable 2	0.034425795	0.038804013	0.887170985	0.415616045	-0.065323097	0.134174686	-0.065323097	0.134174686
X Variable 3	0.159537781	0.063659442	2.506113414	0.054084281	-0.004104024	0.323179585	-0.004104024	0.323179585
X Variable 4	0.027490661	0.022741241	1.208846105	0.280763397	-0.03096756	0.085948882	-0.03096756	0.085948882
X Variable 5	-0.0023959	0.078562891	-0.03049659	0.976850883	-0.204348241	0.19955644	-0.204348241	0.19955644

Network Peak Hour Vehicle Trips

Thursday (PM)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.997128358
R Square	0.994264962
Adjusted R Square	0.737096164
Standard Error	269.7728593
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	50468722.42	8411453.736	115.5778338	0.001230444
Residual	4	291109.5825	72777.39563		
Total	10	50759832			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.015725645	0.012363497	1.271941528	0.272311981	-0.018600925	0.050052216	-0.018600925	0.050052216
X Variable 2	-0.02576835	0.032065849	-0.80360724	0.466663266	-0.114797418	0.063260721	-0.114797418	0.063260721
X Variable 3	0.135420452	0.031885803	4.247045408	0.013189132	0.046891271	0.223949632	0.046891271	0.223949632
X Variable 4	0.039624475	0.011209519	3.534895232	0.024123976	0.008501861	0.070747089	0.008501861	0.070747089
X Variable 5	0.210291529	0.054982387	3.824707139	0.018702683	0.057635949	0.362947109	0.057635949	0.362947109
X Variable 6	-0.02537903	0.038669734	-0.6563021	0.547466278	-0.132743421	0.081985366	-0.132743421	0.081985366

Network Peak Hour Vehicle Trips

Friday (PM)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.995843951
R Square	0.991705175
Adjusted R Square	0.731336645
Standard Error	307.8486641
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	45322087.8	7553681.3	79.70473292	0.002137368
Residual	4	379083.1999	94770.79997		
Total	10	45701171			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	-0.00108114	0.014108484	-0.07663035	0.942597444	-0.040252569	0.038090293	-0.040252569	0.038090293
X Variable 2	-0.0061412	0.03659163	-0.16783062	0.874860255	-0.107735849	0.095453457	-0.107735849	0.095453457
X Variable 3	0.13263579	0.036386172	3.645225132	0.021863458	0.03161158	0.23366	0.03161158	0.23366
X Variable 4	0.034497983	0.012791633	2.696917793	0.054267359	-0.001017284	0.070013249	-0.001017284	0.070013249
X Variable 5	0.185851017	0.062742614	2.962117838	0.041467177	0.011649593	0.360052441	0.011649593	0.360052441
X Variable 6	-0.03401339	0.044127589	-0.77079658	0.483830235	-0.156531224	0.088504434	-0.156531224	0.088504434

Network Peak Hour Vehicle Trips

Saturday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.991932419
R Square	0.983929924
Adjusted R Square	0.713842329
Standard Error	553.8014988
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	75112892.6	12518815.43	40.81830656	0.005739765
Residual	4	1226784.4	306696.1001		
Total	10	76339677			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.004591461	0.025380326	0.180906312	0.865237472	-0.065875621	0.075058544	-0.065875621	0.075058544
X Variable 2	0.019436821	0.065826174	0.295274962	0.782476352	-0.163325938	0.20219958	-0.163325938	0.20219958
X Variable 3	0.143979349	0.065456567	2.199616558	0.092692287	-0.037757217	0.325715915	-0.037757217	0.325715915
X Variable 4	0.037890377	0.02301139	1.646592292	0.174987237	-0.025999483	0.101780236	-0.025999483	0.101780236
X Variable 5	0.190133026	0.112870244	1.684527466	0.167363607	-0.12324501	0.503511063	-0.12324501	0.503511063
X Variable 6	-0.03332529	0.079382917	-0.41980434	0.696196141	-0.253727605	0.187077019	-0.253727605	0.187077019

Network Peak Hour Vehicle Trips

Sunday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.985058829
R Square	0.970340896
Adjusted R Square	0.746613613
Standard Error	578.2542514
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	54698319.1	10939663.82	32.71646011	0.002433311
Residual	5	1671889.896	334377.9793		
Total	10	56370209			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.021376281	0.024405289	0.875887244	0.421169956	-0.041359512	0.084112074	-0.041359512	0.084112074
X Variable 2	0.054948693	0.038875538	1.413451635	0.216648138	-0.044984059	0.154881446	-0.044984059	0.154881446
X Variable 3	0.122116827	0.063776781	1.914753689	0.113690961	-0.041826608	0.286060263	-0.041826608	0.286060263
X Variable 4	0.019083709	0.022783159	0.83762351	0.440431099	-0.039482264	0.077649683	-0.039482264	0.077649683
X Variable 5	-0.02910374	0.078707701	-0.36976994	0.72669869	-0.231428329	0.173220845	-0.231428329	0.173220845

Peak Parking Accumulation

Thursday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99962861
R Square	0.999257358
Adjusted R Square	0.748329055
Standard Error	101.0968741
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	55008916.69	9168152.781	897.0288	5.74871E-05
Residual	4	40882.31183	10220.57796		
Total	10	55049799			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.026989746	0.004633197	5.825296072	0.00432549	0.014125928	0.039853565	0.014125928	0.039853565
X Variable 2	0.034351292	0.012016617	2.858649167	0.045992157	0.000987815	0.067714769	0.000987815	0.067714769
X Variable 3	0.032124618	0.011949145	2.688444901	0.054746334	-0.001051527	0.065300762	-0.001051527	0.065300762
X Variable 4	0.049331343	0.004200746	11.74347149	0.000300786	0.037668202	0.060994485	0.037668202	0.060994485
X Variable 5	0.086900552	0.020604547	4.217542541	0.013504176	0.029693159	0.144107945	0.029693159	0.144107945
X Variable 6	-0.07140373	0.01449141	-4.92731421	0.007887984	-0.111638338	-0.03116913	-0.111638338	-0.031169127

Peak Parking Accumulation

Friday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.996190915
R Square	0.992396339
Adjusted R Square	0.732891763
Standard Error	293.1743455
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	44871888.21	7478648.035	87.01040016	0.001876557
Residual	4	343804.7875	85951.19689		
Total	10	45215693			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.018434463	0.01343597	1.372023194	0.241971661	-0.018869771	0.055738697	-0.018869771	0.055738697
X Variable 2	0.050543548	0.034847406	1.450424977	0.220552043	-0.046208361	0.147295457	-0.046208361	0.147295457
X Variable 3	0.048540447	0.034651741	1.400808309	0.23387703	-0.04766821	0.144749104	-0.04766821	0.144749104
X Variable 4	0.035159151	0.01218189	2.886181927	0.044734178	0.001336802	0.068981501	0.001336802	0.068981501
X Variable 5	0.044170365	0.059751842	0.739230177	0.500798309	-0.121727345	0.210068076	-0.121727345	0.210068076
X Variable 6	-0.0711247	0.042024146	-1.69247232	0.165811546	-0.187802436	0.04555303	-0.187802436	0.04555303

Peak Parking Accumulation

Saturday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.995006295
R Square	0.990037526
Adjusted R Square	0.727584435
Standard Error	394.9950098
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	62019417.77	10336569.63	66.25111875	0.002810829
Residual	4	624084.2312	156021.0578		
Total	10	62643502			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.001363486	0.018102339	0.075320995	0.943575922	-0.048896663	0.051623635	-0.048896663	0.051623635
X Variable 2	0.028290829	0.046950054	0.602572882	0.579286875	-0.102063418	0.158645077	-0.102063418	0.158645077
X Variable 3	0.082182055	0.046686434	1.760298388	0.153163464	-0.047440267	0.211804378	-0.047440267	0.211804378
X Variable 4	0.043547941	0.016412711	2.653305743	0.056785492	-0.002021051	0.089116932	-0.002021051	0.089116932
X Variable 5	0.064497408	0.080503905	0.80117118	0.467921348	-0.159017264	0.288012081	-0.159017264	0.288012081
X Variable 6	0.036120421	0.056619305	0.637952388	0.558195885	-0.121079972	0.193320814	-0.121079972	0.193320814

Peak Parking Accumulation

Sunday

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.992725912
R Square	0.985504737
Adjusted R Square	0.773908526
Standard Error	368.7072242
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	46213185.91	9242637.183	67.9880541	0.000584875
Residual	5	679725.0859	135945.0172		
Total	10	46892911			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.010033203	0.015561332	0.644752201	0.547499331	-0.029968474	0.050034881	-0.029968474	0.050034881
X Variable 2	0.023649479	0.024787871	0.954074649	0.383860762	-0.040069772	0.087368731	-0.040069772	0.087368731
X Variable 3	0.081262319	0.040665434	1.998314317	0.102159169	-0.023271507	0.185796144	-0.023271507	0.185796144
X Variable 4	0.031754196	0.014527027	2.18587023	0.08051474	-0.005588716	0.069097108	-0.005588716	0.069097108
X Variable 5	0.066794988	0.050185706	1.330956414	0.240664515	-0.062211477	0.195801453	-0.062211477	0.195801453