



Roads and Maritime Services
Trip Generation Surveys
Schools
Analysis Report

transportation planning, design and delivery

Roads and Maritime Services

Trip Generation Surveys, Schools

Analysis Report

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A	25/08/14	Final	Chris Slenders	Kelly Yoon	Ken Hollyoak	Ken Hollyoak

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1. Introduction

1.1 Background

Roads and Maritime Services (RMS) is seeking to determine contemporary trip generation data for 'Schools' within Metropolitan Sydney and Regional NSW. RMS previously published the RTA Guide to Traffic Generating Developments (Guide) as well as a Technical Direction (TDT 2013/04) update. These documents provide traffic generation characteristics for a variety of land uses, however data has not been publicly collated for School land uses. Given the lack of suitable collated and localised data, there was a need to undertake trip generation and parking surveys at schools to assist with the assessment of transport impacts when planning new schools.

In February 2014, RMS commissioned GTA Consultants (GTA) to evaluate trip generation and parking rates for persons and vehicles from Schools based upon surveys undertaken at suitable schools.

The study has also assessed the impact of the 'Accessibility Score' for each site which accounts for the proximity and quantum of public transport services located close to the school as well as the proximity to activity centres.

1.2 School Types

The purpose of this study was to determine trip generation rates for range of schools in NSW. The range was to include:

- Primary
- Secondary
- Combined Primary/ Secondary
- Public
- Private
- Independent.

1.3 Study Approach

As part of the study to determine trip generation rates for schools, the following approach was adopted:

- GTA prepared a list of potential survey locations for the study and submitted to RMS for their review. This included key site information, aerial images and indicative public transport ratings.
- A total of 22 sites were approved by RMS for the purpose of undertaking traffic surveys to determine the trip generation rates.
- Further site inspections were carried out by GTA and each site was inspected to determine the suitability of undertaking the surveys.
- A total of 22 schools were selected for the study and a letter was delivered to each school to inform of the proposed survey.
- GTA commissioned traffic and pedestrian surveys at the selected 22 sites. This involved counting vehicles and pedestrian accessing the sites and undertaking a sample of pedestrian interview surveys.

- Parking demand was also recorded on-site and on surrounding streets at the start and end of each AM and PM survey period.
- The survey data was then analysed to provide trip generation and parking demand data for the school in terms of person and vehicle trips.
- The results of the study were to be presented in the form of a data report and an analysis report.

2. Survey Methodology

2.1 Site Selection

2.1.1 Criteria

The purpose of this study was to determine trip generation rates for range of school types in NSW. The range was to include:

- Primary
- Secondary
- Combined
- Public
- Private
- Independent
- A range of sizes
- A range of accessibility scores
- Schools in metropolitan Sydney and surrounding regions.

2.1.2 Site Selection Methodology

The selection of potential sites utilised multiple resources including:

- NSW Education & Communities School Locator
- Australian Schools Directory
- Aerial photography (Google Maps, SIX Maps, Nearmap).

Sites were chosen on the basis of ease and the ability to accurately survey the trip generation of the school. Schools that were relatively isolated or located in residential precincts were favoured. This included schools that were near to, but not adjacent to retail and business precincts.

2.1.3 Challenges

Ideally, all schools would have provided on-site parking facilities to satisfy demand, however the reality is that many schools rely on surrounding streets to accommodate the relatively short term parking demands associated with drop-off and pick-up.

The following issues were considered and used to eliminate potential schools on the basis of being too difficult to accurately survey:

- Directly adjacent land uses that are equal or higher density, such as retail or business districts
- Access points with more than two road frontages
- Schools adjacent to a fine grain road network with a large range of parking options on many nearby roads.

On this rationale and in agreement with RMS, the following schools were surveyed as outlined in Table 2.1.

Table 2.1: Selected Survey Sites

School	Urban (U)/ Regional (R)	Primary (P)/ Secondary (S)/ Both Primary & Secondary (B)	Public (P)/ Private or Independent (I)
Bass Hill High School	U	S	P
Casula High School	U	S	P
Camden High School (Cawdor)	R	S	P
Dapto Public School (Horsley)	R	P	P
Eagle Vale High School	U	S	P
Galston High School	U	S	P
Glenaeon Rudolf Steiner School (Middle Cove)	U	B	I
Good Samaritan Catholic College (Hinchinbrook)	U	S	I
Grays Point Primary School	U	P	P
Gwandalan Public School	R	P	P
Harrington Street Public School (Cabramatta West)	U	P	P
JJ Cahill Memorial High School (Mascot)	U	S	P
Kiama High School	R	S	P
Kurnell Public School	U	P	P
Mt View High School (Cessnock)	R	S	P
St Columba's High School (Springwood)	R	S	I
St Kevin's Catholic Primary School (Dee Why)	U	P	I
St Mary's Catholic Primary School (Noraville)	R	P	I
Turrumurra High School (South Turrumurra)	U	S	P
Xavier College (Llandilo)	U	S	I
Woronora River Public School	U	P	P
Wyong High School	R	S	P

A summary of the school locations and types is provided in Table 2.2.

Table 2.2: School Location and Type Summary

Location	School Type	Public	Private	Sub Total
Sydney Metro	Primary	4	1	5
	Secondary	6	2	8
	Primary and Secondary	0	1	1
Sydney Metropolitan Total				14
Regional	Primary	1	1	2
	Secondary	5	1	6
Regional Total				8
All Schools	Primary	5	2	7
	Secondary	11	3	14
	Primary and Secondary	0	1	1
Grand Total				22

2.1.4 Survey Periods

The survey period methodology was determined in consultation with a representative from each school.

In the AM Period, surveys were generally conducted in a two hour period beginning 1.5 hours before the commencement of school to 0.5 hours after the commencement of school.

In the PM Period, surveys were generally conducted in a two hour period, one hour before and one after the end of the school day.

School representatives were questioned about the occurrence of before and after school activities. Where these were identified, the survey periods were adjusted to record additional school activities. These generally consisted of before and after school care at primary schools.

School representatives were also asked to nominate typical school days. This eliminated days where significant characteristics occurred that would impact typical traffic generation rates. In this process, the following issues were identified:

- days where the majority of HSC students finish earlier than usual
- sports days where additional movements occur between the school and off-site sports facilities
- external education days where a significant number students would undertake learning at an off-site location.

3. Survey Analysis Overview

3.1 Survey Data

The key objective of the data collection was to determine all mode trip generation and parking demand of the various types of schools.

Person trips to each school include every person irrespective of mode choice that entered the school property. External vehicle trips did not include occupants (i.e. parents) that did not enter the school, however the vehicle trip generation was recorded.

Mode split to and from the schools was separated into the following mode types:

- Private vehicle (on-site and on the surrounding road network)
- Bus (on-site and on the surrounding road network)
- Walk.

Sample interview surveys were conducted in the AM survey period to provide an insight of mode split in terms of main transport mode. These surveys aimed to capture trips that could not be entirely observed (i.e. remote drop-off).

3.2 Key Independent Variables for Trip Rate Calculation

The key independent variables selected to assess trip generation were:

- Student Population
- 'Accessibility Score'.

3.3 Trip Rates per School Population

The rates calculated include:

- Person trip rates per peak hour (AM and PM peak periods)
- Private vehicle trip rates per peak hour (AM and PM peak periods).

3.4 Parking Demand

Peak parking was calculated by determining the pre AM survey period cars parked in surrounding streets and on-site and then again after the AM survey period. From this, the difference in cars was noted. The rationale for this is that it would provide an acceptable level of accuracy given the schools surveyed were generally isolated from other significant traffic generating land uses.

3.5 School Comparison

Schools have been assessed collectively and separated into primary and secondary schools to determine overall differences in trip generation and parking rates. Where applicable, a further breakdown of school locations was assessed to determine if there are any differences between metropolitan and regional schools. Differences between public and private schools have also been noted. It is intended that the overall range of school types provides an inclusive range of

data that provides a reasonable insight into the expected traffic and parking characteristics of schools in NSW.

4. Survey Analysis

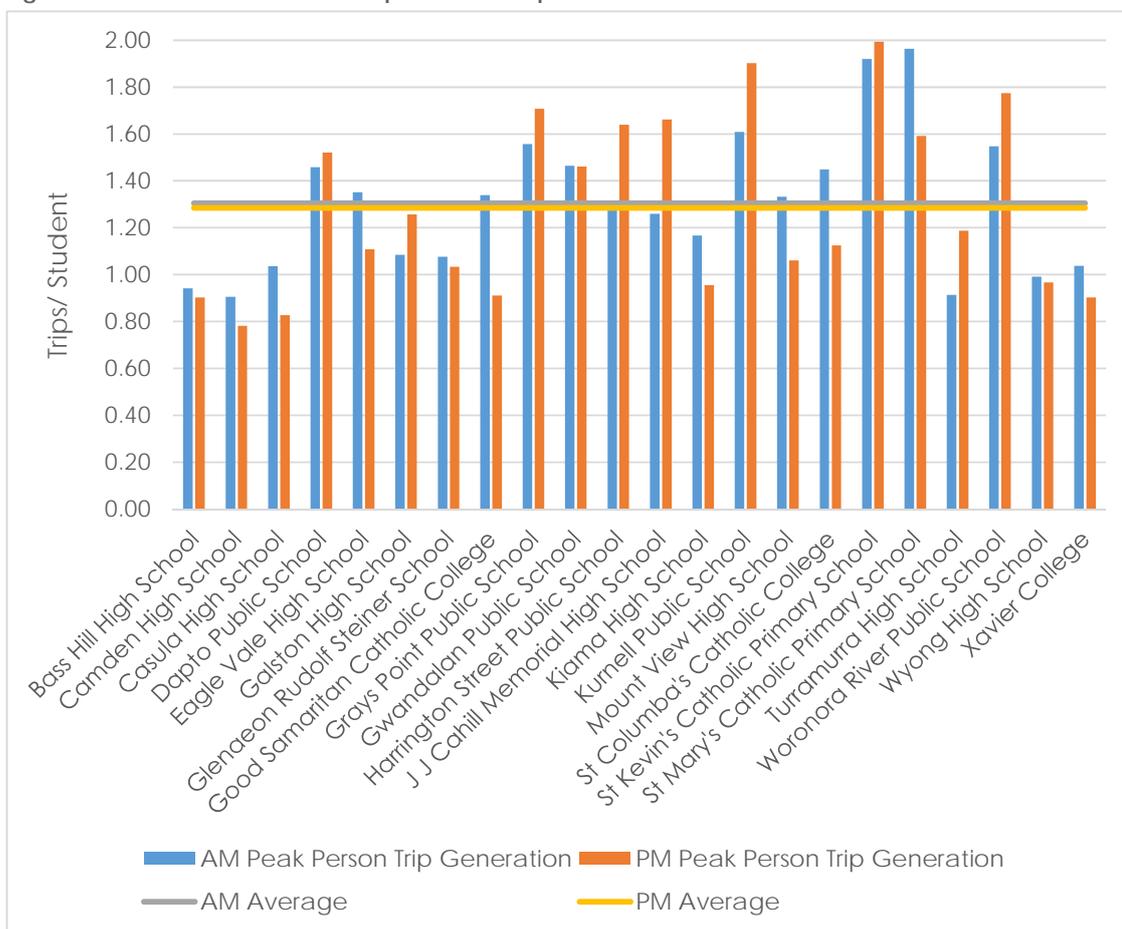
4.1 Person Trip Generation Rate per Student

All Schools

For all periods and all schools, the peak person trip generation rate varied between 0.78 – 1.99 trips per student. Person trips include all students, parents and staff entering and leaving the school grounds.

Peak person trip generation rates for all the schools surveyed are shown in Figure 4.1.

Figure 4.1: School Peak Person Trip Generation per Student



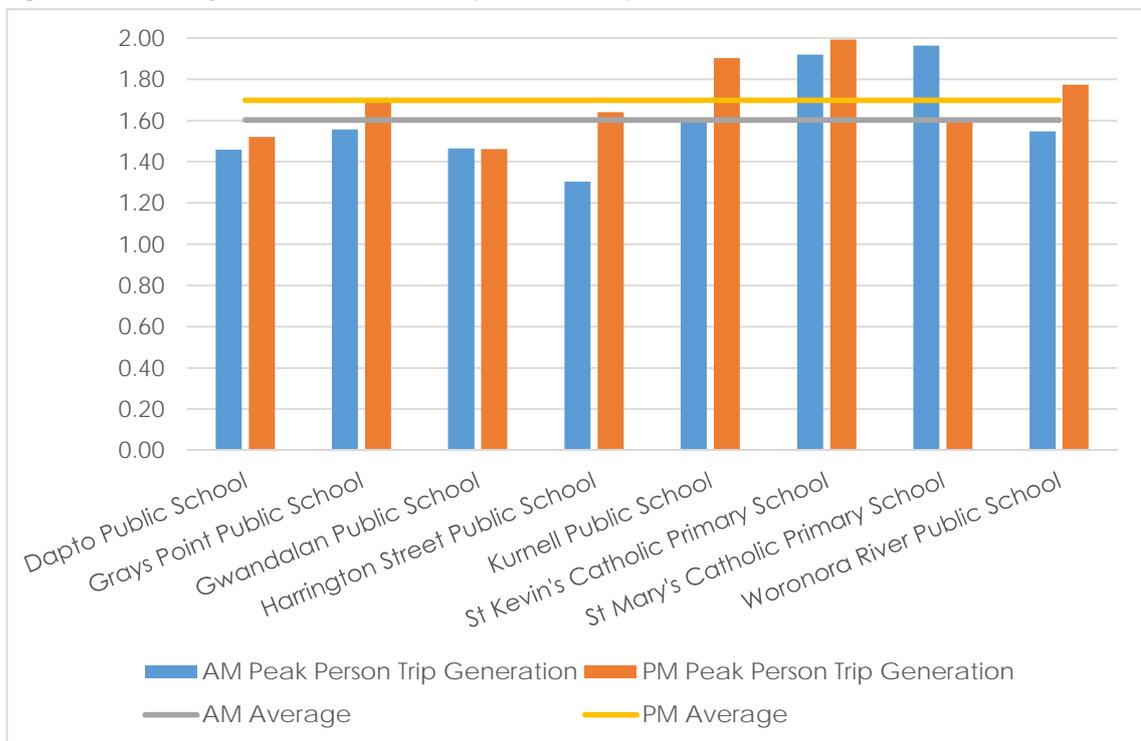
Primary Schools

An assessment of primary school peak person trip rates per student found these varied between 1.30 – 1.96 in the AM peak and 1.46 – 1.99 in the PM peak.

The private primary schools had higher average trip rates, however this subset of data is too limited to draw a conclusion and it is noted Kurnell Public School is the third highest school trip rate.

Peak trips rates between the AM and PM periods of individual schools are generally within a close range of each other. The primary school peak person trip rates per student are shown in Figure 4.2.

Figure 4.2: Primary School Peak Person Trip Generation per Student



Secondary Schools

Overall, secondary schools were found to have lower peak person trip generation rates compared to primary schools. This could be attributed to less parent accompaniment to school.

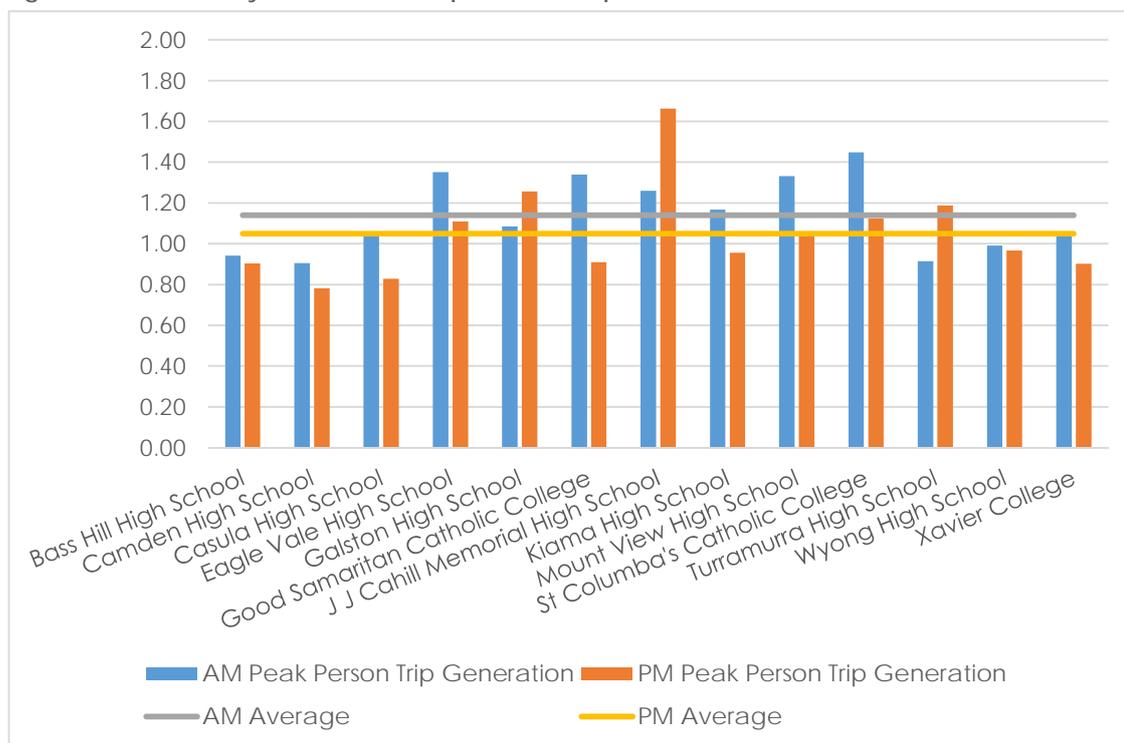
The AM peak person trip generation range is between 0.91 and 1.45 movements per student, and the PM peak range is between 0.78 and 1.66 person trips per student.

The difference in average peak person trip generation between private and public secondary schools is minimal, with the public school trip generation range falling within the private school range.

The AM and PM peak person trip generation rates are generally consistent when assessing individual schools. It is noted that three secondary schools had higher PM period rates, whereas ten of the schools had higher AM peak person trip rates.

The results of the secondary school peak period person trip generation rates per student are shown in Figure 4.3.

Figure 4.3: Secondary School Person Trip Generation per Student



Summary of Person Trip Rates

A summary of the average peak person trip generation rates is provided in Table 4.1.

Table 4.1: Summary of Peak Person Trip Rates per Student

School Type	Period	Average	Minimum	Maximum	Range
All	AM	1.30	0.91	1.96	1.05
	PM	1.28	0.78	1.99	1.21
Primary	AM	1.60	1.30	1.96	0.66
	PM	1.70	1.46	1.99	0.53
Secondary	AM	1.14	0.91	1.45	0.54
	PM	1.05	0.78	1.66	0.88

As indicated in Table 4.1, secondary schools had the lowest person trip rates whereas primary schools had the highest person trip rates.

4.2 Vehicle Trip Rates

All Schools

Vehicle trip rates include all vehicle trips related to school activity including movements in/ out of the grounds and the observed on-street movements. On-street drop-off/ pick-up movements were recorded as two movements (i.e. to and then from school).

The recorded peak vehicle trip generation varied between 0.11 and 1.35 for all schools for both AM and PM periods.

The vehicle trip generation for all schools is shown in Figure 4.4 and a summary is provided in Table 4.2.

Figure 4.4: Vehicle Trip Generation Rate per Student

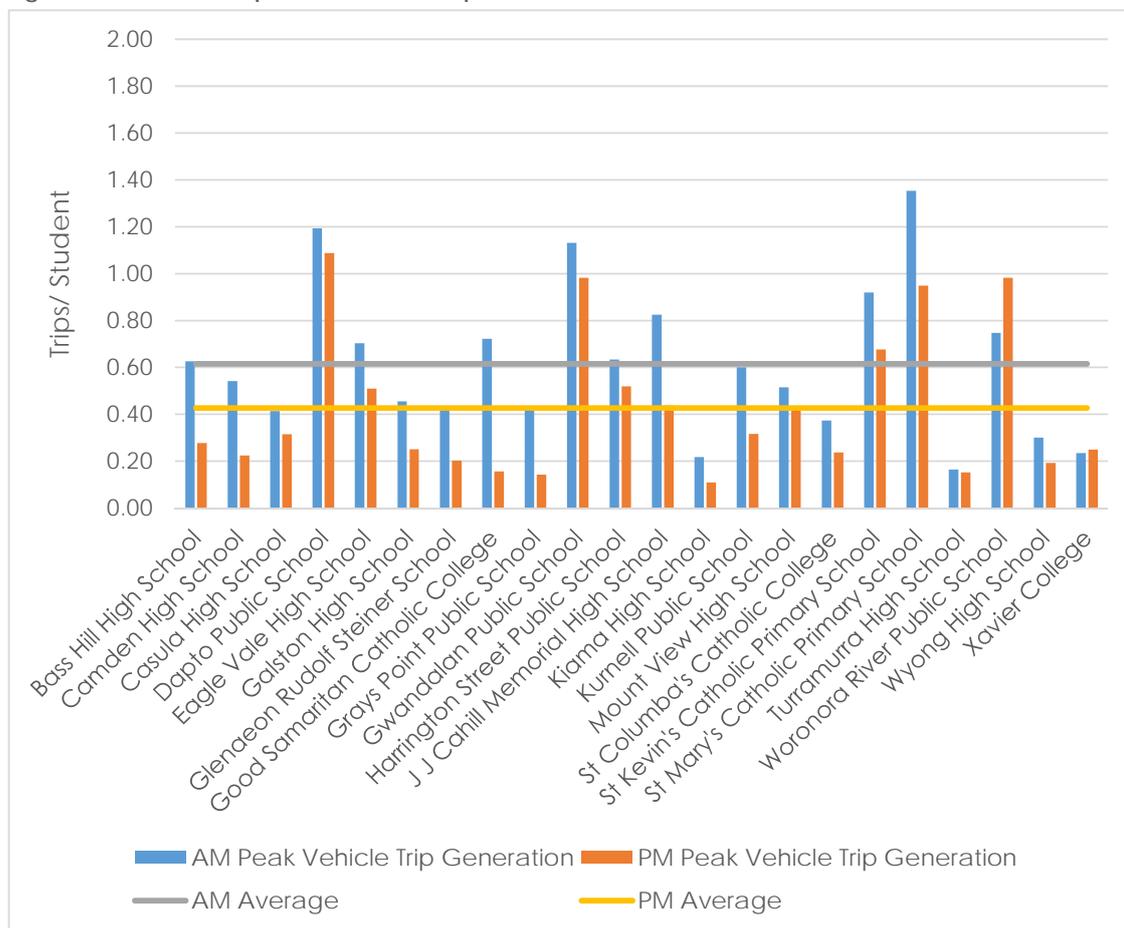


Table 4.2: Summary of Vehicle Trip Generation per Student

School Type	Period	Average	Minimum	Maximum	Range
All	AM	0.62	0.16	1.35	1.19
	PM	0.43	0.11	1.09	0.98
Primary	AM	0.88	0.43	1.35	0.92
	PM	0.71	0.14	1.09	0.95
Secondary	AM	0.47	0.16	0.83	0.67
	PM	0.27	0.11	0.51	0.40

As indicated in Table 4.2, average vehicle trip rates are generally higher for primary schools than secondary schools. Vehicle trip generation rates peak are higher in the AM period compared to the PM period.

Primary Schools

The three highest generation rates recorded were at primary schools in regional areas, however these were also the only primary schools surveyed in regional areas. A larger survey sample would be required to confirm this overall trend. Even without the three highest traffic generating schools, the primary school average would still be higher than the secondary school average.

Peak vehicle trip generation rates per student varied between 0.43 – 1.35 in the AM peak period and 0.14 – 1.09 in the PM peak period.

There was no strong correlation in a difference of trip rates between public and private primary schools.

The results of the peak vehicle traffic generation for primary schools are shown in Figure 4.5 and a summary is provided in Table 4.3.

Figure 4.5: Primary School Vehicle Trip Generation Rate per Student

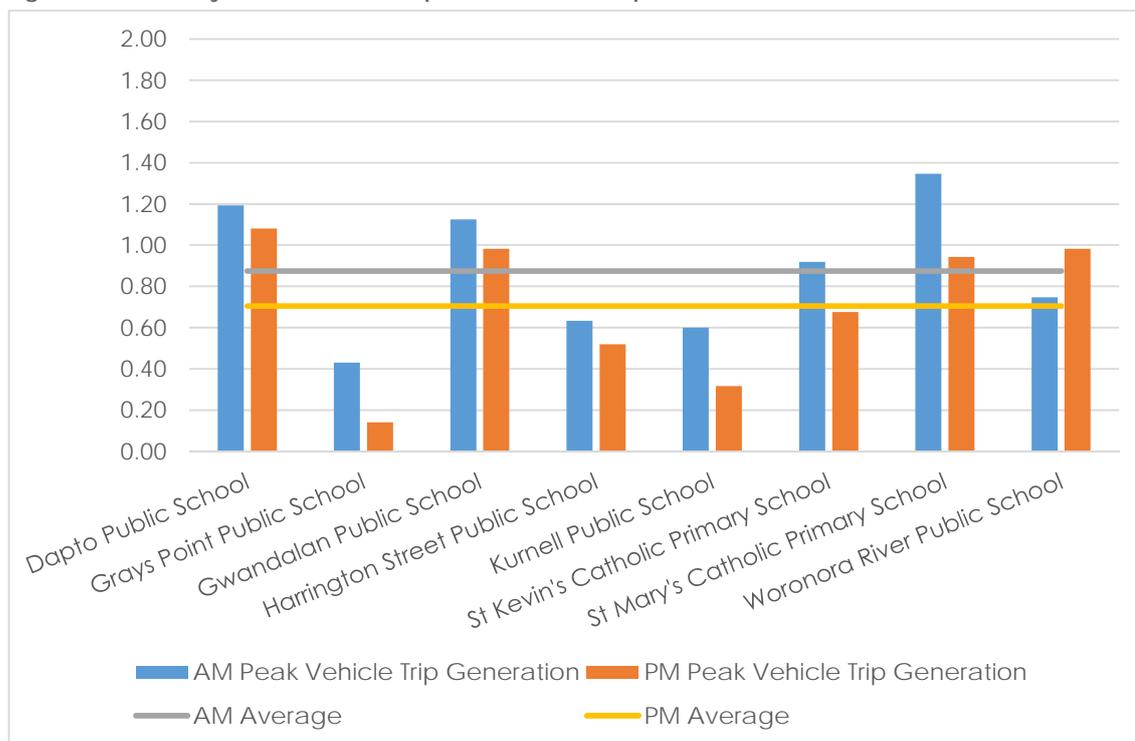


Table 4.3: Primary School Peak Vehicle Trip Generation per Student Summary

Primary School Location	Period	Average	Minimum	Maximum	Range
All	AM	0.88	0.43	1.35	0.92
	PM	0.71	0.14	1.09	0.95
Sydney Metropolitan	AM	0.67	0.43	0.92	0.49
	PM	0.53	0.14	0.98	0.84
Regional	AM	1.23	1.13	1.35	0.22
	PM	1.01	0.95	1.09	0.14

As indicated in Table 4.3, Sydney metropolitan primary schools have average peak vehicle trip rates of 0.67 and 0.53 in the AM and PM periods respectively, whereas the regional primary schools surveyed had higher average peak vehicle trip rates of 1.23 and 1.01 in the AM and PM periods respectively.

Secondary Schools

Peak vehicle trip generation rates per student in secondary schools were found to be lower than in primary schools which can be attributed to a greater number of students commuting by public transport.

Secondary schools typically had a higher peak vehicle trip generation per student in the AM period with the exception of J J Cahill Memorial School.

Vehicle trip generation rates per student varied between 0.16 – 0.83 in the AM peak period and 0.11 – 0.51 in the PM peak period for all secondary schools. On average, it was found that regional schools exhibited lower peak vehicle generation in both the AM and PM periods. Notwithstanding, both metropolitan and regional schools feature in the top as well as in the lowest three schools in terms of vehicle trip generation. The location of a school in a metropolitan or regional area does not seem to impact the peak vehicle trip generation rate.

It was found that private and public secondary schools generated near identical vehicle trip generation in both AM and PM peak periods.

The results of the peak vehicle traffic generation for secondary schools are shown in Figure 4.6 and a summary is provided in Table 4.4.

Figure 4.6: Secondary School Peak Vehicle Trip Generation Rate per Student

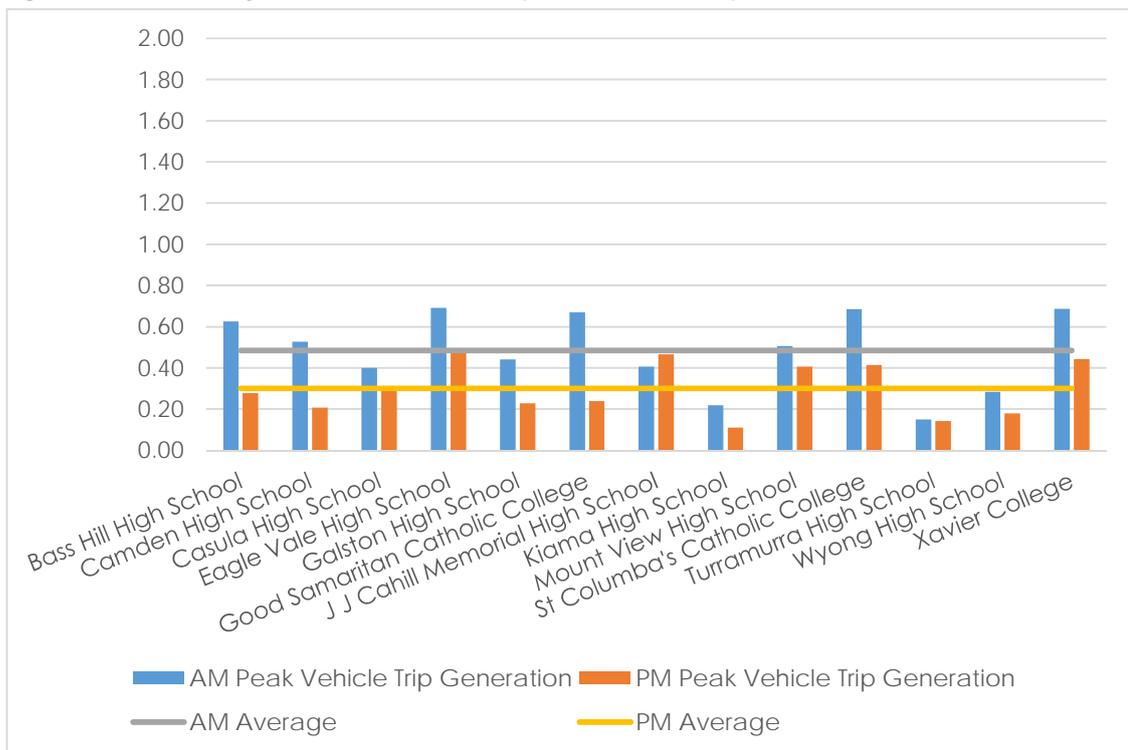


Table 4.4: Secondary School Peak Vehicle Trip Generation per Student Summary

Secondary School Location	Period	Average	Minimum	Maximum	Range
All	AM	0.47	0.16	0.83	0.67
	PM	0.27	0.11	0.51	0.40
Sydney Metropolitan	AM	0.51	0.16	0.83	0.67
	PM	0.28	0.15	0.51	0.36
Regional	AM	0.35	0.22	0.52	0.30
	PM	0.24	0.11	0.42	0.31

Table 4.4 shows that metropolitan schools on average have slightly higher AM vehicle traffic generation.

4.3 Vehicle Directional Split

All Schools

Many schools exhibit similar vehicle directional splits. As expected, the overall averages indicated more vehicles travel to the school in the AM period and away from the school in the PM period. The overall averages are 55% in, 45% out in the AM period and 43% in, 57% out during the PM period.

The results of the AM and PM vehicle directional splits are presented in Figure 4.7 and Figure 4.8 respectively with an overall summary provided in Table 4.5.

Figure 4.7: AM Vehicle Directional Split

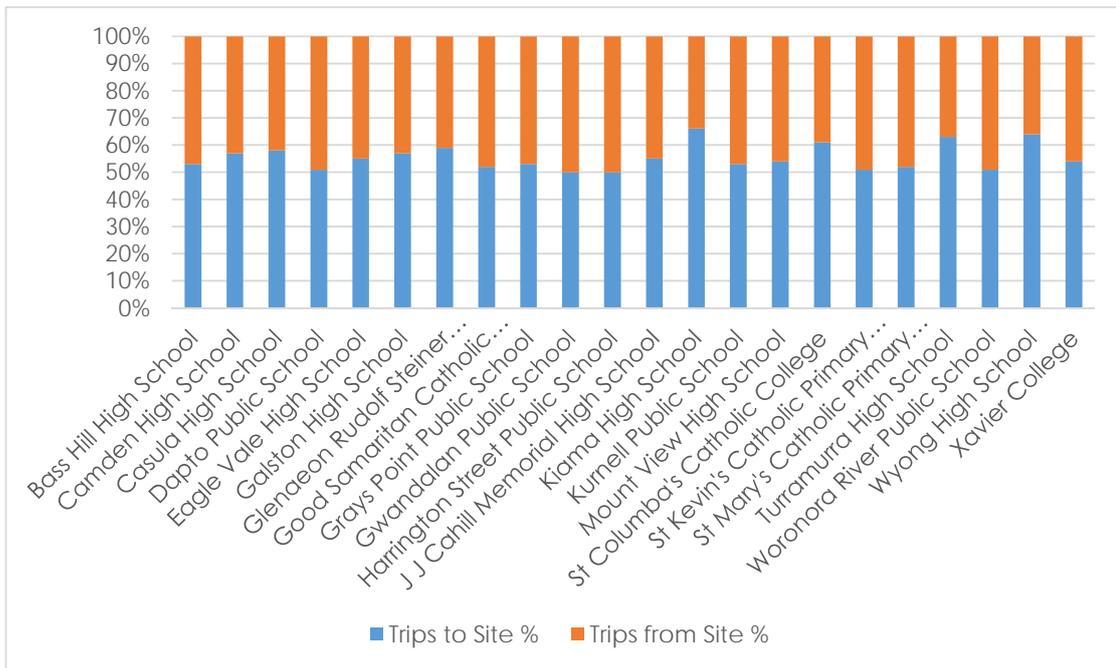


Figure 4.8: PM Vehicle Direction Split

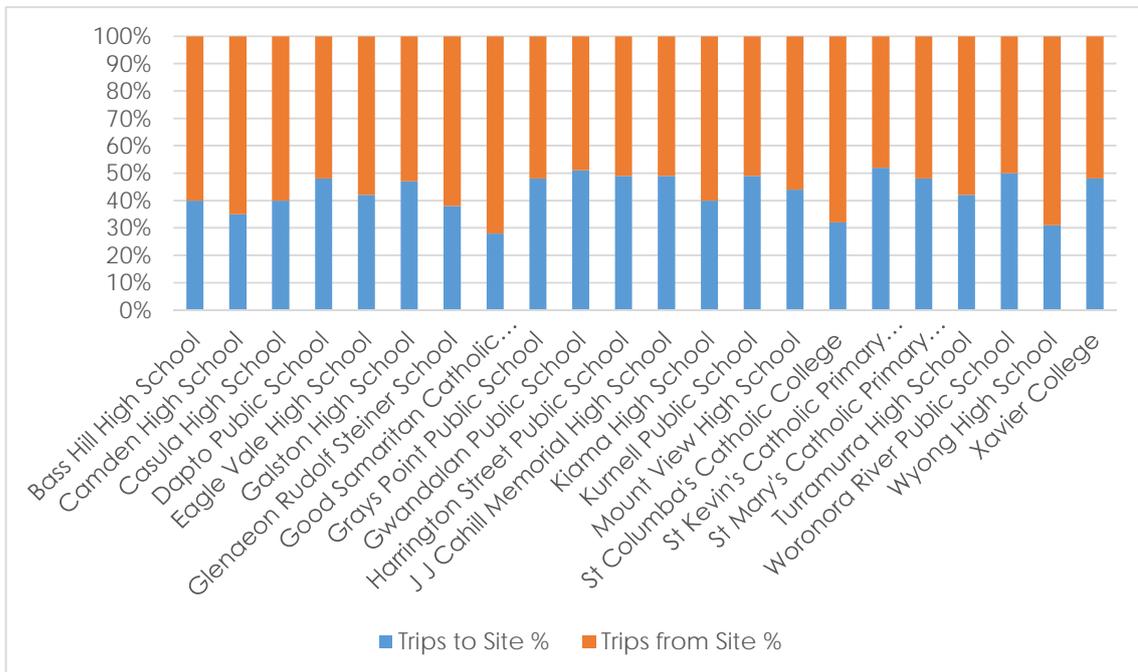


Table 4.5: Average Vehicle Directional Split

School Type	Period	Vehicle Trip In %	Vehicle Trip Out %
All	AM	55%	45%
	PM	43%	57%
Primary	AM	51%	49%
	PM	49%	51%
Secondary	AM	59%	41%
	PM	39%	61%

4.4 Daily Traffic Variation

Three schools (Good Samaritan Catholic College, Wyong High School and St Columba’s Catholic College) had surveys conducted over a school week to provide a broad assessment of the daily variation in trip generation. Good Samaritan Catholic College was conducted as a full observational survey in the AM and PM periods, and vehicle tube counts were undertaken at Wyong High School and St Columba’s Catholic College.

The results of the daily variance of Good Samaritan Catholic College are shown in Figure 4.9. The vehicle and person total, is the total of both the AM and PM survey periods.

Figure 4.9: Daily Variation, Good Samaritan Catholic College

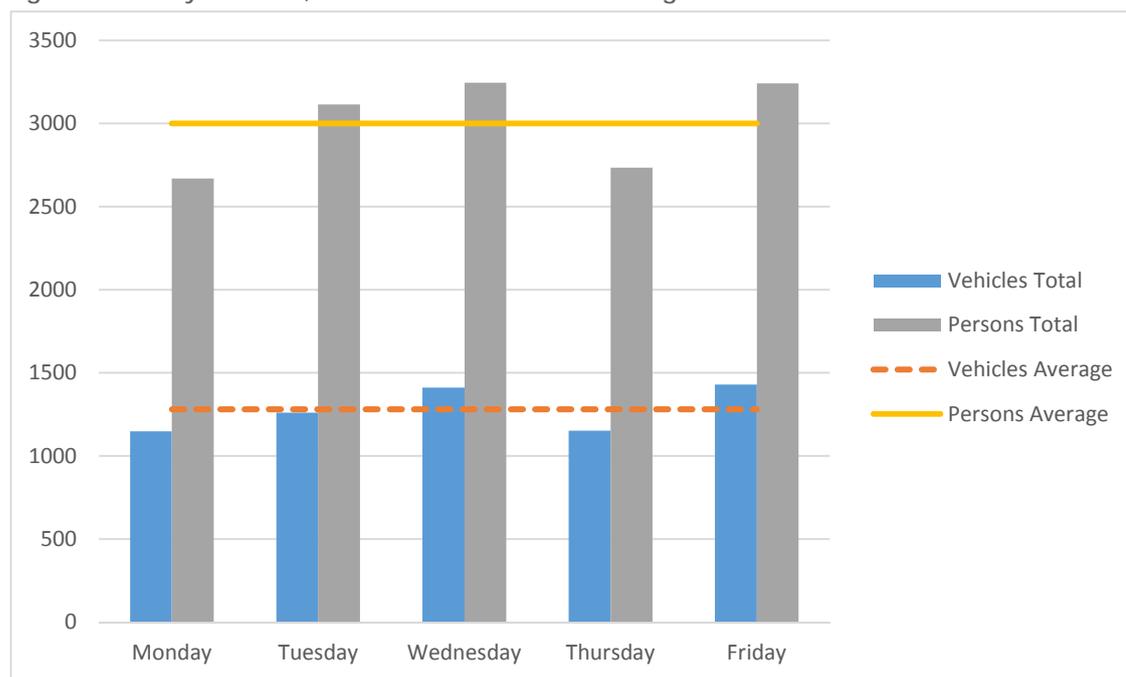
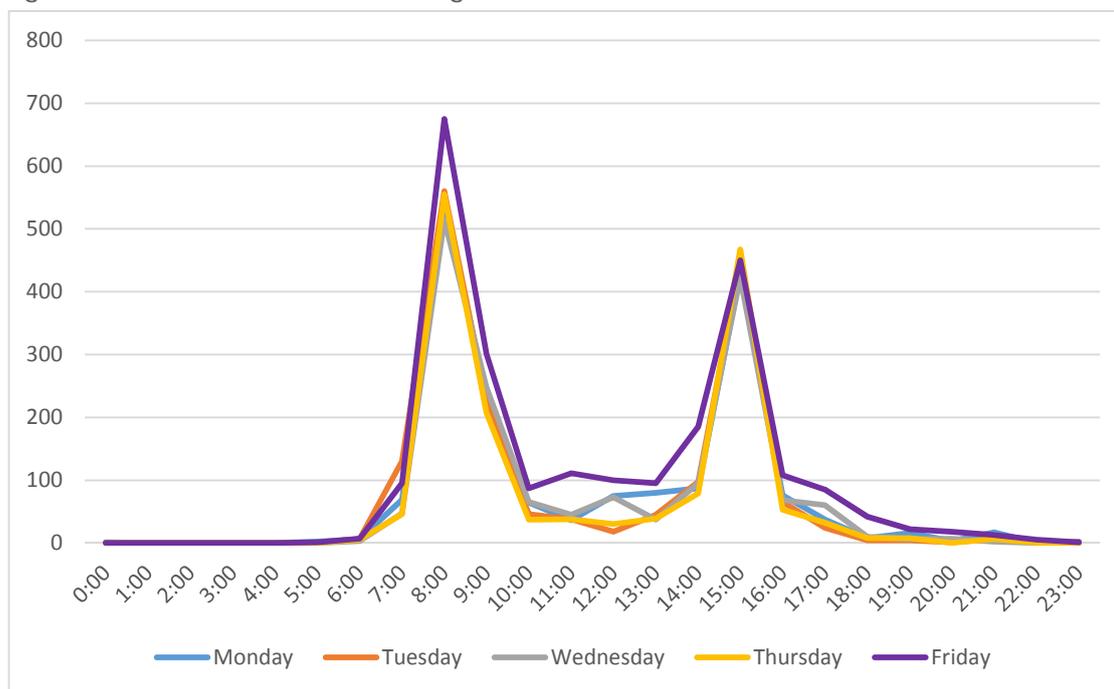


Figure 4.9 indicates Wednesdays and Fridays are typically busier days. It is noted that Good Samaritan Catholic College nominated Wednesday as a typical school day for the one day survey period.

The counts conducted at St Columba’s Catholic College and Wyong High School have been presented as temporal graphs given the availability of whole of day data. These are shown in Figure 4.10 and Figure 4.11 respectively.

Figure 4.10: St Columba's Catholic College Vehicle Counts



St Columba's access road data presented in Figure 4.10 indicates that vehicle trip generation was notably higher on the Friday, with a higher AM peak and traffic generation during the school day. It is noted the Friday PM peak is similar to other school days, however there is also notable evening traffic generation.

Figure 4.11: Wyong High School Vehicle Counts

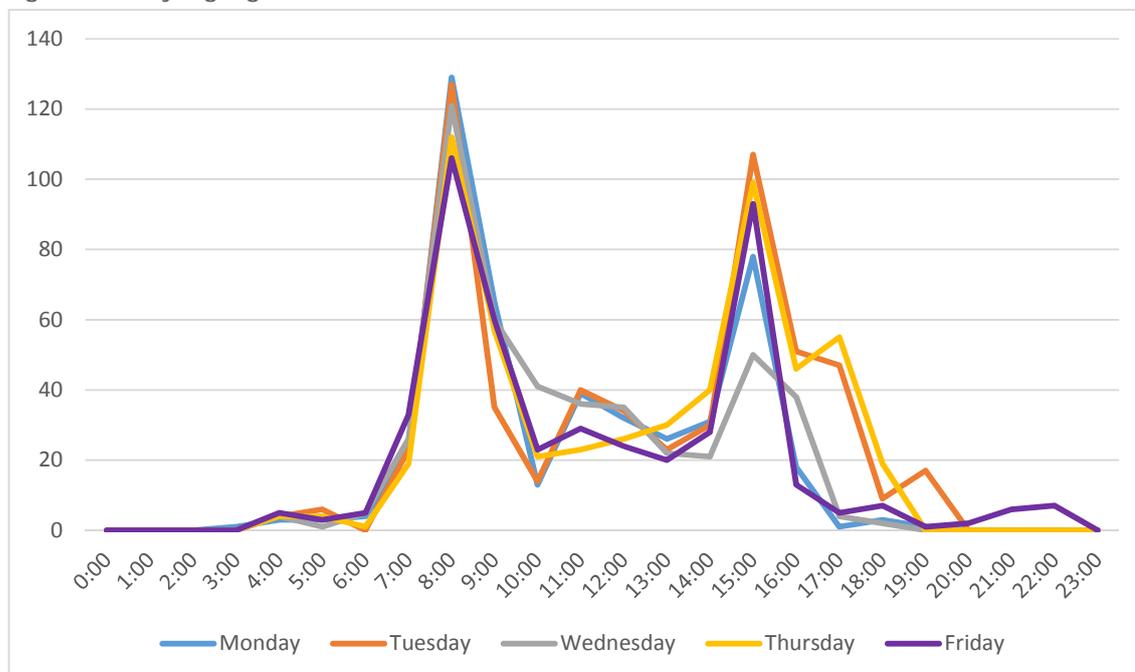


Figure 4.11 is the summation of both access roads to Wyong High School. Similar peak vehicle generation levels with the exception of Wednesday where afterschool vehicle trip generation was less than half of the Tuesday afterschool peak. For the one day surveys, the school advised GTA Consultants that Wednesday was not a typical day due to school sports in the afternoon.

There was higher evening traffic generation on Tuesdays and Thursdays which is indicative of afterschool activities on-site.

Based on all the week long surveys, the difference in daily traffic volumes, with the overall average of each school being 100% is shown in Table 4.6.

Table 4.6: Daily Traffic Variation Comparison

School	Monday	Tuesday	Wednesday	Thursday	Friday
Good Samaritan Christian College	90%	98%	110%	90%	112%
Wyong High School	93%	112%	92%	110%	93%
St Columba's	97%	93%	92%	87%	130%
Overall Average	93%	101%	98%	96%	112%

Based on the three schools surveyed over a school week, Tuesday typically represents an average traffic generation day for schools.

4.5 Observed Mode Split

All Schools

During the observational surveys, primary modes near to the school site were observed. If another mode was observed within visible distance of the survey points, this was counted as the primary mode. In this regard, walk, the mode which most people travel across the school boundary was able to be separated from other modes. Overall, there seemed to be no common relationship in regards to mode split between different schools.

The AM and PM mode split as a percentage for each school is shown in Figure 4.12 and Figure 4.13 respectively.

Figure 4.12: All Schools AM Period Mode Split

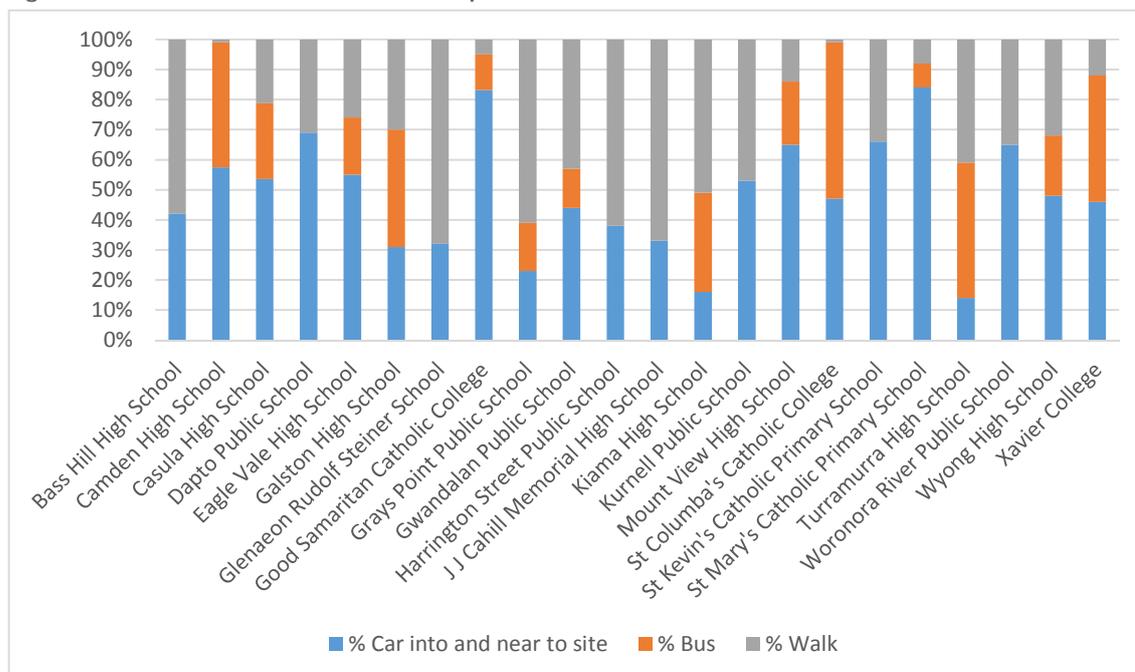
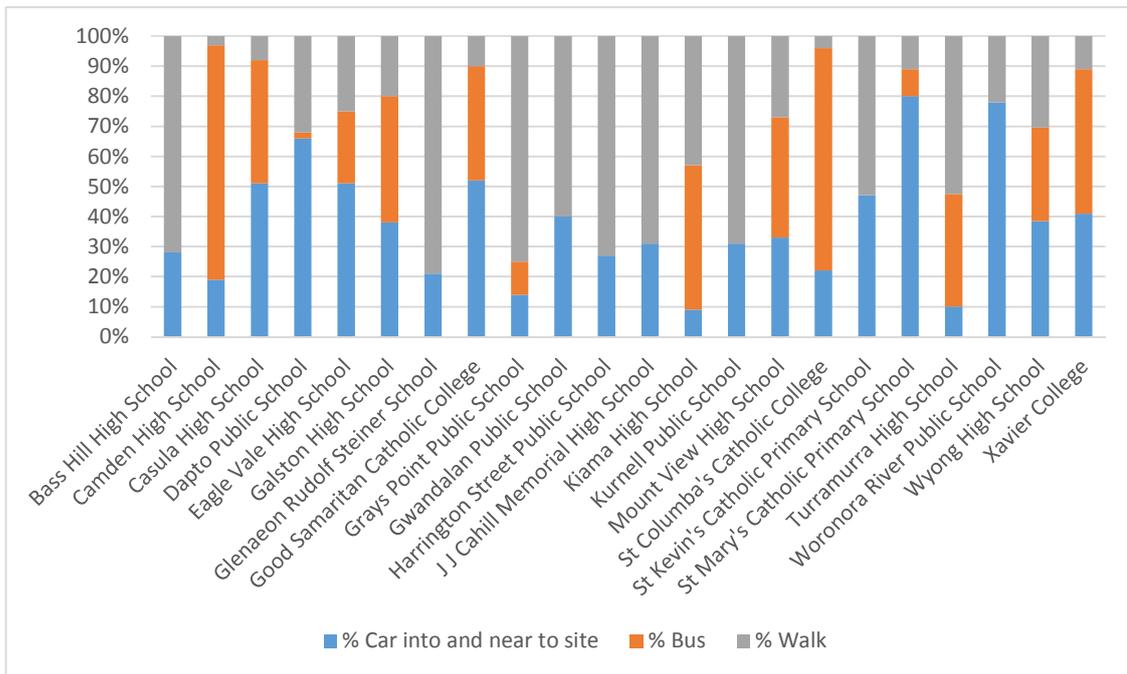


Figure 4.13: All Schools PM Period Mode Split



From Figure 4.13 and Figure 4.14 it can be seen there is a wide variance in mode split between all schools.

As an overall average, it was recorded that car travel represented the majority mode in the AM period, with some share giving way to both walking and bus in the PM period for all schools.

The overall average mode split for all schools in the AM and PM period is shown in Figure 4.14 and Figure 4.15 respectively with a summary provided in Table 4.7.

Figure 4.14: All Schools Average AM Mode Split

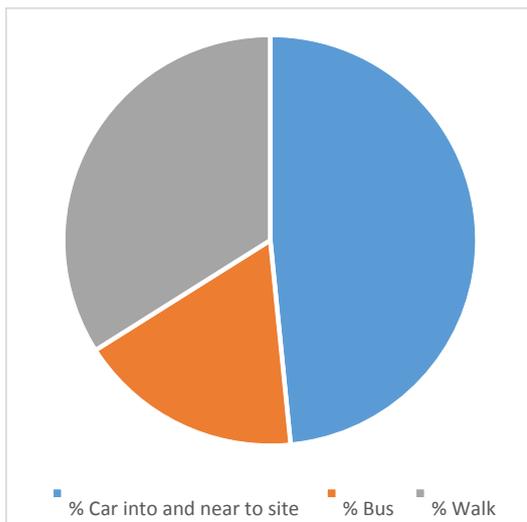


Figure 4.15: All School Average PM Mode Split

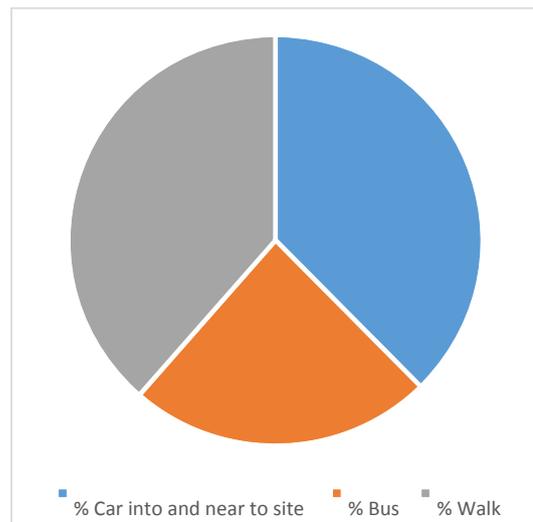


Table 4.7: Summary of Average Mode Split

School Type	Period	Car	Bus	Walk
All	AM	49%	16%	34%
	PM	38%	22%	40%
Primary	AM	56%	4%	40%
	PM	46%	3%	49%
Secondary	AM	45%	26%	29%
	PM	34%	36%	30%

Rounding to nearest 1%

Primary Schools

Primary schools were found to have a low share of bus mode as primary transport to/ from school relative to secondary schools.

As with the overall trend for all schools, car mode split dominated the AM period, whereas walking dominated in the PM period. This indicates trip types where children are dropped off as part of a multi-purpose trip in the AM period and some are left to walk home in the PM period. The overall average mode split for primary schools in the AM and PM period is shown in Figure 4.16 and Figure 4.17 respectively.

Figure 4.16: Primary School Average AM Mode Split

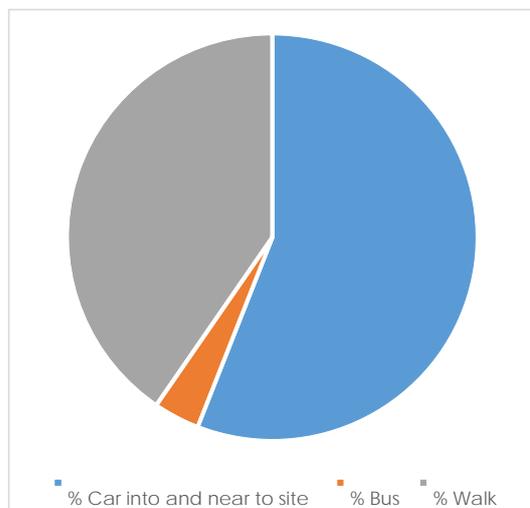
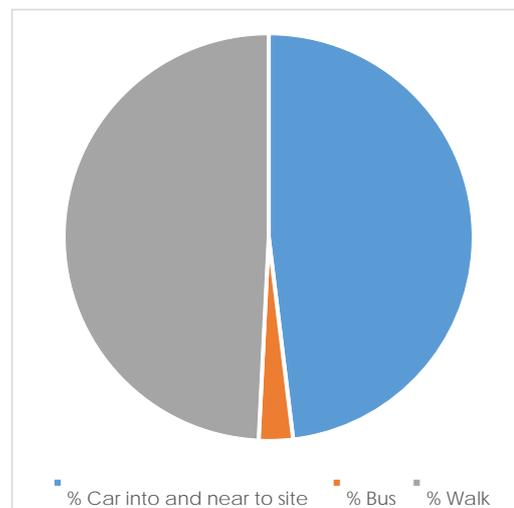


Figure 4.17: Primary School Average PM Mode Split



An assessment of primary school mode split in regional areas indicated that car mode split exceeded 60% in both the AM and PM periods.

In metropolitan areas, car mode split was found to be equal or less than 50% for both AM and PM periods. Vehicle mode split was least 25% and 16% higher for private public schools (2 schools) in the AM and PM periods respectively compared to the overall average.

A summary of primary school transport mode splits is provided in Table 4.8.

Table 4.8: Primary School Average Mode Split Summary

School Type	Period	Car	Bus	Walk
All	AM	56%	4%	40%
	PM	48%	3%	49%
Sydney Metropolitan	AM	50%	2%	48%
	PM	40%	2%	58%
Regional	AM	66%	7%	28%
	PM	62%	4%	34%

Rounding to nearest 1%

Secondary Schools

Mode split at secondary schools was observed to be more balanced. Car travel dominated the AM travel preference. In the PM period, the mode split was close to evenly split between car, bus and foot. Average bus mode choice exceeded 25% in both the AM and PM peak periods. This share is significantly greater than the primary school bus mode choice averages.

As per primary schools, it is expected that children are more likely to be dropped off on the way to school by parents/ guardians on their way to work and students more likely to use another mode to travel home. This is also reflective of students undertaking after school activities or socialising in the afterschool period.

Public and private secondary schools had similar mode splits.

The overall average mode split for secondary schools in the AM and PM period is shown in Figure 4.18 and Figure 4.19 respectively and a summary of secondary school transport mode splits is provided in Table 4.9.

Figure 4.18: Secondary School Average AM Mode Split

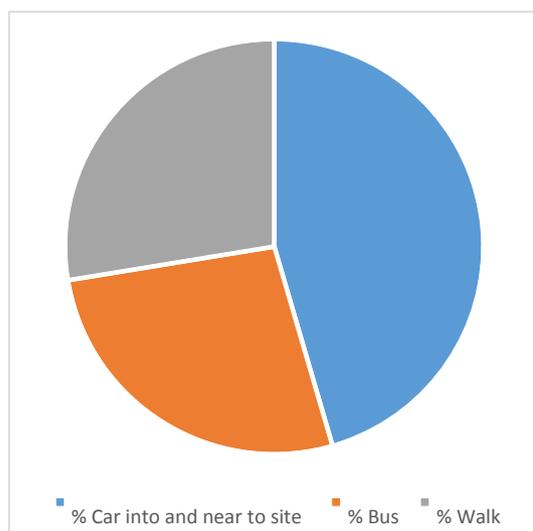


Figure 4.19: Secondary School Average PM Mode Split

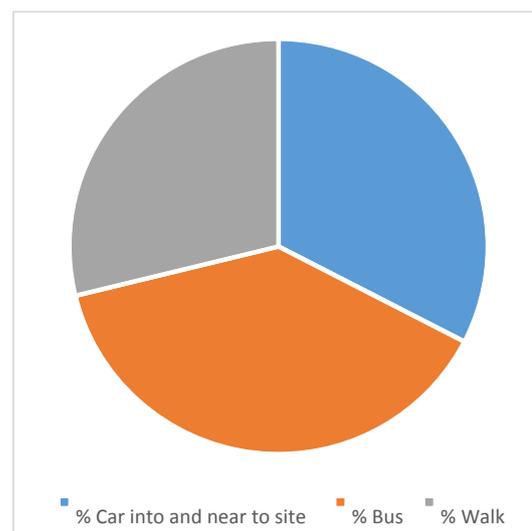


Table 4.9: Secondary School Average Mode Split Summary

School Type	Period	Car	Bus	Walk
All	AM	46%	26%	29%
	PM	34%	36%	30%
Sydney Metropolitan	AM	46%	21%	33%
	PM	34%	31%	35%
Regional	AM	45%	30%	26%
	PM	30%	39%	30%

Rounding to nearest 1%

4.6 Sample Interview Survey Mode Split

Interview surveys were conducted in the AM period at the main school access point to supplement the observational surveys. This was to provide an insight into the trip generation characteristics of each school, in particular to identify trip characteristics that would not be obvious from observation surveys. Interview surveys were not conducted at Camden High School and St Columba’s Catholic College as these are isolated sites and mode split was clear from the observational surveys. The interview respondents nominated a transport mode and it is assumed that they would state the transport mode used to travel the greatest distance.

All Schools

The interview surveys from all schools indicated that the dominant mode is car travel, either as a passenger or driver. Walking only trips contributed to just over a quarter (26%) of respondents.

The overall average mode split from all schools is provided in Figure 4.20 and a summary is provided in Table 4.10.

Figure 4.20: All Schools Interview Survey Average Mode Split

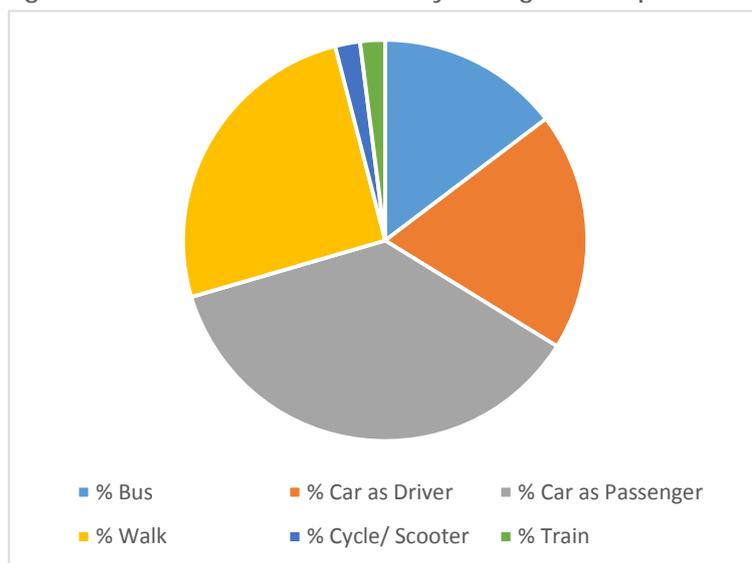


Table 4.10: All Schools Interview Survey Summary

Mode	Average
Bus	15%
Car as driver	19%
Car as passenger	37%
Walk	26%
Cycle/ Scooter	2%
Train	2%

Rounding to nearest 1%

Primary Schools

Car mode split dominated in the primary school interview surveys. This is also an indicator that parents and staff would have provided responses when accompanying children to school. When compared in regions, it was noted that walking share was lower in regional areas with motorised transport consisting of over 75% of respondents. From all primary schools, it was noted the minimal walk respond rate was 25%.

The overall average responses for primary schools is presented in Figure 4.21 with comparisons of metropolitan and regional primary schools in Figure 4.22 and Figure 4.23 and a summary provided in Table 4.11.

Figure 4.21: Primary School Interview Survey Average Mode Split

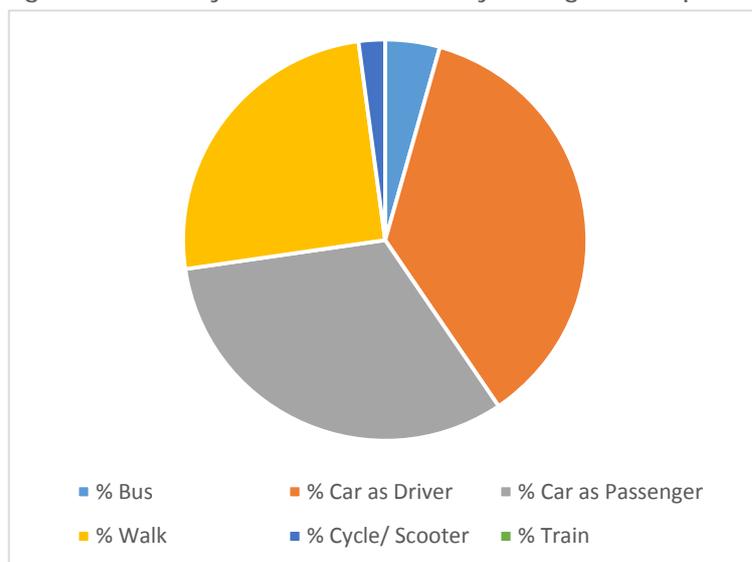


Figure 4.22: Metropolitan Primary School Interview Survey Average Mode Split

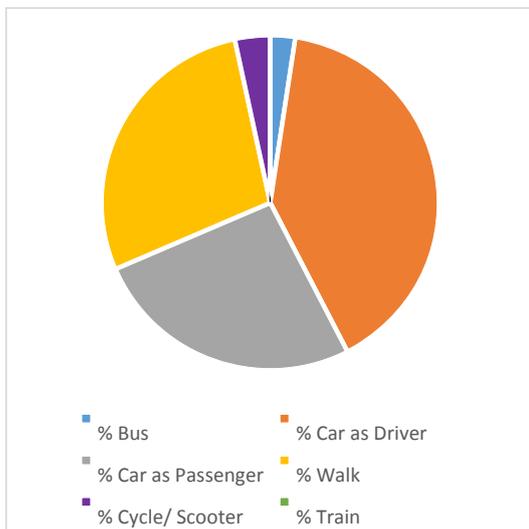


Figure 4.23: Regional Primary School Interview Survey Average Mode Split

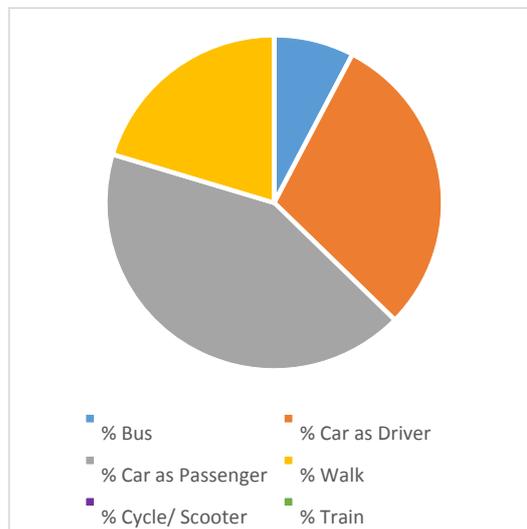


Table 4.11: Primary School Interview Survey Results Summary

Mode	Average
Bus	4%
Car as driver	36%
Car as passenger	32%
Walk	25%
Cycle/ Scooter	2%
Train	0%

Rounding to nearest 1%

Table 4.11 follows on from the observed trend of low bus mode split for primary school students. The high proportion of car as driver respondents indicates a high participation rate from adults, most probably parents of students.

Secondary Schools

Overall, car mode split was less than 50% for the secondary school respondents. In metropolitan areas, car mode split was greater than 50% and in regional areas, walking was the most dominant mode choice.

The overall average responses for secondary schools is presented in Figure 4.24 with comparisons of metropolitan and regional secondary schools in Figure 4.25 and Figure 4.26 and a summary provided in Table 4.12.

Figure 4.24: Secondary School Interview Survey Average Mode Split

Figure 4.25: Metropolitan Secondary School Interview Survey Average Mode Split

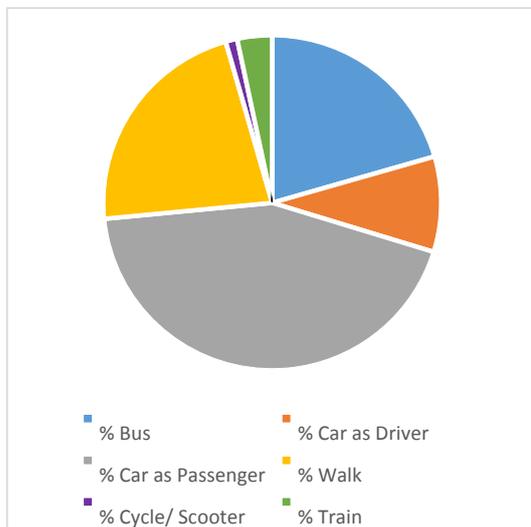


Figure 4.26: Regional Secondary School Interview Survey Average Mode Split

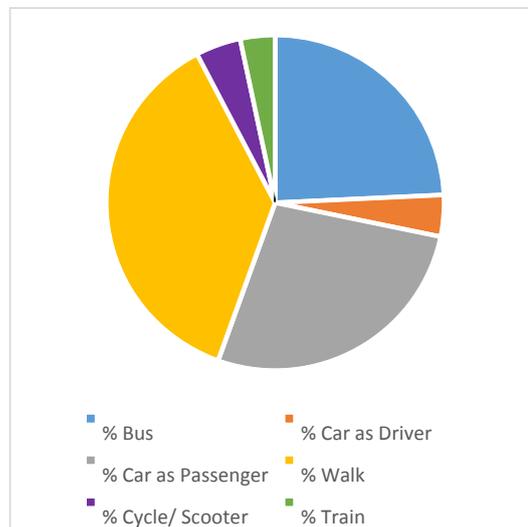


Table 4.12: Secondary School Interview Survey Results Summary

Mode	Average
Bus	23%
Car as driver	6%
Car as passenger	40%
Walk	28%
Cycle/ Scooter	1%
Train	2%

Rounding to nearest 1%

Table 4.12 indicates greater independence of high school students with the train mode being represented in the secondary school surveys.

4.7 Parking Demand

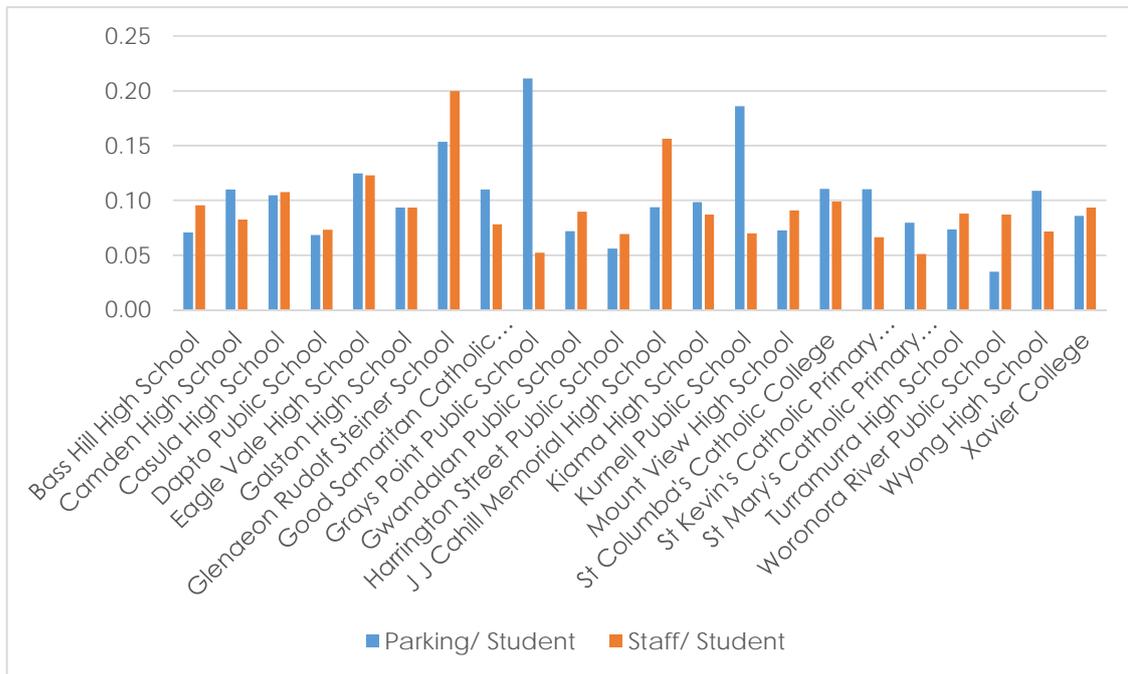
All Schools

Peak parking generated by the school was assessed just after the start of the school and prior to the end of school period. The surveyed parking demand includes both on-site and on-street demands. The overall average was found to be marginally higher in the AM period than the PM period. During the peak activity periods, there would be very short time periods of higher parking demand generated by pick-up and drop-off activities. As such, the reported parking demands should be viewed as long-term school generated car parking throughout the day.

The parking generation rate of each school has been compared against the staff to student ratio at each school. This provides an indication as to if parking demands are directly related to staffing levels. It was observed that there is a general correlation at many schools between staff and parking levels. Where parking rates are higher than the staff/ student ratio, this indicates increased visitor or student parking demands. Where the parking/ student ratio is less than the staff student ratio, this indicates staff selecting an alternative commute transport mode.

The AM peak parking demand for all schools is presented in Figure 4.27.

Figure 4.27: Parking Demand per Student and Staff per Student Comparison

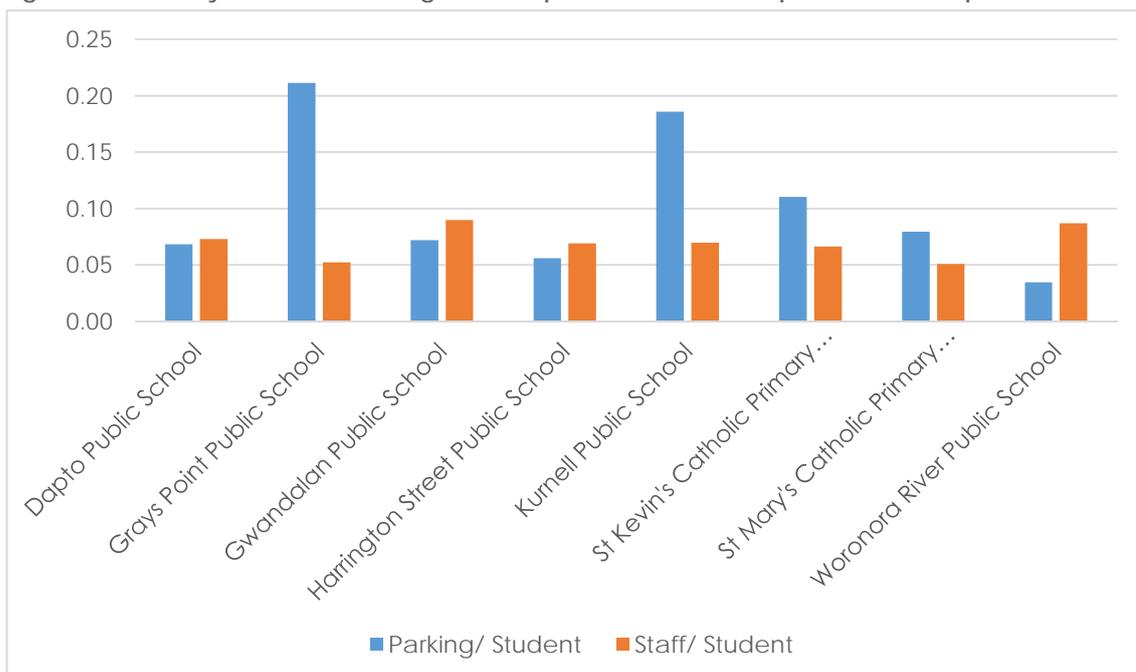


Primary Schools

Primary school parking rates per student and staff per student rates were generally consistent. The exceptional results at Grays Point and Kurnell are indicative of an increased number of visitors to the schools given primary school students cannot drive to school. These schools also have relatively low student populations, therefore a small amount of visitor parking will result in a notably higher parking rate.

The AM peak parking demand for primary schools is presented in Figure 4.28.

Figure 4.28: Primary School AM Parking Demand per Student and Staff per Student Comparison

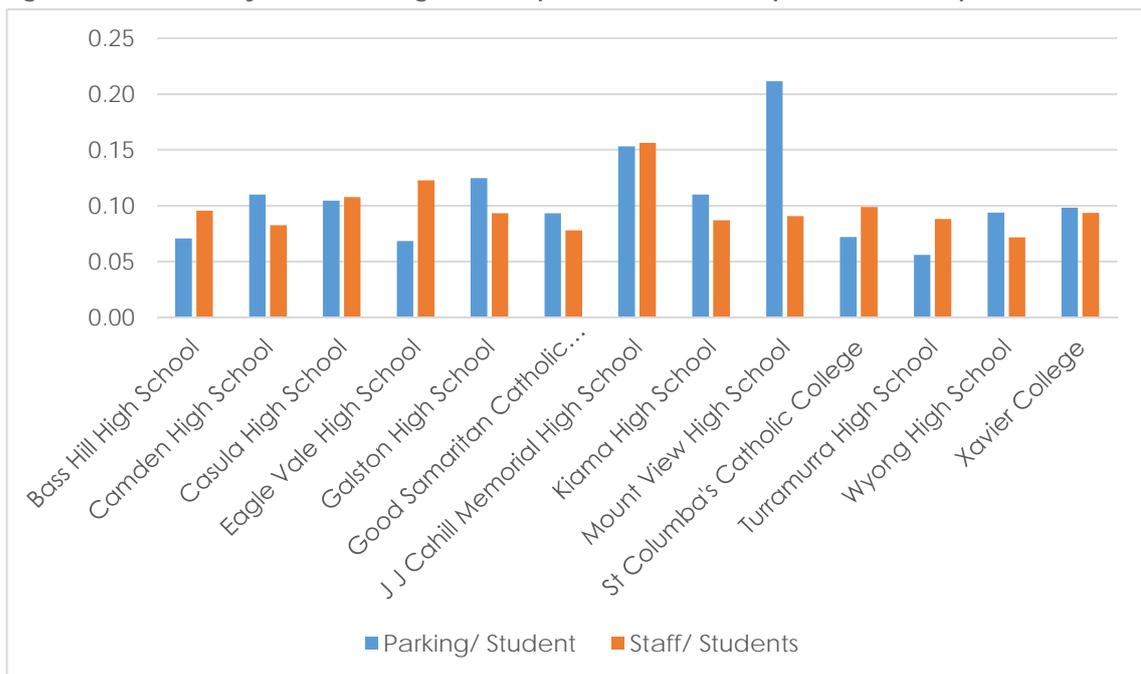


Secondary Schools

Prior to the surveys being conducted, it was expected that secondary school car parking rates would be consistently higher than the staff/ student rate as an indication of student driver parking demands. This was only noticeable at Mount View. It was noted there was a significant car park opposite the school to facilitate this. At all other schools, parking per student rates were generally similar to staff/ students rates.

The AM peak parking demand for secondary schools is presented in Figure 4.29.

Figure 4.29: Secondary School Parking Demand per Student and Staff per Student Comparison



A summary of peak parking demand is provided in Table 4.13. This shows that all schools surveyed have almost an almost identical parking rate and that minimum and maximum rates for primary and secondary schools are virtually identical.

Table 4.13: Peak Parking Demand per Student

School Type	Average	Minimum	Maximum
All	0.10	0.03	0.21
Primary	0.10	0.03	0.21
Secondary	0.11	0.06	0.21

5. Regression Analysis

Regression analysis of the data was undertaken to determine if there was any correlation between the trip and parking generation rates which could be attributed to the student population or the school's accessibility score.

5.1 Student Population

5.1.1 Person Trips

The following analysis was conducted to determine if there was any correlation between peak person trip generation and school student population:

- All Schools AM Peak Person Trips per Student, Figure 5.1
- All Schools PM Peak Person Trips per Student, Figure 5.2
- Primary School AM Peak Person Trips per Student, Figure 5.3
- Primary School PM Peak Person Trips per Student, Figure 5.4
- Secondary School AM Peak Person Trips per Student, Figure 5.5
- Secondary School PM Peak Person Trips per Student, Figure 5.6.

No strong correlation was noted, however the overall trend is a reduction in the person trip rate as the school population increases.

Figure 5.1: All Schools AM Peak Person Trips per Student

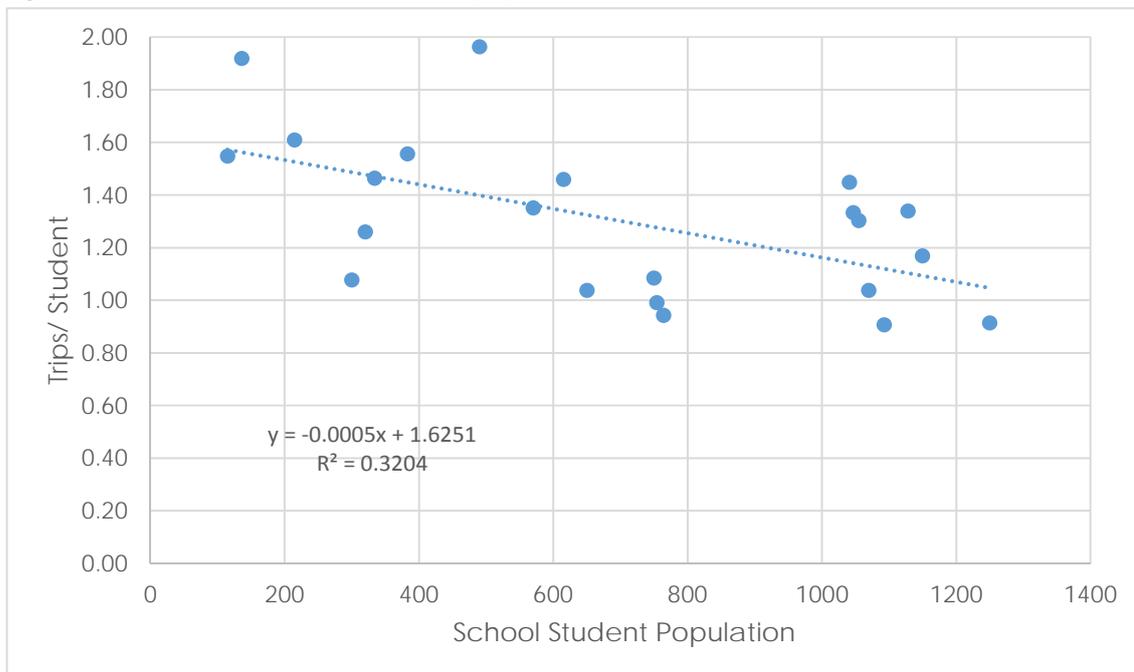


Figure 5.2: All Schools PM Peak Person Trip per Student

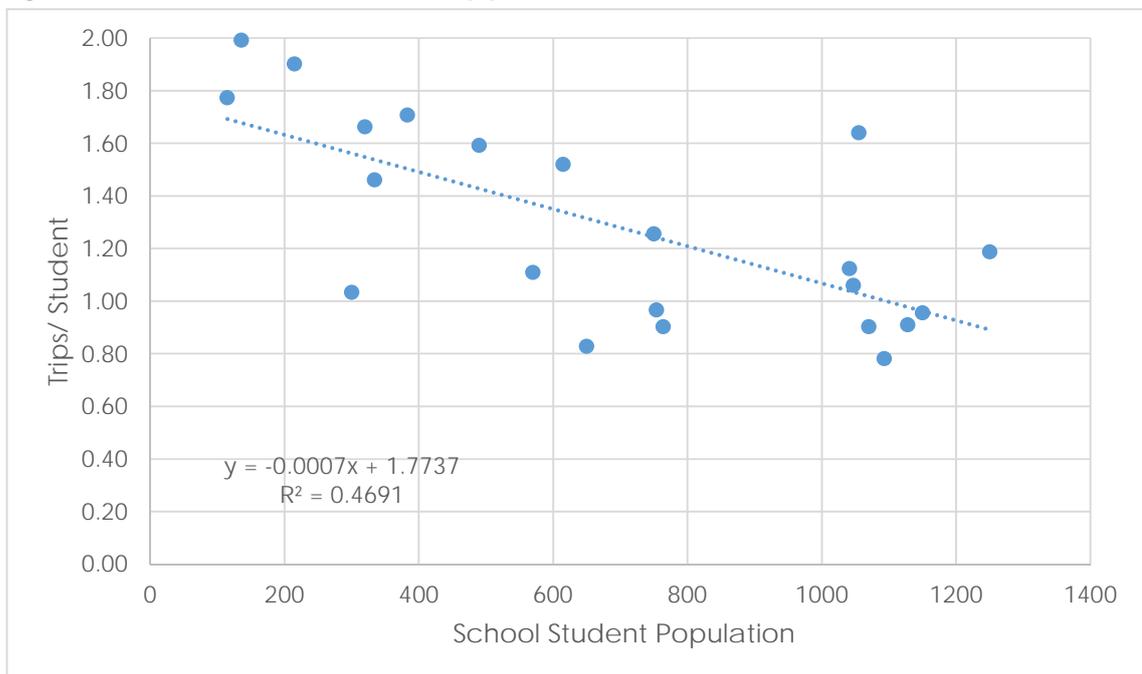


Figure 5.3: Primary School AM Peak Person Trips per Student

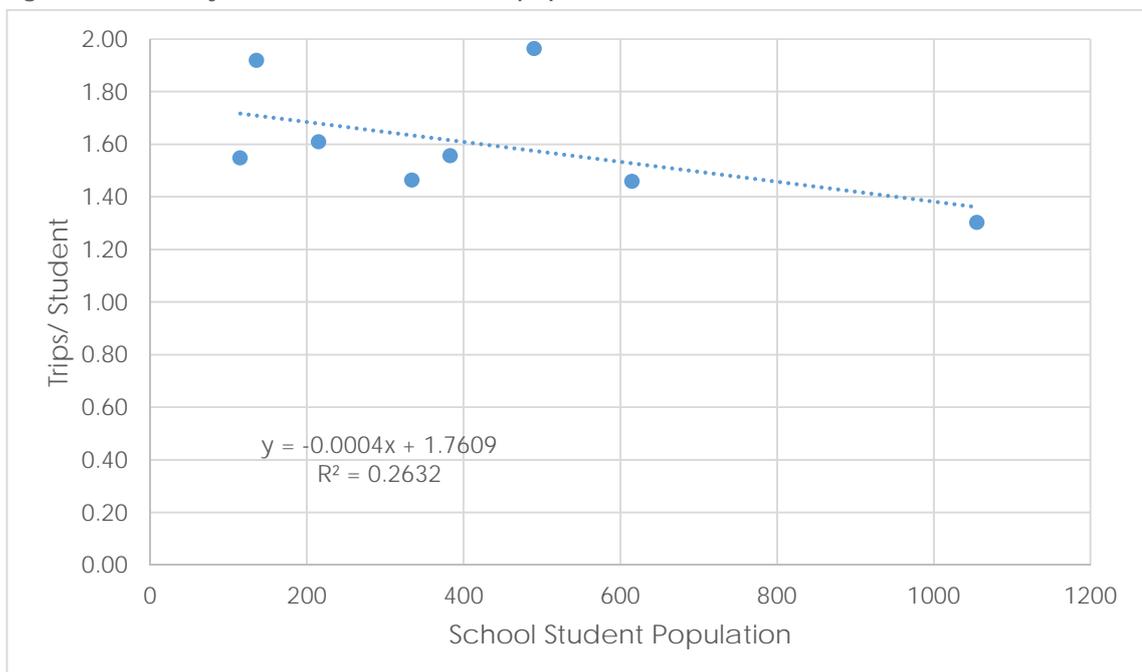


Figure 5.4: Primary School PM Peak Person Trips per Student

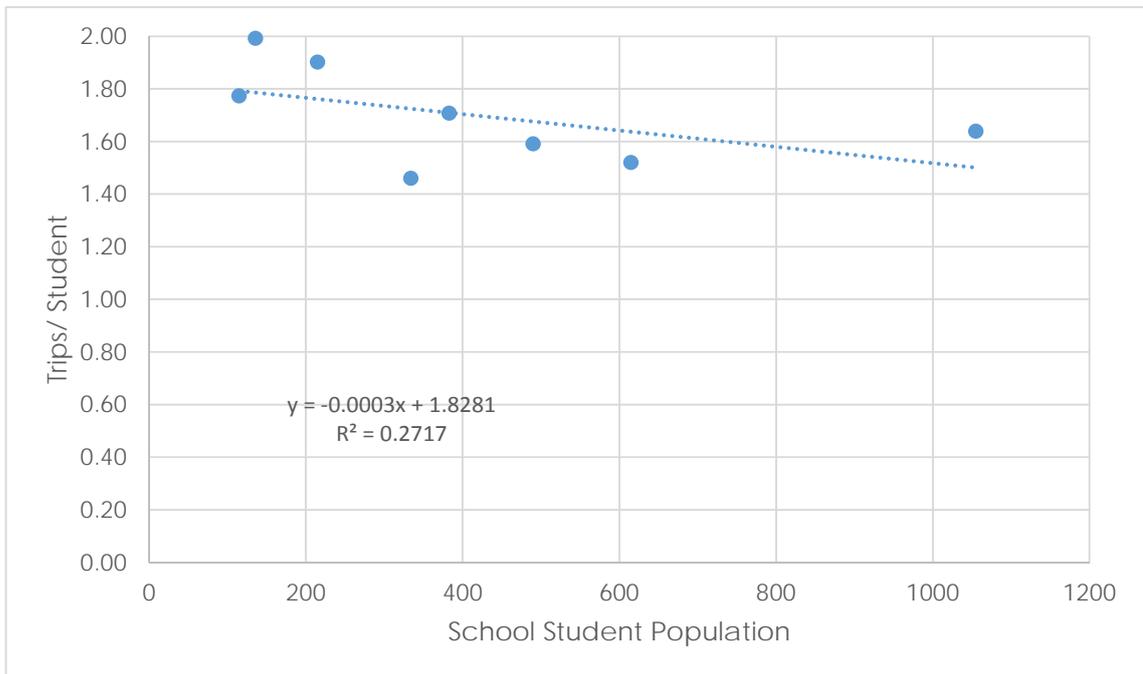


Figure 5.5: Secondary School AM Peak Person Trips per Student

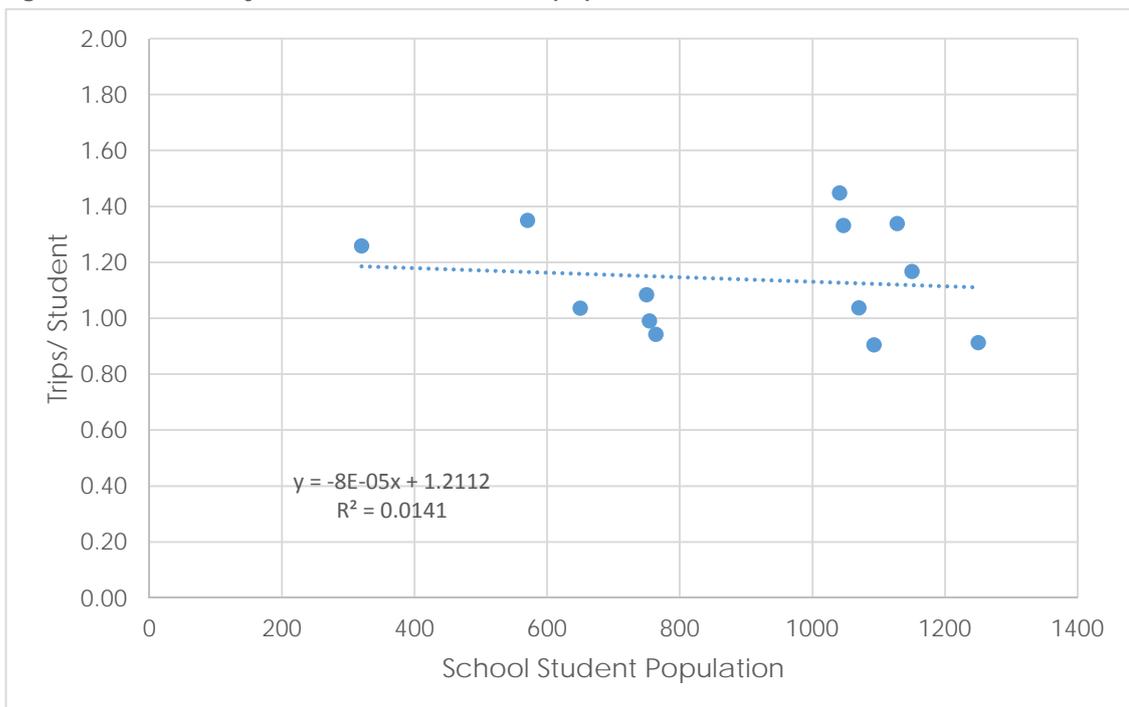
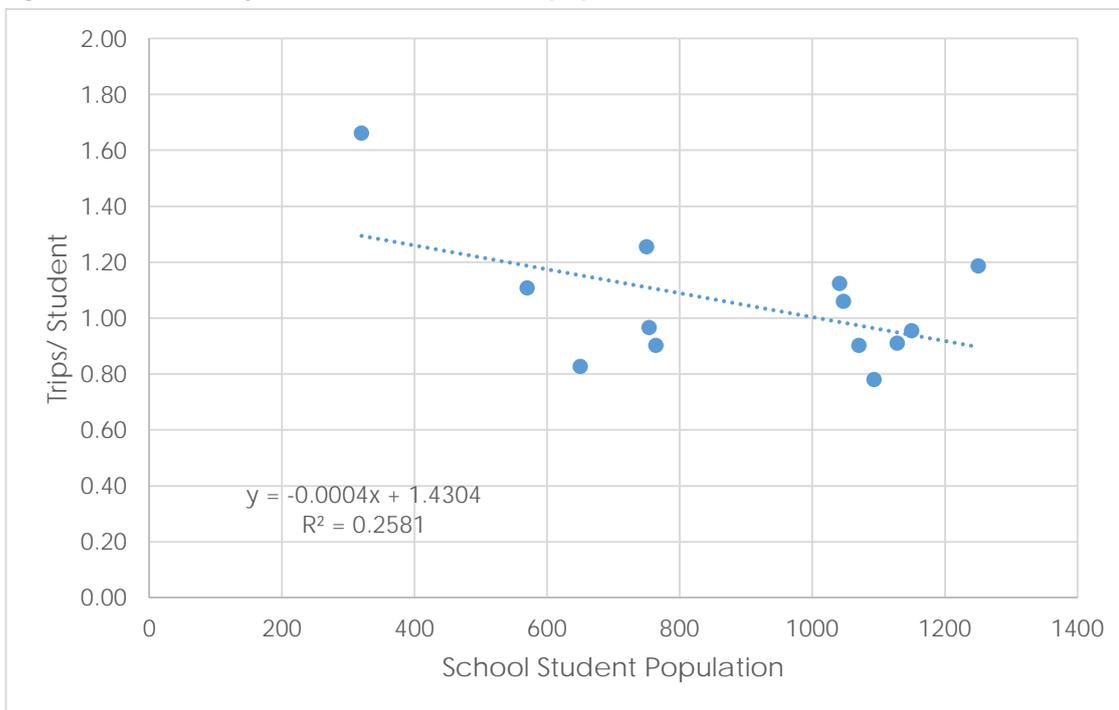


Figure 5.6: Secondary School PM Peak Person Trips per Student



5.1.2 Vehicle Trips

The following analysis was conducted to determine if there was any correlation between peak vehicle trip generation and school student population:

- All Schools AM Peak Vehicle Trips per Student, Figure 5.7
- All Schools PM Peak Vehicle Trips per Student, Figure 5.8
- Primary School AM Peak Vehicle Trips per Student, Figure 5.9
- Primary School PM Peak Vehicle Trips per Student, Figure 5.10
- Secondary School AM Peak Vehicle Trips per Student, Figure 5.11
- Secondary School PM Peak Vehicle Trips per Student, Figure 5.12.

No strong correlation was noted and it would seem that factors other than the population of a school are responsible for the variance in vehicle trip rates.

Figure 5.7: All Schools AM Peak Vehicle Trips per Student

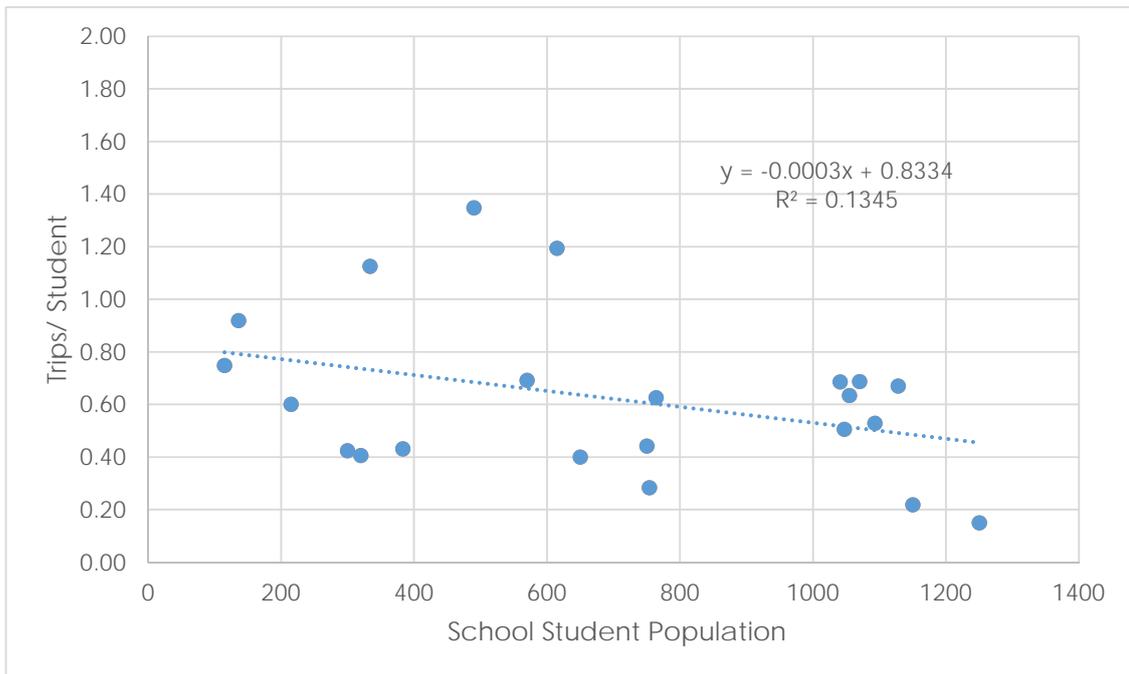


Figure 5.8: All Schools PM Peak Vehicle Trips per Student

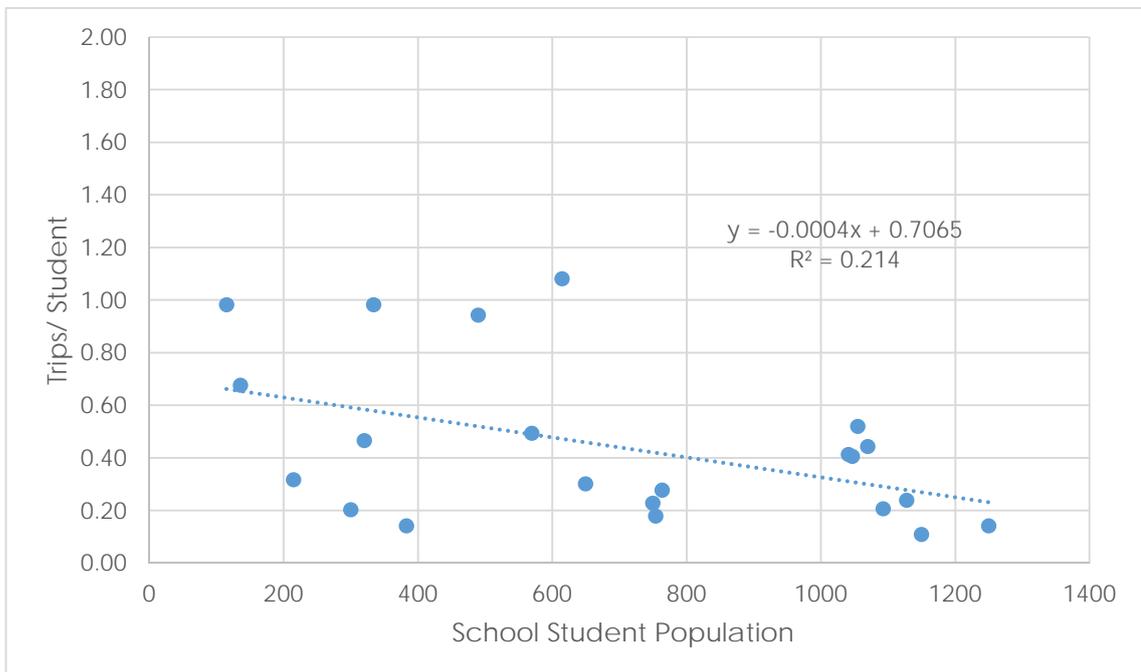


Figure 5.9: Primary School AM Peak Vehicle Trips per Student

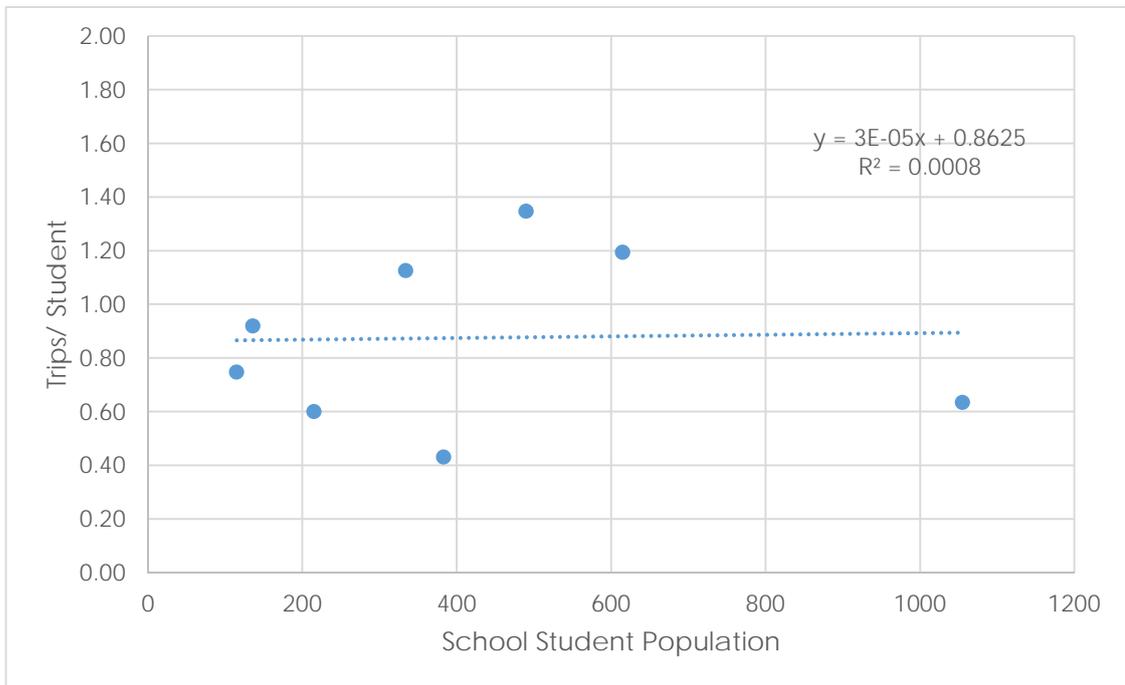


Figure 5.10: Primary School PM Peak Vehicle Trips per Student

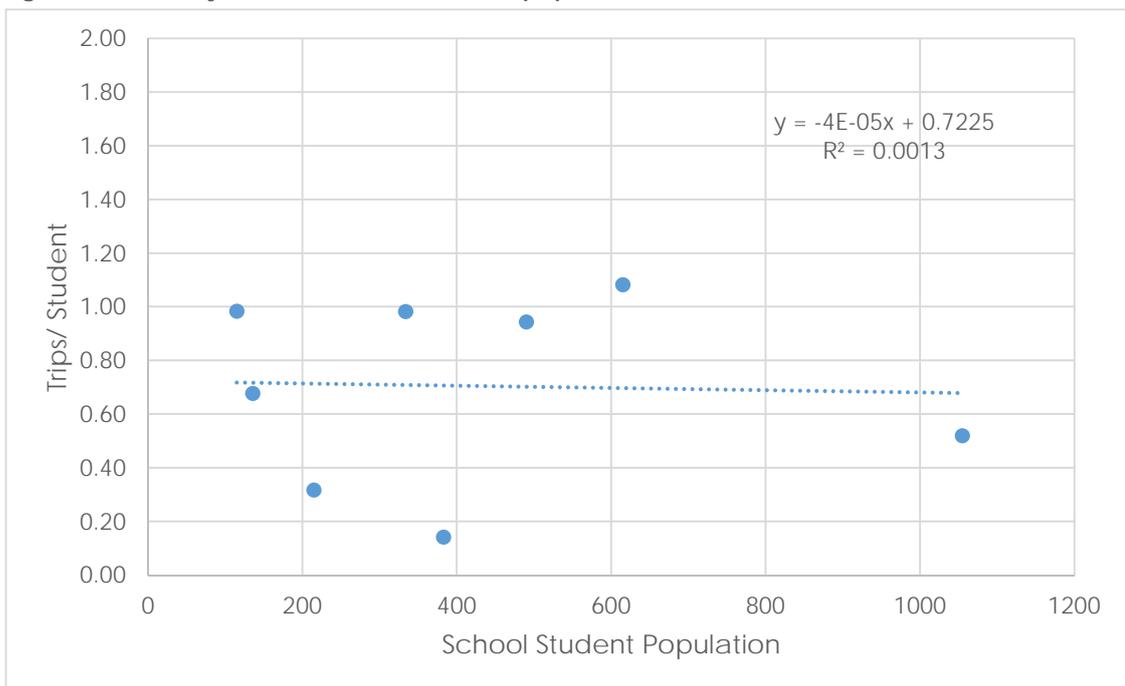


Figure 5.11: Secondary School AM Peak Vehicle Trips per Student

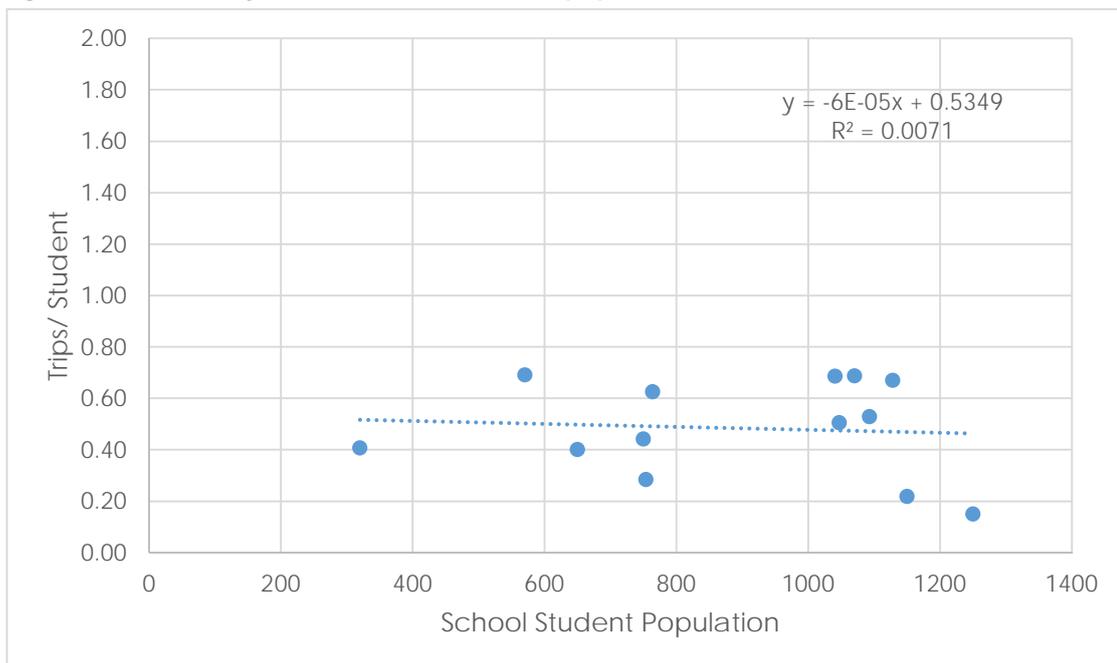
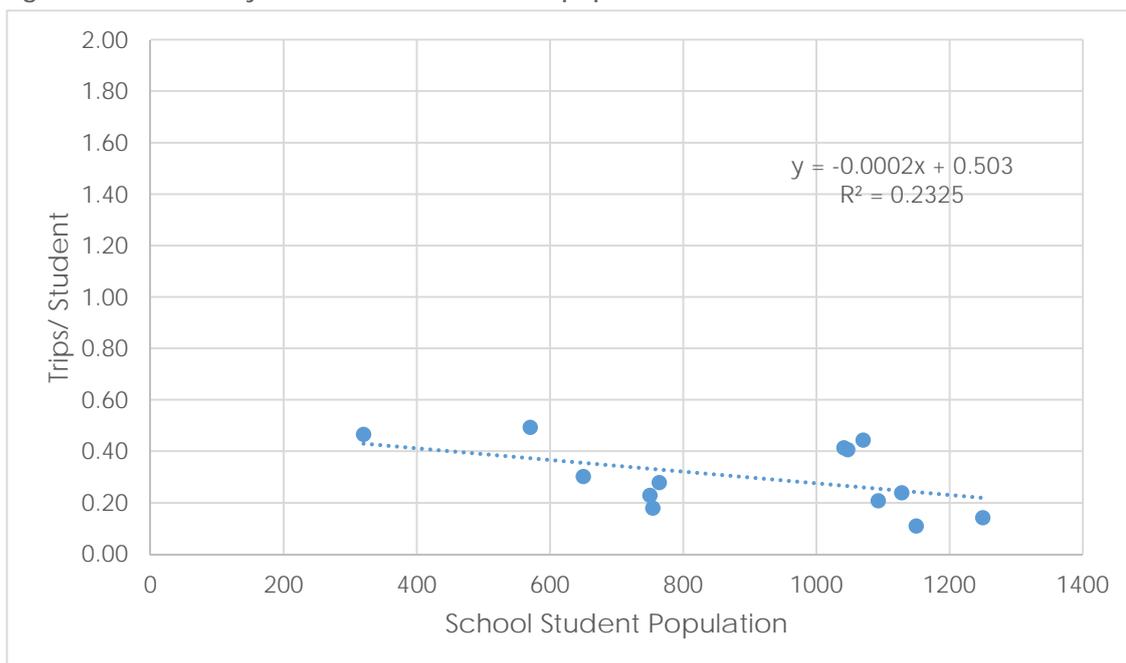


Figure 5.12: Secondary School PM Peak Vehicle Trips per Student



5.1.3 Peak Parking Demand

Peak parking demand was assessed at the end of the AM survey period for each school. This was considered the most accurate time period, whereas other parking demands unrelated to the school were more probable in the PM period. Nevertheless, the recorded parking demand in the PM period was generally very similar to the AM period. The tested analysis includes:

- All Schools Peak Parking Demand, Figure 5.13
- Primary School Peak Parking Demand, Figure 5.14

- Secondary School Peak Parking Demand, Figure 5.15.

Figure 5.13: All Schools Peak Parking Demand

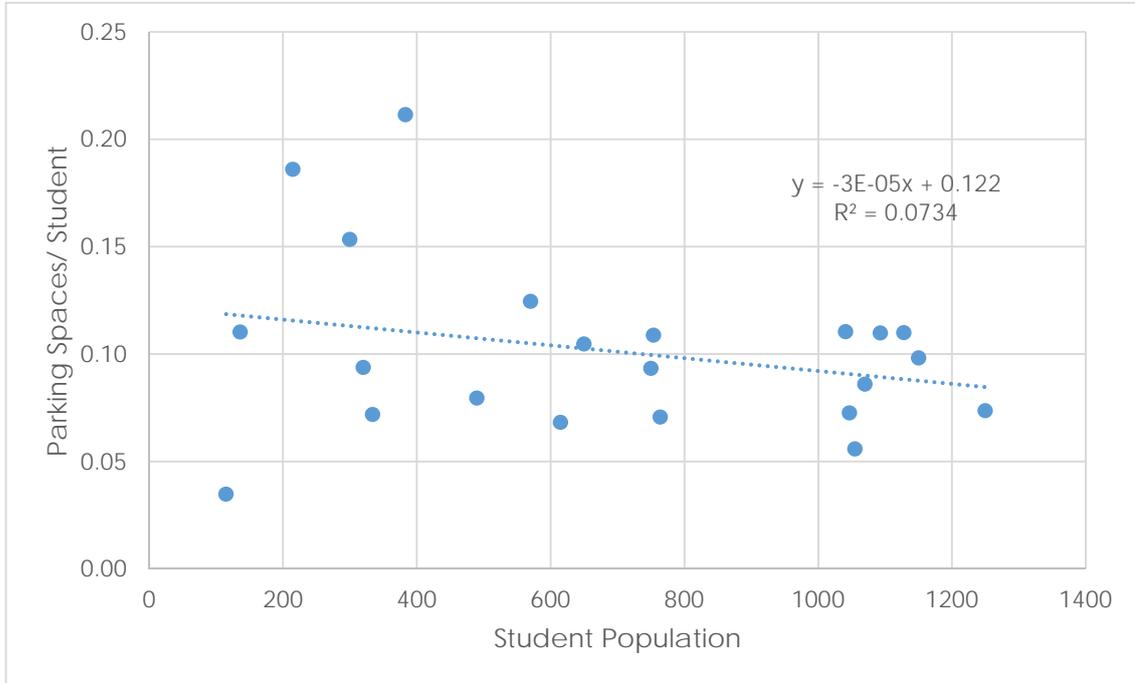


Figure 5.14: Primary Schools Peak Parking Demand

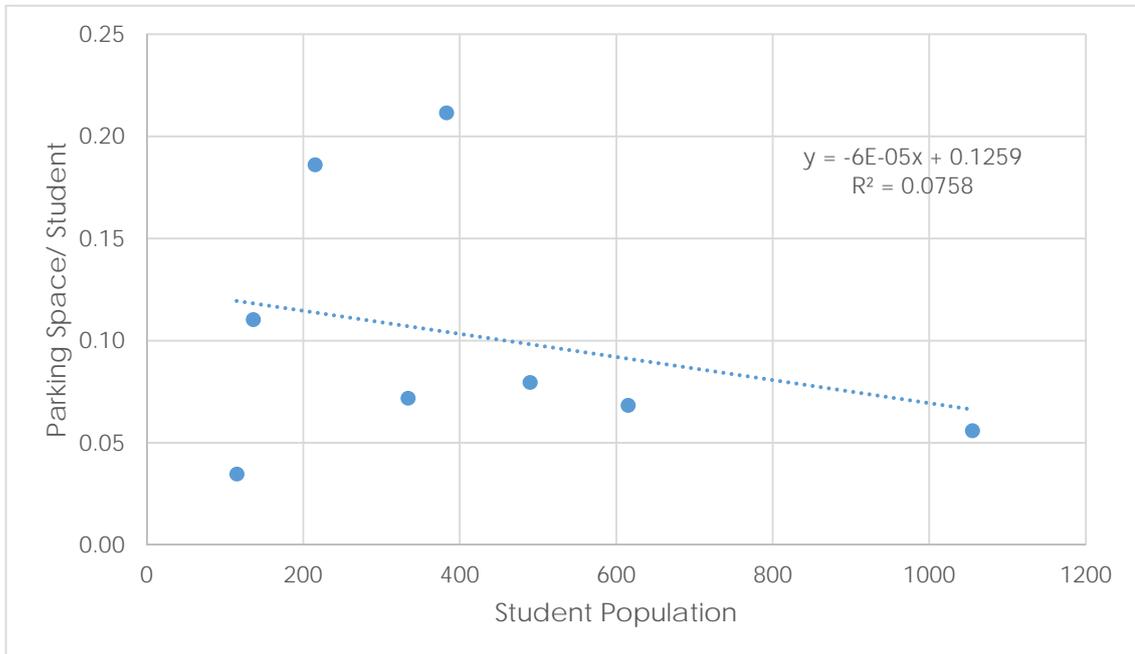
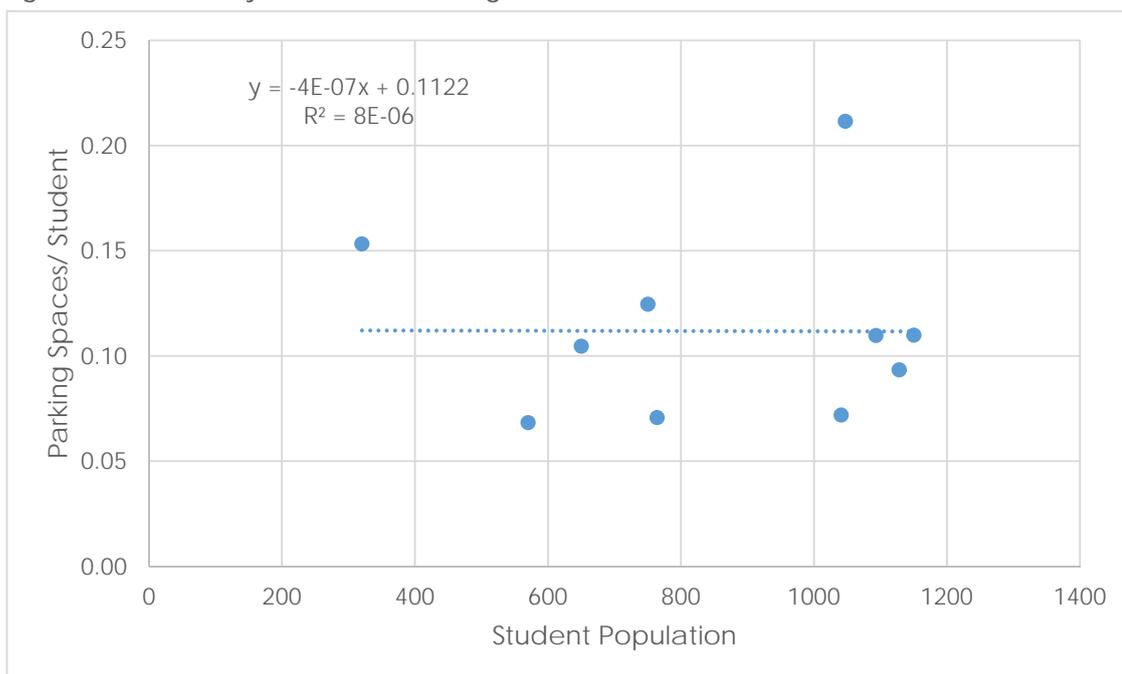


Figure 5.15: Secondary Schools Peak Parking Demand



5.2 Accessibility Score

5.2.1 Vehicle Trip Rate

The following analysis was conducted to determine if there was any correlation between peak vehicle trip generation and each school’s accessibility score:

- All Schools AM Peak Vehicle Trips versus Accessibility Score, Figure 5.16
- All Schools PM Peak Vehicle Trips versus Accessibility Score, Figure 5.17
- Primary School AM Peak Vehicle Trips versus Accessibility Score, Figure 5.18
- Primary School PM Peak Vehicle Trips versus Accessibility Score, Figure 5.19
- Secondary School AM Peak Vehicle Trips versus Accessibility Score, Figure 5.20
- Secondary School PM Peak Vehicle Trips versus Accessibility Score, Figure 5.21.

Given the requirement to separate schools from land uses that would generate significant traffic, many schools naturally have lower accessibility scores. It is noted that various trip generation rates were noted for the schools clustered around a zero accessibility score. No conclusive trends were observed in regards to the vehicle trip generation rate compared to the schools’ accessibility score.

Figure 5.16: AM Peak Vehicle Trip Generation vs Accessibility Score

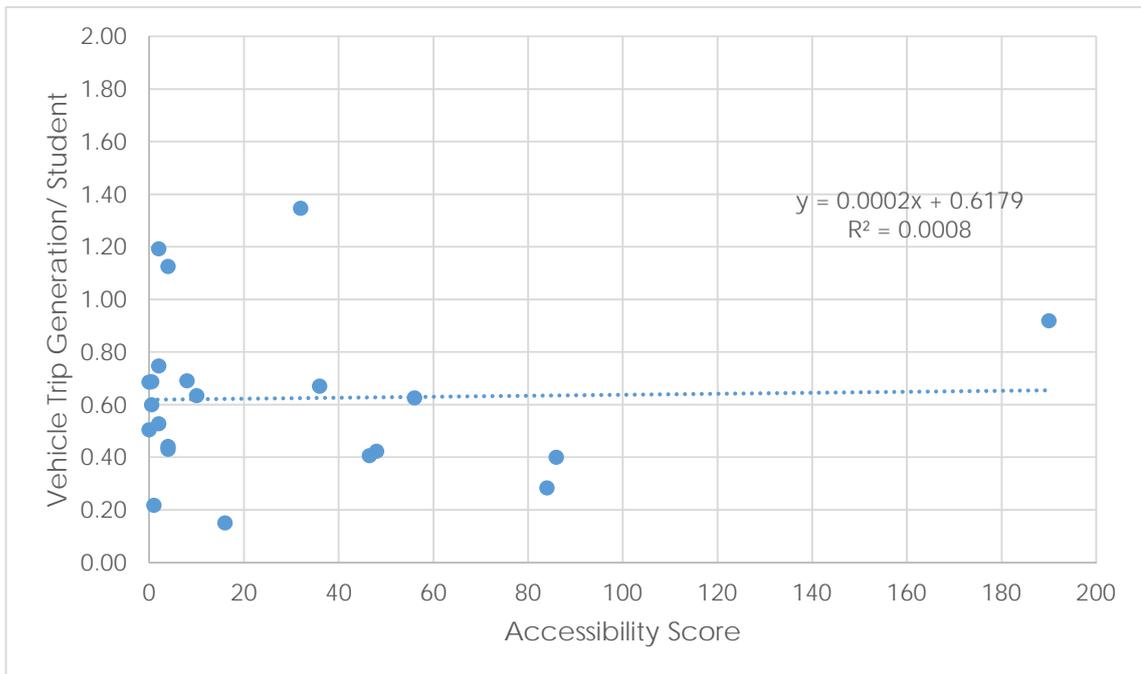


Figure 5.17: PM Peak Vehicle Trip Generation vs Accessibility Score

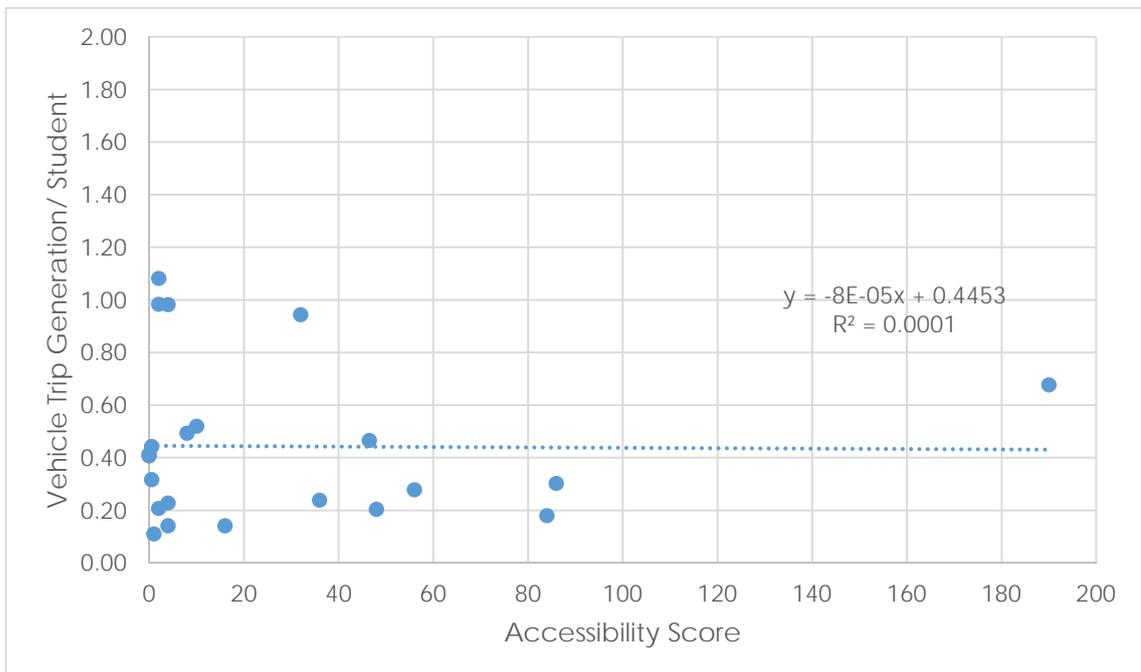


Figure 5.18: Primary School AM Peak Vehicle Trip Generation vs Accessibility Score

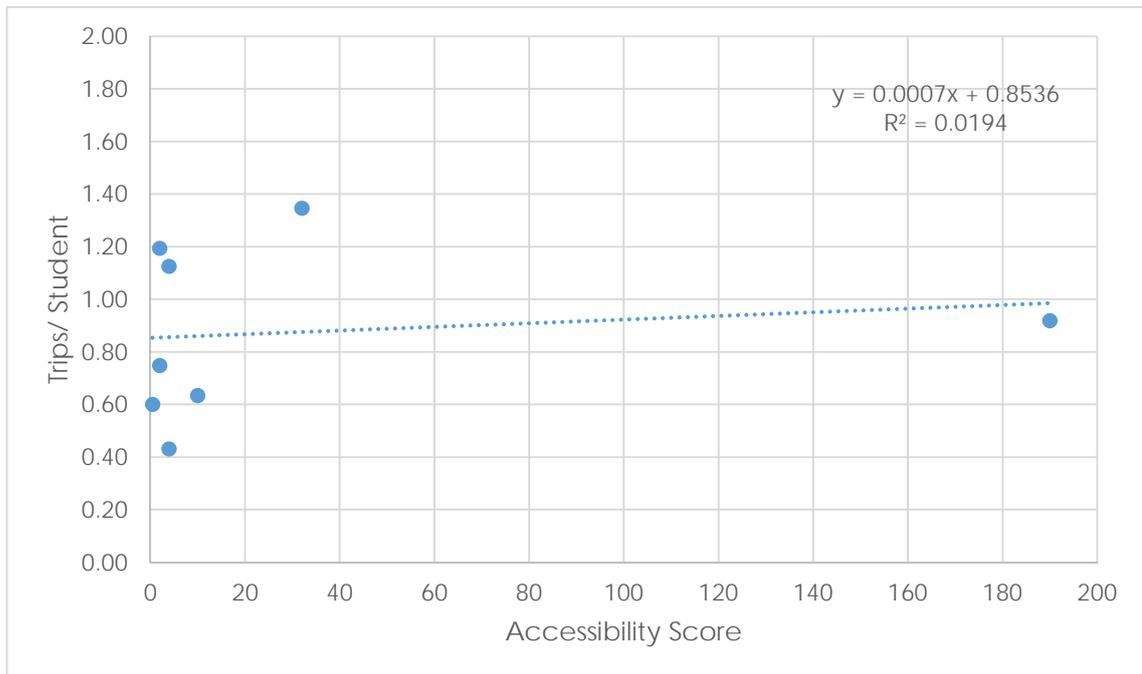


Figure 5.19: Primary School PM Peak Vehicle Trip Generation vs Accessibility Score

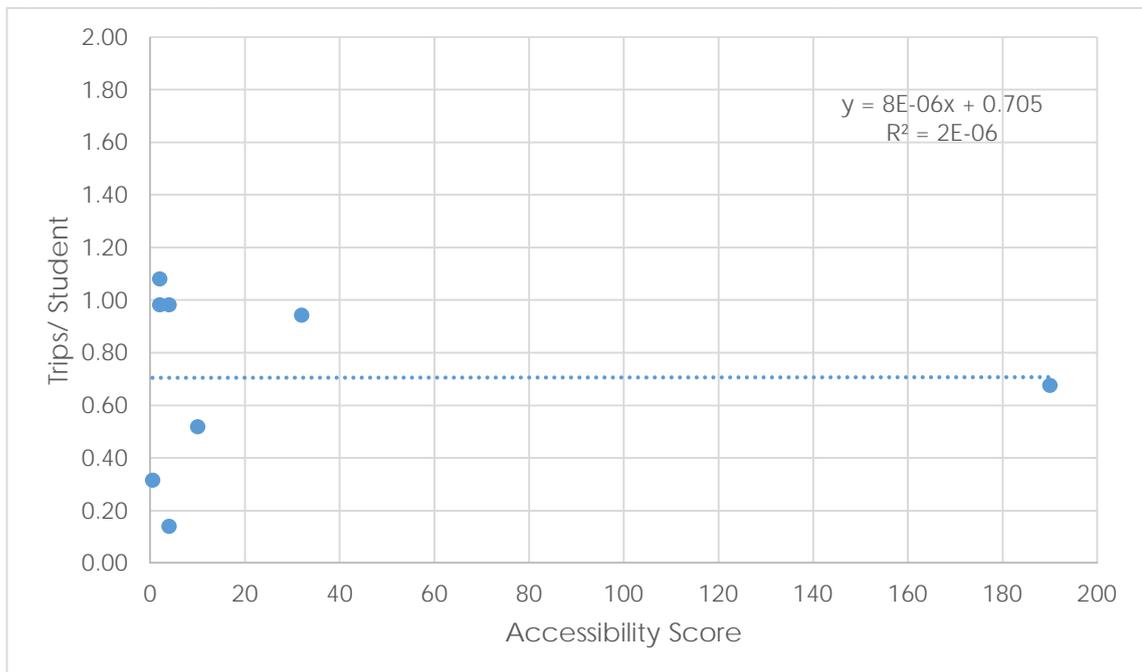


Figure 5.20: Secondary School AM Peak Vehicle Trip Generation vs Accessibility Score

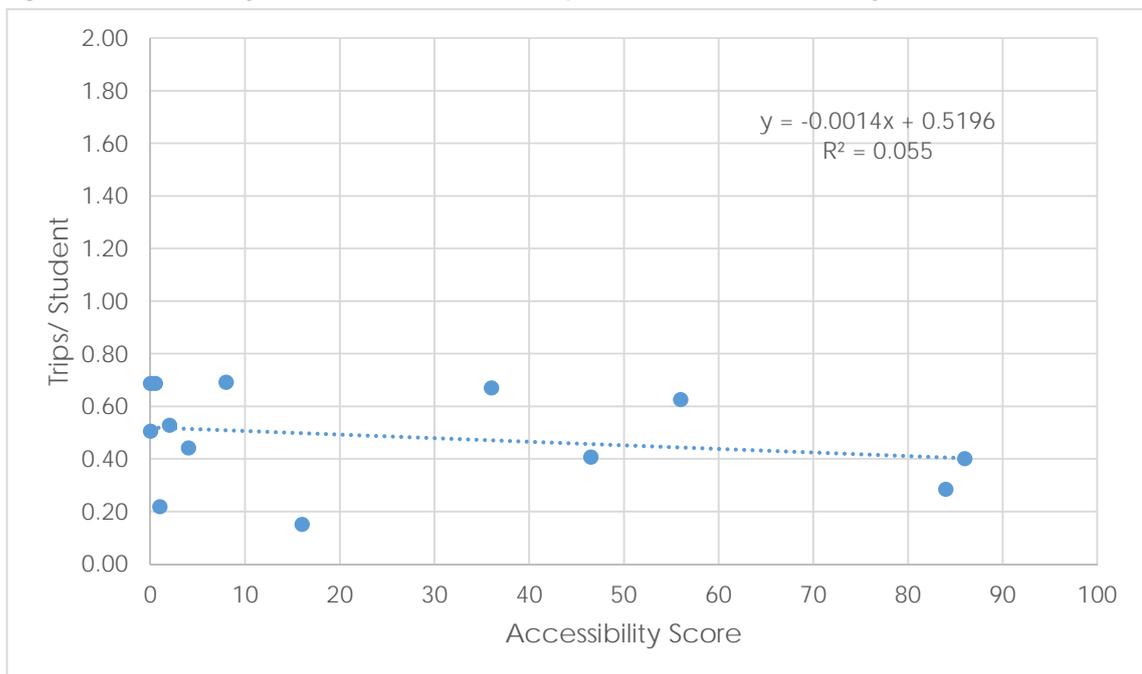
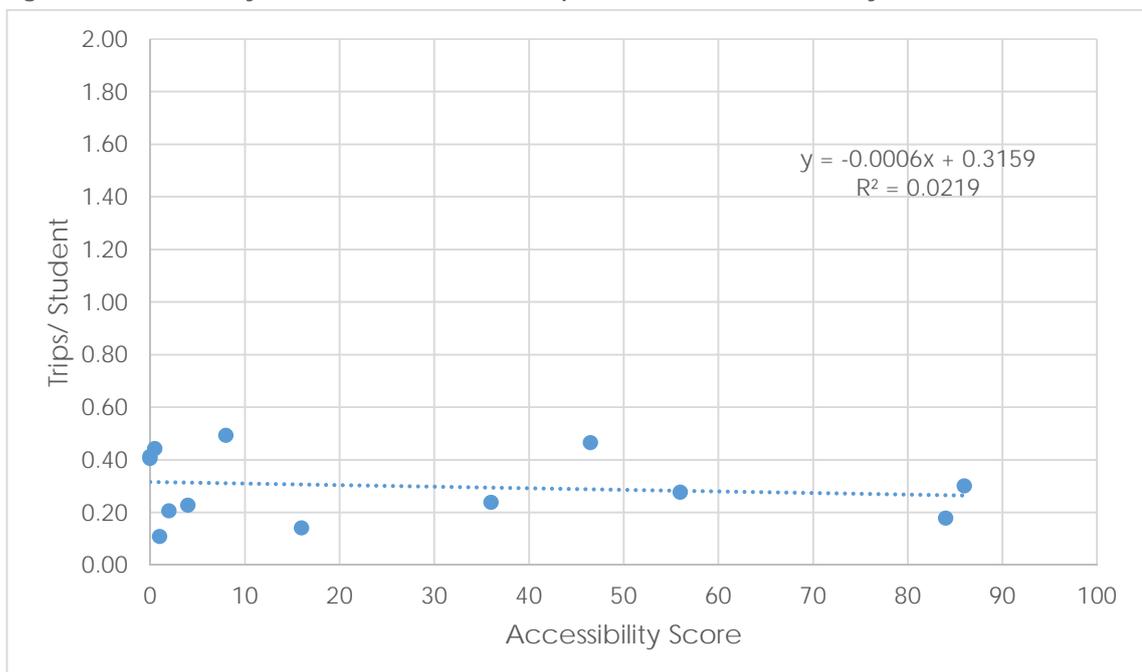


Figure 5.21: Secondary School PM Peak Vehicle Trip Generation vs Accessibility Score



5.2.2 Vehicle Mode Share

Vehicle mode share as a percentage of total mode split was tested against accessibility score to determine any relationship. These tests included the following:

- All Schools AM Peak Vehicle Mode Share versus Accessibility Score, Figure 5.22
- All Schools PM Peak Vehicle Mode Share versus Accessibility Score, Figure 5.23
- Primary School AM Peak Vehicle Mode Share versus Accessibility Score, Figure 5.24
- Primary School PM Peak Vehicle Mode Share versus Accessibility Score, Figure 5.25
- Secondary School AM Peak Vehicle Mode Share versus Accessibility Score, Figure 5.26
- Secondary School PM Peak Vehicle Mode Share versus Accessibility Score, Figure 5.27.

On the outset, it was expected that a higher accessibility score would result in lower vehicle mode share percentages, however the testing did not conclude any strong relationship.

Figure 5.22: All Schools AM Vehicle Mode Split vs Accessibility Score

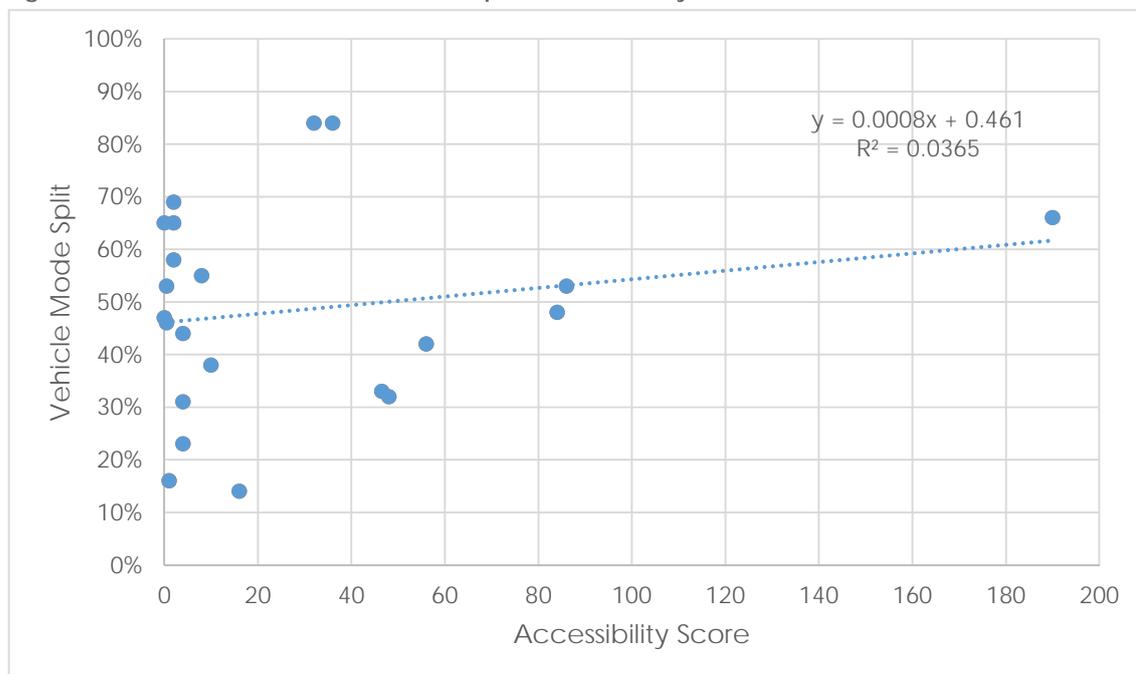


Figure 5.23: All Schools PM Vehicle Mode Split vs Accessibility Score

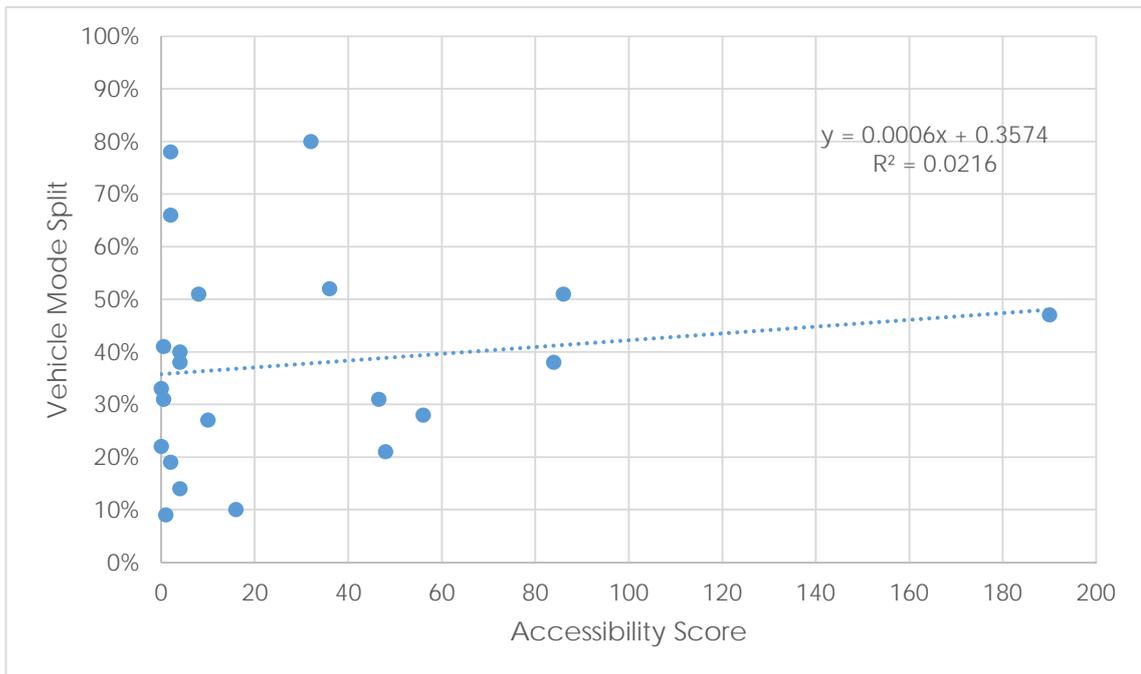


Figure 5.24: Primary School AM Vehicle Mode Split vs Accessibility Score

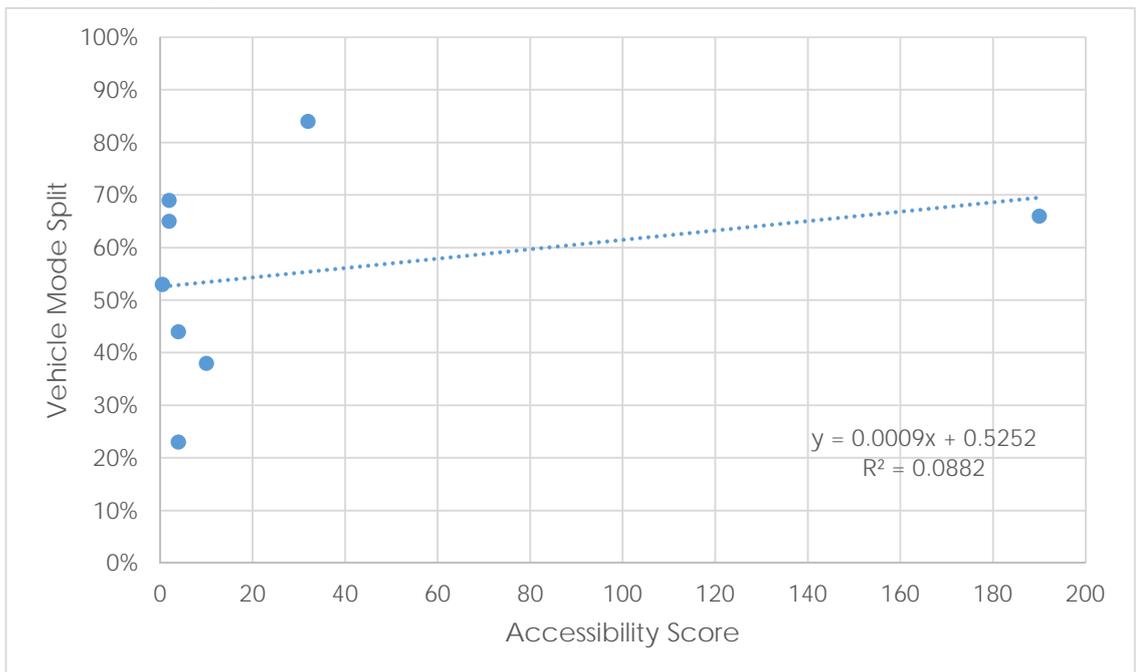


Figure 5.25: Primary School PM Vehicle Mode Split vs Accessibility Score

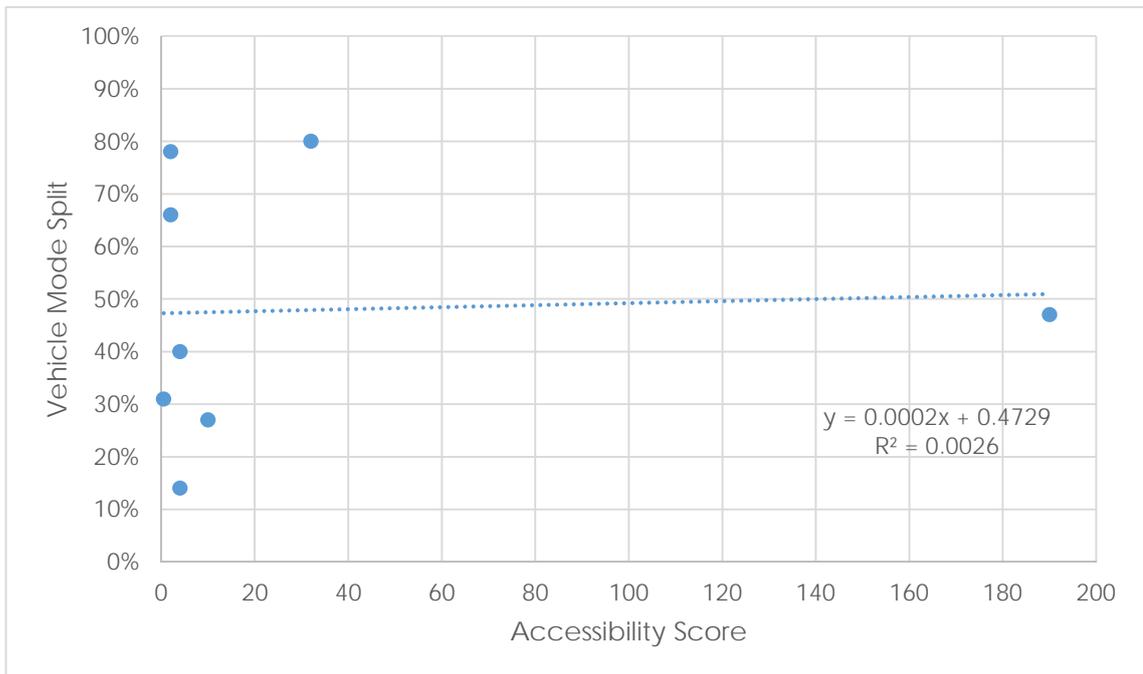


Figure 5.26: Secondary School AM Vehicle Mode Split vs Accessibility Score

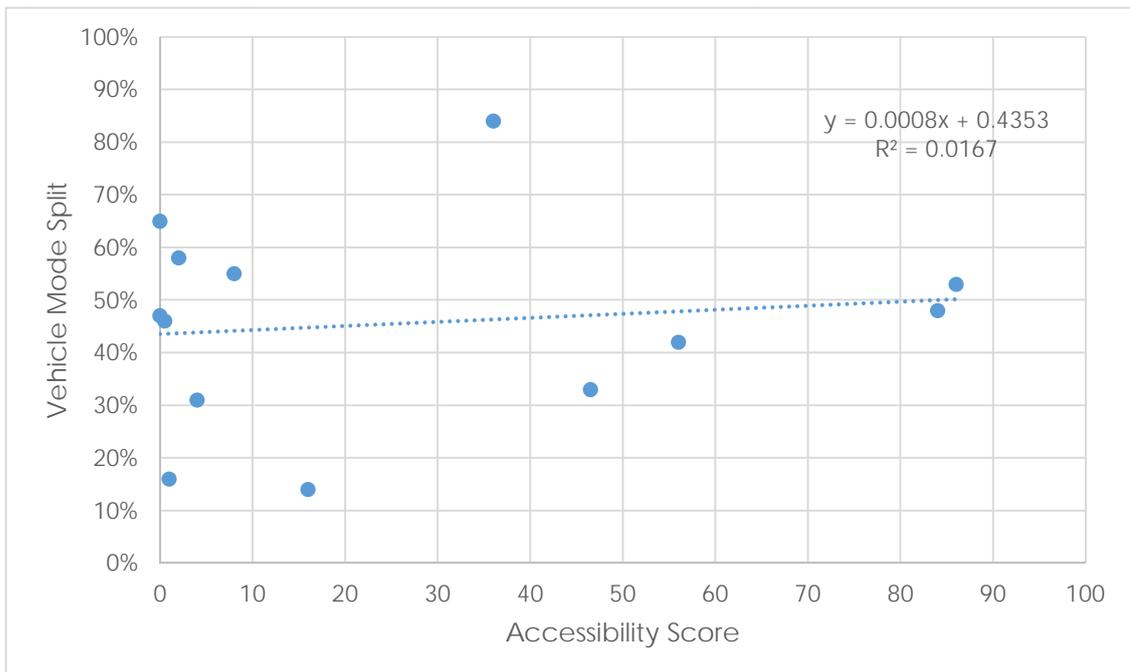
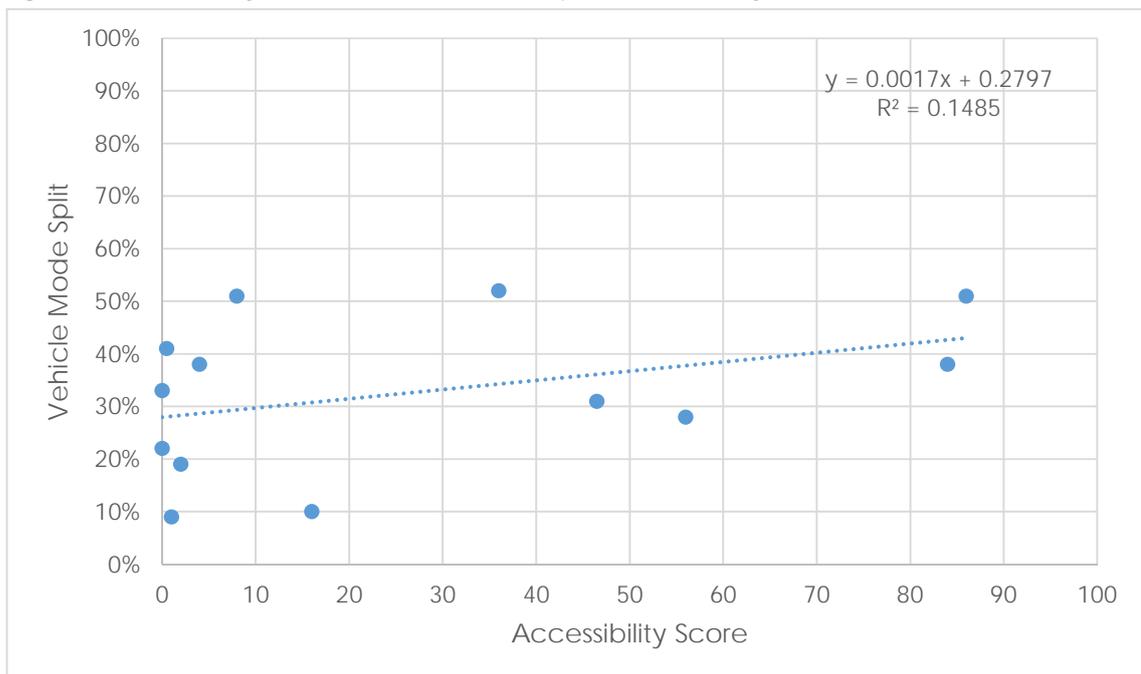


Figure 5.27: Secondary School PM Vehicle Mode Split vs Accessibility Score



5.2.3 Peak Parking Demand

Peak parking demand was assessed against accessibility score. The rationale for the accessibility score is to justify reductions in historical parking rates for land uses. In the tests conducted, no strong correlation could be identified between parking rates and accessibility scores. The analysis includes:

- All Schools Peak Parking Demand, Figure 5.28
- Primary School Peak Parking Demand, Figure 5.29
- Secondary School Peak Parking Demand, Figure 5.30.

Figure 5.28: Peak Parking Demand vs Accessibility Score

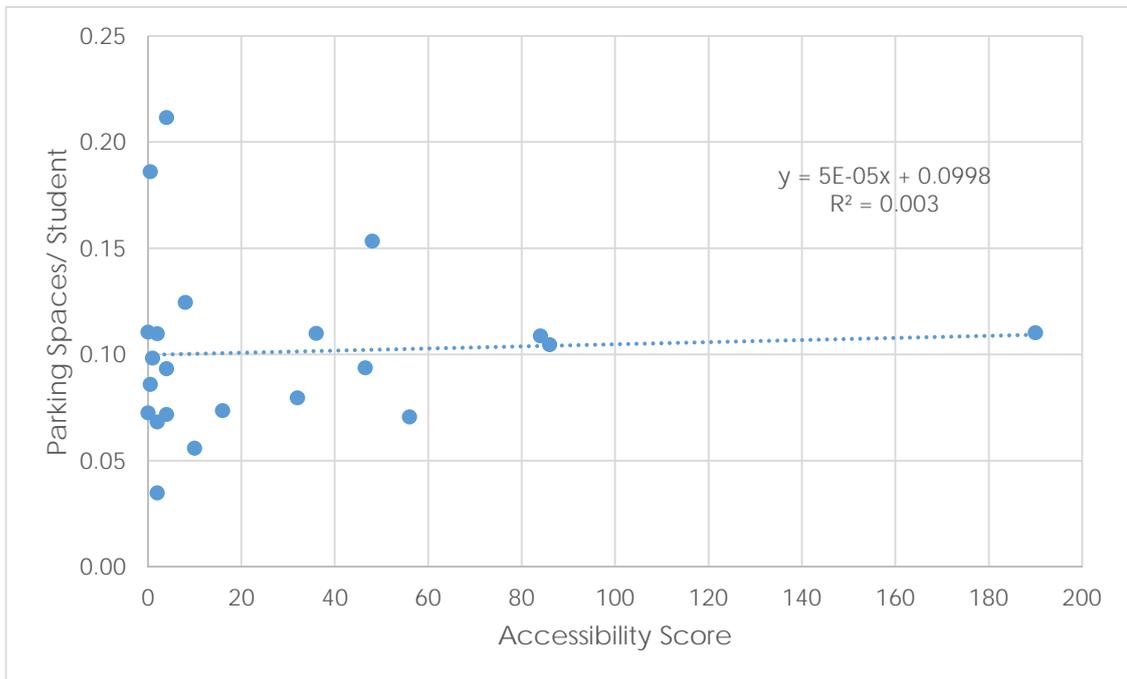


Figure 5.29: Primary School Peak Parking Demand vs Accessibility Score

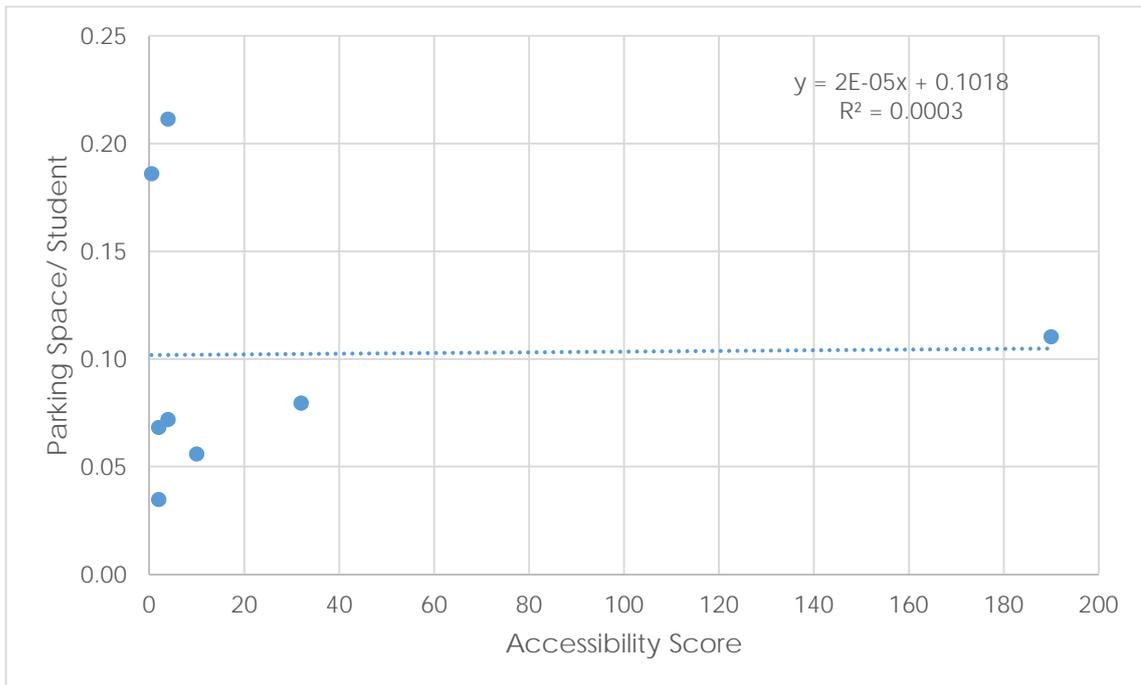
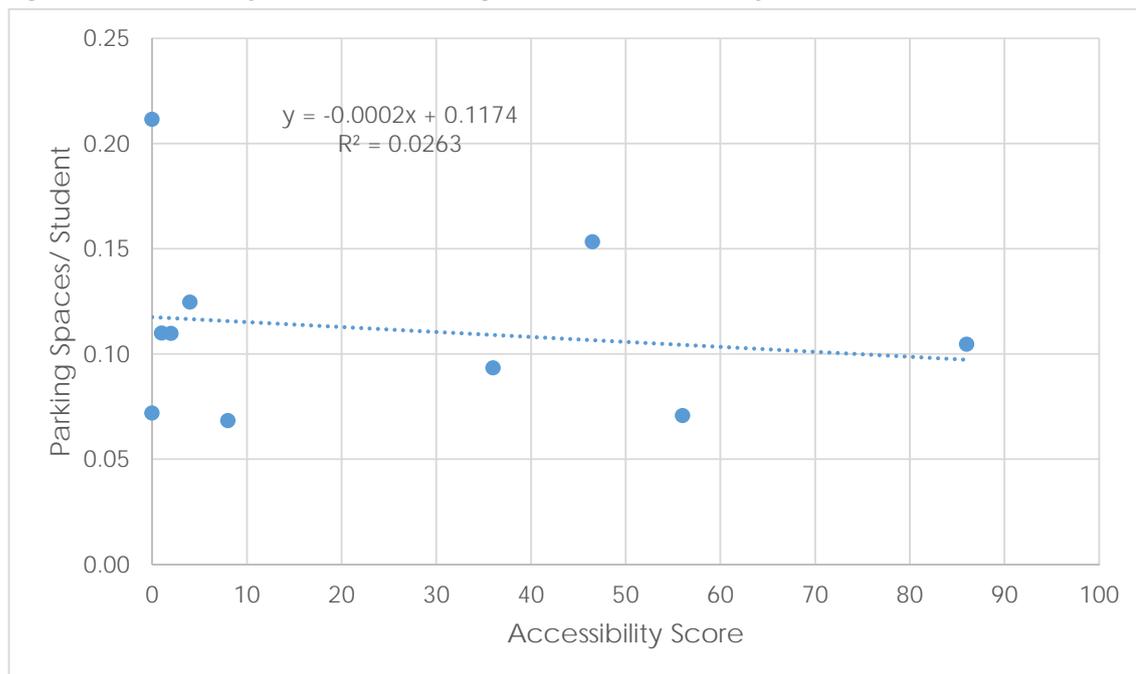


Figure 5.30: Secondary School Peak Parking Demand vs Accessibility Score



5.3 Regression Analysis Summary

A series of 24 individual tests were undertaken to determine any relationships with student population and accessibility score in relation to a series of other dependent variables as outlined in Table 5.1.

Table 5.1: Regression Analysis Tests

Independent Variables	Dependant Variables		
	Factor	Period	Schools
Student Population	Person Trip Rate per Student Parking Space Demand per Student [1]	AM Peak PM Peak	All Primary Secondary
Accessibility Score	Vehicle Trip Rate per Student Vehicle Mode Split % per Student Parking Space Demand per Student[1]	AM Peak PM Peak	All Primary Secondary

[1] AM Peak Only

No strong relationships were observed with any of the tests. In this regard it is evident that other localised and unique factors would have a greater impact on the tested factors.

6. Summary

The purpose of this study was to determine trip and parking generation rates for a range of school types throughout NSW. This is to provide publicly available trip and parking generation rates for the first time in NSW with the aim of assisting in the planning of new schools and expanding schools.

A total of 22 schools were surveyed over a typical day. The school types included a combination of:

- Public
- Private
- Primary
- Secondary
- Metropolitan
- Regional
- A range in student population
- A range in Accessibility Scores.

In each AM and PM period, surveys were conducted for a minimum of 2 hours. The time periods were chosen to capture the peak trip generation periods in the before and after school periods. Some schools were surveyed over a longer period when additional on-site before and after school activities were identified.

Three schools had 5-day (weekday) surveys to assess the variation of traffic over the school week. The traffic generation was found to be consistent over the weekday, except on days where other events which were identified impacted on traffic generation.

The data summary is provided in the following tables:

- Person trip generation per student, Table 6.1
- Vehicle trip generation per student, Table 6.2
- Average vehicle direction split, Table 6.3
- Peak parking demand per student, Table 6.4.

These data summary tables provide the core outputs from the school trip and parking generation study.

Table 6.1: Person Trip Generation Rate per Student

Schools	Location	Period	Average	Minimum	Maximum	Range
All	All	AM	1.30	0.91	1.96	1.05
		PM	1.28	0.78	1.99	1.21
	Metropolitan	AM	1.26	0.91	1.92	1.01
		PM	1.31	0.78	1.99	1.21
	Regional	AM	1.40	0.99	1.96	0.97
		PM	1.24	0.96	1.59	0.63
Primary	All	AM	1.60	1.30	1.96	0.66
		PM	1.70	1.46	1.99	0.53
	Metropolitan	AM	1.59	1.30	1.92	0.62
		PM	1.80	1.64	1.99	0.35
	Regional	AM	1.63	1.46	1.96	0.50
		PM	1.52	1.46	1.59	0.13
Secondary	All	AM	1.14	0.91	1.45	0.54
		PM	1.05	0.78	1.66	0.88
	Metropolitan	AM	1.09	0.91	1.35	0.45
		PM	1.06	0.78	1.66	0.88
	Regional	AM	1.23	0.99	1.45	0.46
		PM	1.03	0.96	1.12	0.17

Table 6.2: Vehicle Trip Generation per Student

Schools	Location	Period	Average	Minimum	Maximum	Range
All	All	AM	0.62	0.16	1.35	1.19
		PM	0.43	0.11	1.09	0.98
	Metropolitan	AM	0.56	0.16	0.92	0.76
		PM	0.36	0.14	0.98	0.84
	Regional	AM	0.73	0.22	1.35	1.13
		PM	0.57	0.11	1.09	0.98
Primary	All	AM	0.88	0.43	1.35	0.92
		PM	0.71	0.14	1.09	0.94
	Metropolitan	AM	0.67	0.43	0.92	0.49
		PM	0.53	0.14	0.98	0.84
	Regional	AM	1.23	1.13	1.35	0.22
		PM	1.01	0.95	1.09	0.14
Secondary	All	AM	0.47	0.16	0.83	0.66
		PM	0.27	0.11	0.51	0.40
	Metropolitan	AM	0.51	0.16	0.83	0.66
		PM	0.28	0.15	0.51	0.36
	Regional	AM	0.35	0.22	0.52	0.30
		PM	0.24	0.11	0.42	0.31

Table 6.3: Average Vehicle Directional Split

School Type	Period	Vehicle Trip In %	Vehicle Trip Out %
All	AM	55%	45%
	PM	43%	57%
Primary	AM	51%	49%
	PM	49%	51%
Secondary	AM	59%	41%
	PM	39%	61%

Table 6.4: Peak Parking Demand per Student

Schools	Location	Average	Minimum	Maximum
All	All	0.10	0.03	0.21
	Metropolitan	0.11	0.03	0.21
	Regional	0.10	0.07	0.15

Regression analysis was conducted with the independent variables, student population and accessibility score against several criteria. No meaningful relationships were determined in regards to these tests and as such, person and vehicle trip generation rates as well as parking demand would best be forecast by reference to the summary of rates.

Appendix A



School Data Summary Sheet

Melbourne

A Level 25, 55 Collins Street
PO Box 24055
MELBOURNE VIC 3000
P +613 9851 9600
F +613 9851 9610
E melbourne@gta.com.au

Sydney

A Level 6, 15 Help Street
CHATSWOOD NSW 2067
PO Box 5254
WEST CHATSWOOD NSW 1515
P +612 8448 1800
F +612 8448 1810
E sydney@gta.com.au

Brisbane

A Level 4, 283 Elizabeth Street
BRISBANE QLD 4000
GPO Box 115
BRISBANE QLD 4001
P +617 3113 5000
F +617 3113 5010
E brisbane@gta.com.au

Canberra

A Unit 4, Level 1, Sparta Building, 55 Woolley Street
PO Box 62
DICKSON ACT 2602
P +612 6243 4826
F +612 6243 4848
E canberra@gta.com.au

Adelaide

A Suite 4, Level 1, 136 The Parade
PO Box 3421
NORWOOD SA 5067
P +618 8334 3600
F +618 8334 3610
E adelaide@gta.com.au

Gold Coast

A Level 9, Corporate Centre 2
Box 37
1 Corporate Court
BUNDALL QLD 4217
P +617 5510 4800
F +617 5510 4814
E goldcoast@gta.com.au

Townsville

A Level 1, 25 Sturt Street
PO Box 1064
TOWNSVILLE QLD 4810
P +617 4722 2765
F +617 4722 2761
E townsville@gta.com.au