Transport for NSW

Large Format Warehousing

Data and analysis note

September 2024

transport.nsw.gov.au

Introduction

The Guide to Transport Impact Assessment (the Guide) is Transport for NSW's current guidance for the preparation and assessment of transport impact assessments. Estimated trip generation rates are fundamental to assessing transport impacts of a proposed development, and practitioners are encouraged to source the most recent, relevant, and best available data.

TfNSW periodically conducts trip generation surveys for sites throughout NSW and publishes associated survey data and analysis reports for industry to use. TfNSW also encourages survey contributions for the collective benefit of industry from applicants who have carried out independent surveys.

This data and analysis note includes an overview of the 2024 survey contribution received for large format warehousing, published with permission from Ason Group. The industrial market has evolved in recent years with large format warehousing emerging as a distinct land use. Large format warehousing typically comprises warehousing, storage, distribution, and logistics activities, with tenancies greater than 5,000m^2 and is characterised by advanced logistic systems, scalability and automation.

Practitioners should refer to Chapter 5 of the Guide for details on trip generation estimation methods, including appropriate uses of the Average rates presented in this technical note.

Survey Methodology

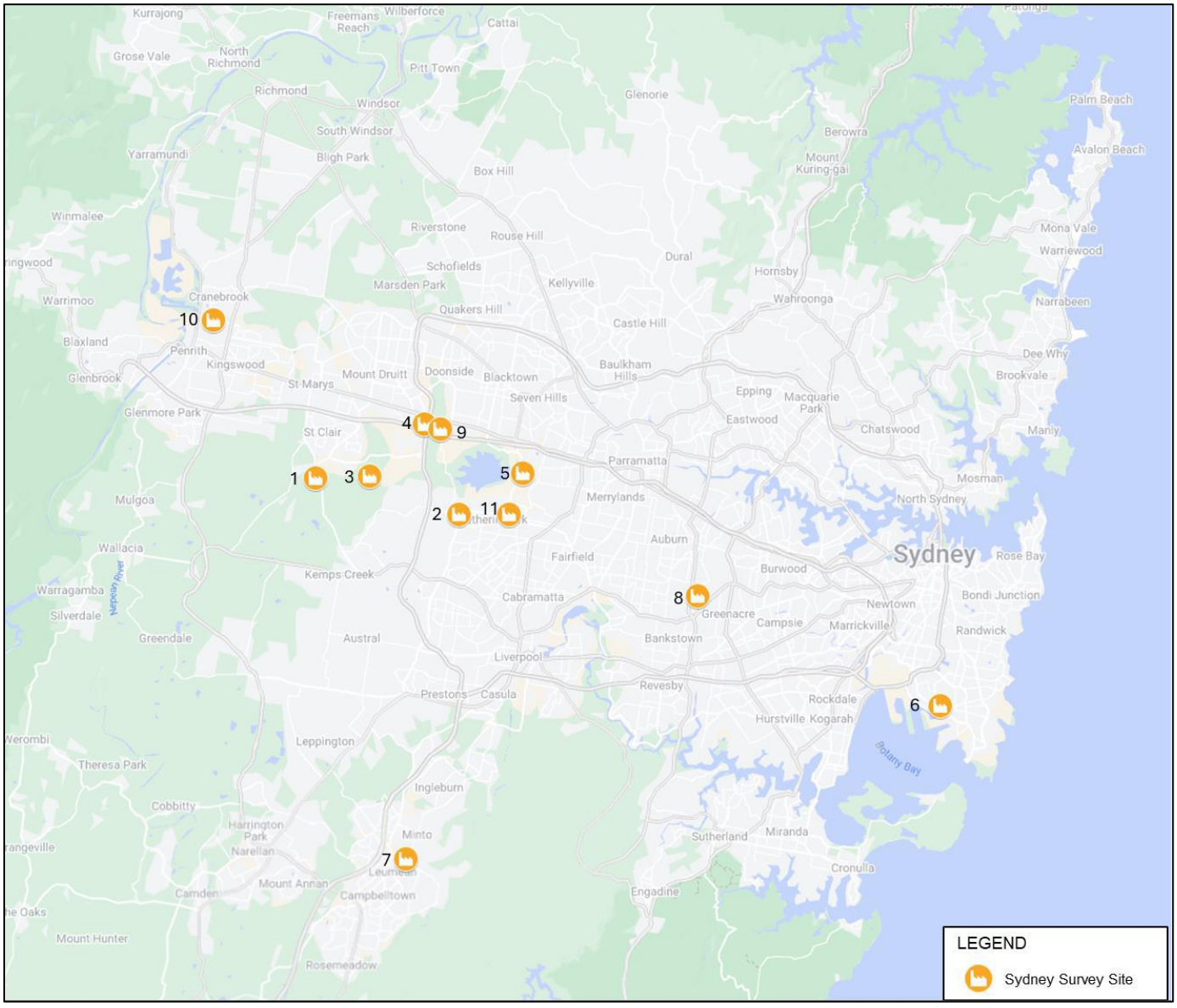
In May and June of 2024, a total of 11 sites were surveyed within Greater Sydney, ranging from 1 to 13 units in size. The sites are detailed in **Table 1** and shown in **Figure 1**.

Each site was surveyed over 24 hours and identified the number and classification of vehicle trips. While not presented, six individual sites across three of the estates were identified as other land uses (e.g. retail) and were therefore surveyed separately and excluded from the survey results.

Table 1 Site details, 2024

ID	Site name	Address	Suburb
1	First Estate	2 Distribution Drive	Kemps Creek
2	Horsley Drive Business Park	6 Burilda Close	Wetherill Park
3	Oakdale South Industrial Estate	Chelodina Street	Kemps Creek
4	Calibre Estate	60 Wallgrove Road	Eastern Creek
5	Quarry Industrial Estate	7 Basalt Road	Pemulway
6	Port Botany Industrial Estate	26 McPherson Street	Banksmeadow
7	Keylink Industrial Estate (South)	415 Pembroke Road	Minto
8	15-19 Muir Road	15-19 Muir Road	Chullora
9	William Dean Street Estate	William Dean Street	Eastern Creek
10	128 Andrews Road	128 Andrews Road	Penrith
11	300 Victoria Street	300 Victoria Street	Wetherill Park

Figure 1 Survey sites, 2024



Analysis

The analysis considered a range of time periods, defined as:

- **Absolute Peak:** the peak 1-hour development generation across the day, irrespective of time
- **Study Area Peak:** peak 1-hour development volumes during all or part of traditional assessment periods (6-10am and 3-7pm)
- **Network Peak:** development volumes that coincide with the adjacent road network peak period, separated into before and after midday (12am-noon and noon-12am)

Linear regression analysis of trips against Gross Floor Area (GFA) established very good ($R^2 > 0.8$) to acceptable correlation for most time periods, as shown in **Table 2**.

Table 2 Linear regression analysis results

Time period	Site Peak	Network Peak
AM Peak	0.76	0.85
PM Peak	0.66	0.75
Absolute Peak	0.86	-

Data Results

Refer to **Appendix A – Detailed Site Summary** and **Appendix B – Trip Generation Profiles** for detailed 2024 survey results by site.

Trip rates

The survey results have been aggregated with two further sites previously surveyed as industrial estates in 2012, located in Erskine Park and Eastern Creek. Further details on these sites may be found in the Business Parks and Industrial Estates Data Report. A wide range of values were observed for estates with GFA less than 100,000m^2 (see **Appendix C**) and the average rate is not recommended, but has been provided for indicative purposes below.

Table 3 Large format warehousing average vehicle trip rates (vehicle trips/100m^2 GFA)

	Estate GFA		
Weekday rates	**0 – 10,000 m^2**	**10,000m^2 - 100,000m^2**	**> 100,000m^2**
Site AM Peak	0.5	0.26	0.17
Site PM Peak	Not available	0.23	0.15
Network AM Peak	Not available	0.17	0.14
Network PM Peak	Not available	0.21	0.14
Daily	4	2.83	1.94

Notes

- Trip generation rates vary substantially depending on the tenants, type of goods being warehoused and the nature of the facilities. A benchmarking approach is recommended where details of tenants and proposed activities are known.
- The site AM and PM peak hours are based on the peak traffic generating hour calculated for each study area between 6am to 10am and 3pm to 7pm for the AM and PM periods, respectively.
- The recommended rates are based on large estates, rather than individual warehouses. However, individual warehouses within a larger estate may apply a rate based on the size of the total estate for the purposes of any off-site cumulative assessment in Greater Sydney, where the proposed use is for large format warehousing. At this time, rates for other parts of NSW are not available.

- It is suggested that for development applications that involve a single large format warehouse, benchmarking be undertaken or a sensitivity test be undertaken using 0.5 trips/100 m^2 for the purposes of estimating the impact of any critical issues (for example such as road safety implications or increased demand for unprotected right turn movements).
- The rates presented account for all areas of the estates surveyed, including a small portion of non-warehousing uses.
- Site peak periods varied widely from 6am-9:30am and 3pm-7pm. Network peak periods varied widely between 7am-9am and 2pm-6pm. The network peak should only be used in conjunction with local traffic data and reference to surveys of an appropriate benchmarked site. Analysis should consider if trip generation during the site peak will result in a larger impact than trip generation in the network peak.
- Average rates have been calculated using the aggregated average method, which divides the total number of trips by the total GFA, to reduce emphasis on individual developments.
- Due to limited samples, trip rates for warehouses with GFA between 0 to 10,000m^2 have been retained from the 2002 Guide to Traffic Generating Developments.
- Particular care should be taken:
    - For large estates with few warehouses, large hardstand areas and many loading docks.
    - In assessing industrial unit developments where a high proportion of warehouse uses are proposed. These developments can also suit small factory operations such as electronics / computer assembly and repairs. Uses such as these can substantially increase trip generation.

Vehicle classifications

The 2024 survey classified vehicles according to the AUSTROADS vehicle classification system. A summary of the vehicle classes observed inbound (entry) and outbound (exit) are included in Table 4.

Table 4 Large format warehousing vehicle classifications by direction

		Classification (entry : exit)			
Time period	**All vehicles Class 1-11**	**Light Class 1**	**Medium Class 2-5**	**Long Class 6-9**	**Double Combo Class 10-11**
Site AM Peak	100% (58% : 42%)	77% (44% : 33%)	15.5% (9.5% : 6%)	6% (3.5% : 2.5%)	1.5% (1% : 0.5%)
Site PM Peak	100% (62% : 38%)	69% (49% : 20%)	21.5% (7.5% : 14%)	7.5% (4% : 3.5%)	2% (1.5% : 0.5%)
Network AM Peak	100% (34.5% : 65.5%)	72.5% (17.5% : 55%)	20% (13% : 7%)	5.5% (3% : 2.5%)	2% (1% : 1%)
Network PM Peak	100% (70% : 30%)	68% (53.5% : 14.5%)	20.5% (11% : 9.5%)	9.5% (4.5% : 5%)	2% (1% : 1%)
Daily	100% (34% : 66%)	70% (16.5% : 53.5%)	21% (13% : 8%)	7% (3.5% : 3.5%)	2% (1% : 1%)

Notes

- Vehicle classification should be identified for a development based on the supply chain process it intends to serve.
    - First-mile rely on trucks for long-distance, bulk transport from production sites to distribution centres.

    - Middle-mile handle moderate to long-distance transport between distribution hubs, often focused on capacity and efficiency.
    - Last-mile rely on smaller, more manoeuvrable vehicles suited for short-distance, frequent deliveries to final destinations, focusing on accessibility and speed.

- No surveys recorded any triple combination road trains (class 12), which are generally restricted west of Newell Highway.
- A portion of the Class 1 traffic was observed to be of a 'commercial' nature, rather than staff movements, and thus not potentially able to be assigned to a different travel mode.

Other considerations

Correlation between trips generated and GFA varied, and the variation in trips generated was not fully explained through GFA. Where the proposed tenant or use is known, a benchmarking approach or first principles approach is always preferred.

Additional considerations that may influence trip generation include:

- The number of loading docks, size of loading docks (e.g. sized for B-Doubles, semi-trailers, rigid trucks or vans), number of tenants and number of car parking spaces can offer insights into trips generation, including the potential operational throughput of large format warehousing, and may influence heavy vehicle generation and heavy vehicle composition. For example, two warehouses with the same GFA might have different traffic patterns if one has more loading docks or operates more intensively or over the full 24-hour day. Similarly, a large warehouse with few loading docks may generate less vehicle traffic than a smaller warehouse with many docks, as the latter might handle more frequent deliveries or shipments.
- Parameters such as site location and transport network factors provide additional context for a warehouse or distribution centre. For example, a distribution centre that serves middle-mile in the supply chain cannot be sited in an area with poor access to the primary freight and B-double road network. Conversely, it may not be efficient to cluster last-mile delivery operations, but a combination of middle-mile and last-mile operations could provide a more optimised supply chain.
- The breakdown of vehicle classification has implications for network impact assessments and should be site-specific based on the supply chain process it intends to serve. This is important as a development with higher intensity of longer and heavier trucks may increase road congestion and road safety risk compared to a development that predominantly uses rigid trucks and light commercial vehicles for distribution.
- Transport for NSW's Draft NSW Heavy Vehicle Access Policy April 2024 outlines support for greater efficiencies in the freight and supply chain system. Future trends may see more access for High Productivity Vehicles.

Appendix A – Detailed Site Summary

ID	1 First Estate	2 Horsley Drive Business Park	3 Oakdale South	4 Calibre Estate	5 Quarry Industrial Estate	6 Port Botany Industrial Estate	7 Keylink Industrial Estate (South)	8 15-19 Muir Road, Chullora	9 William Dean Street	10 128 Andrews Road	11 300 Victoria Street
Site Details											
Suburb	Kemps Creek	Wetherill Park	Oakdale South	Eastern Creek	Pemulwuy	Banksmeadow	Minto	Chullora	Eastern Creek	Penrith	Wetherill Park
Date of survey	Tue 28th to Thu 30th May 2024	Tue 28th to Thu 30th May 2024	Tue 28th to Thu 30th May 2024	Tue 28th to Thu 30th May 2024	Tue 28th to Thu 30th May 2024	Tue 28th to Thu 30th May 2024	Tue 28th to Thu 30th May 2024	Tue 28th to Thu 30th May 2024	Tue 28th to Thu 30th May 2024	Tue 28th to Thu 30th May 2024	Tue 28th to Thu 30th May 2024
GFA in Study Area (m^2) occupied	173,552	100,836	331,657	109,906	127,922	40,386	60,464	22,565	80,881	50,150	37,951
Study Area (hectares)	37.5	21.4	117.1	21.8	23.7	9.8	16.8	6.0	22.5	27.0	7.9
Floor Space Ratio / Site Coverage (%)	46.3%	47.0%	28.3%	50.5%	54.1%	41.1%	36.0%	37.4%	36.0%	18.5%[1]	47.8%
No. Occupied Units/Lots	8	8	13	5	7	2	5	1	3	1	2
No. Vacant Units/Lots	0	0	-	0	0	-	0	0	0	0	0
No. Ancillary Businesses	0	0	-	0	0	-	0	0	0	0	0
Typical Hours of Opening	24 hours	24 hours	24 hours	24 hours	24 hours	24 hours	24 hours	24 hours	24 hours	24 hours	24 hours
Council	Penrith City	Fairfield City	Penrith City	Blacktown City	Cumberland	Bayside	Campbelltown City	Canterbury Bankstown	Blacktown City	Penrith City	Fairfield City
Adjacent Main Road	Mamre Road	CowpastureRoad	Lenore Drive	Wallgrove Road	Prospect Highway	Botany Road	Pembroke Road	Muir Rd	Great Western Highway	Andrews Road	Victoria Street
Daily											
Daily: Vehicle-trips	2,978	1,963	6,073	1,701	2,444	1,982	889	1,057	2,810	226	1,307
Daily: Vehicle-trips per 100m^2 GFA	1.72	1.95	1.83	1.55	1.91	4.91	1.47	4.68	3.47	0.45	3.44

[1] The site area for Site 10 includes significant areas of undevelopable land leading to a low Floor Space Ratio.

ID	1 First Estate	2 Horsley Drive Business Park	3 Oakdale South	4 Calibre Estate	5 Quarry Industrial Estate	6 Port Botany Industrial Estate	7 Keylink Industrial Estate (South)	8 15-19 Muir Road, Chullora	9 William Dean Street	10 128 Andrews Road	11 300 Victoria Street
Peak Hours											
Study area absolute peak: Vehicle-trips (1-hour)	364	191	568	203	228	189	97	143	255	20	112
Study area absolute peak: Time (1-hour)	05:30 to 06:30	13:45 to 14:45	05:30 to 06:30	13:15 to 14:15	13:45 to 14:45	13:45 to 14:45	14:15 to 15:15	05:45 to 06:45	17:30 to 18:30	13:45 to 14:45	07:30 to 08:30
Study area absolute peak: Vehicle-trips per 100m² GFA	0.21	0.19	0.17	0.19	0.18	0.47	0.16	0.63	0.32	0.04	0.3
Study area AM peak: Vehicle-trips (1-hour)	364	186	568	124	222	158	66	143	252	16	112
Study area AM peak: Time (1-hour)	05:30 to 06:30	08:15 to 09:15	05:30 to 06:30	08:15 to 09:15	06:45 to 07:45	07:15 to 08:15	06:00 to 07:00	05:45 to 06:45	08:30 to 09:30	07:30 to 08:30	07:30 to 08:30
Study area AM peak: Vehicle-trips per 100m² GFA	0.21	0.18	0.17	0.11	0.17	0.39	0.11	0.63	0.31	0.03	0.30
Study area PM peak: Vehicle-trips (1-hour)	223	117	426	101	185	158	97	62	255	13	94
Study area PM peak: Time (1-hour)	15:45 to 16:45	17:00 to 18:00	15:00 to 16:00	15:00 to 16:00	15:15 to 16:15	15:30 to 16:30	14:15 to 15:15	15:15 to 16:15	17:30 to 18:30	15:30 to 16:30	16:00 to 17:00
Study area PM peak: Vehicle-trips per 100m² GFA	0.13	0.12	0.13	0.09	0.14	0.39	0.16	0.28	0.32	0.03	0.25
Network AM peak: Vehicle-trips (1-hour)	185	176	449	113	207	107	53	68	140	14	106
Network AM peak: Time (1-hour)	08:00 to 09:00	07:00 to 08:00	07:00 to 08:00	07:00 to 08:00	07:00 to 08:00	08:00 to 09:00	08:00 to 09:00	08:00 to 09:00	07:00 to 08:00	08:00 to 09:00	07:00 to 08:00
Network AM peak: Vehicle-trips per 100m² GFA	0.11	0.17	0.14	0.10	0.16	0.26	0.09	0.30	0.17	0.03	0.28
Network PM peak: Vehicle-trips (1-hour)	190	115	469	101	180	154	69	49	246	12	94
Network PM peak: Time (1-hour)	15:00 to 16:00	16:00 to 17:00	14:00 to 15:00	15:00 to 16:00	15:00 to 16:00	15:00 to 16:00	15:00 to 16:00	16:00 to 17:00	17:00 to 18:00	16:00 to 17:00	16:00 to 17:00
Network PM peak: Vehicle-trips per 100m² GFA	0.11	0.11	0.14	0.09	0.14	0.38	0.11	0.22	0.30	0.02	0.25

ID	1 First Estate	2 Horsley Drive Business Park	3 Oakdale South	4 Calibre Estate	5 Quarry Industrial Estate	6 Port Botany Industrial Estate	7 Keylink Industrial Estate (South)	8 15-19 Muir Road, Chullora	9 William Dean Street	10 128 Andrews Road	11 300 Victoria Street
Midblock Tube Count (Adjacent Road)											
Study area absolute peak: Vehicle-trips (1-hour)	1,276	1,068	1,186	2,617	1,263	1,279	1,593	1,238	3,044	1,077	1,267
Study area absolute peak: Time (1-hour)	05:30 to 06:30	13:45 to 14:45	05:30 to 06:30	13:15 to 14:15	13:45 to 14:45	13:45 to 14:45	14:15 to 15:15	05:45 to 06:45	17:30 to 18:30	13:45 to 14:45	07:30 to 08:30
Study area AM peak: Vehicle-trips (1-hour)	1,874	1,009	1,519	2,642	1,379	1,178	927	1,238	2,660	1,076	1,267
Study area AM peak: Time (1-hour)	06:00 to 07:00	08:15 to 09:15	06:00 to 07:00	08:15 to 09:15	06:45 to 07:45	07:15 to 08:15	06:00 to 07:00	06:00 to 07:00	08:30 to 09:30	07:30 to 08:30	07:30 to 08:30
Study area PM peak: Vehicle-trips (1-hour)	1,791	965	1,286	3,019	1,298	1,385	1,840	1,707	3,044	1,322	1,483
Study area PM peak: Time (1-hour)	15:45 to 16:45	17:00 to 18:00	15:00 to 16:00	15:00 to 16:00	15:15 to 16:15	15:30 to 16:30	15:00 to 16:00	15:15 to 16:15	17:30 to 18:30	15:30 to 16:30	16:00 to 17:00
Network AM peak: Vehicle-trips (1-hour)	2,244	1,059	1,682	2,772	1,379	1,259	1,841	1,891	2,701	1,134	1,267
Network AM peak: Time (1-hour)	08:00 to 09:00	07:00 to 08:00	07:00 to 08:00	07:00 to 08:00	07:00 to 08:00	08:00 to 09:00	08:00 to 09:00	08:00 to 09:00	07:00 to 08:00	08:00 to 09:00	07:00 to 08:00
Network PM peak: Vehicle-trips (1-hour)	2,079	1,224	1,411	3,019	1,298	1,385	1,840	1,867	3,044	1,463	1,483
Network PM peak: Time (1-hour)	15:00 to 16:00	16:00 to 17:00	14:00 to 15:00	15:00 to 16:00	15:00 to 16:00	15:00 to 16:00	15:00 to 16:00	16:00 to 17:00	17:00 to 18:00	16:00 to 17:00	16:00 to 17:00

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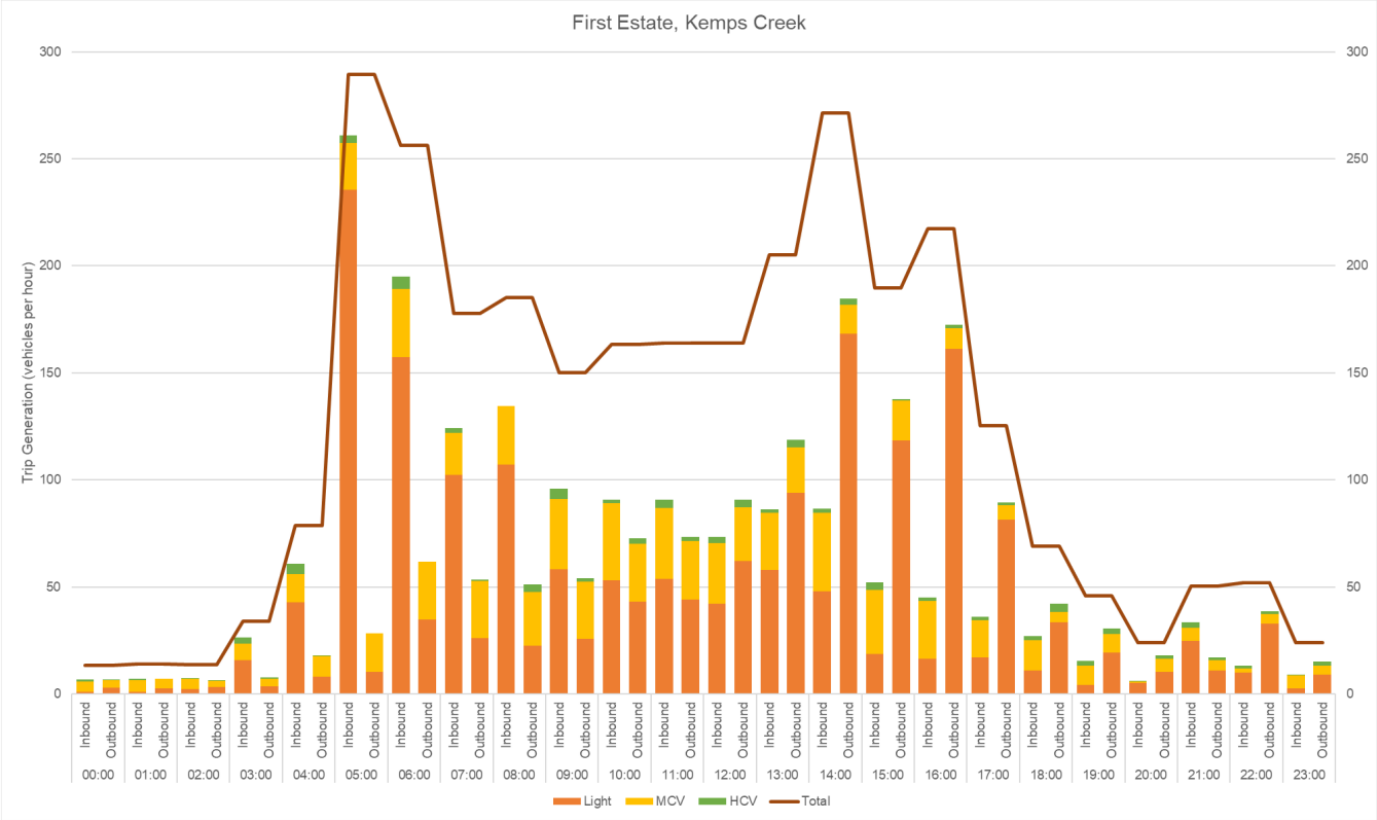
Entry / Exit Split											
Entry split (%) - Study area absolute peak	85%	38%	79%	41%	24%	47%	24%	57%	54%	36%	67%
Exit split (%) - Study area absolute peak	15%	62%	21%	59%	76%	53%	76%	43%	46%	64%	33%
Entry split (%) - Study area AM peak	76%	81%	75%	63%	71%	35%	67%	44%	25%	57%	67%
Exit split (%) - Study area AM peak	24%	19%	25%	37%	29%	65%	33%	56%	75%	43%	33%
Entry split (%) - Study area PM peak	19%	12%	37%	33%	20%	55%	24%	35%	54%	47%	32%
Exit split (%) - Study area PM peak	81%	88%	63%	67%	80%	45%	76%	65%	46%	53%	68%
Entry split (%) - Network AM peak	72%	68%	72%	65%	69%	60%	69%	56%	74%	44%	63%
Exit split (%) - Network AM peak	28%	32%	28%	35%	31%	40%	31%	44%	26%	56%	37%
Entry split (%) - Network AM peak	27%	18%	30%	33%	23%	53%	24%	25%	52%	47%	32%
Exit split (%) - Network PM Peak	73%	82%	70%	67%	77%	47%	76%	75%	48%	53%	68%
Vehicle Class Splits (daily)											
Light Vehicles	71%	70%	65%	79%	75%	86%	67%	64%	55%	50%	54%
Medium Commercial Vehicles (MCV)	26%	28%	30%	18%	24%	13%	32%	36%	41%	46%	40%
Heavy Commercial Vehicles (HCV)	3%	2%	5%	3%	1%	1%	1%	0%	4%	5%	6%

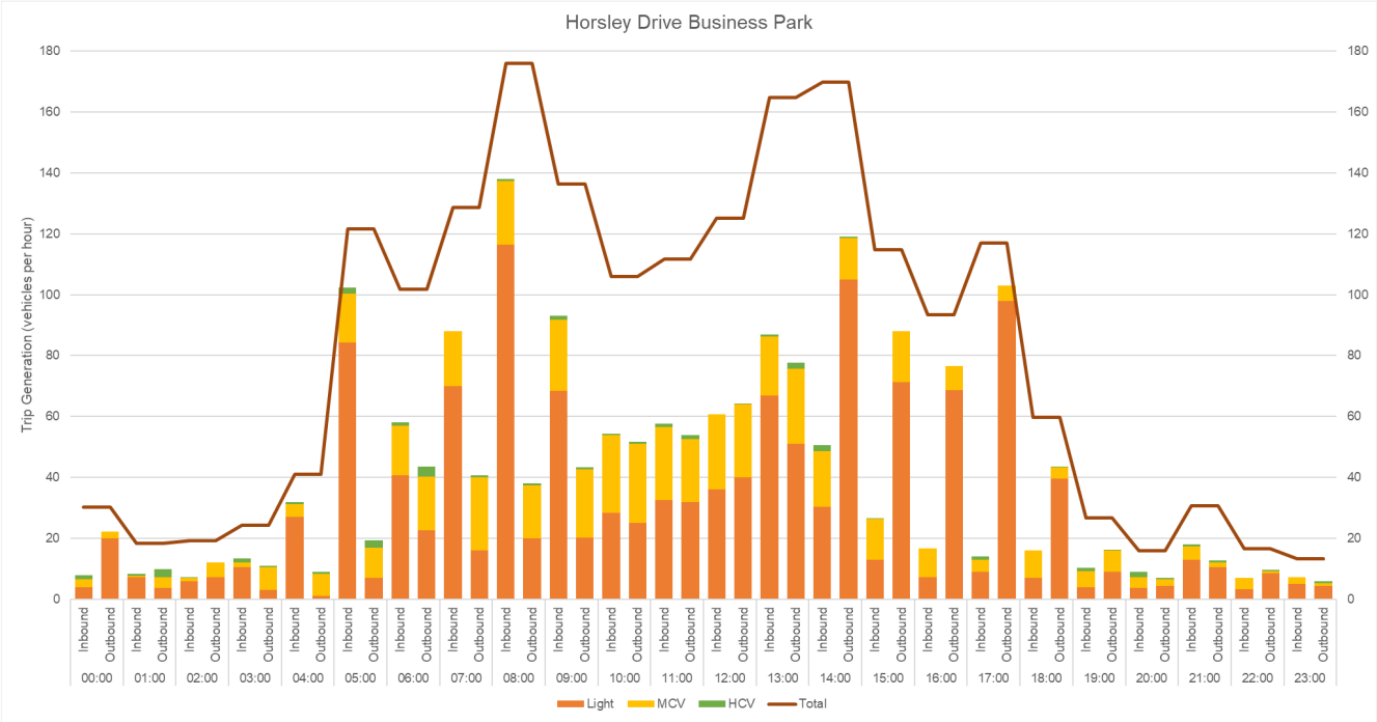
Appendix B – Trip Generation Profiles

This section provides the trip generation profiles by vehicle classification for the surveyed sites across a 3-day weekday average (Tuesday, Wednesday and Thursday).

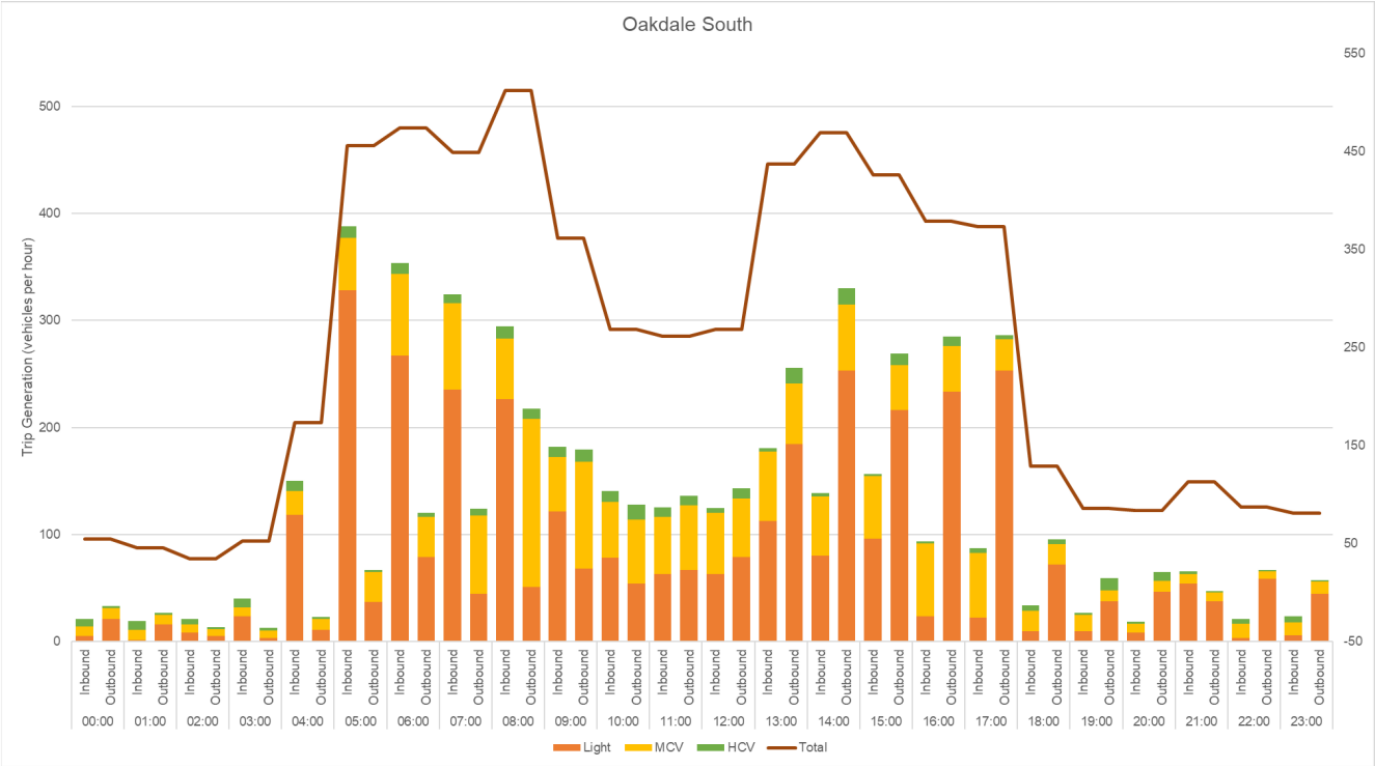
Site 1



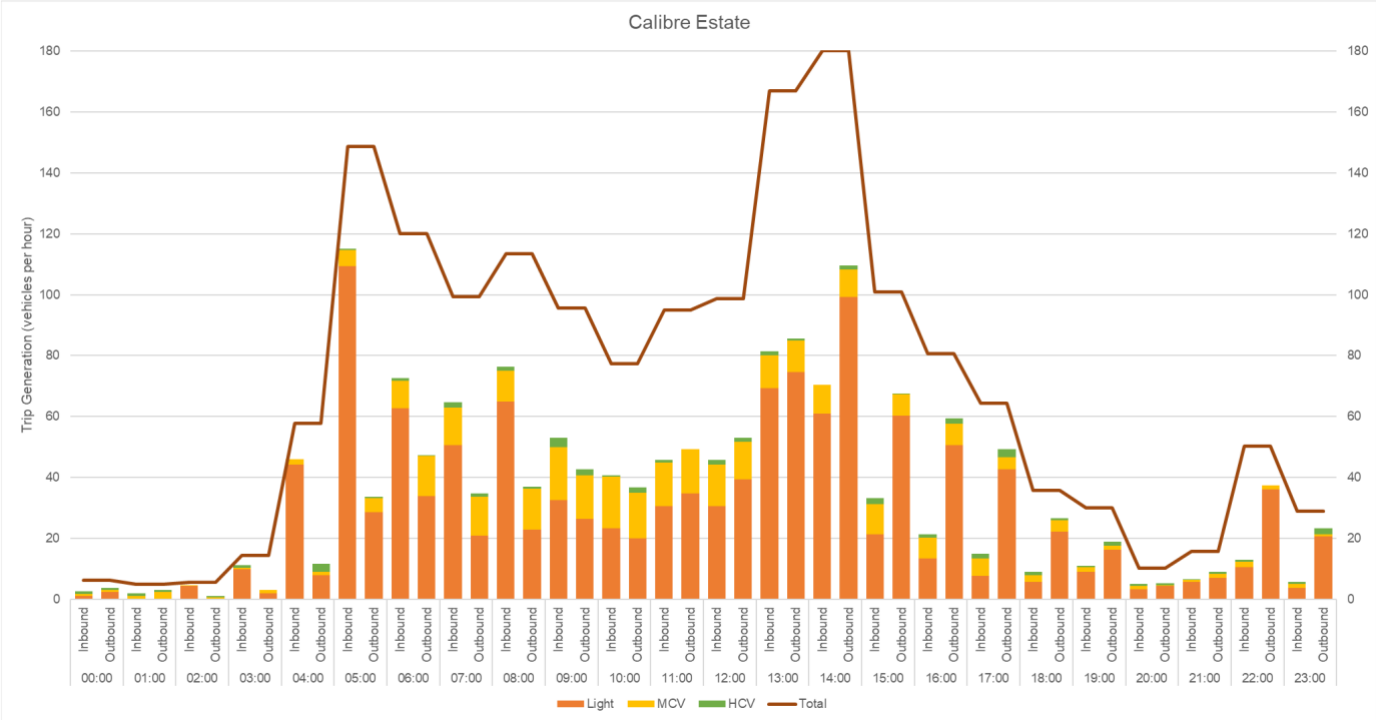
Site 2



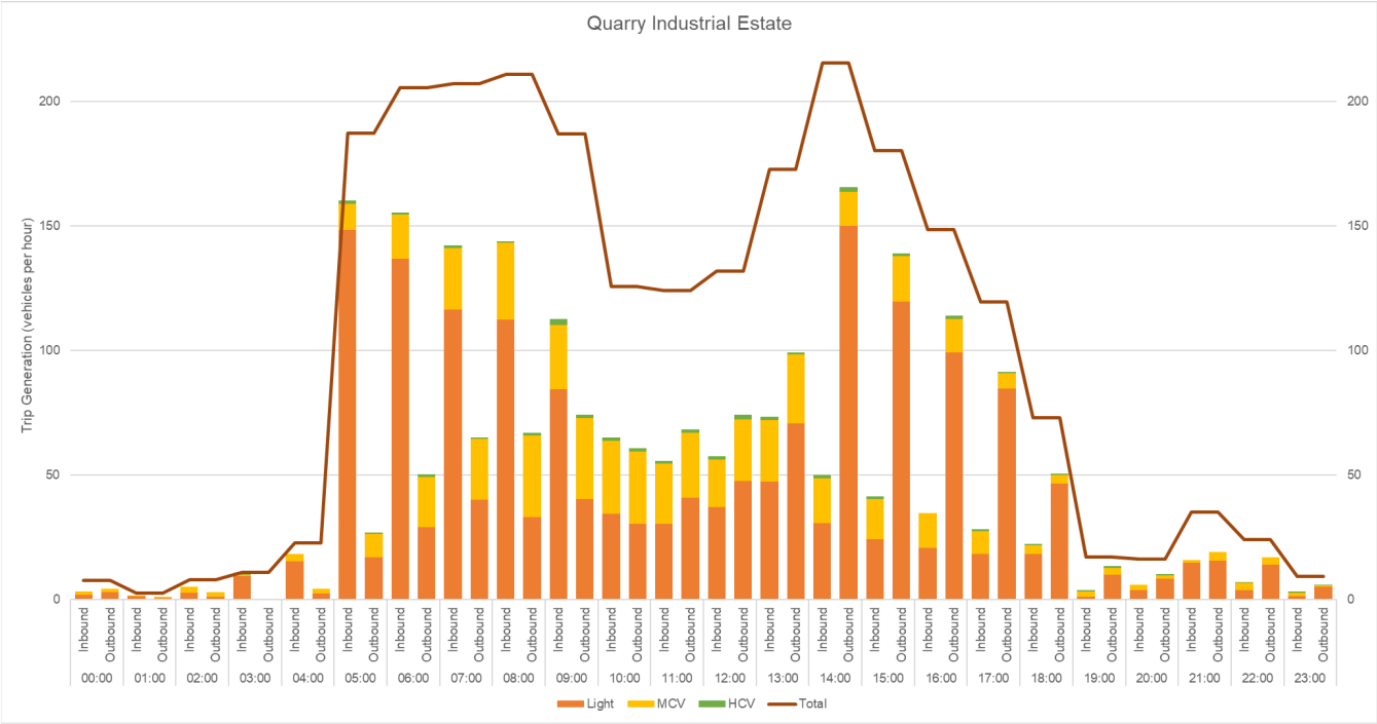
Site 3


Oakdale South
Trip Generation (vehicles per hour)
Light
MCV
HCV
Total

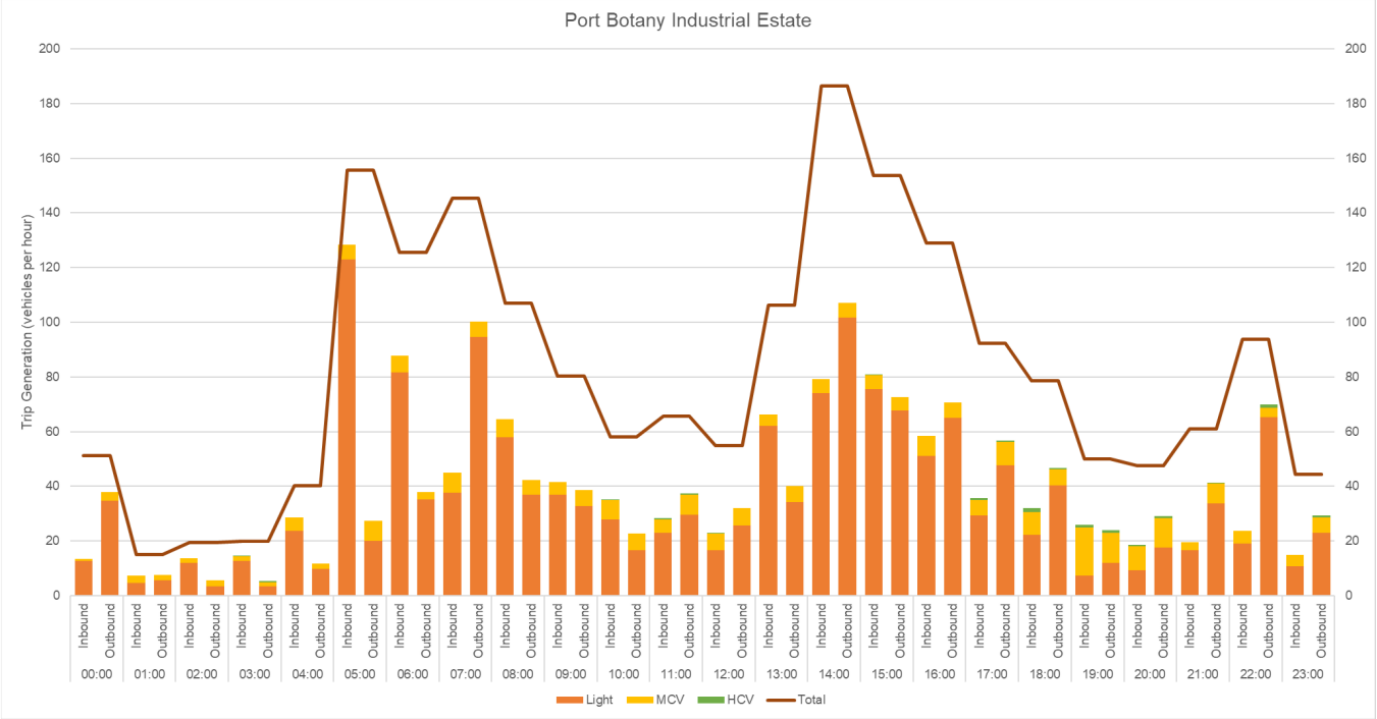
Site 4


Calibre Estate
Trip Generation (vehicles per hour)
Light
MCV
HCV
Total

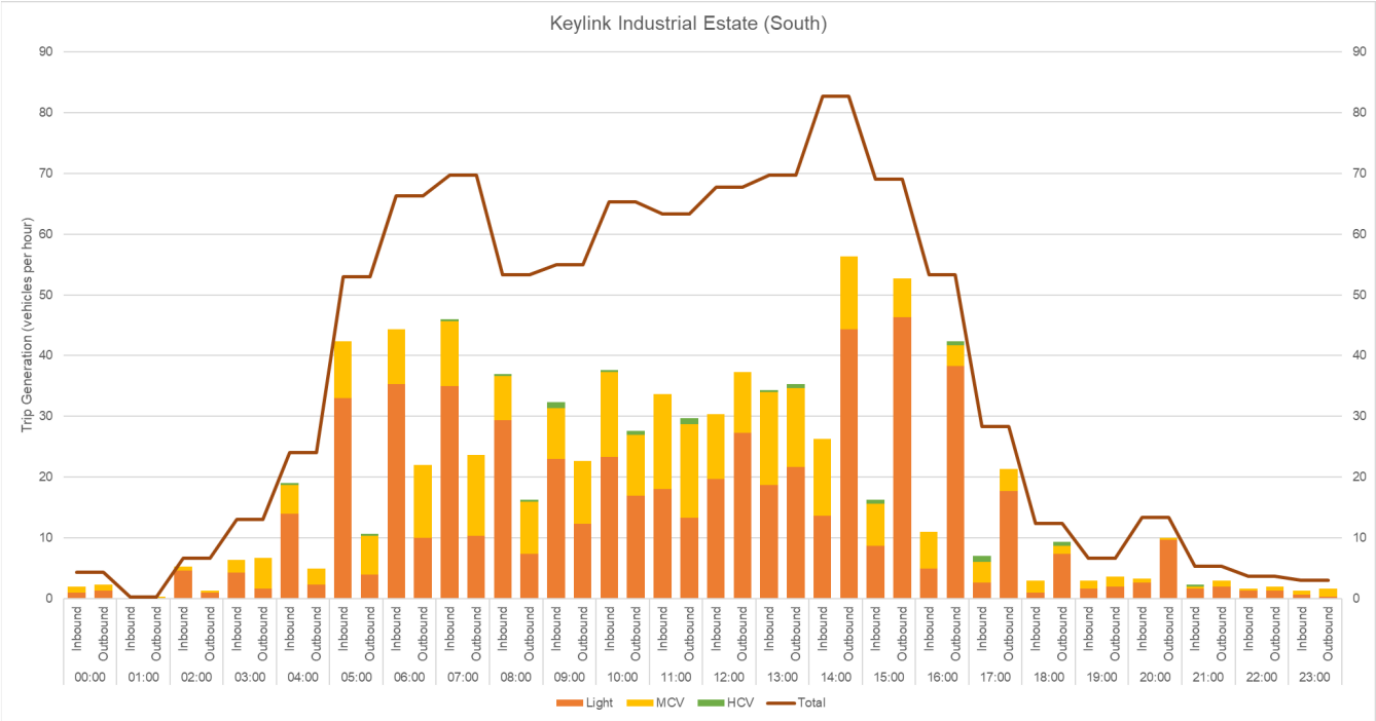
Site 5


Quarry Industrial Estate
Trip Generation (vehicles per hour)
0
50
100
150
200
Inbound
Outbound
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Light
MCV
HCV
Total

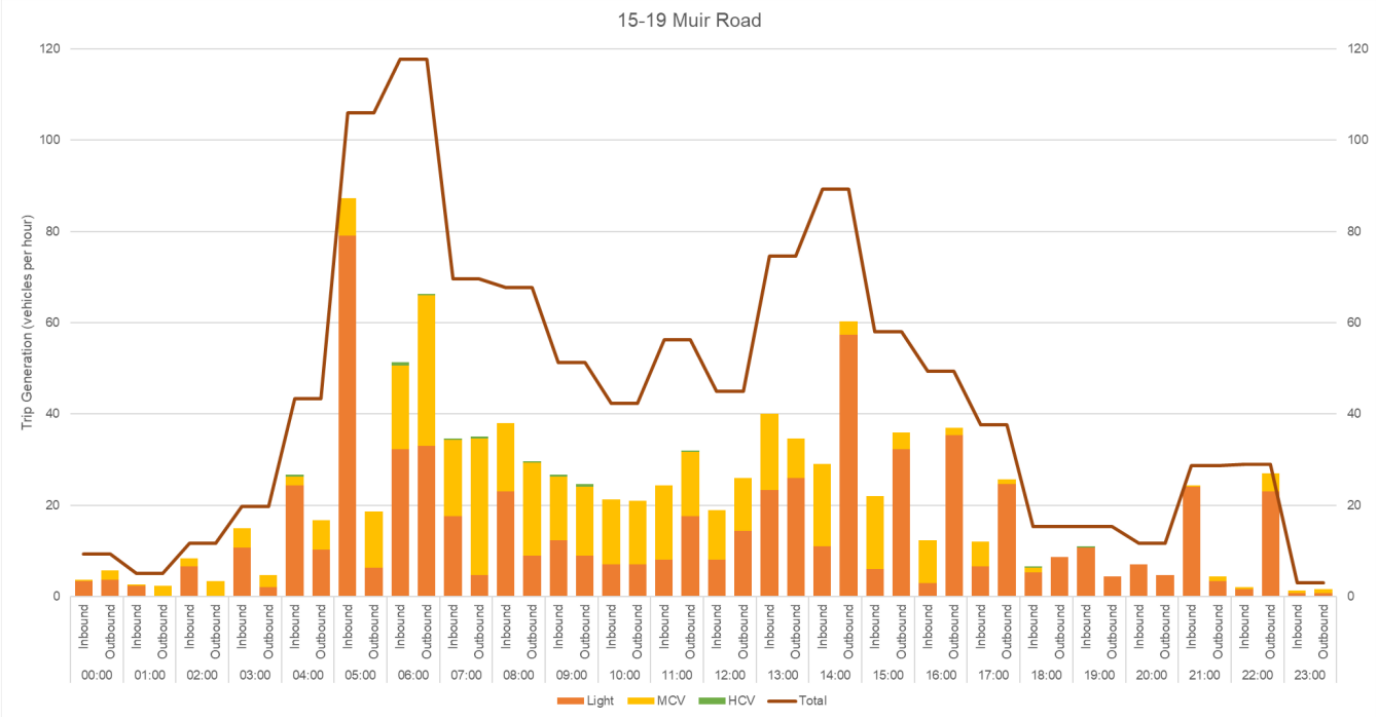
Site 6


Port Botany Industrial Estate
Trip Generation (vehicles per hour)
0
20
40
60
80
100
120
140
160
180
200
Inbound
Outbound
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Light
MCV
HCV
Total

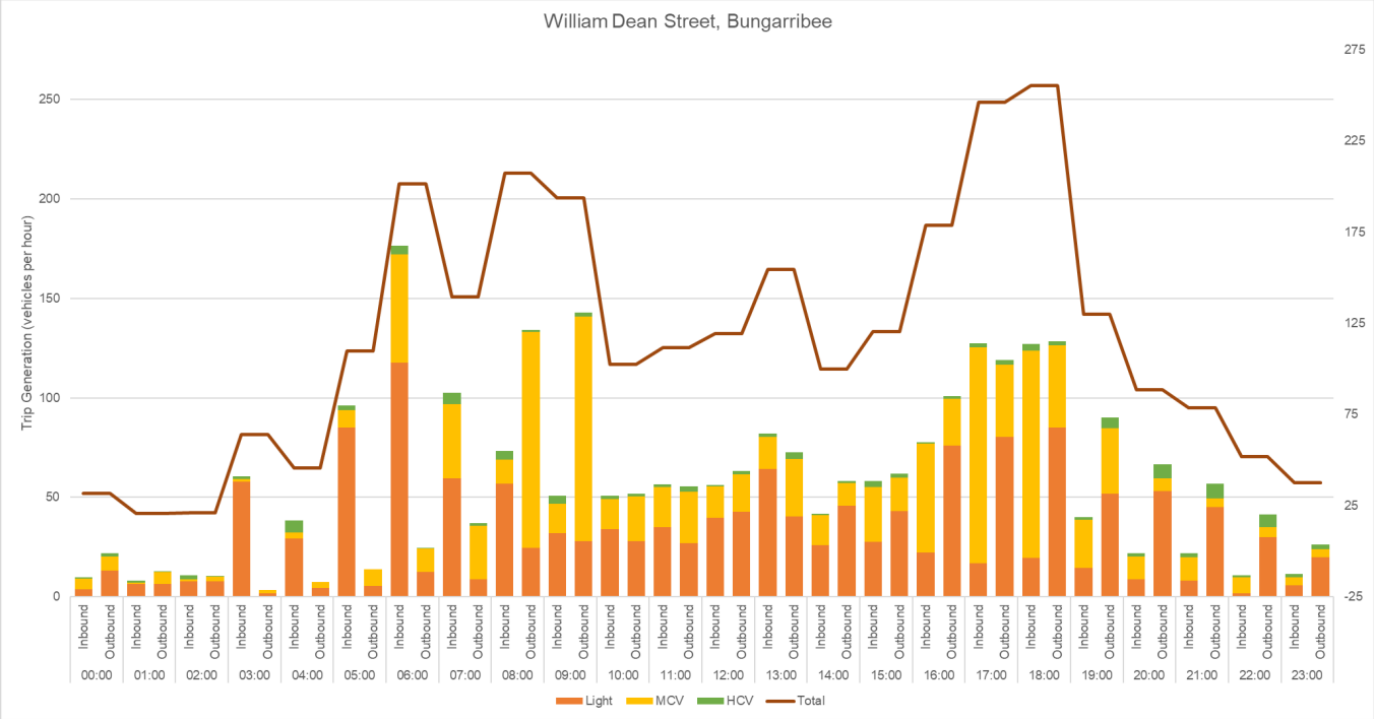
Site 7


Keylink Industrial Estate (South)
Trip Generation (vehicles per hour)
Light
MCV
HCV
Total

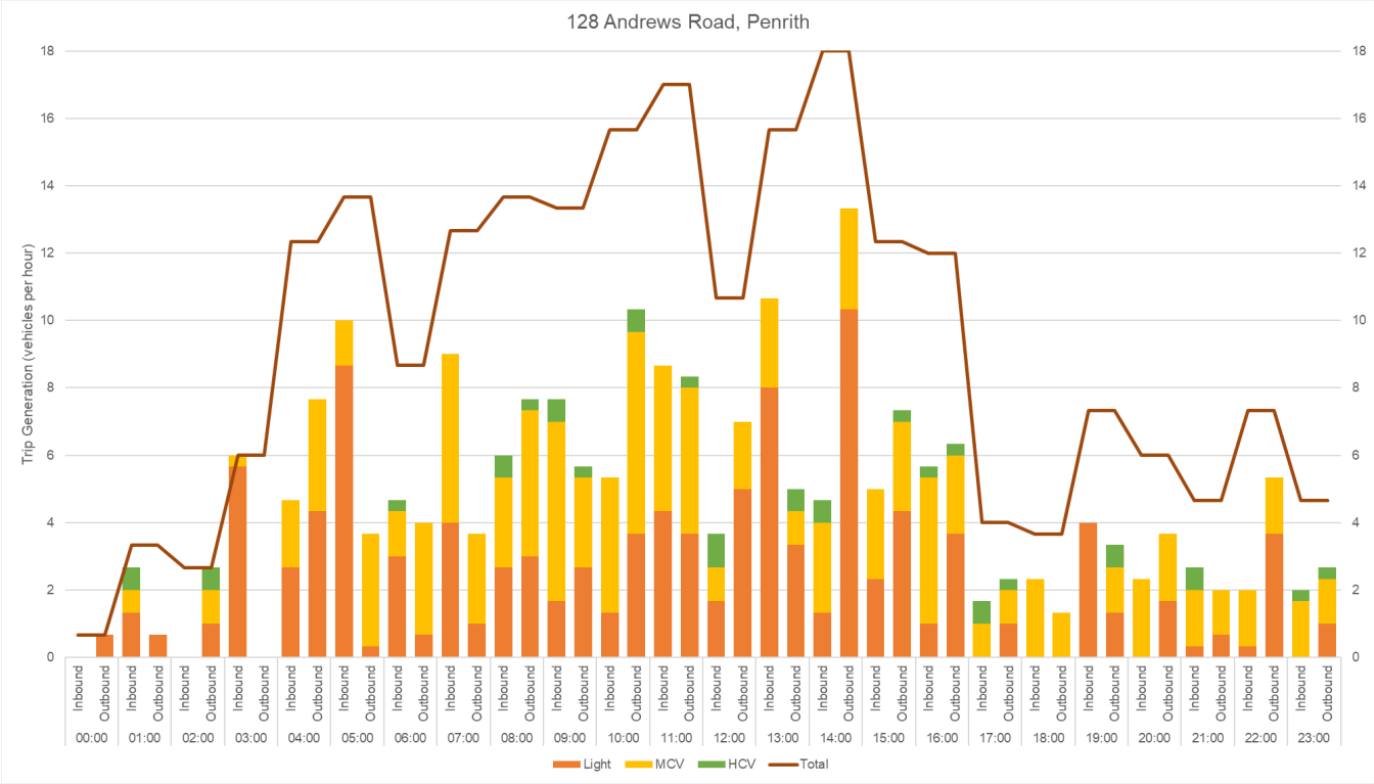
Site 8


15-19 Muir Road
Trip Generation (vehicles per hour)
Light
MCV
HCV
Total

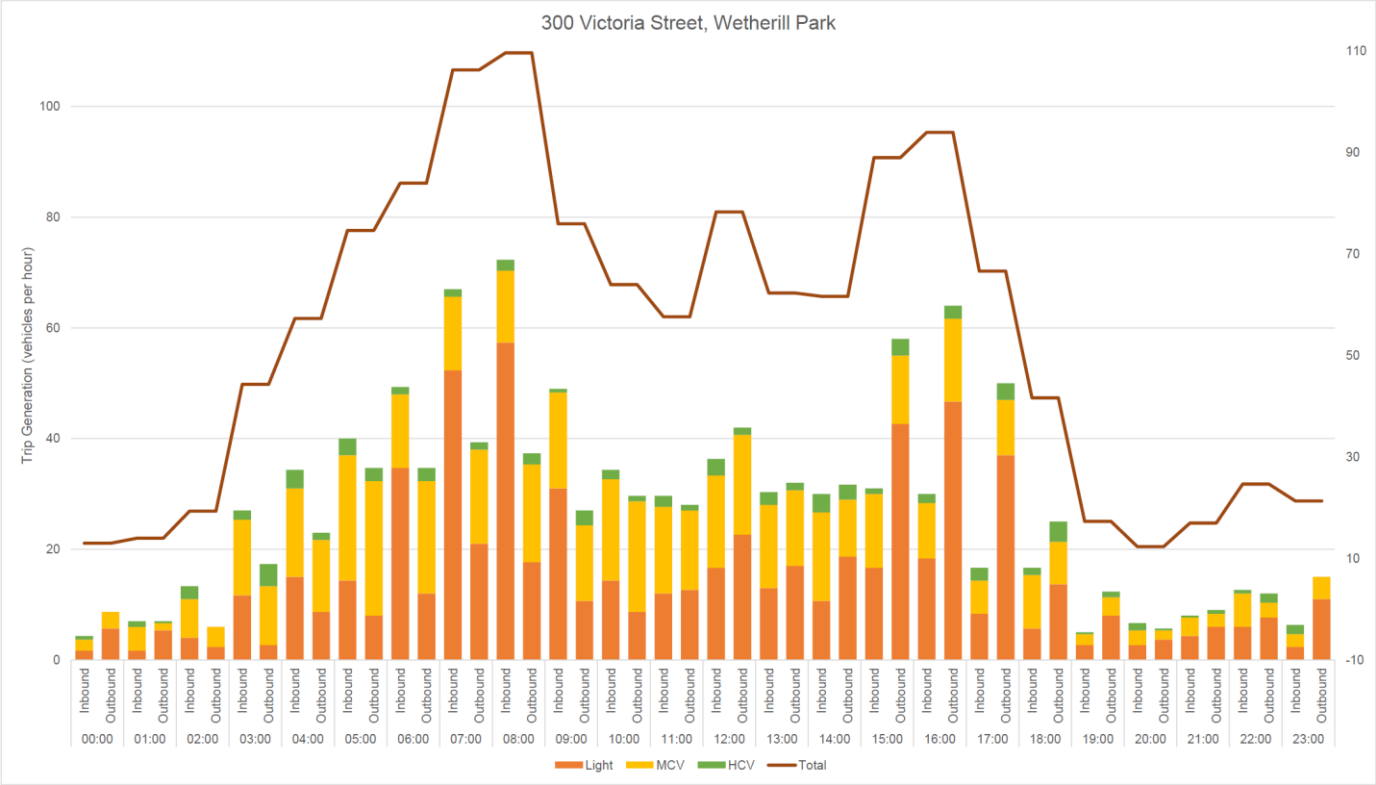
Site 9



Site 10

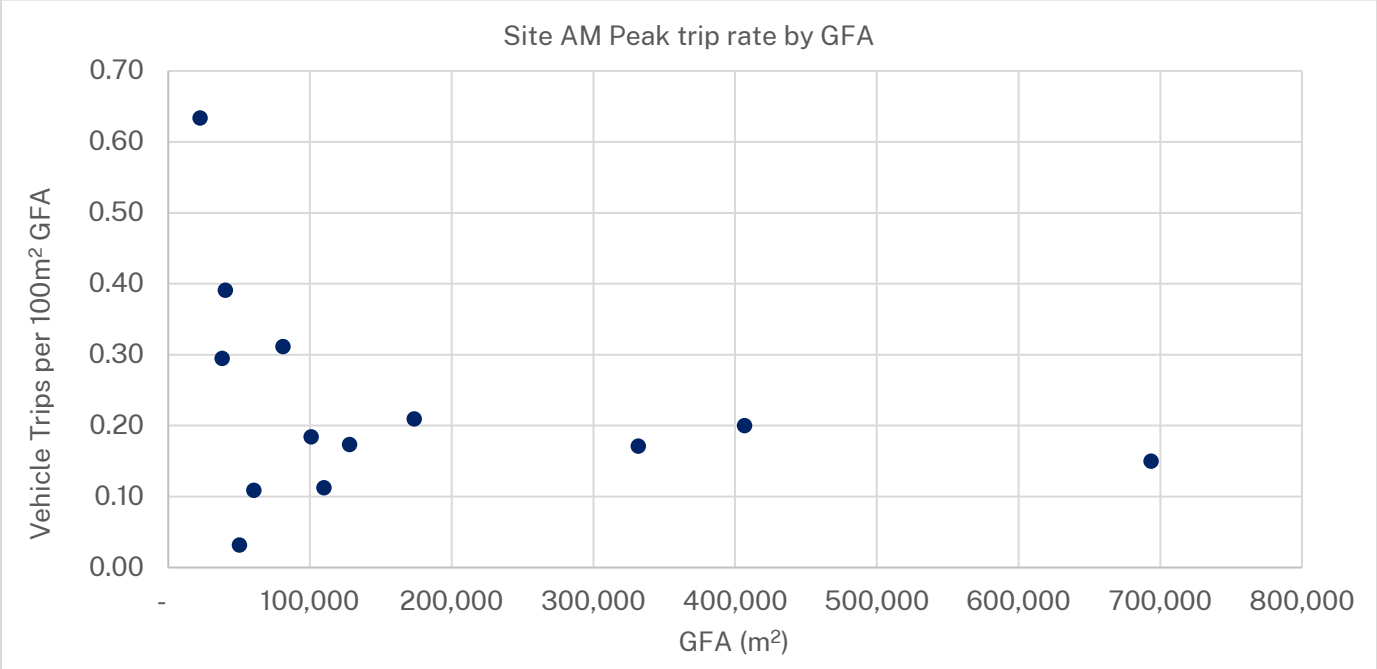


Site 11

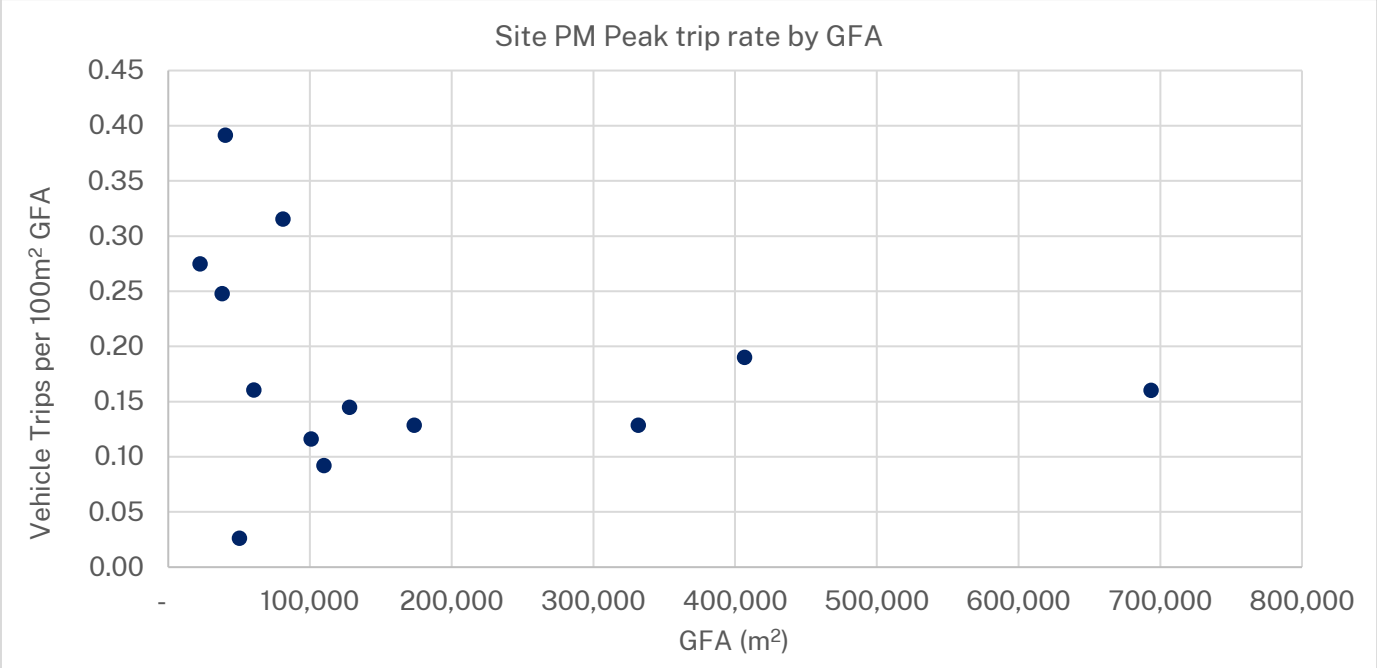

300 Victoria Street, Wetherill Park
Trip Generation (vehicles per hour)
110
100
90
80
70
60
50
40
30
20
10
0
-10
Inbound
Outbound
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Light
MCV
HCV
Total

Appendix C – Trip rates by GFA

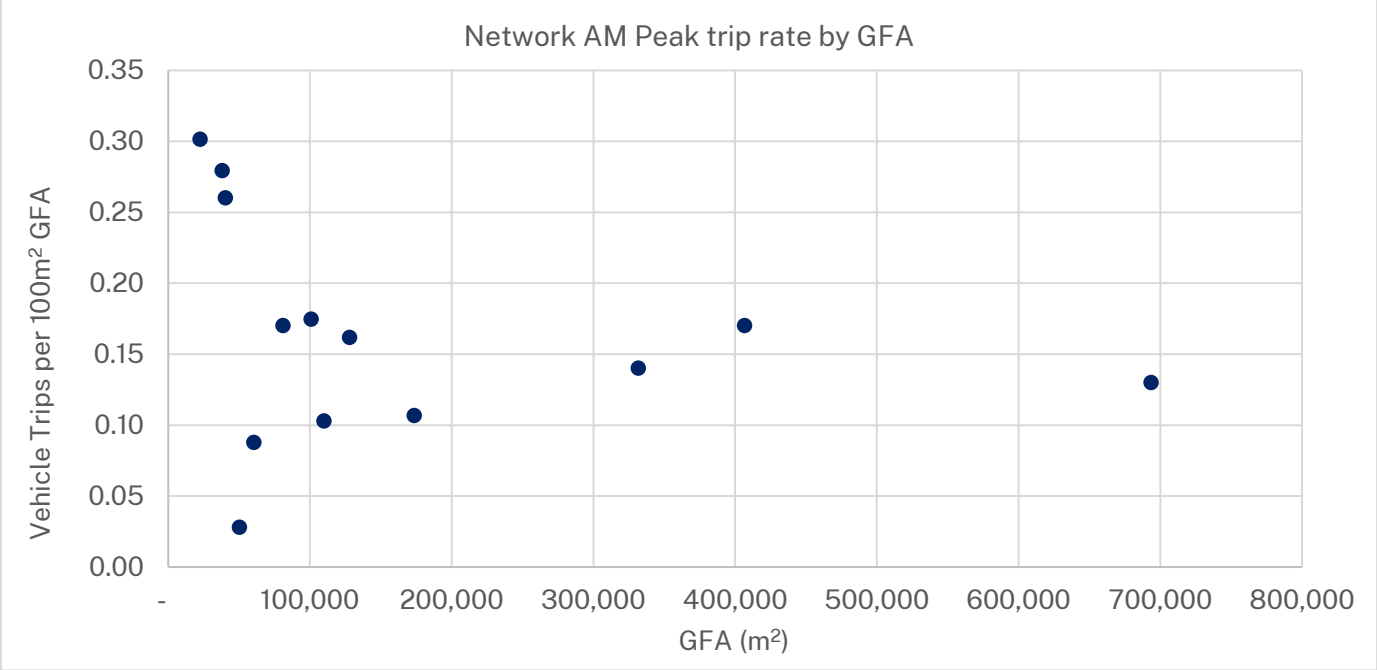
Site AM Peak



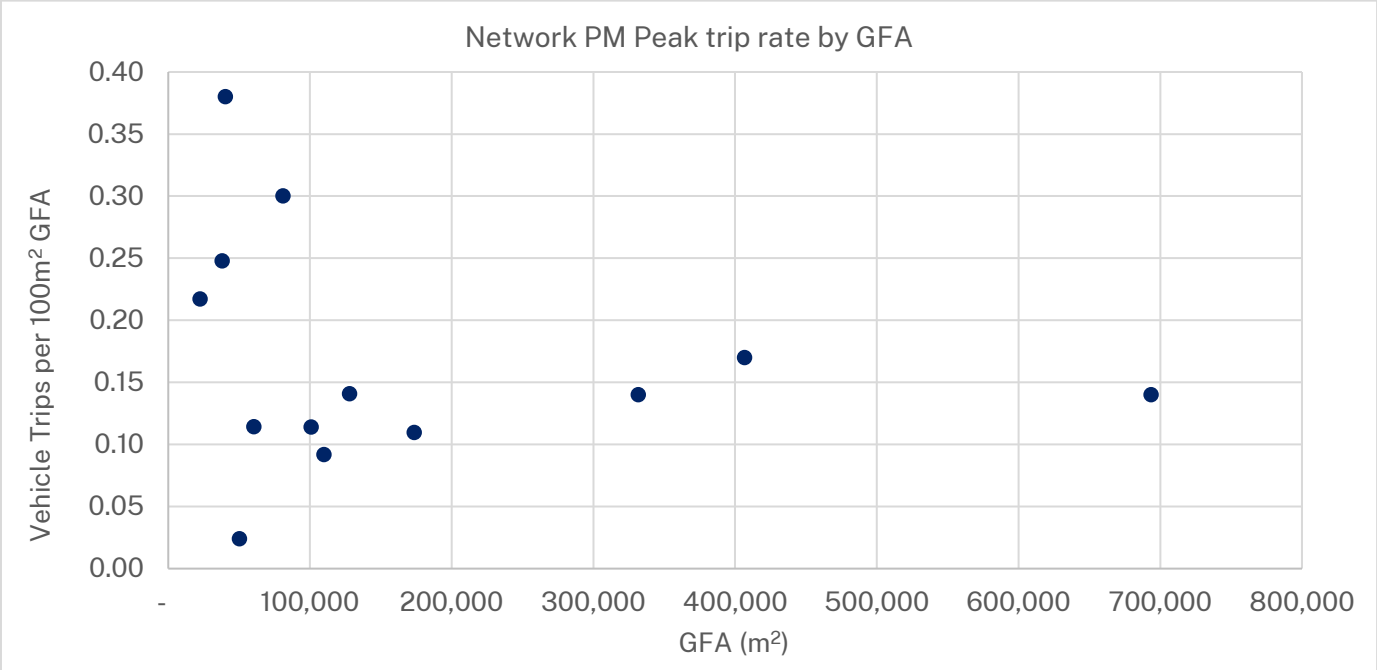
Site PM Peak



Network AM Peak

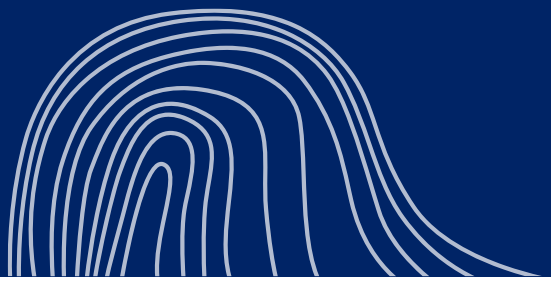


Network PM Peak



Daily


Daily trip rate by GFA
Vehicle Trips per 100m² GFA
6.00
5.00
4.00
3.00
2.00
1.00
-
-
100,000
200,000
300,000
400,000
500,000
600,000
700,000
800,000
GFA (m²)



NSW GOVERNMENT