



Transport
for NSW

Freight Trip Generation to High Density Residential Developments in Sydney



Contents

1	Background.....	4
1.1	Global trends context.....	4
1.2	Problem statement	4
1.3	Scope	5
1.4	Limitations & assumptions	5
2	Comparison of high level trip rates (2017 vs 2020)	7
3	Residential freight generation (Nov 2020)	8
3.1	Sites and survey dates	8
3.2	Trip generation rates	8
3.3	Holistic daily profiles	9
3.3.1	Vehicle type	9
3.3.2	Visit purpose	12
3.4	Vehicle types by building	14
3.5	Visit purpose by building	15
3.6	Dwell times	16
4	Residential freight generation (Nov 2017)	17
4.1	Sites and survey dates	17
4.2	Trip generation rates	17
4.3	Daily profiles	18
4.3.1	Vehicle type	18
4.3.2	Visit purpose	20
4.4	Vehicle types	22
4.5	Visit purpose	23
4.6	Dwell times	23
5	Conclusions	24
5.1	Residential freight demand is increasing, mainly from an uptake in food deliveries	24
5.2	Recommended trip generation rates	24
5.3	Suburb demographics and location correlated to certain behaviours	25
5.4	Freight arrival daily profile	25

Author: Nikolai Tinsley – Planning & Project Support Officer
Reviewed: Michael Stokoe – Director, Urban Freight
Date: May, 2021
Version: Final
Reference:
Division: CST
Contact: FREIGHT@TRANSPORT.NSW.GOV.AU

LIST OF TABLES

Table 1: Comparison of High Level Trip Rates (2017 vs 2020)	7
Table 2: 2020 Residential Sites	8
Table 3: 2020 Trip Rates.....	9
Table 4: Hourly composition of freight vehicles across all sites and days	10
Table 5: Hourly composition of freight vehicles across all sites and days	12
Table 6 Hourly comparison of freight & service vehicles visit purpose across all sites and days	13
Table 7: Average daily freight and servicing movements by vehicle type and site	15
Table 8: Average daily freight and servicing movements by vehicle type per unit.....	15
Table 9: Average daily freight and servicing movements by visit type and site.....	15
Table 10: Median dwell times of visit purpose	16
Table 11 2017 Residential Sites	17
Table 12: 2017 Trip Rates	17
Table 13: Hourly composition of vehicle type across all sites and survey period	18
Table 14: Hourly composition of freight and servicing vehicles across all sites and survey period.....	20
Table 15: Hourly composition of visit ype across all sites and survey period	21
Table 16: Average daily freight & servicing movements by site	22
Table 17: Average daily freight & servicing movements by site – adjusted per unit	22
Table 18: Average daily number of freight and servicing related movements by visit purpose.....	23
Table 19: Median dwell times by visit purpose	23
Table 20 Recommended arrival rates and dwell times for use in loading dock analysis	24

LIST OF FIGURES

Figure 1: Removal activity unable to enter a residential development	5
Figure 2: Hourly summation of freight & service vehicles across all sites and days	9
Figure 3: Hourly summation of freight & service vehicles across all sites and days (bike/motorbike only)	11
Figure 4: Hourly summation of freight & service vehicle types across all sites and days (except bike/motorbike).....	11
Figure 5: Hourly summation of freight & service vehicles visit purpose across all sites and days.....	13
Figure 6: 2020 Residential freight and servicing composition	14
Figure 7: Hourly Summation of freight and servicing vehicles across all sites and days	18
Figure 8: Hourly Summation of freight and servicing vehicles across all sites and days (cyclists and motorbikes only).....	19
Figure 9: Hourly Summation of freight and servicing vehicles across all sites and days (excludes cyclists and motorbikes)	19
Figure 10: Hourly Summation of freight and servicing visit purposes across all sites and days	21
Figure 11: 2017 Residential Freight Composition	22

1 Background

As Sydney's CBDs and other metropolitan centres continue to grow, it is critical to maintain an understanding of the changing nature and levels of freight needed to service them. Failure to consider freight and servicing activity can lead to an increase in congestion, pollution, poor productivity and safety issues.

Accurate forecasting of the future freight task allows planners and developers to design self-sufficient buildings and precincts which can comfortably accommodate their freight requirements, and ultimately lead to a better experience for residents, workers and visitors.

1.1 Global trends context

Within the 2017-2020 timeframe of this assessment, several global trends continue to emerge:

- Increasing density of residential developments in inner urban centres of metropolitan Sydney.
- The second set of measures in this report were taken in late 2020. At this time the impacts of COVID-19 were still evident with approximately 50-60 per cent of people continuing to work from home.
- Continuing increase of e-commerce deliveries to the home. In December 2020, Australia Post delivered 52 million parcels. This continues their approximate 20 per cent year-on-year increase in volumes.
- Between 2017 and 2020 food courier deliveries became common place. In 2017 deliveries via bike/motorbike were virtually non-existent.

1.2 Problem statement

This information is aimed to assist planners from state and local authorities with compliance during Development Approval (DA) processes for new developments. In recent years urban freight subject matter experts have worked directly with planners in Transport for NSW (TfNSW), Department of Planning, Industry and Environment (DPIE), local government and external consultants to advocate for better infrastructure in new developments to accommodate the growing freight task.

Consultants working for developers will often contend that current information is outdated. Transport impact assessments rarely provide good evidence to demonstrate understanding of the freight task a building will generate.

As well as insufficient capacity being provided, buildings often do not cater for sufficient sized vehicles on site (typically removal and waste). This can lead to impacts on the public domain and safety risks from activity not being conducted on level ground (Figure 1).



Figure 1: Removal activity unable to enter a residential development

By sharing the enclosed information externally with some anonymity of the addresses, it is believed that better outcomes can be sought from developers.

1.3 Scope

Video and manual surveys were undertaken during weekdays in November of 2017 and 2020 to record the volume and types of freight-related movements generated by residential buildings. A total of nine residential sites in metropolitan Sydney were surveyed; five in 2020 and four in 2017. The size and location of each residential site deliberately kept diverse to capture any sizable differences in trends or behaviours.

1.4 Limitations & assumptions

- Occupancy has not been determined. It is assumed that mature apartment blocks will always have a level of vacancy or people away. Observed levels of activity are therefore treated as being representative.
- No major internal construction activities at buildings were being undertaken during the survey period. These activities would generate more trade and service movements than usual. Renovation of some individual apartments was identified by traffic profiles. This is assumed to be a common activity.
- The size and occupancy per apartment in each development has not been assessed. In all cases the apartments represent a range of sizes.
- For the sites surveyed in 2020, Tuesday, Wednesday and Thursday were selected for the survey period. This is based on general freight activity observed throughout Sydney's loading zones and previous observations. It is unknown exactly how Mondays and Fridays would deviate from these.
- Movements categorised as 'pedestrian' are likely to have come from a vehicle parking outside of camera/staff view and should be considered when applying the

recommended freight trip generation rate. The size of these vehicles is obviously unknown. For the purpose of calculation average dwell time, we have excluded pedestrian movements that are shorter than 2 minutes and longer than 2 hours in duration.

- While attention has been given to distinguish non-private movements in private vehicles, it cannot be guaranteed that all private movements occurring in private vehicles are indeed private. Deliveries, especially from crowd-sourced organisations are not clearly branded and are difficult to identify. Tradespeople arriving at a site in their private vehicle (car) are also difficult to identify. Similarly Ute's are common as a private vehicle. Vehicles that stayed overnight or longer were excluded.
- Due to privacy constraints, it was difficult to identify whether a commercial vehicle was delivering or servicing a site. We have therefore manually categorised events marked as trade/service with a dwell time of less than 10 minutes as deliveries, with the assumption that trades/services need longer than this to be completed.

2 Comparison of high level trip rates (2017 vs 2020)

Residential buildings in 2020 are generating substantially more freight-related movements to service residents than in 2017. Most of this increase can be attributed to an uptake in food delivery services which comprise 96 per cent of bicycle deliveries and 92 per cent of motorbike deliveries.

Excluding bicycles and motorbikes, freight vehicle movements to apartments have increased by 21 per cent over the three year period. This does not reflect on the quantities or co-incidental drops that, for example, an Australia Post parcel courier may have made to various apartments in a single building during one visit. Without such consolidation, the increases observed could be higher. High density residential would result in an efficiency factor for freight consolidation. This would be reflected in the below figures.

Table 1: Comparison of High Level Trip Rates (2017 vs 2020)

Movements Generated	2017	2020	Qty Change	% Change
All freight activity	0.16 /unit/day	0.26 /unit/day	+ 0.10 /unit/day	+ 62.5%
All freight (excluding deliveries made by cyclists and motorbikes)	0.14 /unit/day	0.17 /unit/day	+ 0.03 /unit/day	+ 21%

Between the types of movements it is observed that:

- Freight vehicles and food delivery bikes (including motorbikes) have different time of day profiles. There is some significant variability of these rates for different apartments potentially reflecting its location and demographic profiles.
- The buildings' infrastructure to support deliveries is different for bikes versus other vehicles. Typical loading dock facilities are required to receipt 0.17 freight movements per apartment per day (17 movements per 100 apartments) with consideration to profiles and dwell times described within this document. Unlike food deliveries by bike, these are relatively consistent numbers.

3 Residential freight generation (Nov 2020)

3.1 Sites and survey dates

The following five residential sites were surveyed for three consecutive weekdays (Tuesday-Thursday).

Table 2: 2020 Residential Sites

Address	Suburb	GFA	Dates Surveyed
Building20-1	Sydney CBD	256 apartments (37,950sqm) Commercial (50sqm)	10 th -12 th November, 2020
Building20-2	Sydney CBD	292 apartments (37,364sqm) Retail: (1,000sqm) Commercial: (2,000sqm)	10 th -12 th November, 2020
Building20-3	North Sydney	242 apartments (36,553sqm) Retail (1,000sqm)	3 rd -5 th November, 2020
Building20-4	North Sydney	211 apartments (13,890sqm) Retail (200sqm)	3 rd -5 th November, 2020
Building20-5	Green Square	302 apartments (26,376sqm) Retail (789sqm)	24 th -25 th November, 2020

3.2 Trip generation rates

Table 3 shows the amount of freight-related trips generated by each building. Since each site has a different number of units, a 'per unit per day' rate is applied to provide a comparative analysis.

When including food deliveries, some sites show lower or higher than expected levels of movements. It is suggested these behaviours are highly correlated with tenant demographics of that suburb.

Table 3: 2020 Trip Rates

	All Freight		All Freight (minus bicycles & motorbikes)	
Site	Trips per day	Trips per unit per day	Trips per day	Trips per unit per day
Building20-1	61	0.24/unit	38	0.15/unit
Building20-2	80	0.27/unit	54	0.18/unit
Building20-3	41	0.17/unit	35	0.14/unit
Building20-4	51	0.24/unit	41	0.19/unit
Building20-5	116	0.38/unit	48	0.16/unit

3.3 Holistic daily profiles

3.3.1 Vehicle type

With consideration to all buildings across all days surveyed (illustrated in Figure 2), peak arrival rate occurs at midday with 90 vehicles within the hour. Most van deliveries occur during business hours with peaks around mid-morning and mid-afternoon.

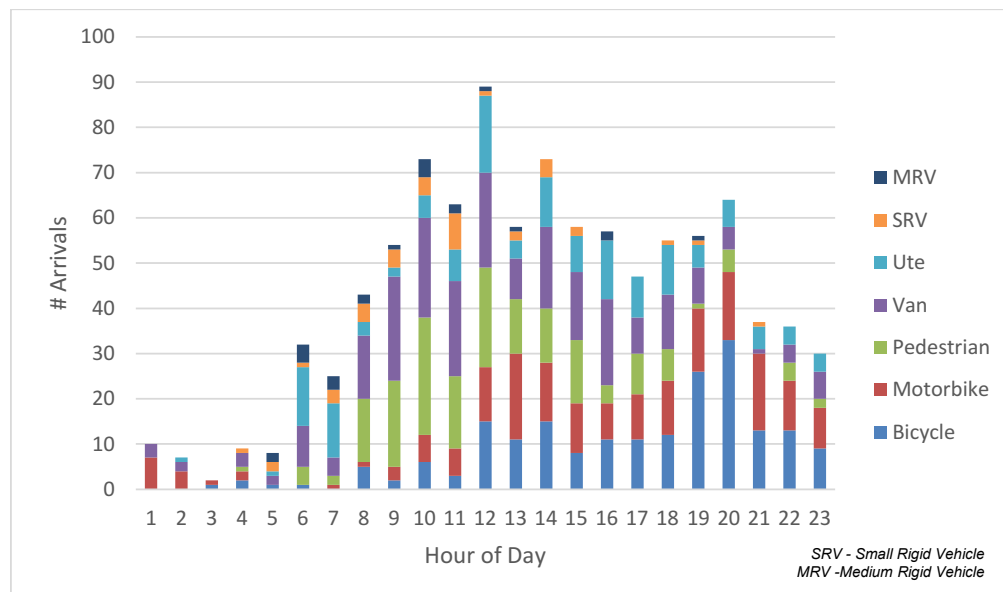


Figure 2: Hourly summation of freight & service vehicles across all sites and days

Table 4: Hourly composition of freight vehicles across all sites and days

Hour	Bicycle	Motorbike	Pedestrian	Van	Ute	SRV	MRV
1	0%	70%	0%	30%	0%	0%	0%
2	0%	57%	0%	29%	14%	0%	0%
3	50%	50%	0%	0%	0%	0%	0%
4	22%	22%	11%	33%	0%	11%	0%
5	13%	0%	0%	25%	13%	25%	25%
6	3%	0%	13%	28%	41%	3%	13%
7	0%	4%	8%	16%	48%	12%	12%
8	12%	2%	33%	33%	7%	9%	5%
9	4%	6%	35%	43%	4%	7%	2%
10	8%	8%	36%	30%	7%	5%	5%
11	5%	10%	25%	33%	11%	13%	3%
12	17%	13%	25%	24%	19%	1%	1%
13	19%	33%	21%	16%	7%	3%	2%
14	21%	18%	16%	25%	15%	5%	0%
15	14%	19%	24%	26%	14%	3%	0%
16	19%	14%	7%	33%	23%	0%	4%
17	23%	21%	19%	17%	19%	0%	0%
18	22%	22%	13%	22%	20%	2%	0%
19	46%	25%	2%	14%	9%	2%	2%
20	52%	23%	8%	8%	9%	0%	0%
21	35%	46%	0%	3%	14%	3%	0%
22	36%	31%	11%	11%	11%	0%	0%
23	30%	30%	7%	20%	13%	0%	0%

Food deliveries made up 96 per cent of bicycle activity and 92 per cent of motorbike activity. Isolating these vehicle types (Figure 3) shows arrival times occurring mostly into the evening.

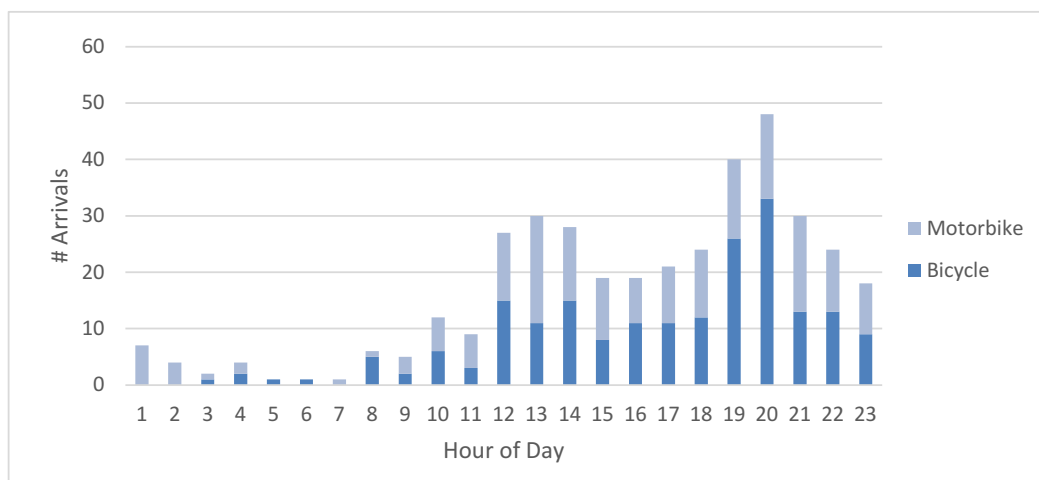


Figure 3: Hourly summation of freight & service vehicles across all sites and days (bike/motorbike only)

Without the bike/motorbike vehicles as illustrated in Figure 3, the arrival profile is similar to previously observed freight & servicing profiles. This is illustrated in Figure 4. The peak is more prolonged from 10am to 1pm. Food delivery cyclists or motorbikes are unlikely to require access to park in a loading dock. Therefore Figure 4 is a profile of vehicles that will require access to a loading dock. As previously observed, “pedestrian” access is a vehicular demand but the type of vehicle is unknown.

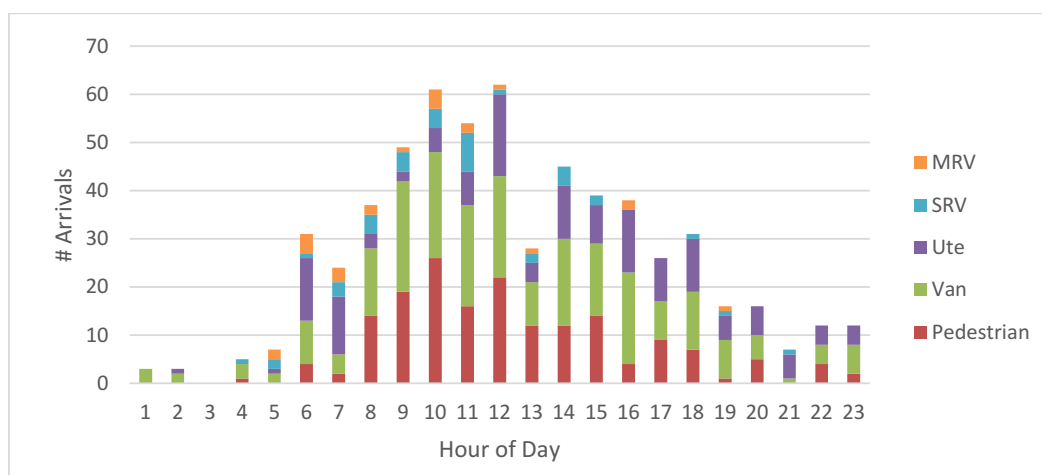


Figure 4: Hourly summation of freight & service vehicle types across all sites and days (except bike/motorbike)

Table 5: Hourly composition of freight & service vehicles across all sites and days (excluding bike/motorbike)

Hour	Pedestrian	Van	Ute	Car	SRV	MRV
1	0%	100%	0%	0%	0%	0%
2	0%	67%	33%	0%	0%	0%
4	20%	60%	0%	0%	20%	0%
5	0%	29%	14%	0%	29%	29%
6	13%	29%	42%	0%	3%	13%
7	8%	16%	48%	4%	12%	12%
8	37%	37%	8%	3%	11%	5%
9	38%	46%	4%	2%	8%	2%
10	43%	36%	8%	0%	7%	7%
11	30%	39%	13%	0%	15%	4%
12	35%	34%	27%	0%	2%	2%
13	41%	31%	14%	3%	7%	3%
14	26%	39%	24%	2%	9%	0%
15	36%	38%	21%	0%	5%	0%
16	11%	50%	34%	0%	0%	5%
17	35%	31%	35%	0%	0%	0%
18	23%	39%	35%	0%	3%	0%
19	6%	50%	31%	0%	6%	6%
20	31%	31%	38%	0%	0%	0%
21	0%	14%	71%	0%	14%	0%
22	33%	33%	33%	0%	0%	0%
23	17%	50%	33%	0%	0%	0%

3.3.2 Visit purpose

The graph below illustrates:

- Food deliveries begin from midday and maintain a constant level until all the way to midnight, peaking at 8pm.
- Trade vehicles arrive at a consistent rate from 6am to 6pm.
- There is an influx of courier deliveries from 9am to 1pm. This declines as the day progresses.

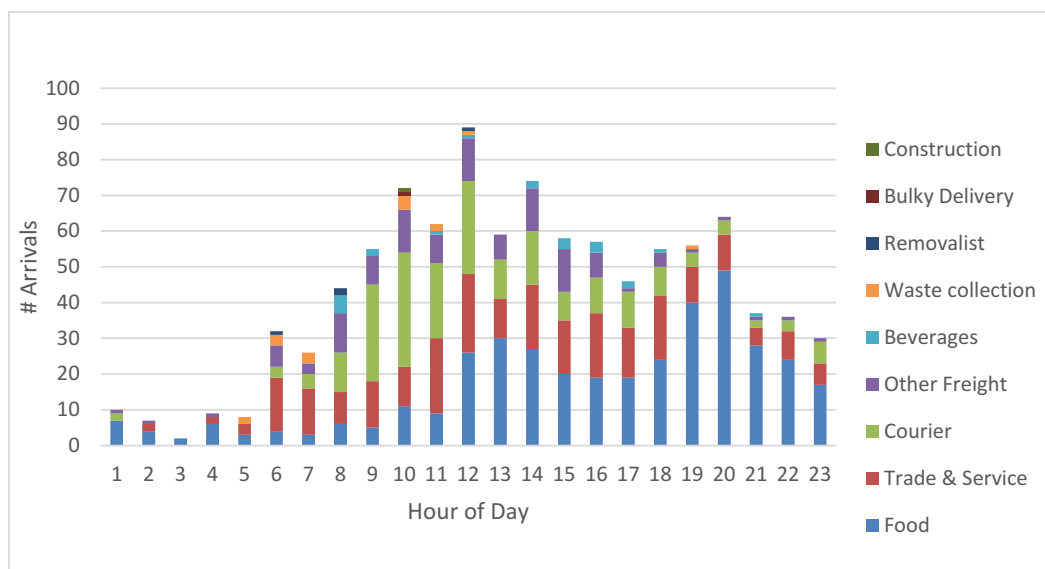


Figure 5: Hourly summation of freight & service vehicles visit purpose across all sites and days

Table 6: Hourly comparison of freight & service vehicles visit purpose across all sites and days

Hour	Food	Trade & Service	Courier	Other Freight	Beverages	Waste	Removalist
1	7	0	2	1	0	0	0
2	4	1	0	2	0	0	0
3	2	0	0	0	0	0	0
4	6	2	0	1	0	0	0
5	3	1	0	2	0	2	0
6	4	15	3	6	0	3	1
7	3	12	4	4	0	3	0
8	6	8	11	12	5	0	2
9	5	12	28	8	2	0	0
10	11	9	32	14	0	4	0
11	9	19	21	10	1	2	0
12	26	19	27	14	1	1	1
13	30	10	11	8	0	0	0
14	27	17	15	13	2	0	0
15	20	14	8	13	3	0	0
16	19	18	10	7	3	0	0
17	19	14	10	1	2	0	0
18	24	18	8	4	1	0	0
19	40	10	4	1	0	1	0
20	49	10	4	1	0	0	0
21	28	5	2	1	1	0	0
22	24	8	3	1	0	0	0
23	17	5	6	2	0	0	0

Note: The table excludes bulky deliveries and construction as there were only one data point for each.

While the quantities of movements are consistent, the suburb demographic of residential buildings appears to provide a high degree of influence over the types of freight generated. This would require further research.

Green Square (Zetland) demographics strongly lean towards young highly skilled and educated professionals from overseas with higher than average incomes. The population working more than 40 hours a week is significantly higher (56 per cent) than Sydney CBD (39 per cent), which supports the higher trend of food delivery services¹.

The Sydney CBD buildings (Buildings20-1 & 2) have identical food delivery ratios (34 per cent); as do the two North Sydney buildings (Buildings20-3 & 4) with food delivery ratios of 18 per cent.

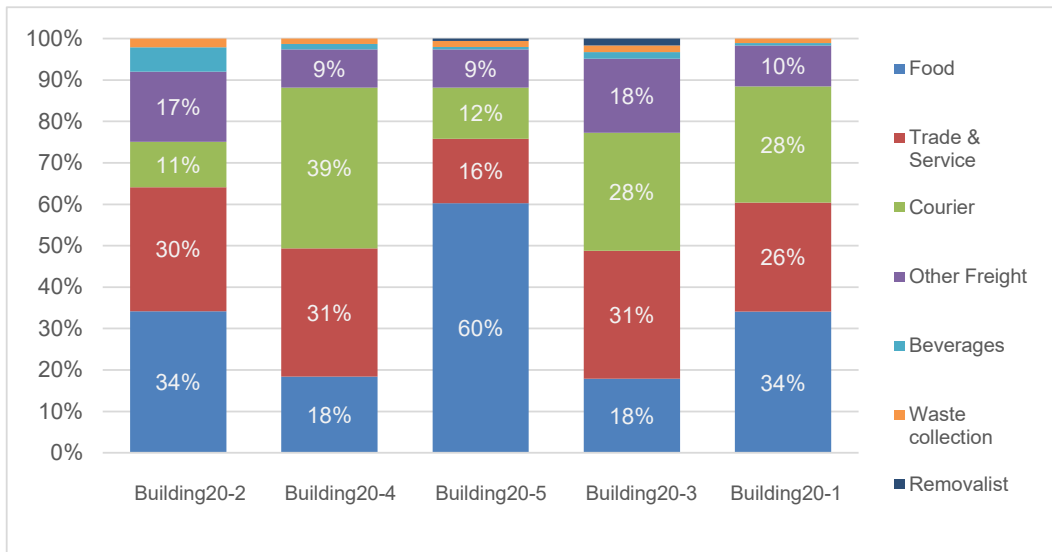


Figure 6: 2020 Residential freight and servicing composition

3.4 Vehicle types by building

The following tables show the average number of freight and servicing related movements per day made by each type of vehicle.

¹ <https://quickstats.censusdata.abs.gov.au>

Table 7: Average daily freight and servicing movements by vehicle type and site

Site	Pedestrian	Bicycle	Motorbike	Car	Van	Ute	SRV	MRV
Building20-1	9.7	21.7	1.7	0.7	16.3	8	3	0.3
Building20-2	10	19.7	6.3	1	27	10.7	2.7	2.7
Building20-3	7	1.7	5.3	0.7	14.3	7	4	1.7
Building20-4	7.3	5	5	0	19.3	12	1.3	1
Building20-5	24.3	21.3	45.7	0	5.7	14.7	2	2

In Table 8 below, the above figures have been adjusted to a per unit quantity:

Table 8: Average daily freight and servicing movements by vehicle type per unit

Site	Pedestrian	Bicycle	Motor bike	Car	Van	Ute	SRV	MRV
Building20-1	0.038	0.085	0.007	0.003	0.064	0.031	0.012	0.001
Building20-2	0.034	0.067	0.022	0.003	0.092	0.037	0.009	0.009
Building20-3	0.029	0.007	0.022	0.003	0.059	0.029	0.017	0.007
Building20-4	0.035	0.024	0.024	0.000	0.091	0.057	0.006	0.005
Building20-5	0.080	0.071	0.151	0.000	0.019	0.049	0.007	0.007

3.5 Visit purpose by building

The following Table 9 shows the average number of freight and servicing related movements per day by the purpose of the visit. This:

- Excludes Unknowns
- Excludes Construction and Bulky Deliveries (as there was only one of each movement observed across the entire period)

Table 9: Average daily freight and servicing movements by visit type and site

Site	Beverages	Courier	Food	Other Freight	Removal	Service	Waste
Building20-1	0.3	17.0	20.7	6.0	0.0	16.0	0.7
Building20-2	4.7	8.7	27.0	13.3	0.0	23.7	1.7
Building20-3	0.7	11.7	7.3	7.3	0.7	12.7	0.7
Building20-4	0.7	19.7	9.3	4.7	0.0	15.7	0.7
Building20-5	0.7	14.3	69.7	10.7	0.7	18.0	1.7

3.6 Dwell times

Median was used to calculate the typical dwell time for each activity purpose as there were outliers skewing the average. Overall dwell times are consistent with 2017 data and other wider observations. Courier and food deliveries take much less time to unload than bulky deliveries and tradespeople who require access to the site for prolonged periods to complete servicing tasks.

Table 10: Median dwell times of visit purpose

Visit Purpose	Data points with valid dwell time	Median dwell time [hh:mm:ss]
Beverages	21	00:10:06
Bulky Deliveries	1	00:36:25
Construction	1	01:16:06
Courier	211	00:04:33
Food	392	00:02:22
Other Freight	125	00:06:24
Removalist	4	00:50:53
Trade & Service	218	03:08:32
Waste Collection	16	00:08:35

When calculating dwell times, pedestrian events where dwell time has been recorded as less than 2 minutes or longer than 2 hours have been excluded. This is because parking and loading activity occurred out of camera view.

Table 10 includes only events with an arrival and exit time where dwell time can be calculated.

4 Residential freight generation (Nov 2017)

4.1 Sites and survey dates

The following four residential sites were surveyed for two weekdays within the same week (Tuesday and Thursday) on 21st & 23rd November, 2017.

Table 11 2017 Residential Sites

Address	Suburb	Apartments
Building17-1	The Rocks	212
Building17-2	Sydney CBD	170
Building17-3	Sydney CBD	178
Building17-4	Sydney CBD	131

4.2 Trip generation rates

Table 12 shows the amount of freight-related trips generated by each building. Since each site has a different number of units, a 'per unit per day' rate is also applied to provide a comparative analysis.

When including food deliveries, some sites show lower or higher than expected levels of movements. It is clear from further investigation this is highly correlated with tenant demographics of that suburb.

Table 12: 2017 Trip Rates

Site	All Freight		All Freight (excluding bicycles & motorbikes)	
	Trips per day	Trips per unit per day	Trips per day	Trips per unit per day
Building17-1	31	0.15/unit	23	0.11/unit
Building17-2	33	0.25/unit	28.5	0.17/unit
Building17-3	22.5	0.13/unit	20	0.11/unit
Building17-4	21	0.12/unit	20	0.15/unit

4.3 Daily profiles

4.3.1 Vehicle type

There is a substantial peak for van deliveries from 11am-12pm, with shoulder peaks during 8am-9am and 2pm-3pm.

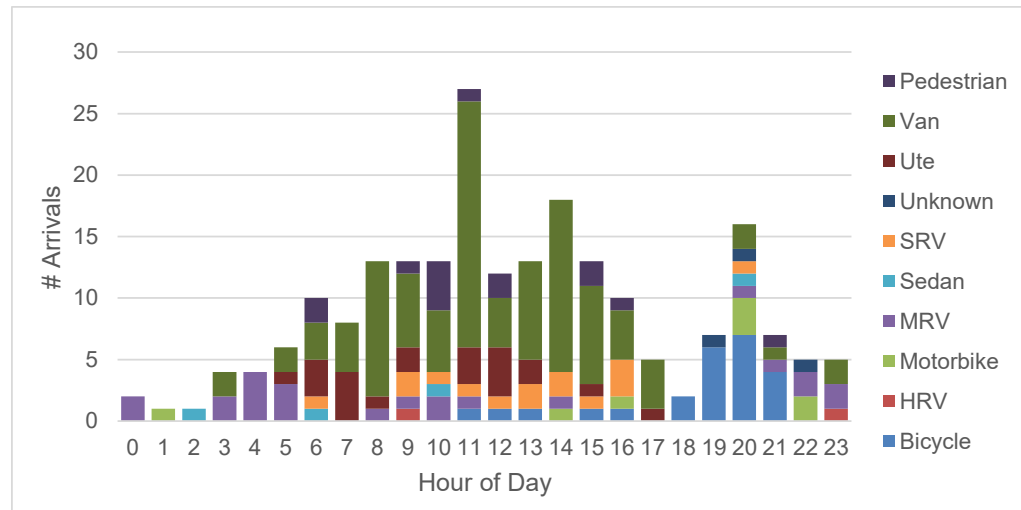


Figure 7: Hourly Summation of freight and servicing vehicles across all sites and days

Table 13: Hourly composition of vehicle type across all sites and survey period

Hour	HRV	MRV	Sedan	SRV	Ute	Van	Pedestrian
0	0%	100%	0%	0%	0%	0%	0%
2	0%	0%	100%	0%	0%	0%	0%
3	0%	50%	0%	0%	0%	50%	0%
4	0%	100%	0%	0%	0%	0%	0%
5	0%	50%	0%	0%	17%	33%	0%
6	0%	0%	10%	10%	30%	30%	20%
7	0%	0%	0%	0%	50%	50%	0%
8	0%	8%	0%	0%	8%	85%	0%
9	8%	8%	0%	15%	15%	46%	8%
10	0%	15%	8%	8%	0%	38%	31%
11	0%	4%	0%	4%	12%	77%	4%
12	0%	0%	0%	9%	36%	36%	18%
13	0%	0%	0%	17%	17%	67%	0%
14	0%	6%	0%	12%	0%	82%	0%
15	0%	0%	0%	8%	8%	67%	17%
16	0%	0%	0%	38%	0%	50%	13%
17	0%	0%	0%	0%	20%	80%	0%
20	0%	20%	20%	20%	0%	40%	0%
21	0%	33%	0%	0%	0%	33%	33%
22	0%	100%	0%	0%	0%	0%	0%
23	20%	40%	0%	0%	0%	40%	0%

Similarly to 2020 patterns, when bicycles and motorbikes are isolated, they tend to be skewed towards the evening and used for food deliveries:

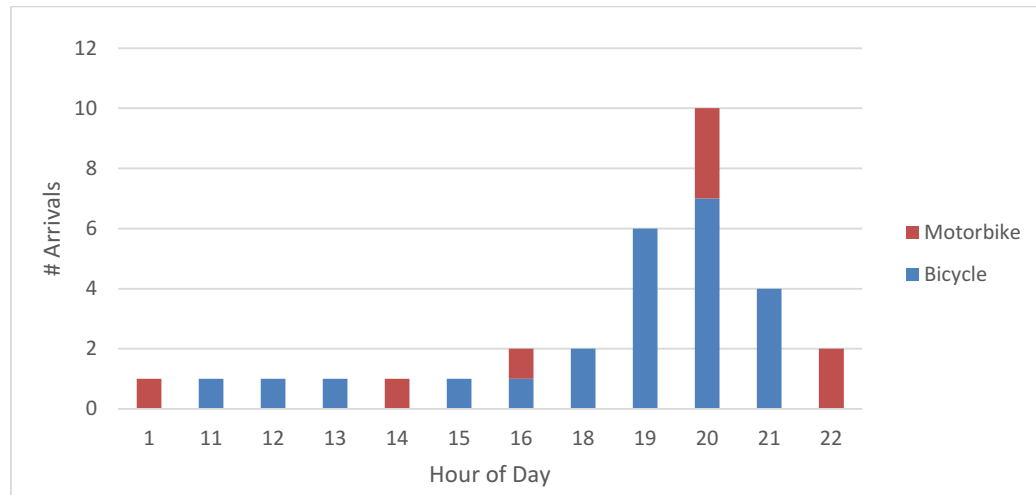


Figure 8: Hourly Summation of freight and servicing vehicles across all sites and days (cyclists and motorbikes only)

Excluding cyclists and motorbikes, the profile differs to the 2020 study in that there are distinct peaks that stand out from the profile (11am and 2pm). The smaller sample size of this assessment may influence the more erratic profile compared to 2020 data.

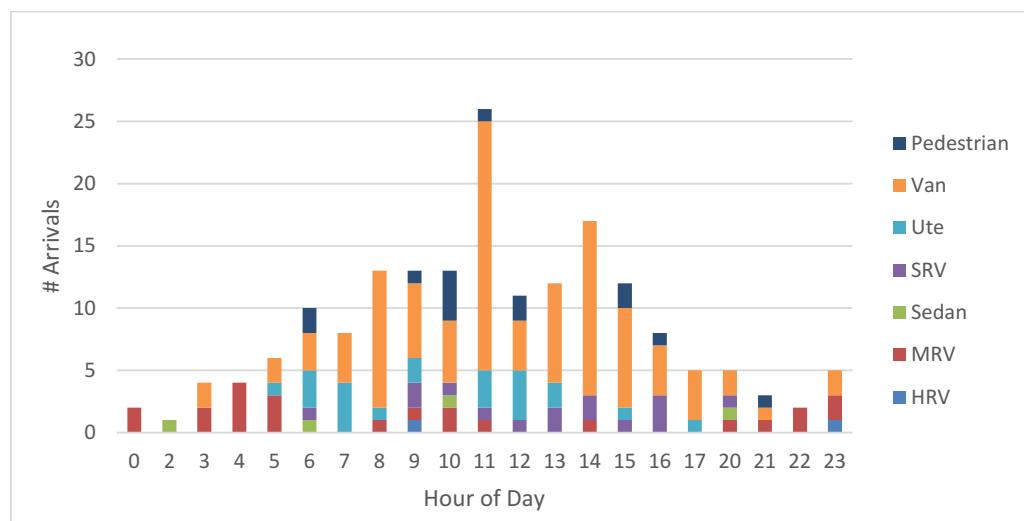


Figure 9: Hourly Summation of freight and servicing vehicles across all sites and days (excludes cyclists and motorbikes)

Table 14: Hourly composition of freight and servicing vehicles across all sites and survey period

Hour	HRV	MRV	Sedan	SRV	Unkn wn	Ute	Van	Pedest rian
0	0%	100%	0%	0%	0%	0%	0%	0%
2	0%	0%	100%	0%	0%	0%	0%	0%
3	0%	50%	0%	0%	0%	0%	50%	0%
4	0%	100%	0%	0%	0%	0%	0%	0%
5	0%	50%	0%	0%	0%	17%	33%	0%
6	0%	0%	10%	10%	0%	30%	30%	20%
7	0%	0%	0%	0%	0%	50%	50%	0%
8	0%	8%	0%	0%	0%	8%	85%	0%
9	8%	8%	0%	15%	0%	15%	46%	8%
10	0%	15%	8%	8%	0%	0%	38%	31%
11	0%	4%	0%	4%	0%	12%	77%	4%
12	0%	0%	0%	9%	0%	36%	36%	18%
13	0%	0%	0%	17%	0%	17%	67%	0%
14	0%	6%	0%	12%	0%	0%	82%	0%
15	0%	0%	0%	8%	0%	8%	67%	17%
16	0%	0%	0%	38%	0%	0%	50%	13%
17	0%	0%	0%	0%	0%	20%	80%	0%
19	0%	0%	0%	0%	100%	0%	0%	0%
20	0%	17%	17%	17%	17%	0%	33%	0%
21	0%	33%	0%	0%	0%	0%	33%	33%
22	0%	67%	0%	0%	33%	0%	0%	0%
23	20%	40%	0%	0%	0%	0%	40%	0%

4.3.2 Visit purpose

Broader definitions of visit purposes were used in 2017 to categorise activity, hence there are only five listed compared with the nine in 2020.

- Food/drink deliveries follow the same pattern as 2020 with a peak period of 8pm.
- Courier activity has a pronounced spike at 11am compared with 2020. As mentioned previously, this could be an effect of a relatively smaller sample size.

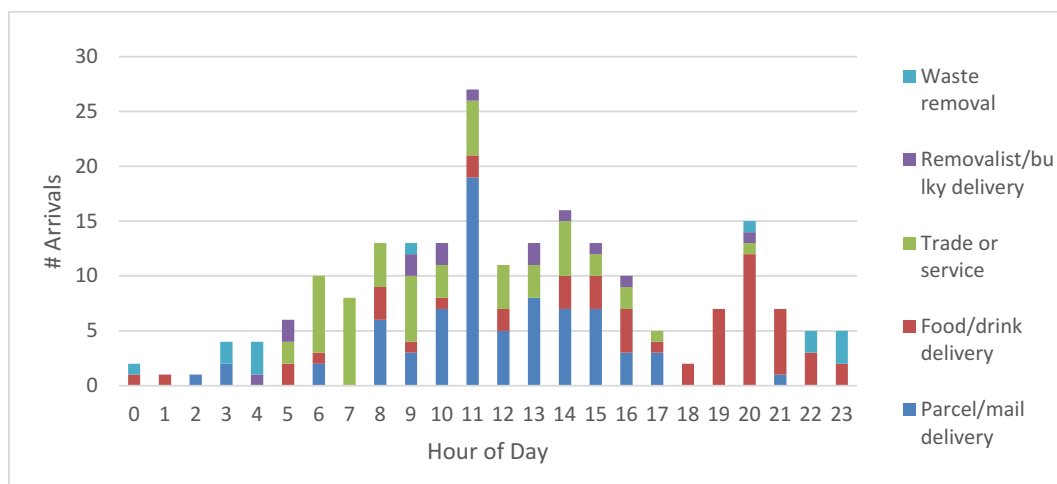


Figure 10: Hourly summation of freight and servicing visit purposes across all sites and days

Table 15: Hourly composition of visit type across all sites and survey period

Hour	Parcel/mail delivery	Food/drink delivery	Trade or service	Removalist/bulky delivery	Waste removal
0	0%	50%	0%	0%	50%
1	0%	100%	0%	0%	0%
2	100%	0%	0%	0%	0%
3	50%	0%	0%	0%	50%
4	0%	0%	0%	25%	75%
5	0%	33%	33%	33%	0%
6	20%	10%	70%	0%	0%
7	0%	0%	100%	0%	0%
8	46%	23%	31%	0%	0%
9	23%	8%	46%	15%	8%
10	54%	8%	23%	15%	0%
11	70%	7%	19%	4%	0%
12	45%	18%	36%	0%	0%
13	62%	0%	23%	15%	0%
14	44%	19%	31%	6%	0%
15	54%	23%	15%	8%	0%
16	30%	40%	20%	10%	0%
17	60%	20%	20%	0%	0%
18	0%	100%	0%	0%	0%
19	0%	100%	0%	0%	0%
20	0%	80%	7%	7%	7%
21	14%	86%	0%	0%	0%
22	0%	60%	0%	0%	40%
23	0%	40%	0%	0%	60%

As was observed in 2020 data, sites sharing the same suburb tend to have similar freight composition profiles. This trend is also apparent in the 2017 data. Building17-1

(The Rocks) shows a much different profile to those in Sydney CBD, especially in terms of food deliveries. Although food delivery ratios aren't identical in the Sydney CBD sites, they are very similar.

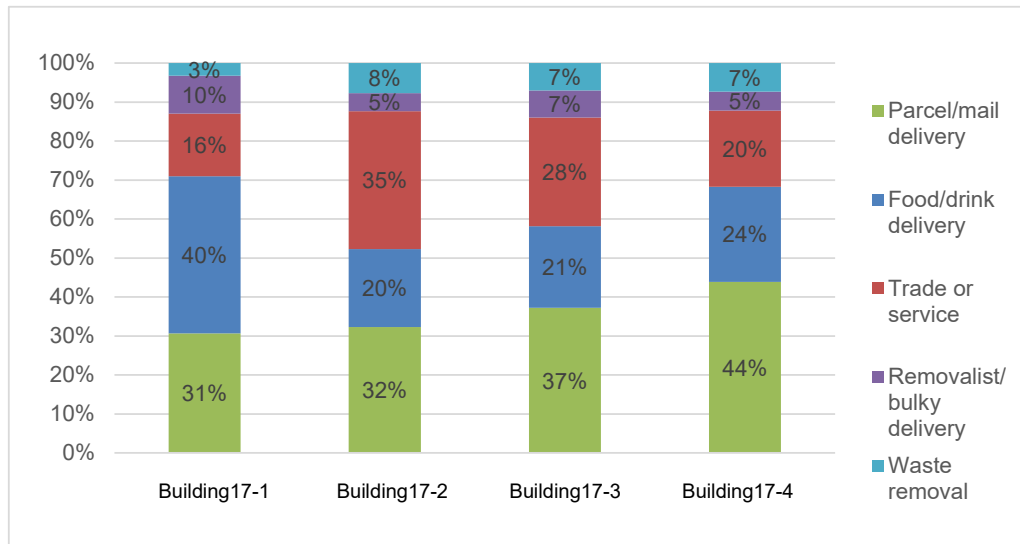


Figure 11: 2017 Residential freight composition

4.4 Vehicle types

Table 16 and 17 show the average number of freight and servicing related movements per day made by each type of vehicle.

Table 16: Average daily freight & servicing movements by site

Site	Pedestrian	Bicycle	Motorbike	Car	Van	Ute	SRV	MRV
Building17-1	1.5	5.5	2.5	0.5	13	1.5	3.5	2
Building17-2	3	4.5	0	0	15	4.5	2	2.5
Building17-3	0.5	2	0.5	0	11	3.5	0.5	4.5
Building17-4	2	0	1	1.5	11	1.5	1.5	2.5

Adjusted per unit:

Table 17: Average daily freight & servicing movements by site – adjusted per unit

Site	Pedestrian	Bicycle	Motorbike	Car	Van	Ute	SRV	MRV
Building17-1	0.007	0.026	0.012	0.002	0.061	0.007	0.017	0.009
Building17-2	0.018	0.026	0.000	0.000	0.088	0.026	0.012	0.015
Building17-3	0.003	0.011	0.003	0.000	0.062	0.020	0.003	0.025
Building17-4	0.015	0.000	0.008	0.011	0.084	0.011	0.011	0.019

4.5 Visit purpose

Table 18 shows the average number of freight and servicing related movements per day made by each purpose of visit.

- Excludes Unknowns
- Construction grouped as Service

Table 18: Average daily number of freight and servicing related movements by visit purpose

Site	Bulky/ Removalist	Parcel/ drink delivery	Food/ Drink	Trade/ Service	Waste
Building17-1	3	9.5	12.5	5	1
Building17-2	1.5	10.5	6.5	11.5	2.5
Building17-3	1.5	8	4.5	6	1.5
Building17-4	1	9	5	4	1.5

4.6 Dwell times

Median was used to calculate the typical dwell time for visit purposes, as outliers skewed the data. The only noticeable exception to anticipated results was the dwell time of tradespeople, these movements dwelled for considerably shorter period than 2020.

Table 19: Median dwell times by visit purpose

Visit Type	Data Points	Median Dwell Time [hh:mm:ss]
Removalist/Bulky Delivery	14	00:16:56
Parcel/Mail Delivery	74	00:02:48
Food/Drink Delivery	57	00:03:14
Trade/Service	53	01:36:22
Waste Removal	13	00:05:40

5 Conclusions

5.1 Residential freight demand is increasing, mainly from an uptake in food deliveries

On a per unit (apartment) basis, the arrival rate for freight-related movements increased 62.5 per cent from 2017 to 2020 for residential buildings. The increase is attributed to strong growth in food deliveries to residential premises, which increased by 40.9 per cent. Excluding bike and motorbike deliveries, residential demand for freight increased 14 per cent from 2017 to 2020.

While suburb demographics are closely tied with this, COVID-19 restrictions introduced in 2020 have undoubtedly added further incentive for tenants to order online and eat-in without leaving their homes. This may be viewed as an acceleration of expected trends.

It is unlikely that food deliveries by courier bicycle or motorbike will require a parking activity and therefore no access to the loading dock.

5.2 Recommended trip generation rates

It is recommended that when calculating loading dock designs for residential buildings, the following freight trip generation rates and dwell time (Table 20) are applied:

Table 20: Recommended arrival rates and dwell times for use in loading dock analysis

Movement purpose	Trip rate	Average dwell [hh:mm:ss]
Delivery	0.13/unit/day	00:06:24
Trade/Service	0.04/unit/day	03:08:44
Removals	0.001/unit/day	00:51:00
Total	0.17 unit/day	

Calculation:

- Table 8: Average daily freight and servicing movements by vehicle type per unit: (excluding cyclists and motorbikes) = 0.17
- Table 6: Hourly comparison of freight & service vehicles visit purpose across all sites and days: 2020 Ratio of delivery/collection (Food, Other Freight & Beverage, waste) to service (Trade/Service, & removalist) = 755:231
 - = 23% of all movements are trade/service related
 - = 77% of all movements are delivery/pickup related
 - = 0.4% of all movements are removals
- Table 10: Median dwell times of visit
 - Sum of data points x Median dwell for all delivery movements excluding food (Beverages, Bulk Deliveries, Courier, waste & Other Freight), minus

pedestrian activity (<2 mins, >2 hours), divided by all delivery data points = 06 mins 24 secs

- Sum of data points x median dwell for all service movements (Construction, Trade & Service), minus pedestrian activity (<2 mins, >2hours, divided by all delivery data points = 03 hrs, 8 mins, 44 secs

These figures only include trips that require a dock space to be serviced (all vehicles except bicycles and motorbikes). Pedestrian activity has also been included as it's assumed all of these movements originated from a vehicle outside of camera view.

It is important to factor both delivery and trade/service rates and dwell times when forecasting dock utilisation levels as there is a significant difference in dwell time use i.e. approx. 24 delivery vehicles could be serviced in the same time it takes to service one service vehicle.

A comprehensive breakdown of vehicular arrivals is shown in sections 3.4 and 4.4.

5.3 Suburb demographics and location correlated to certain behaviours

As the assessment has illustrated, not all residential buildings generate the same levels of activity, particularly for food courier deliveries. Results for other types of vehicles that would require access to a loading dock are more consistent across different buildings. While the universal rate in section 5.2 provides a useful guide, suburb demographics have been shown to heavily influence the demand of freight movements, particularly food deliveries and online shopping arriving via bicycle and motorbikes.

While some buildings illustrate variability in their current profile potentially influenced by demographics, it should be considered that the building and its infrastructure will be in place for many years and profiles may change over the age of the building. The variability between apartments is far greater for food deliveries via bicycle or motorbike than vehicles requiring access to a loading dock.

5.4 Freight arrival daily profile

Each residential building surveyed featured a similar arrival profile with peak activity occurring in the mid-late morning period as summarised in section 3.3. It is recommended that a daily profile and peak demand be considered from this section.