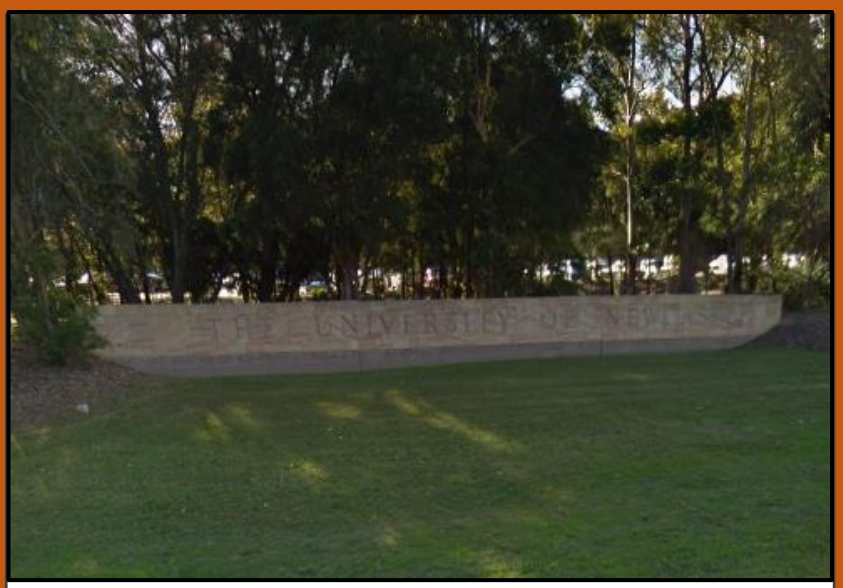

Semester 2, 2019 Modal Study

University of Newcastle

Callaghan Campus

December 2019

SECAsolution

Modal Study 2019
Callaghan Campus, Callaghan NSW

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Contents

1 Executive Summary

Seca Solution Pty Ltd was commissioned to conduct a Travel Mode Survey of the Callaghan Campus during the peak period for students and staff in August 2019 (Semester 2). The purpose of the Survey was to determine the number of vehicles and people accessing the campus by all modes of transport and to compare this with similar historic data to document trends in travel over time. The purpose of the report is also to inform the University and support their future planning and management associated with the Callaghan Campus.

The survey period was nominated to coincide with the commencement of the second semester with the survey period being the second and third week. The survey period commenced Tuesday 13th August and concluded Monday 27th August. A review of the previous report *University of Newcastle Transport Management Strategic Plan* prepared by Northern Transport Planning and Engineering Pty Ltd in 2013 was undertaken which determined that the peak period associated with the campus had been a Tuesday with various critical times throughout the day. This was compared with other more recent data Seca Solution had within the vicinity of the campus which confirmed that peak periods were anticipated to be of a Tuesday and Wednesday.

The Survey recorded the number of people coming to the campus by car, bus, train, walking and cycling. It also documented the travel patterns of passengers using the Callaghan to City campus shuttle and included face to face interviews with passengers using this service. The data collected is outlined in Table 1-1, with this occurring across the two week study period.

Table 1-1 Summary of data collection to inform the modal study

Method	Outcome
Tube counts at the key entry points	Record the number of vehicles entering and leaving the campus across 24 hours.
Vehicle occupancy surveys at the key entry points	Determine the number of people car sharing.
Parking beat surveys	To verify the capacity of the parking across the campus and to quantify the utilisation and vacancy rates.
Video data collection at the key pedestrian entry points	Determine the number of people entering the campus as pedestrians and cyclists.
Bicycle parking beat survey	Determine the number of bikes parked on campus.
Sample survey of activity at Warabrook Railway Station	- Number of arrivals and departures by train, - Percentage of passengers who then entered the campus, - Quantified the number of pedestrians entering campus and - Quantified cyclists entering from Train and Warabrook
Opal card tap on tap off data	Inform the number of passengers arriving and departing the campus by bus and train.
Inter-Campus Shuttle surveys	To determine the level of activity at the various campus bus stops and total patronage.

From the data the following peak hour (8am-9am) and morning peak period (7.30-10am) mode splits were determined per Figure 1-1 and Figure 1-2 respectively. It is noted from a review of prior modal studies completed for the Callaghan campus that the 7:30 to 10am time period provides an accurate reflection of the daily modal split.

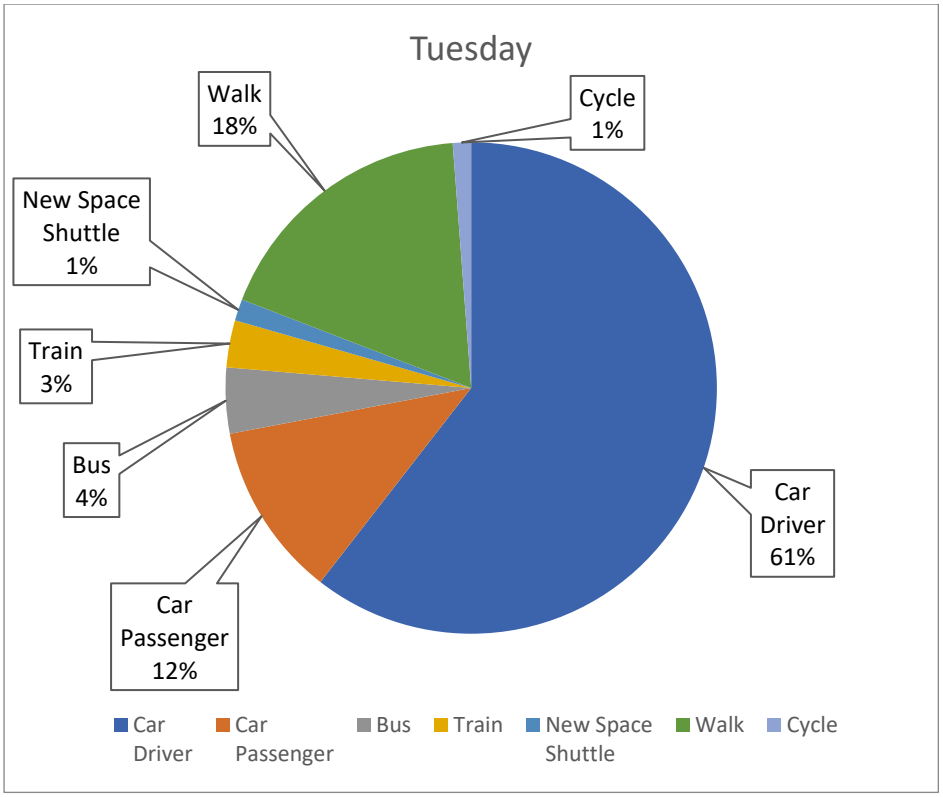


Figure 1-1 Mode split Tuesday AM Peak 8am-9am

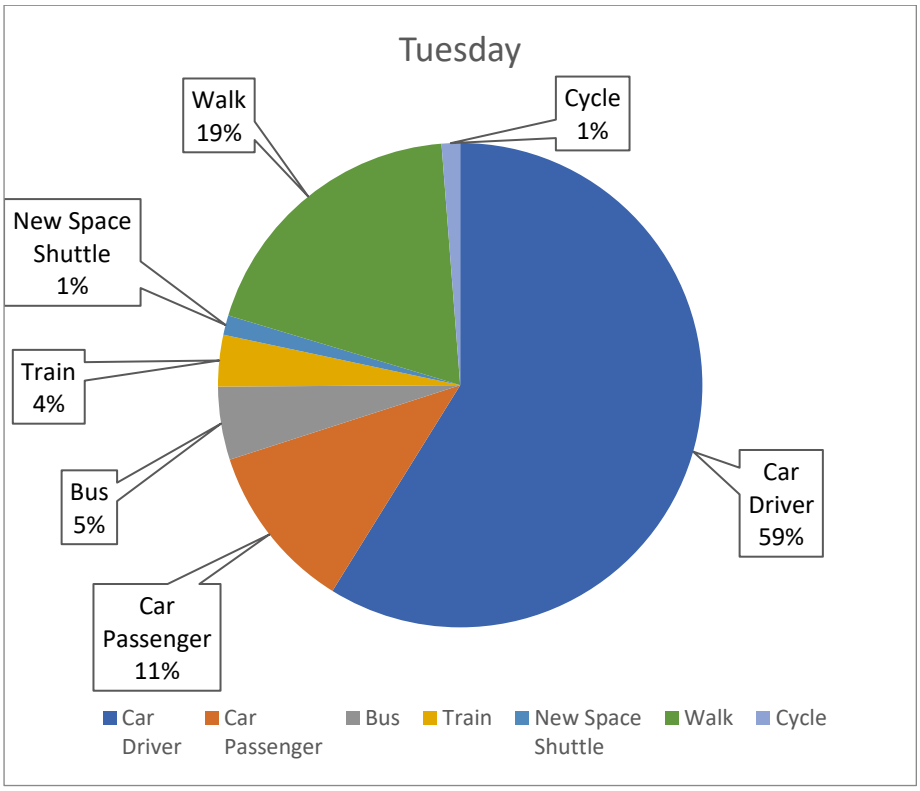


Figure 1-2 Mode Split Tuesday Morning Period 7.30am -10am

These compared with the mode splits provided in the 2013 survey report as shown below in Figure 1-3.

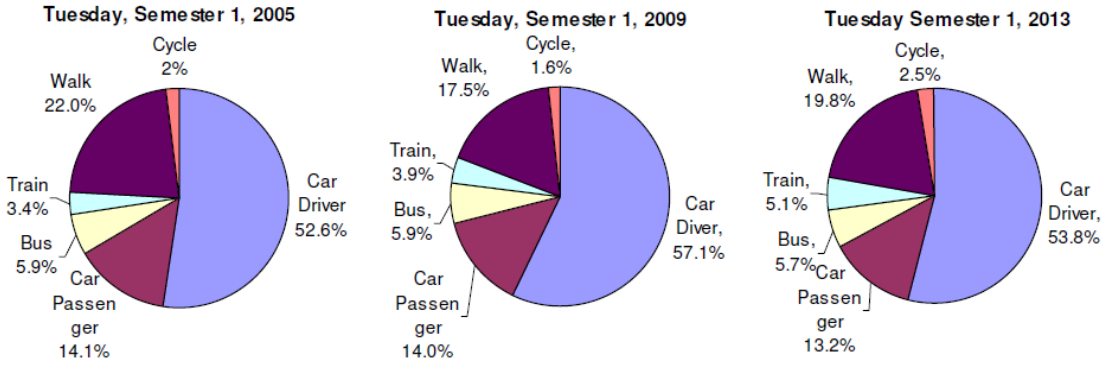


Figure 1-3 Travel Modes, Semester 1, 2005-2013 (Source NTPE 2013)

Compared to the Tuesday 7:30 to 10am period above, train usage has reduced (4% versus 5.1%) as has bus usage, however the Inter-Campus Shuttle has proven to be a popular mode of travel for staff and students between the City and Callaghan in the morning as well as for travel between the two campuses during the day. Cycling has shown to be the mode with the highest reduction with cycling at 1% of arrivals, the lowest percentage recorded.

The key findings below were determined:

- The most significant change across the campus is the reduction in overall activity.
- Overall the mode splits are relatively consistent with the 2013 surveys.
- Reduction in the car occupancy rate sees less arrivals to campus as passengers.
- Percentage of pedestrian movements has increased, reflecting the higher number of students living on campus or its environs.
- Train usage has reduced (4% versus 5.1%).
- Bus usage is consistent at 6% including the Inter-Campus Shuttle, which has proven to be a popular mode of travel for staff and students between the City and Callaghan.
- Cycling has shown to be the mode with the highest reduction with cycling at 1% of arrivals, the lowest percentage recorded.

Whilst the mode splits as percentages are relatively consistent, the numbers of vehicles arriving on campus across a day has dropped significantly and is now consistent with 2005 volumes. This correlates with the reduction in student enrolments at Callaghan with the Faculties of Law and Business as well as some of the Creative Industries now being based in the CBD at NeW Space. Overall student numbers at Callaghan are closer to those of 2005. This drop in overall activity combined with an increase in overall parking supply sees a higher level of parking available. In 2013 10% of parking spaces were vacant, in 2019 20% were. Of the 1353 vacant spaces (Thursday as equivalent point of comparison) 290 of these were general parking however there were 348 vehicles parked informally across the campus. The availability of parking is reflected in the reduced car occupancy rate and the shift away from other modes including cycling and train travel.

Consistent with the 2013 report the following in Table 1-2 is provided as a summary of campus activity (where comparable data is available) between 2005-2019.

Table 1-2 Snapshot of campus activity 2005-2019

Activity	2019	2013	2005
Student Enrolment	18133	22358	17308
Student Resident on Campus	1800	900	
Vehicles:			
Arrived in 24 hour period	11438	12917	11847
Arrived in daytime 7.30am-7.00pm	9747 (85%)	11588 (90%)	10678 (90%)
Arrived in morning peak hour (% of 24 hour total)	2264 (20%)	2770 (21%)	2586 (22%)
Maximum number on campus	5077	4979	4323
Total arrivals (7.30-7.00pm) by Car (% of total arrivals)	11599	14458 (67%)	13532 (67%)
Persons per vehicle	1.19	1.25	1.27
Total arrivals – drivers (% of total arrivals)	9747	11622 (54%)	10678 (53%)
Total arrivals – passengers (% of total arrivals)	1852	2846 (13%)	2854 (14%)
Came as pedestrian (% of total arrivals)	3221	4291 (20%)	4469 (22%)
Came as cyclists (% of total arrivals)	209	533 (2%)	416 (2%)
Parking (Note 2019 based on Wednesday count):			
Capacity on campus (including residential colleges)	5862 car spaces*	5171 spaces	4584 spaces
*Not including informal parking across campus	(+83 motorcycle)	(+119 motorcycle +62 inf motorcycle)	(120 motorcycle)
Parked vehicles on campus (#including informal)	5137# (+57 motorbikes)	4977 (68)	4108
Vacant parking spaces (% of capacity)	1353 (23%)	539 (10%)	703 (15%)
Vacant spaces for reserved parking (% total vacancies)	212 (16%)	150 (21%)	151 (21%)
Vacant spaces for general use (% total vacancies)	290 (21%)	36 (1%)	183 (26%)
Parking in adjacent streets outside the campus:			
Cars parked	387	906	972
Estimated people from these cars to University	461	1132	1232

1.1 Further Investigation

From the overall assessment the following were identified as being worthy of further investigation.

1.1.1 Parking

- The high vacancy rate for time limited parking
- Low utilisation of Park and Ride parking.
- Where vacancies for a category are disproportionally high compared with utilisation the overall demand for this category should be reviewed to assess suitability.
- What pattern of use sees some carparks with a high level of informal parking but also a high vacancy rate? Is there an absolute peak demand early in the morning which sees drivers parking informally which is quickly relieved after an early lecture?
- How can more remote parking spaces be more efficiently utilised?
- What impact does free parking have on driver behaviour? If the free parking within the campus was removed would these motorists park elsewhere for free or would they change their mode of travel? Face to face surveys could be undertaken at these carparks to collect valuable information in a manner similar to that undertaken on the shuttle bus.
- Consider promoting Liftango with its free parking as an option to these motorists

1.1.2 Inter-Campus Shuttle

Adequate Capacity – Passengers report they have been turned away due to full services. Is there adequate capacity to ensure patrons will continue to choose this as their preferred mode of travel? Full services will see passengers board earlier within the route rather than risking not getting on at their preferred stop. This sees more premium parking spaces near earlier bus stops being used instead of the nominated park and ride spaces at Carpark 14.

Use of Park and Ride Spaces – although 23% of patrons had driven to Callaghan to use the shuttle none of these indicated that they had used the Park and Ride parking spaces. This underutilisation of this parking warrants further

investigation to determine whether there are specific reasons for this including whether they are not located in the most appropriate locations to meet the patrons needs, is there a perception that they may not be able to catch the shuttle if they are towards the end of the route, are there safety concerns, do commuters want to get a cup of coffee before they catch the shuttle?

1.1.3 Vehicle Occupancy

- Consider opportunities to increase Liftango usage through awareness and promotion programmes.
- Review rules for Ride Share spaces. Are they able to be used by staff and students who informally carpool or are they restricted to Liftango participants? Is there an opportunity to make parking available for those that register as informal carpoolers who may share trips with friends but don't use the App?
- Increase awareness and promote the use of shared trips both formally and informally.

1.1.4 Bus Services

The ongoing commitment by Keolis Downer to improve bus services provides an opportunity for the University to leverage off this to increase bus patronage to the campus.

Recent changes to the privacy requirements for the Opal card data resulted in a lack of detailed information regarding the origin and destination of passengers by suburb and the demand for the various services. It is anticipated that this type of information may however be available in consultation with Keolis Downer in the future and it is suggested that this be investigated to support future assessments of bus patronage.

The popularity of the shuttle bus demonstrates the level of interest in reliable time effective bus services.

1.1.5 Train Services

The demand for train services is a factor of convenience, journey time and cost. Where commuters can park easily near a station and rely on suitably timed services, they are more likely to commute by train if the door to door travel time is comparable to driving and if parking at the end of the trip adds to the cost of the journey.

It is important that there aren't impediments to train travel and that those staff and students who use this mode are supported in their choice.

There is a definite demand for train travel from the Maitland line, particularly the Maitland LGA. This could warrant further investigation to ensure this pattern continues and that these travellers are supported in their journey choice.

There are opportunities to ensure that commuters from the Central Coast, Lake Macquarie etc are supported by suitable changeover of services at Hamilton. Should delays occur between these two lines then commuters will find this a less appealing travel option.

Ongoing liaison with Transport for New South Wales may see future opportunities for Opal Card Data supported. It is important to review train travel demands regularly to ensure that this mode continues to be well supported by staff and students.

1.1.6 Cycling

The significant reduction in cycling to the campus warrants investigation as this is a mode that has numerous benefits and is a mode that is being supported by ongoing infrastructure improvements. What has changed to reduce cycling? Liaise with NUBUG.

2 Introduction

2.1 Background

Seca Solution Pty Ltd has been commissioned by the University of Newcastle to conduct a Travel Mode Survey of the Callaghan Campus during the peak period for students and staff in August 2019.

The purpose of the Survey is to determine the number of vehicles and people accessing the campus by all modes of transport and to compare this with similar historic data to document trends in travel.

In undertaking this work and preparing this report it has been important to consider the report previously prepared in 2013 which compared that data with earlier (2005) surveys. It is also important however to understand the changes that have occurred at the campus and to take these into consideration in ensuring the new data not only provides trends but is also of value in justifying and supporting future changes associated with the University.

The survey period nominated has been critical in capturing the peak period at the commencement of the second semester with the survey period nominated as ideally being between the 12th and the 23rd August, 2019.

2.2 Report Overview

The report provides a summary of the data collected and its analysis by mode to determine the overall mode split for the Callaghan Campus in August 2019. Each mode has been compared with the historical data with commentary and recommendations for further investigation included in each chapter.

Chapter 11 provides an amalgamation of the peak hour data and morning arrival period to determine the mode split on both a Tuesday and Wednesday of the survey period and allows for comparisons with the historic mode data.

As previously identified, there are many possible factors that influence changes to travel patterns at the university campus. They include:

- numbers of staff and enrolled students
- changes to course structures and attendance requirements including part-time study
- development of NeW Space campus in the Newcastle city centre
- availability of student accommodation on, or within walking distance of, campus
- changes to lecture timetabling practices and presentation including online option
- students away from the campus on placement
- the number of additional parking spaces provided on the campus
- the cost and convenience of parking over other travel options
- the level of enforcement of parking restrictions during the period of the survey
- changes to public transport services
- provision of infrastructure for cycling and walking

3 Methodology

A review of the *University of Newcastle Transport Management Strategic Plan (NTPE 2013)* indicates that the peak period associated with the campus has been of a Tuesday with various critical times throughout the day. Planning was undertaken based on this historic data as well as other relevant information. This included a bike survey that Seca Solution has previously undertaken on the main regional cycling route at Maud Street, as well as traffic surveys conducted on behalf of the University at the key entry points along University Drive.

The methodology in Table 3-1 was proposed and adopted for the collection of data and its reporting:

Table 3-1 Project work methodology and reporting

	Collection Methodology	Reporting
Vehicle Surveys	As nominated in the brief, tube counts were installed at the seven locations requested for a two-week period to capture continuous data throughout the survey period. An initial parking count of all vehicles on campus was undertaken at a point in time to coincide with the tube counters when the number of parked cars would be at a minimum. This allows for analysis of the maximum vehicles accessing the campus in a day.	This data has been reported as requested in a manner that allows for a comparison with past years. The maximum number of vehicles on campus was determined allowing for the net increase in vehicles, allowing for the initial parking count to confirm a starting number. This is consistent with the approach undertaken in 2013. The need to adjust the NIER data through the extraction of traffic volumes associated with the golf course and retirement village has been allowed for.
Vehicle Occupancy	Vehicle occupancy surveys were undertaken at the four key entry points on two days between: • 8am to 10am • 1:30pm to 2:30pm • 4pm to 5pm	This data shall be reported as requested and include a comparison with past years. The vehicle occupancy for the campus is of importance in that it enables: • the number of attendees on campus who arrived by vehicle as either a driver or passenger to be predicted • the number of pedestrians entering the campus to be adjusted to allow for those that may have arrived by car but parked off site (external on-street parking) • commentary on the trends for car sharing, taking into consideration the University's support of carpooling through Liftango and the provision of RideShare parking spaces
Train Patronage	Transport for New South Wales provided Opal Card data for the survey period to detail the travel demands associated with Warabrook Railway Station. The station was also surveyed to quantify the distribution of commuters between the campus and Warabrook. The survey allows for differentiation of the number of people who enter the campus from Warabrook, as well as the number of train	Whilst there was the anticipation that this data would provide considerable value, greater than just the total number of train commuters arriving on each train from the east or west changes to the privacy requirements and levels of sensitivity of this data resulted in less detail than initially indicated. The data received for the two week period did not include the station of origin or departure although it did indicate the local government area that the journey

	users who then complete their trip by bike/scooter/skateboard.	commenced from. As the data was amalgamated by hour with passengers only quantified when greater than 18 the daily analysis was not possible. The peak periods were generally appropriate to determine the level of train patronage as well as peak services across the balance of the day and night time.
Public Buses	In a manner similar to the train data Opal Card data was provided by TfNSW for the 4 bus stops on campus.	In a manner similar to the train data, reporting for bus patronage was impacted upon by the level of detail available under the new privacy guidelines. Peak period patronage was determined in a manner suitable to support the mode share calculations and allowing for the significant changes in bus services since the past period, there is no like for like data comparison available.
Campus Shuttle	The survey of this mode took advantage of the opportunity to provide information that up until now has been unavailable. For two different days, Seca staff members rode the two shuttle buses at the beginning of the day and undertook counts of the number of passengers boarding and alighting at the various stops, including the city, during the morning peak, midday and afternoon peak. A short survey of passengers was undertaken, with questions as approved by the University.	The data for this was reported to reflect the activity by service and by stop across the various times surveyed. The travel survey undertaken enroute has been reported in a suitable summary of the information collected. This information enabled the quantification of the use of this service, including adjusting the inbound travel modes to allow for the departure of these people from Callaghan, as well as quantify the arrivals from the city to Callaghan.
Pedestrian and Cycles	Cameras were installed at the nominated locations to collect video data across two key days. This provided approximately 15 hours of footage per day (subject to light) and quantified the two way movement of pedestrian and cyclists with output provided in 15 minute groupings. Bicycle parking demands were also quantified during the days that the above data was collected. Surveys included the location and number of bicycles parked on campus, as well as sample counts of the bike hubs.	This data has been provided in a manner consistent with the historic data with the number of people entering as pedestrians or as cyclists (including skateboards and scooters). It was reduced by the number of pedestrians arriving to the campus having parked external to the site.
Campus Car Parking	A parking beat survey was undertaken across two busy days during the survey period, between 11am-1pm (peak period identified in 2013 report). The parking beat survey is considered important to verify the typical parking demands across the campus as well as those external to the site.	The parking beat surveys enabled the reporting of: • the number of vehicles parked by the type of parking space allocation, • number of vacant spaces at the busiest time across two days, • space occupancy rates for each carpark, This was reported by nominated precincts and as a total across the campus.

	Data was collected in a manner that allowed distinguishing of the various demands for parking types, including Park and Ride, RideShare, accessible, staff etc.	On-street parking external to the campus but associated with the University was also quantified taking into consideration typical residential demands (Nearmap) as well as those vehicles associated with construction opposite the campus. The traffic survey data also allowed for an accumulation assessment of the site as a whole and was compared with an assessment of the available parking throughout the site to quantify the total parking demands for the campus on an hourly basis.

3.1 Changes Impacting Data Collection

Since prior collection the campus has seen significant changes that have impacted on the data collection.

These are noted below.

Student Enrolments	In Semester 2, prior to census date the student enrolments were in the order of 17,554-18,711. The difference of 1,157 represents students who withdrew prior to census and so may have been on campus during the data collection period. Staff numbers at 31st July 2019 were 2150 FTE with actual numbers of staff of 2,837 excluding casuals. Student enrolments in 2013 were 22,358 and in 2005 were 17,308. Based on this student enrolments would be in the order of 4800 less than in 2013 which equates to a reduction of around 22% and only 800 more than in 2005. This reflects the move to NeW Space of the Faculties of Law and Business as well as students undertaking studies in Creative Industries.
Shuttle Bus Park and Ride	The introduction of the City Campus Shuttle Bus creates demands for parking at Callaghan for staff and students studying in the Newcastle CBD at NeW Space and the Conservatorium. It also however allows for staff and students of Callaghan who live close to the city to travel by shuttle rather than drive to Callaghan. Details of this are in Chapter 6
NIER Site operational	Traffic accessing the campus from Vale Street to the NIER site. No vehicle access to the main campus available.
	In 2013 vehicle movements in this location were noted as being primarily occupied by construction activity with less than 15 vehicles each day parking in the area associated with the campus.
Student accommodation for 900 additional students	The four tower accommodation opened in 2015.
Bike hubs	New bike hubs were installed in 2014 to support cycling to the campus.

4 Vehicle Surveys

4.1 Data Collection

Tube counters were installed at seven locations to determine the movements of vehicles into and out of the campus. The counters were installed from Wednesday 14th August to Tuesday 27th August 2019, with vehicle arrivals and departures across each day for Weeks 2 and 3 of Semester 2 recorded. The locations are listed below and shown in Figure 4-1, including the six vehicular entrances to the campus, with the seventh counter being installed to the north of the NIER precinct in order to determine the demands in this location that are not associated with the University and deduct these from the flows recorded at station 5.

1. University Drive roundabout entry/exit to the Campus
2. University Drive / Stannett Street signalised entry/exit to the Campus
3. Wirra Crescent entry/exit to the Campus
4. University Residences entry/exit
5. Vale Street (NIER) entry/exit to the Campus
6. Kintaiba Road (IDC) entry/exit to the Campus
7. North of the NIER precinct

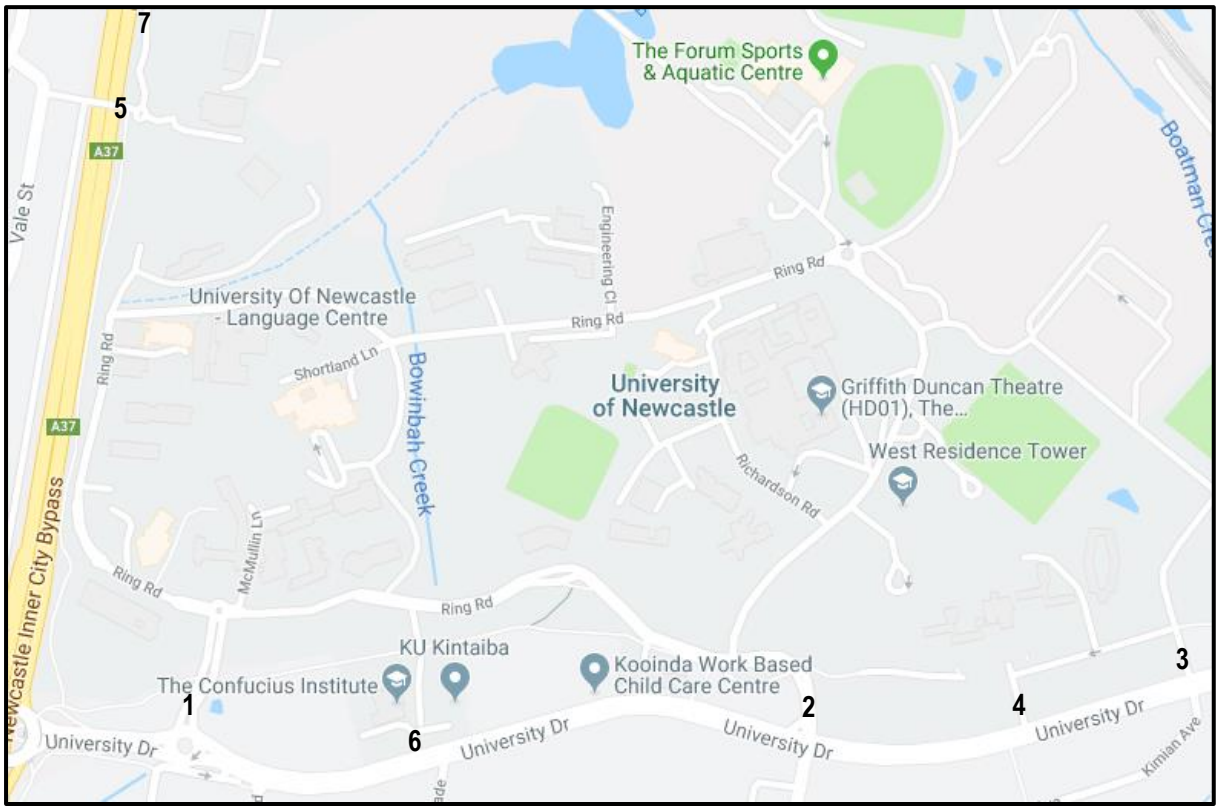


Figure 4-1 Location of electronic tube counters

Tube counters provide a high level of accuracy, however it is recognised there are some intrinsic errors that cannot be avoided, as listed below.

1. Vehicles not tracking in a straight line across the tubes. A vehicle crossing at an angle can generate additional pulses in the tube which result in a false reading by the counter for that vehicle.
2. Vehicles travelling too slowly or slowing down or speeding up as they cross the tube. Location 1 has high volumes with vehicle classifications which may be unlikely as a consequence of this.

The placement of the tubes was to avoid the above occurrences as much as possible.

4.2 Data Output

Based on the data historically collected for the site, three indicators have been used to monitor traffic flows on the campus:

- Daily vehicle arrivals: the number of vehicles arriving in the 24 hour period.
- Morning peak hour arrivals: the number of vehicles arriving between 8.00am and 9.00am.
- Maximum vehicles on campus: the largest difference between vehicle arrivals and departures on the same day, plus the vehicles counted overnight on the campus. The 'maximum vehicles on campus' is an indicator of parking demand. Actual parking demand would be slightly less, since the maximum vehicle number includes vehicles circulating around the campus.

The tube count data for the above main traffic flow indicators has been summarised in Table 4-1 and Table 4-2 below.

Table 4-1 Peak movement during peak arrival period (8am-9am) per count location

	Monday 19th		Tuesday 20th		Wednesday 14th		Thursday 15th		Friday 16th	
	In	Out	In	Out	In	Out	In	Out	In	Out
Location 1	1022	136	1178	135	1241	151	1117	142	988	143
Location 2	681	151	698	168	832	144	691	144	569	155
Location 3	222	41	230	45	251	57	214	54	213	45
Location 4	8	11	5	13	9	5	6	43	11	12
Location 5	136	27	135	22	128	29	133	27	132	21
Location 6	33	8	39	10	38	9	38	8	27	5
Location 7	22	18	21	15	63	24	65	20	26	17
TOTAL*	2080	356	2264	378	2436	371	2134	398	1914	364

*allowing for Location 7 to be deducted

Table 4-2 Daily movements per count location

	Monday 19th		Tuesday 20th		Wednesday 14th		Thursday 15th		Friday 16th	
	In	Out	In	Out	In	Out	In	Out	In	Out
Location 1	4606	4768	5149	5324	5248	5365	4904	5113	3987	4116
Location 2	3971	3930	4071	4060	4069	4173	3935	3948	3376	3441
Location 3	1380	1300	1428	1347	1453	1344	1420	1317	1268	1187
Location 4	270	267	267	287	257	288	324	338	286	298
Location 5	635	609	680	660	782	767	678	663	876	849
Location 6	102	101	143	148	107	105	98	101	69	69
Location 7	305	299	300	299	573	551	389	319	507	494
TOTAL*	10659	10676	11438	11527	11343	11491	10970	11161	9355	9466

*allowing for Location 7 to be deducted

4.3 Vehicle Arrivals

Table 4-3 below shows the total vehicle arrivals on campus for the nominated survey period during Semester 2 2019. Vehicle arrivals were consistent over the course of the week with the peak arrivals observed on Wednesday and the lowest number of arrivals of a Friday. The traffic arriving during the peak hour (8am-9am) on each weekday accounted for 19-21% of the total arrivals.

Table 4-3 Vehicle Arrivals at Callaghan Campus Semester 2, 2019

Time Period	Monday 19th	Tuesday 20th	Wednesday 14th	Thursday 15th	Friday 16th
Early Morning 2:00am - 7:30am	878	971	852	864	819
Morning Peak 7:30am - 10:00am	3731	4195	4355	3981	3686
Day Time Off-Peak 10:00am - 4:00pm	3705	3823	3866	3675	3120
Afternoon Peak 4:00pm - 7:00pm	1602	1729	1528	1562	1103
Night-Time 7:00pm - 2:00am	743	720	742	888	627
Total Arrivals	10659	11438	11343	10970	9355
Peak Hour 8:00am - 9:00am	2080	2264	2436	2134	1914
Percentage of Day Total					
Early Morning	8%	8%	8%	8%	9%
Morning Peak	35%	37%	38%	36%	39%
Day Time Off-Peak	35%	33%	34%	34%	33%
Afternoon Peak	15%	15%	13%	14%	12%
Night-time	7%	6%	7%	8%	7%
Peak Hour	20%	20%	21%	19%	20%

The main traffic flow indicators across each weekday are summarised in Table 4-4, which includes a comparison of the arrivals compared to historic data recorded in 2005 and 2013.To be comparable with 2013 data, reporting only the main entry points have been included for comparison and not Location 4 which provides entry to the residences.

Table 4-4 Callaghan campus traffic generation current and historic excluding Residential College entry

	Monday	Tuesday	Wednesday	Thursday	Friday
2019					
Daily Vehicle Arrivals	10389	11171	11086	10646	9069
Morning Peak Hour Arrivals	2072	2259	2427	2128	1903
Max Vehicles on Campus	4639	5077	5061	4864	4323
2013					
Daily Vehicle Arrivals	12999	12867	13107	12514	10003
Morning Peak Hour Arrivals	2550	2770	2786	2717	2440
Max Vehicles on Campus	4941	5029	5196	4993	4348

2005					
Daily Vehicle Arrivals	11532	11847	11997	11156	9078
Morning Peak Hour Arrivals	2477	2586	2719	2468	2010
Max Vehicles on Campus	4110	4323	4310	4002	3543
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
% Change 2013 to 2019					
Daily Vehicle Arrivals	-25%	-15%	-18%	-18%	-10%
Morning Peak Hour Arrivals	-23%	-23%	-15%	-28%	-28%
Max Vehicles on Campus	-6.5%	1%	-3%	-3%	-1%
% Change 2005 to 2019					
Daily Vehicle Arrivals	-11%	-6%	-8%	-5%	0%
Morning Peak Hour Arrivals	-20%	-15%	-12%	-16%	-6%
Max Vehicles on Campus	11%	15%	15%	18%	18%

A summary of the key trends from the above data is provided below:

- The highest level of activity in 2019 occurs of a Tuesday and Wednesday, consistent with prior surveys.
- Daily arrivals are lower in 2019 than that recorded in 2013, being similar in volume to levels recorded in 2005. This is consistent with 2005 student numbers which were approximately 800 less than 2019. (Refer Section 3.1).
- The difference between 2013-2019 sees variations of between 10% and 25% less daily arrivals across individual days, with morning peak hour arrivals 15%-28% less than in 2013.
- The maximum daily vehicles on campus in 2019 is less than those of 2013 with the exception of Tuesday which sees a slight increase.

This correlates with the potential for several significant factors:

1. Change in student enrolments and staff attending Callaghan Campus in recent periods including:
    a. transfer of courses to NeW Space
    b. changes to course structures and attendance requirements
    c. changes to lecture timetabling practices
    d. students away from the campus on placement
2. Increase in the number of students living on Campus since 2013.
3. Shift in mode of travel to the campus.
4. Changes to parking arrangements within the campus and external to the campus.

A review of the total arrivals for 2019 versus 2013, including the residence access, as a percentage of enrolments (Table 4-5 below) indicates that while peak hour arrivals continue to represent a consistent percentage of enrolments over time (except for Wednesday when total peak arrivals are relatively higher than 2013), the total number of arrivals as a percentage of enrolments has increased. This assessment is a crude comparison only and makes no allowances for the numbers of students living on campus, the number of arrivals associated with the park and ride etc. This shall be considered further in comments regarding vehicle occupancy and mode share.

Table 4-5 Callaghan campus total daily and peak hour arrivals as a percentage of student enrolments: 2019 versus 2013

Time Period	Monday 19th	Tuesday 20th	Wednesday 14th	Thursday 15th	Friday 16th
Total Student Enrolments 2019	18133	18133	18133	18133	18133
Total Arrivals 2019	10659	11438	11343	10970	9355
Peak Hour 2019 8:00am - 9:00am	2080	2264	2436	2134	1914
Total / Peak Hour Vehicle Arrivals as a % of student enrolments	59% / 12%	63% / 13%	63% / 13%	61% / 12%	52% / 11%
Total Student Enrolments 2013	22358	22358	22358	22358	22358
Total Arrivals 2013	13397	13026	13205	12674	10166
Peak Hour 2013 8:00am - 9:00am	2550	2770	2786	2717	2440
Total / Peak Hour Vehicle Arrivals as a % of student enrolments	60% / 11%	58% / 12%	59% / 12%	57% / 12%	45% / 11%

The comparison between the various survey periods for vehicle arrivals on campus are shown in Figure 4-2 below.

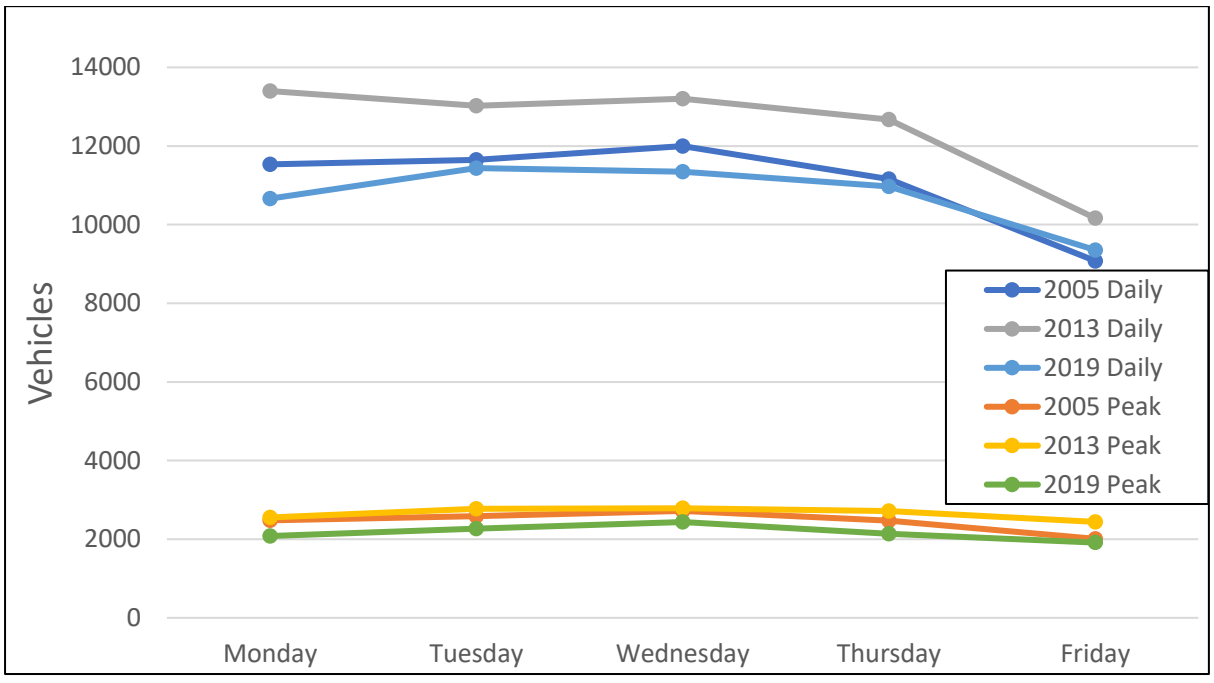


Figure 4-2 Historic comparison of Daily and Peak Hour Arrivals 2005, 2013 and 2019

4.4 Vehicle Departures

As expected, the peak departures occur at the end of the day between 4-5pm with the hour following (5-6pm) similar in volume to the hour preceding the absolute peak. Departures have a morning peak typically at 11am, which remains relatively consistent until 2-3pm when numbers increase steadily until the absolute peak hour.

The pattern of departures is similar on each weekday, Monday to Thursday, with earlier departures and less peak traffic on Friday. These are shown in Table 4-6.

The peak in 2019 typically occurs an hour earlier (4-5pm) than in 2013 when the peak traffic volume occurred in the hour 5-6pm.

Table 4-6 Pattern of peak departures by count location

	Wednesday 14th		Thursday 15th		Friday 16th		Monday 19th		Tuesday 20th	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Location 1	382	819	315	788	324	547	301	756	356	743[1]
Location 2	255	553	212	503	252	384	228	501	217	505
Location 3	98	193	69	184	108	137[2]	74	194	87	160
Location 4	23	27	20[3]	30[1]	24	29[4]	18	22	21	28[5]
Location 5	69	103	55	81	46	146	56	87	53	90
Location 6	*	29	*	36	*	21	*	27	*	30
Location 7	55	70	35	42[5]	33	66[5]	39	30[5]	26	38[5]

[1] 3pm [2] 5pm [3] 9am [4] 1pm [5] 2pm

*AM departure peak occur at 8-9am

4.3 Vehicles on Campus

Table 4-7 calculates the theoretical number of vehicles on the campus across the day, being the difference between the inbound and outbound vehicles at each 15 minute interval, allowing for an initial parking count to determine the existing number of vehicles on site. This initial count was undertaken on Tuesday 14th August from 11pm with in the order of 900 vehicles located on site. Due to systematic errors in the tube count data as detailed above (Section 4.1), and in a manner consistent with the approach in 2013, the number of vehicles remaining on campus overnight is assumed to be reasonably consistent throughout the week, being inclusive of students who reside on campus plus a number of students who remain on site to study/undertake research. Adjustment to a lower parked number on Sunday night/Monday morning reflects the impact of the weekend on overall campus activity.

From Table 4-7 following it can be seen that the peak hourly vehicle accumulation on the campus occurred between 11am-12pm on all days. This is similar to 2013 and 2005 where the peak varied between 11am and 1pm.

The absolute maximum vehicle accumulation on campus was 5,077 vehicles on Tuesday between 11:30pm and 11:45pm. The vehicle accumulation is an indicator of parking demand as well as reflecting those vehicles on campus but not parked i.e. circulating at any one point in time.

Ongoing increases in student residences on campus has seen an increase in overnight parking demands with the majority of these vehicles expected to remain on site for most of the day when students are in class. In 2013 the overnight parking count showed 350 vehicles on the campus. In 2019 the count was in the order of 900 vehicles. These vehicles were parked throughout the campus, with in the order of 120 vehicles parked in areas that would not be considered reflective of residential demands but rather night-time activities on the campus. This increase in residents' vehicles parked on site, while adding to the total vehicle accumulation, provides for trip containment and therefore contributes to the reduction in overall vehicle numbers entering and exiting the site during the peak periods.

Table 4-7 Vehicle accumulation 14th August – 20th August 2019

	Wednesday	Thursday	Friday	Monday	Tuesday
	14th August	15th August	16th August	19th August	20th August
Parked Overnight	**900**	**900**	**900**	**900**	**900**
1am	876	888	900	893	879
2am	882	892	900	901	888
3am	900	912	913	921	905
4am	898	910	912	923	905
5am	930	928	941	969	927
6am	1033	1020	1032	1073	1051
7am	1219	1236	1211	1290	1322
8am	2346	2279	2222	2272	2501
9am	4304	3933	3682	3855	4240
10am	4872	4575	4183	4370	4830
11am	4993	4770	4216	4587	5018
12pm	4828	4741	3963	4498	4945
1pm	4959	4631	3686	4496	4926
2pm	4787	4394	3462	4401	4691
3pm	4210	3781	3019	4053	4145
4pm	3508	3067	2386	3340	3315
5pm	2310	1995	1654	2342	2289
6pm	1672	1585	1184	1791	1752
7pm	1276	1284	1034	1545	1478
8pm	1122	1103	938	1331	1208
9pm	1004	967	874	1053	967
10pm	805	751	820	920	847
11pm	764	705	793	900	828
Maximum	5061	4864	4323	4639	5077

A representation of the vehicle accumulation, showing the trends across the various days of the week, is expressed in Figure 4-3 below. This indicates that the patterns of vehicle accumulation on site is generally consistent throughout the week, with peak accumulation coinciding with peak university times between 8am-5pm. Compared to other days of the week, vehicle accumulation on Friday decreases from 11am onwards, reflecting a higher number of students leaving the campus earlier in the day.

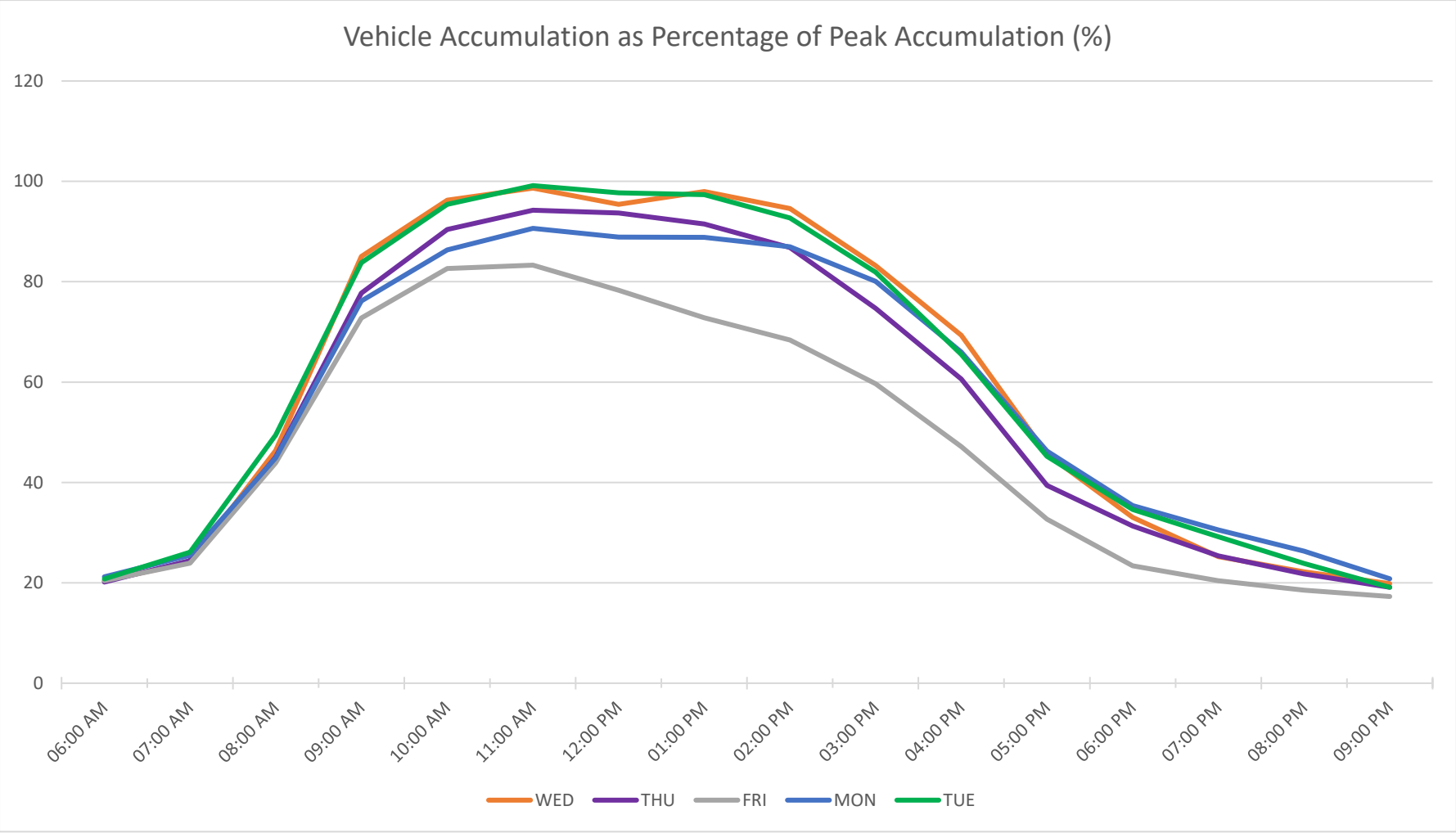


Figure 4-3 - Profile of vehicle accumulation throughout the week, expressed as Percentage of Peak Accumulation (%)

5 Car Parking

A survey of all vehicles parked on-campus was undertaken on the evening of Tuesday 13th August 2019 and between 11:00am and 1:00pm on Wednesday 14th August and Thursday 15th August 2019. Vehicles parking on roads surrounding the campus were also surveyed in these periods, as well as at the start of the day to verify local resident parking demands compared with parking associated with the campus. The time selected for the parking surveys was based on the historic peak demands for the campus which also correlates with the peak accumulation and the two busiest days as detailed above (Table 4-7).

A map of the parking areas and the precincts used for the analysis of the car park data are shown on the campus maps in **Appendix A**.

The car parks in the Ring Road precinct are accessed from the three entrances off University Drive being the Western Entrance Road, Stannett Street, and Wirra Crescent. The car parks in the residential precinct are accessed via University Drive (Residential Access Road) and Wirra Crescent.

Carpark 2C provides parking for the Kooinda Child Care Centre (KIN), Kintaiba Child Care Centre (KOO) and the Industrial Development Centre (IDC). The carpark is divided into two sections with no link between the two. Access to the section of parking west of the IDC building is via University Drive and provides 103 parking spaces while access to the section east of the IDC and adjacent to the childcare centres is provided via the Ring Road with 13 parking spaces.

Parking on campus is permitted in both formally marked spaces and in certain informal parking areas. Where formalised each space is allocated a category which are listed below:

- General – All day paid parking zones
- Staff – Staff only parking zones, permit required
- Reserved – For reserved permit holders such as spaces for Chancellor, Head of School, etc.
- Accessible – For Accessible permit holders only
- Time limited – Time-limited paid parking zones
- Service vehicles – For service vehicles only
- Residents – For resident permit holders only
- Motorcycles – Motorcycle parking only
- Load Delivery – For delivery vehicles only
- Ride Share – For drivers making use of ride share services such as Liftango
- Park and Ride – For drivers making use of the New Space Shuttle
- Fleet Vehicles – For University fleet vehicles
- Set Down / Pick Up – For vehicles dropping off/ picking up passengers

Some carparks were observed to have multiple allocated categories per space such as staff parking during the hours 8:30am-5:00pm and general parking outside these hours.

Monday to Friday (8:00am to 5:30pm) parking is available with a valid permit or by purchasing a parking ticket. At all other times, parking is free.

Informal parking has evolved over time with parking available adjacent to carpark 16 near the Warabrook railway bridge, near the ovals adjacent to carpark 13B and in carpark 15 with a total capacity of 56, 144 and 202 spaces respectively.

On-street parking has also been reported for the streets surrounding the campus. Data collected during the surveyed period has been compared to Nearmap surveys of the area to determine the number of vehicles parked outside of University times and the usage of on-street parking within the area related to the University.

The data and analysis provided in this chapter documents the vacant and parked cars across the campus for all the various types of allocated parking spaces. Informal parking is calculated separately to give a total parking capacity as well as a formal parking capacity.

A review of the vehicle accumulation derived from the tube data against the total number of vehicles parked on campus are comparable and are reflective of the difference in vehicles associated with cars circulating the campus through the 2 hours it took to conduct the parking survey.

5.1 On-Campus Parking

The University provided data on the formal parking capacity for the campus. Per the Archibus extract from 8th September 2019, the formal capacity is 6017 spaces, whilst a review of the plans provided for each nominated parking area determined a total of 6,118 spaces.

From the surveys conducted the actual on-site parking capacity was found to be 5,862 spaces. The drop in parking capacity found on-site is due to inconsistencies in the data provided, including:

- parking areas which do not exist such as parking in carpark 10 (squash courts), and numerous spaces throughout carpark 7 (e.g. adjacent to recent works done to demolish building ST1 to ST6)
- over estimation of parking spaces in non-line marked carparks such as carpark 8 (engineering) where the number of vehicles parked can vary day to day
- Car park 13 (area B) had up to 40 less parking spaces on-site than provided in the plans.

The carparks are divided among 9 precincts across the campus with the NIER precinct an addition to the university since the last modal study conducted in 2013. These precincts are listed below along with the numbered carparks associated with each:

- Precinct A (Front Carparks) – Carparks 1, 2 and 6
- Precinct B (Hunter Buildings – Carparks 7, 10, 11B and 18
- Precinct C (Sports Area) – Carparks 9, 12, 13 and 16
- Precinct D (Engineering) – Carparks 4 and 8
- Precinct E (Shortland Union) – Carpark 5
- Precinct F (Architecture) – Carpark 3
- Precinct G (Shortland Buildings) – Carpark 19
- Precinct H (Residential) – Carparks 11A, 11C, 14 and 15
- Precinct I (NIER) – Carpark 17

During the parking surveys conducted on both the Wednesday 14th and Thursday 15th August, the type of parking space was noted to enable an assessment of the parking utilisation by category. Table 5-1 below shows the parking usage by space allocation.

Table 5-2Table 5-2 and Table 5-3 show the parking space by Precinct for the Wednesday and Thursday surveys respectively. **Appendix C** expands on Table 5-2 and Table 5-3 by showing the parking space by carpark location.

Table 5-1 Callaghan campus parking utilisation by parking type

	2019			2013			2005
	Total Available Spaces	Wednesday 15th August	Thursday 16th August	Total Available Spaces	Tuesday 19th March	Wednesday 20th March	
		% Vacant	% Vacant		% Vacant	% Vacant	% Vacant
General	3016	7%	9%	2240	1%	0%	9%
Staff	891	9%	11%	1006	2%	4%	5%
Reserved	401	60%	53%	374	40%	34%	37%
Accessible	101	61%	72%	126	56%	43%	45%
Time limited	330	61%	73%	255	10%	9%	23%
Service vehicles	82	63%	70%	131	35%	41%	66%
Residents	590	12%	16%	428	12%	13%	13%
Load Delivery	35	60%	80%	9	22%	44%	-
Ride Share	45	40%	71%	39	28%	10%	-
Park and Ride	336	61%	62%	-	-	-	-
Fleet Vehicles	22	64%	41%	-	-	-	-
Set Down / Pick Up	13	69%	77%	-	-	-	-
Leased	-	N/A	N/A	83	35%	28%	-
Total Car Parking	**5862**	**20%**	**23%**	**5352**	**10%**	**9%**	**15%**
Motorcycles	79	30%	28%	119	43%	60%	57%

Table 5-2 Callaghan campus parking utilisation by Precinct, Wednesday 14th August 2019

	General		Staff		Reserved		Accessible		Time limited		Service vehicles		Residents		Load Delivery		Ride Share		Park and Ride		Informal Cars		Fleet Vehicles		Set Down / Pick Up		Motorcycles*		Informal Motorcycles*		Total Formal Parked	Total Formal Vacant	Total Informal Vehicles Parked	Formal Capacity
	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P				
Precinct A	34	1510	30	296	54	28	13	6	7	4	8	6	0	0	1	0	15	10	0	120	0	10	0	0	1	1	4	5	0	2	1981	163	10	2144
Precinct B	0	72	15	333	58	54	25	16	3	3	29	13	0	91	14	11	1	3	0	0	0	16	10	6	8	3	2	12	0	0	605	163	16	768
Precinct C	8	243	25	15	1	0	3	5	185	113	4	1	0	0	0	0	0	0	0	0	0	228	0	0	0	0	8	1	0	0	377	226	228	603
Precinct D	4	331	5	99	62	28	5	7	7	5	1	7	0	0	3	0	2	14	0	0	0	64	0	0	0	0	6	10	0	0	491	89	64	580
Precinct E	10	50	0	0	33	26	3	2	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	1	20	0	0	80	49	0	129
Precinct F	18	245	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	246	20	1	266
Precinct G	23	167	2	24	12	7	1	2	0	0	1	1	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	202	39	3	241
Precinct H	85	75	3	14	6	3	6	0	0	0	9	2	73	426	0	0	0	0	204	12	0	102	4	2	0	0	3	5	0	0	534	390	102	924
Precinct I	16	125	0	30	16	13	4	0	0	3	0	0	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	171	36	26	207
Total	198	2818	80	811	242	159	62	39	202	128	52	30	73	517	21	14	18	27	204	132	0	450	14	8	9	4	24	55	0	2	4687	1175	450	5862

V=Vacant P=Parked

* Motorcycles counted separately to cars

Table 5-3 Callaghan campus parking utilisation by Precinct, Thursday 15th August 2019

	General		Staff		Reserved		Accessible		Time limited		Service vehicles		Residents		Load Delivery		Ride Share		Park and Ride		Informal Cars		Fleet Vehicles		Set Down / Pick Up		Motorcycles*		Informal Motorcycles*		Total Formal Parked	Total Formal Vacant	Total Informal Vehicles Parked	Formal Capacity
	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P				
Precinct A	49	1495	20	306	33	49	16	3	8	3	9	5	0	0	1	0	21	4	4	116	0	2	0	0	0	2	4	7	0	0	1983	161	2	2144
Precinct B	2	70	30	318	61	51	27	14	5	1	33	9	1	90	22	3	0	4	0	0	0	7	7	9	10	1	3	15	0	0	570	198	7	768
Precinct C	52	199	34	6	0	1	6	2	217	81	5	0	0	0	0	0	0	0	0	0	0	209	0	0	0	0	3	2	0	0	289	314	209	603
Precinct D	9	326	2	102	52	38	8	4	8	4	3	5	0	0	3	0	11	5	0	0	0	32	0	0	0	0	9	7	0	0	484	96	32	580
Precinct E	1	59	0	0	25	34	2	3	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	23	0	3	100	29	3	129
Precinct F	17	246	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	246	20	1	266
Precinct G	42	148	3	23	17	2	3	0	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	174	67	3	241
Precinct H	88	72	5	12	5	4	6	0	0	0	6	5	96	403	0	0	0	0	203	13	0	66	2	4	0	0	5	3	0	0	513	411	66	924
Precinct I	30	111	1	29	19	10	4	0	3	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	150	57	25	207
Total	290	2726	95	796	212	189	75	26	241	89	57	25	97	493	28	7	32	13	207	129	0	342	9	13	10	3	26	57	0	6	4509	1353	342	5862

V=Vacant P=Parked

* Motorcycles counted separately to cars

Listed below are a few key observations taken from Table 5-1, Table 5-2 and Table 5-3 above as well as the tables presented in **Appendix C**.

- The total number of cars recorded on campus during the Wednesday survey was 5,137, with a further 57 motorcycles.
- The total number of cars recorded on campus during the Thursday survey was 4,851, with a further 63 motorcycles.
- Overall 20% of total on campus parking was vacant on Wednesday and 23% on Thursday. This sees an increase in vacant spaces by up to 8% over the 2005 surveyed data and an increase in up to 14% over the 2013 surveyed data.
- General parking saw an increase in vacancies from the 2013 results from 0-1% up to 7-9% which is the same as the level of vacancies observed in 2005. This is reflective of the reduction in student enrolments, more student residents on campus and the increase in general parking capacity over the 2013 survey.
- Reserved parking spaces have increased by 27 spaces since 2013. The vacancies however have also since increased by up 20% (from 40% in 2019 to 60% in 2020). It was noted in the 2013 modal study that the reserved parking spaces were not being utilised as efficiently as could be, with the 2019 results confirming this.
- Park and Ride parking spaces are a new type of parking space introduced since 2013. These spaces were highly utilised in Precinct A (carpark 2) with no vacancies observed on the Wednesday or Thursday. The number of vacancies was around 90% for the rest of the spaces within the University showing they are heavily underutilised. The spaces utilisation in carpark 2 is due to students making use of these spaces as general parking. The shuttle bus surveys confirm this with no students or staff surveyed nominating that they use these spaces but rather using general or staff parking. Further investigation of this is warranted.
- A total of 45 Ride Share spaces were observed across the campus with up to up to 40% vacant on Wednesday and 71% vacant on the Thursday showing these spaces are underutilised. Liftango data provided by the University shows an average of 20 vehicles per day using the service, which correlates to the number of vehicles utilising the ride share spaces which saw between 13-27 spaces occupied.
- Residential parking saw minimal changes to those observed in 2013. The evening count confirmed that the demand for resident parking is in excess of the number of spaces provided however the use of general parking overnight within the vicinity of the residences is adequate for this.
- The balance of allocated spaces (load and delivery, ride share etc.) all saw high numbers of vacancies including the new types of spaces (fleet and set down/pick up spaces).
- Precinct C and H have a high number of informally parked vehicles as well as a high number of vacancies. For Precinct C this is due to the high number of informally parked vehicles around carpark 16 and the high number of vacancies in carparks 9, 12 and 13. Precinct H has a high number of vacancies in carpark 14 and the high number of informal parked vehicles in carpark 15. A reason this could occur is the informal parking areas in these precincts are free parking with the adjacent carparks incurring a fee as well as the further the carpark from classes the higher the number of vacancies for paid parking.

The informal parking throughout the university is limited with much of the informal parking occurring around carpark 16 and the Warabrook Station bridge as shown in Photo 1 following. Car park 8 (engineering) sees a large amount of informal parking with up to 64 vehicles parked on the Wednesday. These informally parked cars restrict movements in some locations and may require investigation to understand and manage this parking demand within this area.

Over the two surveyed days a number of carparks saw certain allocated spaces at or near capacity, with these listed below:

Wednesday 14th August

- General Parking: Carpark 4 and 10 full, and carparks 2, 6 and 16 had only one vacant space.
- Staff Parking: Carpark 10 and 17 full. Carparks 1, 6, 8, 10, 17 and 19 saw between 1-3 vacancies.

- Resident Parking: Carpark 11B full.
- Ride Share Spaces: Carpark 4 saw 2 vacancies.
- Set Down / Pick Up: Carpark 2 and 7 full.

Thursday 15th August

- General Parking: Carpark 4 and 16 full, and carparks 5 and 10 with 1 and 2 vacant spaces respectively.
- Staff Parking: Carpark 4 and 18 full. Carparks 4, 6, 11C, 18 and 19 saw between 1-3 vacancies.
- Resident Parking: Carpark 11B had 1 vacancy.
- Ride Share Spaces: Carpark 7 full.
- Set Down / Pick Up: Carpark 2 full.

Photo 1 - Informal parking adjacent to Carpark 16 and the Warabrook Station bridge

5.2 Free Parking

Free parking is provided at the following locations across the University:

- Carpark 16: with a high utilisation across the two surveyed days with only 1 vacancy observed over both days.
- Carpark 13B: with a high utilisation observed on the Wednesday (7 vacant / 137 parked) and a lower utilisation Thursday (48 vacant / 96 parked)
- Informal parking areas around carpark 16 with 96 and 93 parked adjacent to carpark 16 on Wednesday and Thursday respectively and 125 and 121 parked east of carpark 16 alongside the road on Wednesday and Thursday respectively. It is noted that the informal areas near carpark 16 were also observed to be fully utilised on the Tuesday.
- Informal parking areas around carpark 15 with 102 observed parked on Wednesday and 66 parked on Thursday.

5.3 On-Street Parking

On-street parking was surveyed over the course of Wednesday the 14th and Thursday the 15th of August to determine the number of vehicles utilising free parking within the proximity of the University. The following streets surround the University which are shown in Figure 5-1 below:

- University Drive: from Wirra Crescent to the western access to the Ring Road.
- Stannett Street / Kimian Avenue: Along the both sides of both streets for the full length.
- Sunset Boulevarde Area: including Sunset Boulevarde, Turana Parade, Lester Parade, Canara Place, Andrew Close, Faulkner Crescent and Kindra Place.
- West of the Bypass: including Vale St/Moore St, Wilkinson Ave, Naughton Ave, Rae Street, Lee Crescent, King Street, Callaghan Apartments, Margaret Jurd College, Sandgate Road, Coughlin Street and Martin Street.

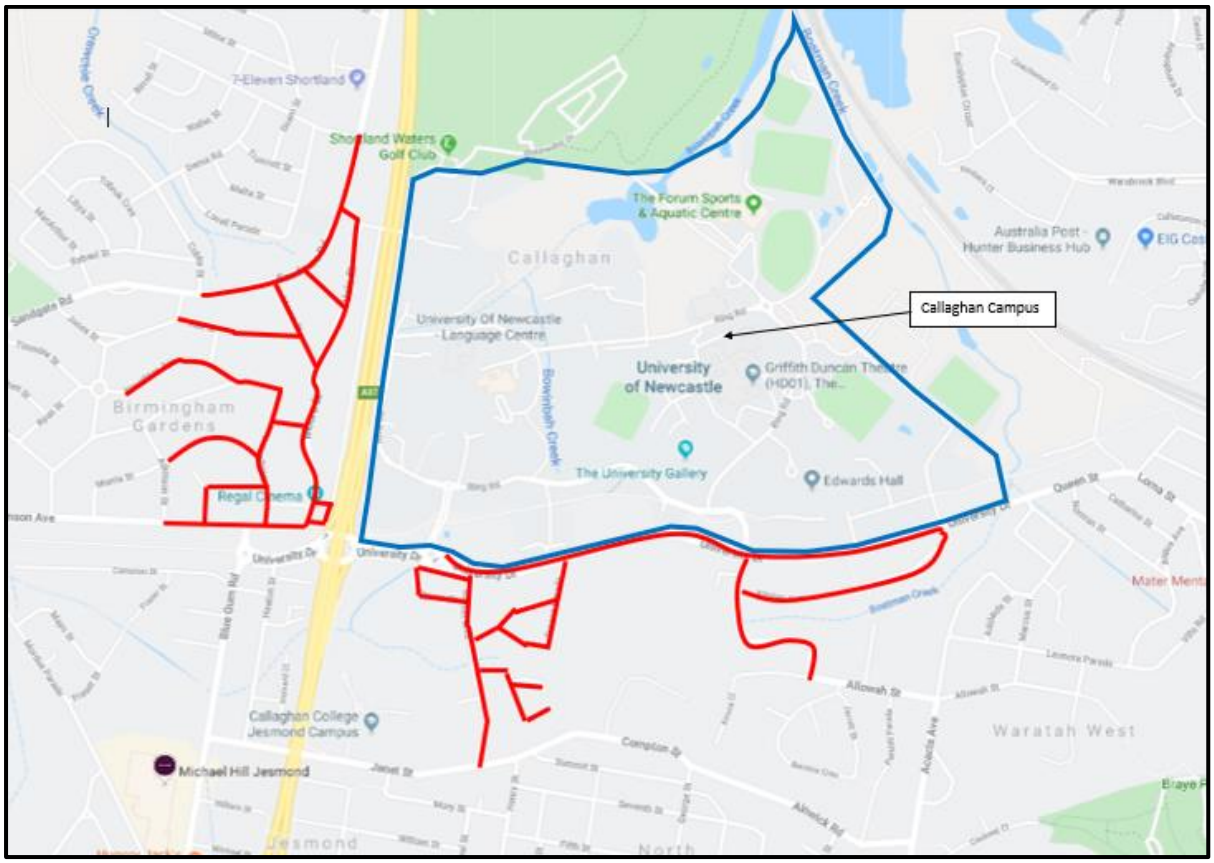


Figure 5-1 Streets surveyed for on-street parking

Table 5-4 below details the total number of vehicles parked on street for both 2013 and 2019.

Table 5-4 Total vehicles parked on-street

	2019		2013	
	Wednesday 14th August	Thursday 15th August	Tuesday 19th March	Wednesday 20th March
University Drive	275	277	369	332
Stannett Street / Kimian Avenue	71	58	131	149
Sunset Boulevarde Area	126	135	168	179
West of the Bypass	179	112	219	208
Total	**651**	**582**	**887**	**868**

As shown above in Table 5-4 the total vehicles parked on-street surrounding the University has decreased since 2013. Most notable is the decrease in vehicles along University Drive, Stannett Street and Kimian Avenue. On Wednesday the number of vehicles along Stannett Street / Kimian Avenue has decreased by over half since 2013 reflecting local parking controls which have been implemented. The number of vehicles parked along University Drive has decreased by 20% on Wednesday. There is current construction being undertaken along University Drive which has had some, but generally little, impact on the parking availability with up to 5 construction vehicles occupying spaces, as well as up to 2-3 spaces unavailable due to construction entry points and sections blocked off with traffic cones. This parking shall be unavailable in the future as there is a sheltered left turn lane being constructed along University Drive to the west of Stannett Street

Further analysis was undertaken to determine the demand for on-street parking not generated by the University. This included:

- A review of Nearmap aerial imagery to determine the typical on-street parking demands for periods outside of the University semesters, with these completed for 8th December 2018 and 22nd April 2019.
- Parking counts undertaken at 7:30am on Wednesday 14th August 2019, prior to the peak university student parking demand on the surrounding streets.

The demands determined are provided below in Table 5-5.

Table 5-5 Surveys of on-street parking

	14th August 2019 (7:30am)	22nd April 2019 (Easter Monday)	8th December 2018
University Drive	129	31	23
Stannett St / Kimian Ave	20	28	22
Sunset Boulevarde Area	54	64	61
West of the Bypass	153	162	184
Total	356	285	290

As shown in Table 5-5 above the on-street parking within the streets surrounding the campus is relatively consistent over the surveyed periods. The only difference being the number of vehicles parking along University Drive with the two surveyed dates outside of the University semesters incurring a lower number of parked vehicles. This reflects the high number of student residents parked here for convenience in the vicinity of the student accommodation.

The following differences have been noted in comparing data from Table 5-4 and Table 5-5:

- Stannett Street / Kimian Avenue saw 51 additional vehicles parked on the 14th August 2019 between the 7:30am and the peak parking count at 11am.
- The Sunset Boulevard area saw 72 additional vehicles parked on the 14th August 2019 between the 7:30am and the peak parking count at 11am.
- On-street parking west of the bypass saw 26 additional vehicles parked on the 14th August 2019 between the 7:30am and the peak parking count at 11am.
- Parking west of the bypass saw similar numbers on non-university days compared to the peak parking count at 11am.

The following summary identifies which streets had a high University utilisation, based on observations on site:

University Drive

- Outside of University semesters the utilisation of University Drive is quite low as shown in Table 5-5.
- The count undertaken at 7:30 am on Wednesday 14th August 2019, shows a higher number of parked vehicles along University Drive compared to non-University times which are related to campus resident parking.

- At the peak parking period University Drive is full with students parked.

Stannett Street / Kimian Avenue

- The eastern end of Kimian Avenue saw higher residential demands throughout the day with the same vehicles parked.
- The western end of Kimian Avenue saw higher University demands with additional vehicles observed between the early morning count and the peak parking count.
- Stannett Street saw higher residential demands towards its southern end whilst higher University demands were observed at the northern end.

Sunset Boulevarde Area

- High residential demands were observed at Faulkner Crescent, Andrew Close, Turana Parade from 100 metres south of the intersection with Lester Parade towards the intersection with University Drive and Sunset Boulevarde towards at its southern end after Faulkner Crescent.
- High University demands were observed along Lester Parade, the first 100 meters of Turana Parade from its intersection with Lester Parade, Sunset Boulevarde north of Faulkner Crescent and Canara Place.

West of Bypass

- High residential demands were observed along King Street, Naughton Avenue, Lee Crescent, Rae Street, Wilkinson Avenue west of King Street and Sandgate Road west of Coughlin Street.
- High University demands were observed along Vale Street / Moore Street, Coughlin Street, Sandgate Road east of Coughlin Street, Wilkinson Avenue east of King Street and the Council carpark on the corner of Moore Street and Vale Street.

Table 5-6 below provides a breakdown of the residential and additional University parking demands on-street. This has been determined using video analysis from the Wednesday 14th August 2019. Surveys of the on-street parking surrounding the university from the 7:30am were compared the surveys conducted at 11am. The number of vehicles which stayed through both surveys were taken as residential demand while the university demand was taken as the peak total parking minus the residential demand.

Table 5-6 Residential and University Demand observed on the 14th August 2019

	Residential Demand	Additional University Demand	Total Peak Demand
University Drive	129*	146	275
Stannett St / Kimian Ave	18	53	71
Sunset Boulevarde Area	39	87	126
West of the Bypass	78	101	179
Total	264	387	651

*The residential demand along University Drive includes those determined to be associated with residents on campus.

On-street parking restrictions were also observed, with these listed below:

- Vale Street – No parking along both sides (for up to 100 metres south of the western access to the University) after 9am-2:30pm during university semester days)
- Council Carpark – 3-hour parking from 9am – 5pm on University semester days
- Sunset Boulevarde – No Parking for 50 metres south of Canara Place during University semester days
- Stannett Street – Several no stopping zones
- Faulkner Crescent – 2-hour parking zone at the start of the street and no parking at the end of the street on the southern side after 9am University semester days
- Canara Place – 2-hour parking from 9am-5pm on the southern side of the southern section

5.4 Further Investigations

Aspects of the parking surveys which warrant further investigation include:

- The high vacancy rate for time limited parking
- Low utilisation of Park and Ride parking. Refer to Section 6 for further comment.
- Where vacancies for a category are disproportionally high compared with utilisation the overall demand for this category should be reviewed to assess suitability.
- What pattern of use sees some carparks with a high level of informal parking but also a high vacancy rate? Is there an absolute peak demand early in the morning which sees drivers parking informally which is quickly relieved after an early lecture?
- How can more remote parking spaces be utilised?
- What impact does free parking have on driver behaviour? If the free parking within the campus was removed would these motorists park elsewhere for free or would they change their mode of travel? Face to face surveys could be undertaken at these carparks to collect valuable information in a manner similar to that undertaken on the shuttle bus.
- Consider promoting Liftango with its free parking as an option to these motorists.

6 Shuttle Surveys

The provision of the inter campus shuttle allows for the transfer of students and staff between Callaghan and the City. This service encourages a sustainable travel mode that supports the ongoing development of both locations with students living in the city able to travel to Callaghan as well as those with their destination being the city able to park/travel and ride.

The Shuttle bus runs from New Space within Newcastle City to the Callaghan campus from 7am to 10pm. There are 6 designated stops located around the Callaghan campus and one stop located along King Street. Figure 6-1 below shows the bus stop locations.

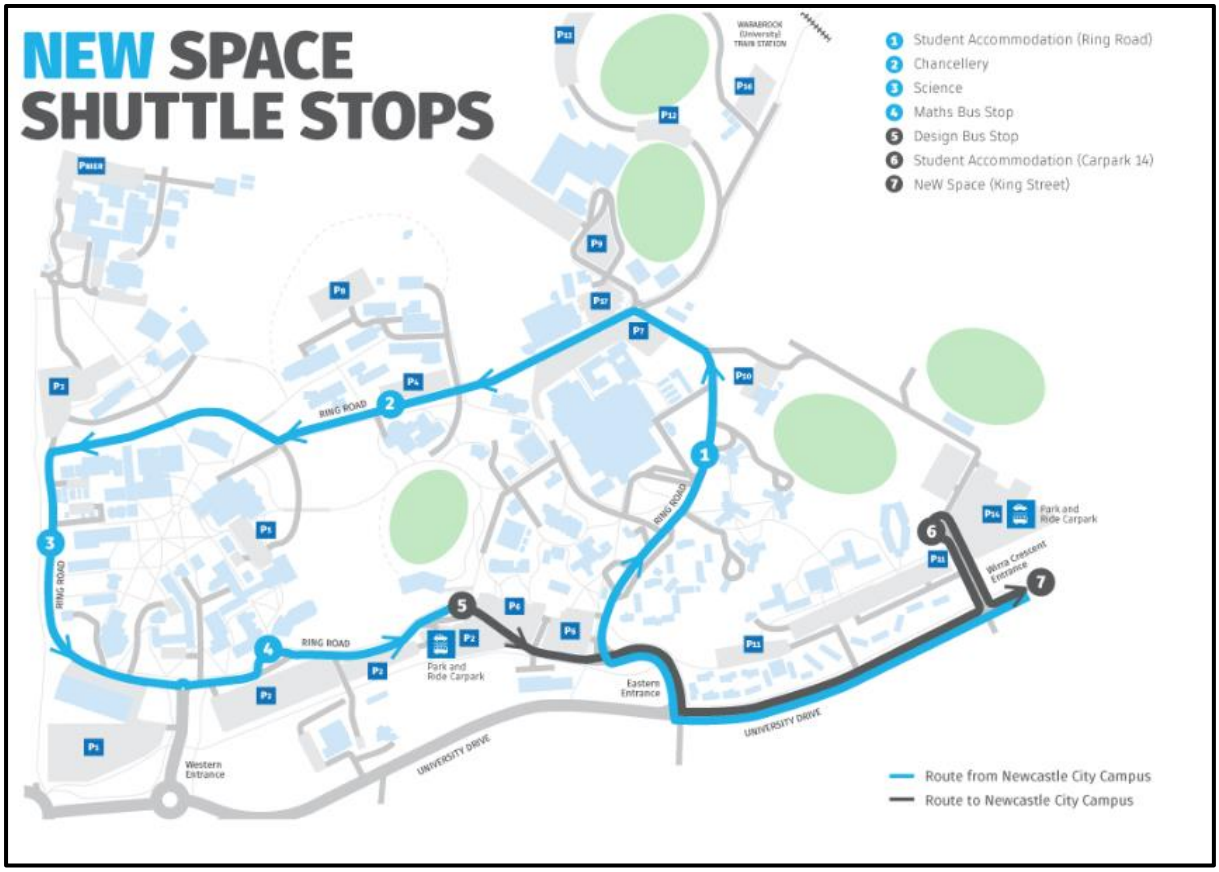


Figure 6-1 New Space shuttle bus stop map

The University has provided shuttle bus numbers for weeks 2 and 3 of Semester 2 2019. The total daily/weekly numbers for both weeks are shown below in Table 6-1 and Table 6-2 respectively.

Table 6-1 Shuttle bus passenger numbers Week 2, Semester 2, 2019

Week 2 - Beginning 12/08/2019												
		Departing Design Stop						Departing New Space				
		MON	TUE	WED	TUR	FRI		MON	TUE	WED	TUR	FRI
Day Total		589	653	635	688	466	**Day Total**	670	664	659	621	440
Peak (8-9am)		45	112	104	61	72	**Peak (8-9am)**	67	55	48	51	35
Week Total		3031					**Week Total**	3054				

Table 6-2 Shuttle Bus Passenger Numbers Week 3, Semester 2, 2019

Week 3 - Beginning 19/08/2019												
		Departing Design Stop						Departing New Space				
		MON	TUE	WED	TUR	FRI		MON	TUE	WED	TUR	FRI
Day Total		539	565	677	596	489	**Day Total**	542	550	627	594	413
Peak (8-9am)		32	63	88	65	82	**Peak (8-9am)**	59	50	46	40	41
Week Total		2866					**Week Total**	2726				

As shown the shuttle sees a high demand, the total two-way demand during Week 2 was 6085 patrons, with Week 3 seeing lower utilisation of 5592. There is a consistently high demand across the weekdays, with patronage dropping off on Fridays with University demands lower across the board on this day.

The peak hour patronage is summarised below in Table 6-3 for both Tuesday and Wednesday during weeks 2 and 3, with the peak hour as well as the morning peak period included.

Table 6-3 Peak Shuttle Bus Patronage

Shuttle Bus Patronage								
	Tuesday				Wednesday			
	8-9am		7:30-10am		8-9am		7:30-10am	
	Departing New Space	Departing Design Stop	Departing New Space	Departing Design Stop	Departing New Space	Departing Design Stop	Departing New Space	Departing Design Stop
Week 2	55	112	100	208	48	104	103	161
Week 3	50	63	85	157	46	88	94	172

Over the course of the day every second bus departing Callaghan sees a larger number of passengers travelling to New Space. This could be due to the bus arriving in time for lectures which begin on the hour. The number of passengers during the morning are generally higher with passengers spread out among the services during the afternoon. From New Space to Callaghan the number of passengers is generally spread out between buses with the majority of passengers using the shuttle consistently between 12-6pm. Outside of these hours the number of passengers is much lower.

Shuttle bus surveys were undertaken by Seca Solution, conducted on Tuesday 20th and Wednesday 21st August in the periods; 7:30-9:30am, 12-1:30pm and 4-6pm. For these two days, Seca staff members travelled on the two shuttle buses (running concurrently in each direction) and undertook counts of the number of passengers boarding and alighting at the various stops, including the city. Where possible, passengers were also questioned on; their mode of travel to the shuttle, where appropriate their parking arrangements, whether they were staff or a student and their suburb of origin. This questionnaire is produced in full in **Appendix B**.

Over the survey times noted above for the two days there were a total of 1,201 passengers counted and 677 who completed the survey.

It was noted that during morning services leaving Callaghan to the City, the bus is full of people standing along the length of the bus. Observed during the survey one service saw two people turned away due to the bus being full.

6.1 Shuttle Bus Stop Demands

The surveys of the shuttle service included recording the numbers of passengers getting on and off the shuttle bus at each stop location (Figure 6-1 above) to determine bus stop demands, with the outputs for Tuesday and Wednesday provided in Table 6-4 and Table 6-5 respectively.

In addition to passengers using the shuttle to travel between Callaghan and the City there were 14 passengers on the Tuesday that used the shuttle service within Callaghan campus for internal transport from the residential stop 1 to the Shortland side at stop number 4.

Table 6-4 Shuttle bus patronage by stop - Tuesday 20th August 2019

Tuesday 20th August 2019																
	1. Hunter		2.Chancellery		3. Science		4. Maths		5. Design		6. CP 14		7. City		Total On	Total Off
	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off		
Morning (7:30-9:30)	33	-22	2	-22	6	-18	43	-23	66	-7	26	-4	98	-115		
Midday (12-1:30)	12	-13	3	-6	1	-2	22	-19	23	-8	5	-1	49	-24		
Afternoon (4-6)	20	-45	7	-3	9	-1	49	-47	57	-18	13	-13	97	-61		
Total	65	-80	12	-31	16	-21	114	-89	146	-33	44	-18	244	-200	641	-472
% of Total On/Off	10%	17%	2%	7%	2%	4%	18%	19%	23%	7%	7%	4%	38%	42%	58%	42%

Table 6-5 Shuttle bus patronage by stop - Wednesday 21st August 2019

Wednesday 21st August 2019																
	1. Hunter		2.Chancellery		3. Science		4. Maths		5. Design		6. CP 14		7. City		Total On	Total Off
	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off		
Morning (7:30-9:30)	23	-15	2	-13	10	-18	45	-30	46	-4	29	0	78	-153		
Midday (12-1:30)	16	-15	3	-10	1	-1	26	-20	17	-16	8	-6	53	-56		
Afternoon (4-6)	19	-24	9	-4	6	-2	64	-34	31	-12	7	-3	67	-117		
Total	58	-54	14	-27	17	-21	135	-84	94	-32	44	-9	198	-326	560	-553
% of Total On/Off	10%	10%	3%	5%	3%	4%	24%	15%	17%	6%	8%	2%	35%	59%	50%	50%

Note the difference in total on and total off passengers of 169 in Table 6-4 is due to the survey in Callaghan finishing at stop number 6. The passengers which had been counted getting on during the 6 stops within the University were then not counted off at New Space.

Of the various Shuttle stops the most popular are shown below in Table 6-6. From this the pattern of usage varies from day to day and time of the day with little consistency across the stops. For example, Design is a popular boarding point for the service but does not represent a similarly popular exit stop and it is more popular of a Tuesday than a Wednesday.

*Table 6-6 Peak Bus Stop Demands (AM/**PM**)*

	Board		Alight	
	Tuesday	Wednesday	Tuesday	Wednesday
Design	66/**57**	46/**31**	7/**18**	4/**12**
Maths	43/**49**	45/**64**	23/**47**	30/**34**
Hunter	33/**20**	23/**19**	22/**45**	15/**24**
City	78/**67**	78/**67**	115/**61**	153/**117**

6.2 Survey Results

This section outlines the results of the surveys undertaken of staff and students utilising the shuttle service. It is noted that if passengers had already undertaken the survey on that day, they were not asked to undertake it again on their return journey. This however enabled passengers who had not been surveyed earlier in the day to be questioned on their return trip.

The top 10 suburbs which the passengers have travelled from are listed below in Table 6-7.

Table 6-7 Top suburbs of passengers on New Space shuttle

	Callaghan to City	City to Callaghan	Total
Campus	118	13	131
Cooks Hill	16	55	71
Wallsend	24	15	39
Jesmond	23	15	38
Shortland	18	10	28
The Junction	7	17	24
Birmingham Gardens	19	3	22
Newcastle	11	10	21
Merewether	6	11	17
Bar Beach	3	13	16

Of the surveyed passengers a total of 81% were students using the shuttle compared to 19% staff as shown below in Table 6-8. More than half of all passengers walked to the shuttle bus at both the City stop and the six Callaghan stops with 51% walking to the City stop and 64% walking to Campus stops. This is reflected in the suburbs given above with high numbers coming from the Campus reflecting students in residence and Cooks Hill as well as many from the suburbs immediately surrounding Newcastle and Callaghan. Driving via car or motorbike accounted for between 23-26% of arrivals to the shuttle, lifts from friends or family accounted for 6-10% of arrivals with the rest of the methods accounting for 5% or less.

Passengers were asked whether they had used the Liftango service which the University is partnered with. Of the surveyed passengers 92% had not used the Liftango service. Of the 8% of passengers only 3 staff members had used the service with the rest being students.

Table 6-8 Shuttle Bus Survey Summary

	Callaghan to City	City to Callaghan	Total
Students	88%	73%	81%
Staff	12%	27%	19%
How they arrived to the Shuttle?			
Walk	64%	51%	
Motorbike	0%	20%	
Drive	23%	6%	
Lift Family/Friend	6%	10%	
Cycle / Skate/Scoot	1%	2%	
Train	1%	2%	
Bus to Campus	2%		
Taxi / Uber	1%		
Train then light rail		1%	
Bus to New Space		5%	
Other/Specify	3%		
Parking location if driving?			
Motorbike Space	17%		
Staff	45%		
Resident	14%		
Free Parking on Street		33%	
Carpool Space Parking Station		11%	
General Space Parking Station		28%	
Accessible Parking		11%	

6.3 Park and Ride Shuttle Parking

Park and Ride shuttle parking is provided at the locations shown in Table 6-9 below.

Table 6-9 Parking locations nominated for park and ride service

Carpark Number	Nearest Shuttle Stop	Number of Allocated Spaces	Number of Vacant Spaces Wednesday	Thursday
2	5	120	0	4
14	6	216	204	203

6.4 Further Investigations

Adequate Capacity - As the shuttle is proving a popular service it is important that patrons can rely on the service. If patrons are turned away due to lack of capacity, then they will turn to other forms of transport. Similarly, they will look to get onto the service earlier along the route to ensure a space and so people using the more remote stop at Carpark 14 are at risk of being turned away. This sees more premium parking spaces near earlier bus stops being used instead of the nominated park and ride spaces at Carpark 14.

Use of Park and Ride Spaces – Although 23% of patrons had driven to Callaghan to use the shuttle none of these indicated that they had used the Park and Ride parking spaces. This underutilisation of this parking warrants further investigation to determine whether there are specific reasons for this including whether they are not located in the most appropriate locations to meet the patrons needs. Is there a perception that they may not be able to catch the shuttle if they are towards the end of the route, are there safety concerns, do commuters want to get a cup of coffee before they catch the shuttle?

7 Vehicle Occupancy

7.1 Survey Details

Sample Vehicle Occupancy data was collected across the four major vehicular entry points on Wednesday 14th August and Thursday 15th August 2019, during the periods outlined below:

- 8am to 10am
- 1:30pm to 2:30pm
- 4pm to 5pm

Vehicle Occupancy was recorded as the number of persons in each vehicle entering the campus, including the driver and passengers. Buses were excluded from this survey.

7.2 Survey Data

A summary of the average vehicle occupancy determined at each access for the Wednesday and Thursday surveys is provided in Table 7-1 and Table 7-2 respectively, with a combined average provided in Table 7-3.

Table 7-1 Callaghan campus vehicle occupancy per access, Wednesday 14th August 2019

Wednesday	Roundabout		Stannett Street		Wirra Crescent		Vale Street	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
8am-10am	1.15	1.06	1.17	1.25	1.11	1.16	1.12	1.26
1:30pm-2:30pm	1.17	1.14	1.25	1.26	1.19	1.20	1.39	1.21
4pm-5pm	1.11	1.15	1.40	1.21	1.13	1.06	1.18	1.15
All Day	**1.14**	**1.12**	**1.27**	**1.24**	**1.14**	**1.14**	**1.23**	**1.21**

Table 7-2 Callaghan campus vehicle occupancy per access, Thursday 15th August 2019

Thursday	Roundabout		Stannett Street		Wirra Crescent		Vale Street	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
8am-10am	1.15	1.11	1.16	1.19	1.09	1.24	1.14	1.20
1:30pm-2:30pm	1.20	1.12	1.25	1.18	1.13	1.23	1.32	1.31
4pm-5pm	1.09	1.17	1.29	1.23	1.15	1.11	1.22	1.13
All Day	**1.15**	**1.13**	**1.24**	**1.20**	**1.12**	**1.19**	**1.23**	**1.21**

Table 7-3 Callaghan campus combined vehicle occupancy

Total	Wednesday	Thursday	Combined
8am-10am	1.16	1.16	1.16
1:30pm-2:30pm	1.23	1.22	1.22
4pm-5pm	1.18	1.17	1.17
All Day	**1.19**	**1.18**	**1.19**

Previously surveys were undertaken at the roundabout, Stannett Street and Wirra Crescent access locations. The surveys undertaken indicate a lower vehicle occupancy in 2019 than that recorded as part of prior surveys since 1999, as shown in Table 7-4.

Table 7-4 Comparison of vehicle occupancy surveys

Year	Total
1999	1.26
2001	1.26
2002	1.26
2003	1.29
2004	1.28
2005	1.27
2013	1.25
2019	1.19

The decline in vehicle occupancy may be reflective of a broad range of factors including:

- Availability of affordable parking reduces the need to share trips.
- Higher number of students attending in a part time mode impacts opportunities to share trips.
- Availability of free parking within the campus encourages students to travel by car without the need to share trips.

7.3 Liftango

The University has partnered with the Liftango service to promote ride share services. Data provided from the University from the 14/08/2019 and 20/08/2019 has been summarised in Table 7-5 below.

Table 7-5 Number of people using Liftango Service from 14/08/2019 to 20/08/2019

	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday
	14/08/2019	15/08/2019	16/08/2019	17/08/2019	18/08/2019	19/08/2019	20/08/2019
No. of Drivers	25	22	7	1	10	21	19
No. of Passengers	3	2	0	0	0	2	0
Total Using Service	28	24	7	1	10	23	19

This low level of participation is consistent with the responses on the Shuttle survey as well as reflecting the parking surveys which showed 27 out of the total 45 ride sharing spaces on campus were occupied during the peak period survey on the Wednesday, whilst only 13 were occupied on the Thursday.

When compared with the size of the student and staff cohort this low level of usage provides opportunities for considerable growth through education and management.

7.4 Further Investigations

- Consider opportunities to increase Liftango usage through awareness and promotion programmes.
- Review rules for Ride Share spaces. Are they able to be used by staff and students who informally carpool or are they restricted to Liftango participants? Is there an opportunity to make parking available for those that register as informal carpoolers who may share trips with friends but don't use the App?
- Increase awareness and promote the use of shared trips both formally and informally.

8 Bus Services

8.1 Survey details

Bus patronage data (in the form of Opal card data) was provided by Transport for NSW based on tap on / tap off data at each of the four bus stops within the Callaghan campus, for the period 13th August to 28th August 2019. Due to sensitivity around this information services that saw less than 18 passengers board or alight were described as having <18 with the place of origin or end destination described by local government area only.

8.2 Bus Service Details

There are four bus terminals on the campus, as below and shown on Figure 8-1.

- Maths North (**1**) and Maths South (**2**) terminals serve the western (Shortland) part of the campus,
- Design North (**3**) and Design South (**4**) serve the eastern (Hunter) part of the campus.

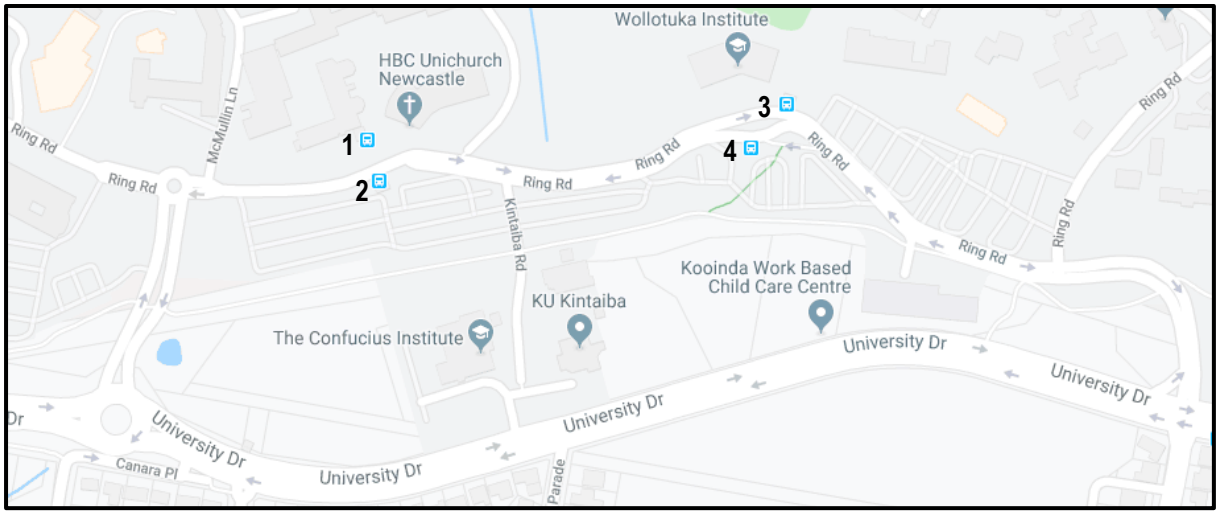


Figure 8-1 Bus stops located within Callaghan campus

It is recognised there are other bus stops located within close proximity to the campus which may see some University related demands, however these demands are negligible and have not been included for the purpose of this assessment.

All bus routes travel along the Ring Road between the two major accesses to the campus with entry/exit via the main roundabout and Stannett Street traffic signals. The four stops above include two for eastbound services and two for westbound services.

In 2017 public bus services in Newcastle were privatised, with a contract awarded to Keolis Downer now operating as Newcastle Transport. Services underwent a significant overhaul with new routes assigned and route frequencies changed, with the new timetables beginning operation from 2018.

Given this, comparison with origin/destination of patron data collected in the previous surveys is no longer like for like. There are less bus routes through the Callaghan campus than in 2013, however services run more frequently.

In 2019 there were 317 bus services between 7.30am and 9.30pm which is an increase of 33 on the number in 2013 (284 services) and 84 on the number in 2005.

The bus routes through the Callaghan campus are listed below in Table 8-1.

Table 8-1 Bus routes through the Callaghan campus

Route No.	Origin- Destination	Operator	Frequency
11	Charlestown to Newcastle via Jesmond	Newcastle Transport	**Weekdays** • Every 15 minutes: 7am-7pm • Every 30 minutes: 7pm-10pm • Hourly: 10pm-3am and 5am-7am **Weekends** • Every 30 minutes 7am-7pm • Hourly between 7pm-7am
24	Wallsend to Marketown via Mayfield	Newcastle Transport	**Weekdays** • Every 30 minutes: 7am-9am and 4pm-6pm • Hourly: 5am-7am, 9am-4pm and 6pm-10pm **Weekends** • Hourly between 7am-10pm
27	Wallsend to Broadmeadow via Newcastle University	Newcastle Transport	
160	Cessnock to Newcastle	Rover Coaches	**Weekdays:** 5 services in each direction 6:45am-6:35pm **Weekends:** 1 morning and 1 afternoon service in each direction
260	Minmi to University	Hunter Valley Buses	**Weekdays:** 6 services in each direction 6:50am-6:20pm **Weekends:** no services
260/ 261	Fletcher to University	Hunter Valley Buses	**Weekdays:** Regular services every 15-30 minutes in each direction from 7:15am-7:25pm **Weekends:** no services
267	West Wallsend to Glendale and University	Hunter Valley Buses	**Weekdays:** Regular services every 15-30 minutes in each direction from 7:10am-7:05pm **Weekends:** no services
270	Toronto to Charlestown, Glendale and University	Hunter Valley Buses	**Weekdays:** Regular services every 15-30 minutes in each direction from 5:40am-4:45pm **Weekends:** no services

The above routes provide access to major areas within the region served by the University.

The redesigned bus network completed by Newcastle Transport sought to focus services around key strategic centres, including Newcastle, Charlestown, Callaghan Campus, John Hunter Hospital and Cardiff-Glendale. It aimed to increase frequency, reliability and directness of bus services along Greater Newcastle's key corridors, including urban renewal corridors, making bus travel more competitive with private vehicle travel.

Whilst Newcastle Transport are focussed on increasing bus participation and have introduced a trial of on-demand bus services in parts of Lake Macquarie to Charlestown and now Merewether to the CBD there are still many locations which lack any direct public transport services to Callaghan Campus.

Many people wanting to travel to Callaghan by bus need to travel by lengthy circuitous routes or with multiple service changes.

8.3 Bus Patronage

Where data provided by TfNSW was limited to patronage <18 not being specifically nominated, analysis was undertaken based on the LGA origin to determine the patronage. Due to the high demand for arrivals by bus at Callaghan during the morning peak period (8am-9am) this period was analysed, with it reflecting the highest level of accuracy for the Opal data and an acceptable level of reliability.

The scheduled bus services between 8am-9am are listed below in Table 8-2 with services arriving 5 minutes either side of this hour included should these potentially arrive early or late. It can be seen the total number of bus services arriving during the morning peak is 19, with 16 services departing during the same period.

Table 8-2 University Bus arrivals and departures from 8:00 to 9:00 AM

Arrivals to the University		Departures from University	
Time	**Route**	**Time**	**Route**
7:55	261 Fletcher to University	8:01	260 Fletcher to University
7:55	27 Wallsend to Broadmeadow via Newcastle University	8:05	11 Charlestown to Newcastle via Jesmond
8:04	11 Charlestown to Newcastle via Jesmond	8:05	24 Wallsend to Marketown via Mayfield
8:14	260 Fletcher to University	8:09	27 Wallsend to Broadmeadow via Newcastle University
8:19	160 Cessnock to Newcastle	8:22	11 Charlestown to Newcastle via Jesmond
8:23	11 Charlestown to Newcastle via Jesmond	8:26	261Fletcher to University
8:26	24 Wallsend to Marketown via Mayfield	8:36	11 Charlestown to Newcastle via Jesmond
8:27	261 Fletcher to University	8:37	267 West Wallsend to Glendale and University
8:28	27 Wallsend to Broadmeadow via Newcastle University	8:38	27 Wallsend to Broadmeadow via Newcastle University
8:33	270 Toronto to Charlestown, Glendale and University	8:40	160 Cessnock to Newcastle
8:34	11 Charlestown to Newcastle via Jesmond	8:45	24 Wallsend to Marketown via Mayfield
8:41	260 Fletcher to University	8:46	11 Charlestown to Newcastle via Jesmond
8:47	267 West Wallsend to Glendale and University	8:48	270 Toronto to Charlestown, Glendale and University
8:50	11 Charlestown to Newcastle via Jesmond	8:56	260 Fletcher to University
8:55	27 Wallsend to Broadmeadow via Newcastle University	9:02	27 Wallsend to Broadmeadow via Newcastle University
8:59	24 Wallsend to Marketown via Mayfield	9:04	11 Charlestown to Newcastle via Jesmond
9:00	261 Fletcher to University		
9:02	270 Toronto to Charlestown, Glendale and University		
9:04	11 Charlestown to Newcastle via Jesmond		

The total bus passenger arrivals at Callaghan between 8am to 9am are provided in Table 8-3 showing each weekday across the survey period.

Table 8-3 Arrival by bus at Callaghan between 8am to 9am

Day	Tuesday 13th	Wednesday 14th	Thursday 15th	Friday 16th	Monday 19th
Patronage	149	164	194	175	131
Day	**Tuesday 20th**	**Wednesday 21st**	**Thursday 22nd**	**Friday 23rd**	**Monday 26th**
Patronage	175	184	161	147	143
Day	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Monday**
Avg Patronage	162	174	178	161	137

The prior study allowed for comparison of bus patronage on a Tuesday and Wednesday, between three nominated time periods (7:30-10am, 10am-4pm and 4pm-7pm). A like for like comparison of the utilisation of individual services is not possible due to the privatisation and subsequent revamp of the Newcastle bus routes.

To allow for a comparison of the existing utilisation with prior surveys, the 2019 data provided by TfNSW has been analysed to obtain an estimated patronage between 7:30am-10am. The level of unknowns in the 7:30-8am and 9am-10am periods is higher than the previously discussed 8am-9am period, however the analysis in Table 8-4 is sufficient to identify trends in bus patronage.

Table 8-4 Arrivals by bus at Callaghan, 7:30am to 10am

Year	Tuesday	Wednesday
2005	539	562
2013	591	505
2019	348	343

It can be seen that there has been an overall decrease in arrivals by bus to Callaghan over the historic survey data. Decreases in bus patronage has been reported across all of Newcastle with reports that overall patronage was down by 2% in the month of February 2018 compared with February 2017 with changes in service routes and uncertainty of buses given as reasons for reduced demand. Newcastle Buses however are committed to increasing bus patronage across the network over time.

8.4 Places of origin

While the Opal data was not able to confirm the origin or destination of passengers it did identify the local government area in which journeys commenced.

A review of this showed that the vast majority of bus arrivals to Callaghan (74-85%) had a starting point in the Newcastle LGA with 14-25% from Lake Macquarie and only 1% from the Cessnock LGA.

8.5 Bus Reliability

Bus reliability was identified in the 2013 Modal Study as a critical element in the retention of passengers.

Although reliability and on-time running has been documented as having declined since the privatisation of the Newcastle bus service, Keolis Downer continues to modify and add to its services to improve the bus service's on-time running performance which it has contractual obligations to achieve.

Ongoing works in the CBD have seriously impacted bus reliability where services enter or exit the city centre. The current construction of the bus interchange in conjunction with the Newcastle Interchange should reduce delays with most services no longer needing to enter the CBD.

Recent upgrades to the bus stops within the campus has included the provision of kiss and drop zones along the Ring Road, reducing the need for motorists to enter the bus stops to drop off passengers.

Improvements to the local road network in the vicinity of Callaghan were identified in the 2013 report. The western entry to the campus has subsequently been partially signalised to improve the performance of the roundabout on University Drive along with the construction of a left turn slip lane. In conjunction with the opening of the Hunter

Expressway in 2014 RMS had upgraded intersections along Newcastle Road and monitored the performance of this corridor.

In the longer term the construction of the Inner-City Bypass between New Lambton and Jesmond will improve queuing associated with Newcastle Road roundabout at Jesmond.

8.6 Further Investigations

The ongoing commitment by Keolis Downer to improve bus services provides an opportunity for the University to leverage off this to increase bus patronage to the campus.

Recent changes to the privacy requirements for the Opal card data resulted in a lack of detailed information regarding the origin and destination of passengers by suburb and the demand for the various services. It is anticipated that this type of information may however be available in consultation with Keolis Downer in the future and it is suggested that this be investigated to support future assessments of bus patronage.

The popularity of the shuttle bus demonstrates the level of interest in reliable time effective bus services.

9 Train Services

9.1 Train Infrastructure

Recent works have been completed by Transport for NSW in upgrading public transport infrastructure within the Newcastle City. Upgrades were undertaken on the railway line between Hamilton and Newcastle with a new interchange replacing the old Wickham station and a new light rail service replacing trains between Wickham (Newcastle Interchange) and Newcastle (now Newcastle Beach).

9.2 Survey Details

Seca Solution conducted train surveys on Tuesday 13th August 2019 during three periods throughout the day to collect a sample of data to inform this assessment. The survey times were 7:30-10:00 AM, 12:00-1:30 PM and 4:00-6:00 PM. The surveys were conducted to determine the patronage numbers for train services through Warabrook station. The survey also quantified the distribution of commuters between the campus and Warabrook as well as the arrival and departure times for each service to help determine reliability.

The surveys undertaken by Seca Solution recorded the following:

- The number of passengers observed to walk to or from the train services at Warabrook station, including which direction (either the University campus or Warabrook). [1]
- The number of train passengers with a bicycle. [2]
- The number of people who walked or cycled across the bridge separate to using the train service.

[1] The passengers coming to or from the train station were recorded coming from either the Newcastle corridor (including service connecting to and from the Newcastle Interchange and connecting services at Hamilton with Central Coast/Sydney trains) and the Maitland Corridor (including services travelling to and from Maitland, Telarah, Dungog, Muswellbrook and Scone).

[2] Train passengers with a bicycle were recorded as train passengers but also noted separately to quantify the number of cyclists using the train.

Opal card data was requested from Transport for NSW based on tap on / tap off data at Warabrook Station for the period 13th August to 28th August 2019. Due to sensitivity around this information, services that saw less than 18 passengers board or alight were only described as having <18 with the place of origin or end destination described by local government area only.

9.3 Train Services

All Hunter line trains travelling between Newcastle Interchange and Maitland, Dungog, Muswellbrook and Scone stop at Warabrook Station. A breakdown of the Hunter line services is shown below:

- A majority of the services have an origin/destination of Telarah which run around every half an hour
- A total of 10 services across the day have an origin/destination of Dungog
- A total of 6 services across the day have an origin/destination of Scone
- A total of 2 services across the day have an origin/destination of Muswellbrook

Passengers travelling via the Newcastle and Central Coast line typically change at Hamilton for connecting services to Warabrook. There are typically two Central Coast services per hour with additional services provided during the morning and afternoon peak.

The peak arrivals for train patronage occur during the morning peak of 8:00-9:00 am. The services between this period are listed in Table 9-1 with services arriving within 10 minutes either side of the hour included.

Table 9-1 University Train Arrivals and Departures from 8:00 to 9:00 AM

Newcastle to Scone / Dungog / Maitland	Scone / Dungog / Maitland to Newcastle
Time	**Time**
7:58	7:56
8:24	8:07
8:39	8:20
8:58	8:34
	9:07

From Table 9-1 above the total number of bus services during the morning peak is 9, with 4 services coming from Newcastle and 5 services coming from Scone / Dungog / Maitland.

9.4 Train Patronage

Table 9-2 Summary of arrivals for peak travel days (source Opal Card Data)

	From	Tuesday 13th	Wednesday 14th	Tuesday 20th	Wednesday 21st
4-6am	East	<18	<18	<18	<18
	West	<18	<18	<18	<18
6-8am	East	<18	<18	<18 except 21 from Newcastle	<18
	West	<18	<18 except 30 from Maitland	<18 except 34 from Maitland	<18 except 30 from Maitland
8-9am	East	66	50	47	71
	West	64	65	54	53
9-10am	East	41	55	49	46
	West	34	35	45	28
10-11am	East	30	28	34	31
	West	18	17	18	17
11am-Noon	East	11	19	17	
	West	38	20	27	
Noon-2pm	East	<18 total around 24	<18 except 19 from Newcastle	<18	<18 except 20 from Newcastle and 18 from Central Coast
	West	<18	<18 except 31 from Maitland	<18	<18 except 31 from Maitland
2-4pm	East	<18	<18	<18	<18
	West	<18	<18	<18	<18
4-5pm	East	<18	<18	<18	<18
	West	<18	<18	<18	<18
5-6pm	East	<18 except 22 from Newcastle	<18	<18 except 19 from Newcastle	<18
	West	<18	<18	<18	<18
6-8pm	East	<18	<18	<18	<18
	West	<18	<18	<18	<18
8-10pm	East	<18	<18	<18	<18
	West	<18	<18	<18	<18

Whilst the Opal card data does not enable a daily patronage figure for Warabrook Station, the higher demands for the peak periods do enable a quantifying of arrivals during the peak periods. Minor differences in timing of tap off compared with actual train arrival can see some minor discrepancies however the main impact on the arrival pattern occurs when services due near the hour arrive late and so are included in the following period. This is evident on Tuesday 13th when the westbound train from Newcastle due at 7.58am arrived three minutes late and so 22 passengers were included in the 8-9am period.

The survey undertaken on the 13th August showed that of the arrivals to Warabrook, 90% of passengers entered the campus whilst 10% exited to the north towards Warabrook. This percentage was consistent for both directions of travel and was generally evenly distributed throughout the day. This is a reduction since 2013 when 95.5% of all commuters entered the campus with 92% in 2005.

A comparison of the arrivals in the peak periods 7.30am-10am for Tuesday 13th August compared with equivalent Tuesdays in 2013 and 2005 is shown in Table 9-3.

Table 9-3 Comparison of arrivals in morning peak 2005-2019

	2019		2013		2005	
	From Newcastle	From Maitland	From Newcastle	From Maitland	From Newcastle	From Maitland
Tuesday 7.30-10am	110	135	273	355	197	144
Wednesday 7.30-10am	152	132	-	-	-	-

Whilst overall patronage has dropped since 2015, similar to other findings in this study, patronage is generally comparable to 2005 when student enrolments were similar to the current numbers. This is particularly evident for the Maitland service where demands from Newcastle, which capture all train travellers to the east but also to the south through to Sydney have declined.

The ratio of travel in each direction has also changed.

- Newcastle service: 50% in 2019, 43% in 2013 and 58% in 2005.
- Maitland service: 50% in 2019, 57% in 2015 and 42% in 2005.

9.5 Cyclists as Train Travellers

The cyclists as train travellers was quantified in conjunction with the sample survey on Tuesday 13th as Opal card data cannot provide this information. During the peak period (8am-9am) the percentage of train travellers with a bicycle was 3% whilst across the sample period it averaged to be less than 1%.

Across the sample period as a percentage this is lower than past years and with train patronage down over the 2013 period the number of cyclists as train travellers is also reduced. As can be seen below (

Table 9-4) the number of cyclists using the trains to and from Warabrook has decreased steadily since 2001 from 7% of the total passenger number down to 3% in 2005 and now 1% in 2019.

Given the small number of cyclists counted it would appear that the direction cyclists are arriving from is relatively balanced. The data does show an unusual anomaly however in 2013 with a huge spike in cyclists from Maitland and only one from Newcastle. It is wondered whether these numbers were possibly reported incorrectly in 2013.

The total shown in Table 9-4 also represents the morning total 7.30-10am with no cyclists as train travellers noted during the balance of the survey period.

As noted in Section 9.2 above the number cyclists were counted as a train passengers and noted separately to avoid any errors in the analysis.

Table 9-4 Comparison of Cyclists Train Patronage from 2001 – 2019

	From Newcastle	From Scone / Dungog / Maitland	Total	Maximum per Train	% of Uni Passengers	Total Uni Train Passengers
2001	45	15	60	5	7%	846
2002	44	9	53	6	6%	908
2003	29	9	38	6	4%	893
2004	21	6	27	3	4%	655
2005 Tuesday	19	3	22	5	3%	695
2013 Tuesday	1	53	54	5	3%	2153
2019 Tuesday	3	2	5	2	<1%	683*
2019 Peak (8-9am)	2	2	4	1	3%	150

*Sample period only

9.6 Train Reliability

On the day sampled all services arrived within 5 minutes of the scheduled time with the majority within 2 minutes of the timetable.

2019 saw an even number of trains arriving early compared to those arriving late, with data from 2005 and 2013 showing 1 early train between the two years and the majority of the unreliable services running late.

From the sample it would appear that overall the reliability of the trains has improved.

9.7 Further Investigations

The demand for train services is a factor of convenience, journey time and cost. Where commuters can park easily near a station and rely on suitably timed services, they are more likely to commute by train if the door to door travel time is comparable to driving and if parking at the end of the trip adds to the cost of the journey.

It is important that there aren't impediments to train travel and that those staff and students who use this mode are supported in their choice.

There is a definite demand for train travel from the Maitland line, particularly the Maitland LGA. This could warrant further investigation to ensure this pattern continues and that these travellers are supported in their journey choice.

There are opportunities to ensure that commuters from the Central Coast, Lake Macquarie etc are supported by suitable changeover of services at Hamilton. Should delays occur between these two lines then commuters will be find this a less appealing travel option.

Ongoing liaison with Transport for New South Wales may see future opportunities for Opal Card Data supported. It is important to review train travel demands regularly to ensure that this mode continues to be well supported by staff and students.

10 Pedestrians and Cyclists

10.1 Survey Details

The survey of Pedestrians and Cyclists was conducted between 6am and 9pm on both Tuesday 20th August and Wednesday 21st August 2019. These counts were undertaken through video data collection and included inbound and outbound movements. The cameras were positioned at the following locations:

1. NIER bridge off Vale Street.
2. Zebra crossing at western pathway adjacent to Newcastle Inner City Bypass (Main Road).
3. South West corner from the pedestrian/cycle underpass at University Drive and Main Road.
4. Pathway from University Drive opposite Sunset Boulevard.
5. Pathway on University Drive near IFS building.
6. Wirra Crescent from Cycleway.
7. North of the Stannett Street traffic signals, excluding internal Residential College area movements.
8. Pathway from IDC to car park 2.
9. Warabrook Station pedestrian bridge*.

* Spot counts were completed at the Warabrook Station pedestrian bridge between 7:30am-10am on Tuesday 13th August 2019, with these allowing for arrivals who walked/cycled from the eastern side of the rail line, excluding those who had parked on the eastern side or alighted from a train. A total of 24 pedestrians walked across the bridge between 7:30am-10am. Based on the average percentage of arrivals occurring in this period (discussed in Section 10.2) an extrapolated daily total of 55 pedestrians from 6am-9am was determined. A total of 6 cyclists crossed the bridge in this period. Based on the average percentage of arrivals occurring in this period (discussed in Section 10.3) an extrapolated daily total of 14 cyclists from 6am-9am was determined.

The above locations are identified on Figure 10-1, which includes the location of previous surveys.

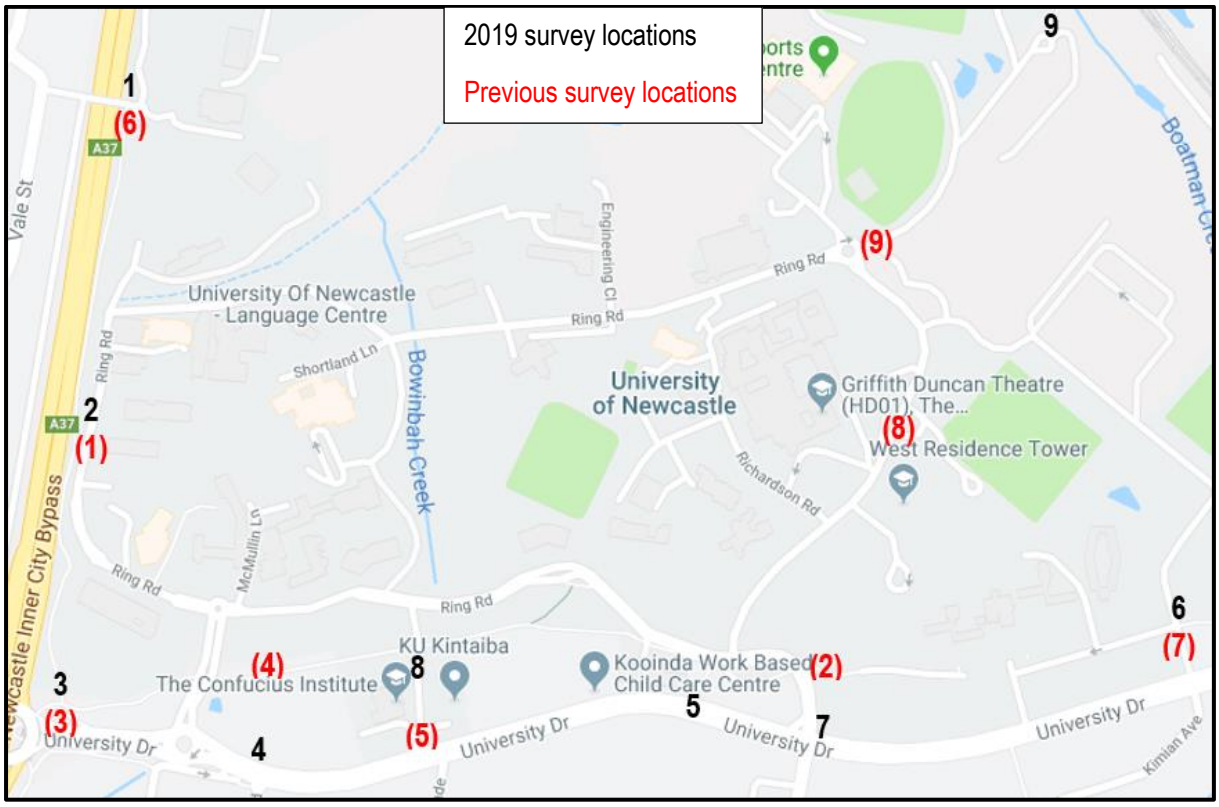


Figure 10-1 Pedestrian and cyclist survey locations

In reviewing the previous survey locations, these included counts within the campus at Ring Road via the pathway past Evatt House and also to the north of the Stannett Street signals. These captured residential college movements within the student accommodation on site, as well as students who may have parked in the eastern areas of the campus and walked through the above locations.

As the purpose of these counts is to determine the number of people who arrive (or depart) the campus by foot or as a cyclist, counts at the external connection points is appropriate. Counts completed within the campus do not assist nor validate this data but rather risk such information being counted twice.

The 2013 data disregarded counts at the most eastern point of the campus (Wirra Crescent) in favour of the use of the internal count north of Stannett Street. The surveys undertaken as part of the 2019 project work incorporated the counts undertaken at Wirra Crescent to capture external demands to/from the campus.

The number of current students living on campus has been provided by the University, with this determined to be in the order of 1,800 residents compared with an estimated 1000 in 2013. It is reasonable to assume that these residents who have classes at Callaghan walk/cycle throughout the campus. This is supported by the shuttle survey where students living on campus using the shuttle reported that they walked to the shuttle stop.

10.2 Pedestrians

The total daily inbound pedestrian volumes recorded at each nominated location from 6am to 9pm are shown in Figure 10-2 and Figure 10-3 for Tuesday and Wednesday respectively. The extrapolated daily total at Warabrook Station determined from the spot count has been applied to both days.

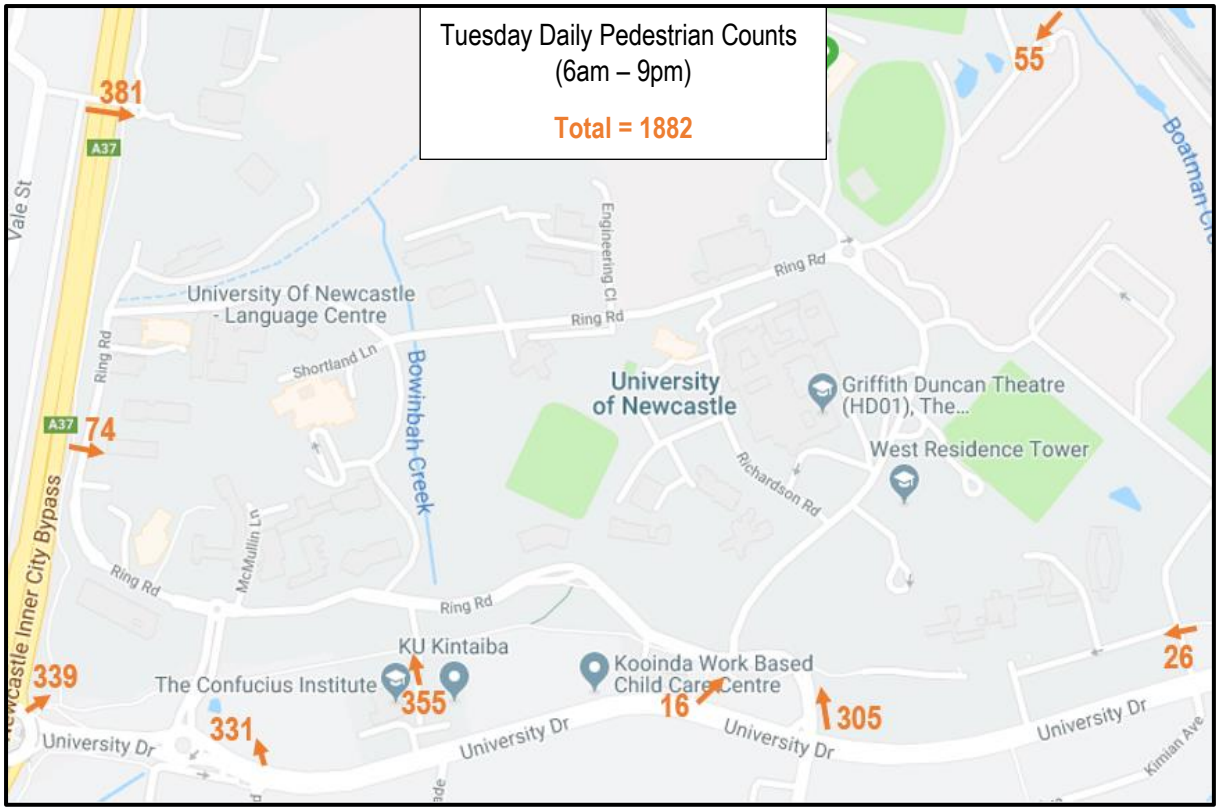


Figure 10-2 Pedestrian volumes for the Callaghan campus, 6am to 9pm Tuesday 20th August 2019

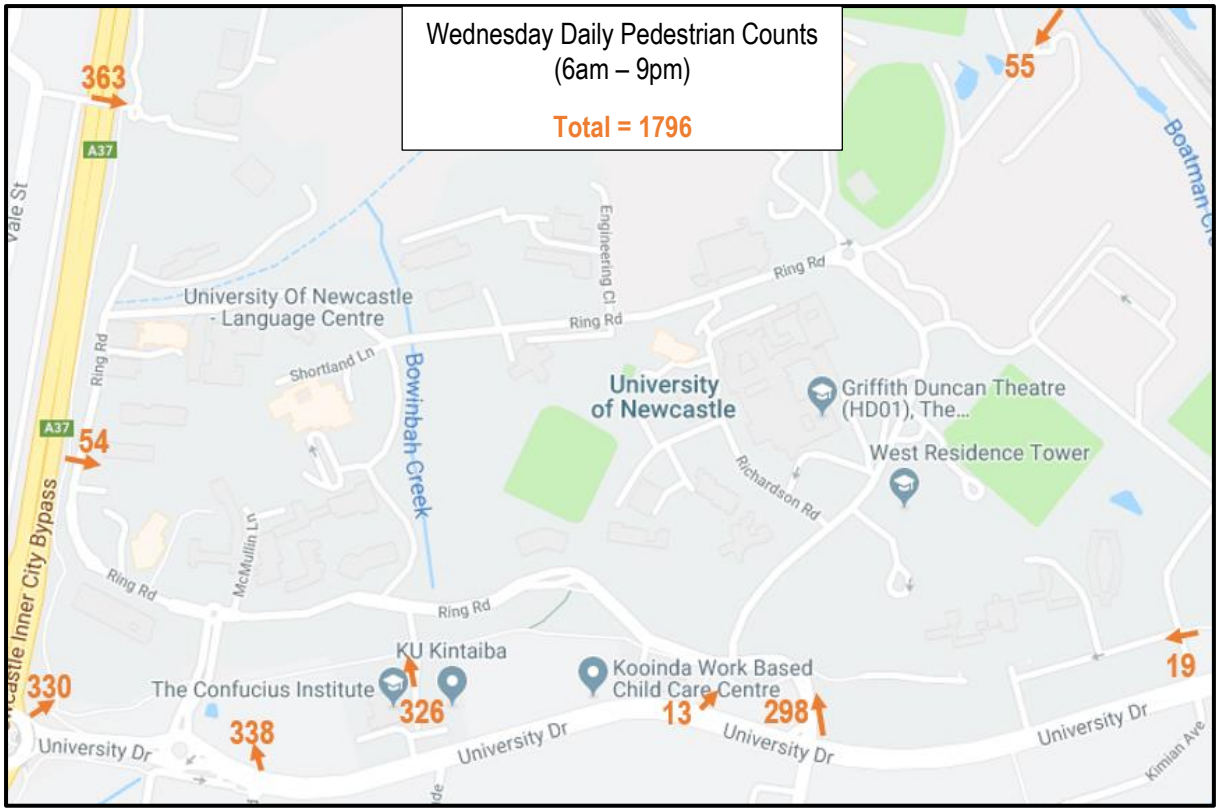


Figure 10-3 Pedestrian volumes for the Callaghan campus, 6am to 9pm Wednesday 21st August 2019

Some of these pedestrians came from cars parked in the streets adjacent to the University. The number of vehicles parked on-street was recorded on a Wednesday and Thursday, with the vehicles determined to be University related quantified in Table 5-6. In order to remove pedestrians associated with these parked cars from the pedestrian counts, the number of car-based pedestrians was estimated using the car occupancy rate (per Section 7.2). Based on the on-street University related parking demands of 387 vehicles (determined on a Wednesday) a total of 461 pedestrians are to be deducted from the pedestrian totals (1.19 vehicle occupancy). Parking counts were not conducted on a Tuesday; however these would be similar to those recorded on the Wednesday and the above 461 has been deducted from both data sets.

The survey results have been broken down into five periods across the day, with this including the three time periods analysed as part of the prior surveys. The results are provided in Table 10-1 and Table 10-2 for Tuesday and Wednesday respectively.

Table 10-1 Pedestrian volumes for the Callaghan campus, Tuesday 20th August 2019

Time	NIER	Zebra Crossing	South West	Opposite Sunset Bvd	IFS Pathway	Wirra Cres	Traffic Signals	IDC	Total	% Daily Total
	1	2	3	4	5	6	7	8		
6am-7:30am	10	3	6	9	2	1	5	7	43	2%
7:30am-10am	191	21	149	154	8	6	124	134	787	43%
10am-4pm	156	46	169	152	3	9	150	156	841	46%
4pm-7pm	18	3	14	15	3	5	24	55	137	8%
7pm-9pm	6	1	1	1	0	5	2	3	19	1%
Total	381	74	339	331	16	26	305	355	1827	100%
% Total	21%	4%	19%	18%	1%	1%	17%	19%	100%	
Pedestrians from cars parked outside the campus									- 461	
Pedestrians over Warabrook bridge									+ 55	
Residents on campus									+1800	
Net pedestrians									3221	

Table 10-2 Pedestrian volumes for the Callaghan campus, Wednesday 21st August 2019

Time	NIER	Zebra Crossing	South West	Opposite Sunset Bvd	IFS Pathway	Wirra Cres	Traffic Signals	IDC	Total	% Daily Total
	1	2	3	4	5	6	7	8		
6am-7:30am	12	3	3	8	1	1	3	10	41	2%
7:30am-10am	169	17	158	162	6	7	142	109	770	44%
10am-4pm	154	30	146	154	6	5	133	172	800	46%
4pm-7pm	27	4	21	12	0	6	16	34	120	7%
7pm-9pm	1	0	2	2	0	0	4	1	10	1%
Daily Total	363	54	330	338	13	19	298	326	1741	100%
% Total	21%	3%	19%	19%	1%	1%	17%	19%	100%	
Pedestrians from cars parked outside the campus									- 461	
Pedestrians over Warabrook bridge									+ 55	
Residents on campus									+1800	
Net pedestrians									3135	

An additional summary of the total pedestrian arrivals between 8am to 9am and 7:30am to 10am (Table 10-3) has been completed to allow for comparison with other modes of travel across these periods. The distribution of the daily resident on campus movements (1800) between 8am to 9am has been determined consistent with the portion of arrivals recorded during this period for the remainder of the pedestrian surveys. This allowed for 21.2% to occur between 8am to 9am on Tuesday, equating to 382 additional movements and 21.7% to occur in this period on Wednesday, equating to 391. Similarly, the resident movements in the 7:30am to 10am period have allowed for distribution per the % daily totals in the tables above of 43% on Tuesday and 44% on Wednesday.

Pedestrians from cars parked on street in these time periods have also been deducted consistent with the percentages applied above, giving a reduction of 98 pedestrians on Tuesday and 100 on Wednesday between 8am to 9am and 198 pedestrians on Tuesday and 203 on Wednesday from 7:30am to 10am.

Table 10-3 Pedestrian arrivals 8am – 9am, 7:30am – 10am

	Tuesday 20th August		Wednesday 21st August	
	8am – 9am	7:30am – 10am	8am – 9am	7:30am – 10am
Pedestrian Arrivals	387-98 = 289	787-198 = 589	377-100 = 277	770-203 = 567
Resident movements	382	774	391	792
Total	671	1363	668	1359

Due to the number of changes that have occurred, including higher numbers of students as residents on campus, a shift in parking off-street to the west of the campus, the opening of the NIER precinct with parking to support this part of the campus and the differences in count location a comparison of pedestrian data like for like is not possible. Table 10-4 below however incorporates the 2019 data to provide for the ongoing trends with the following however noted:

1. The location of historical counts may have seen the double counting of some internal pedestrian movements, particularly Location 3 leading into Location 4.
2. The location of the 2019 count internal to the IDC building and childcare would see pedestrians accessing these sites via University Drive not included however these numbers are unlikely to be significant when compared with the past data.
3. Pedestrian demands at Location 3 are significantly less.

Total pedestrian movements on a Tuesday were determined as being 3221 compared with the 2013 number of 3157. Points to note are:

1. Pedestrian numbers from off-campus cars have declined from 1133 to 461. This is reflected in the lower number of vehicles parking in the streets surrounding the campus coupled with a lower vehicle occupancy rate.
2. Overall pedestrian volumes remain high and are supported by the number of students living on campus
3. As a percentage of student enrolments, the percentage of students as pedestrians in 2019 (enrolment=18,133) is 17.8% compared with a 2013 (enrolment=22,358) percentage of 14.1%.
4. New student accommodation currently being constructed on University Drive opposite the campus will further support this mode of travel to the campus.

Table 10-4 Pedestrian volumes for the Callaghan campus, 1999-2019

Year	NIER	Zebra Crossing	South West	Opposite Sunset Bid	IFS Pathway	Wirra Cres	Traffic Signals	IDC	Wararbrook	Ring Rd at Evatt	On Campus Residents	From Off campus (-ve)	Total
	1	2	3	4	5	6	7	8	9				
1999	255	104	682	660	-	23	945	324	31	500	-	738	2786
2001	246	117	590	471	-	6	1198	448	134	812	-	857	3165
2002	367	71	617	488	-	16	1212	452	112	829	-	1035	3129
2003	286	83	626	592	-	51	1002	484	100	1206	-	1082	3348
2004	295	101	646	595	-	51	1003	459	128	966	-	923	3321
2005	347	172	695	689	-	-	1125	410	119	912	-	1232	3237
2013	560	93	940	550	-	-	1597	459	91	-	-	1133	3157
2019	381	74	339	331	16	26	305	355	55	-	1800	461	3221
									% change 2013 to 2019				2%
									% change 1999 to 2019				15.6%

The above shows that the total number of pedestrian arrivals increased by 2% between 2013 and 2019. Pedestrian arrivals have increased by 15.6% since 1999.

10.3 Cyclists

The total daily cyclist volumes recorded at each nominated location from 6am to 9pm are shown in Figure 10-4 and Figure 10-5 for Tuesday and Wednesday respectively. The extrapolated daily total at Warabrook Station determined from the spot count has been applied to both days.

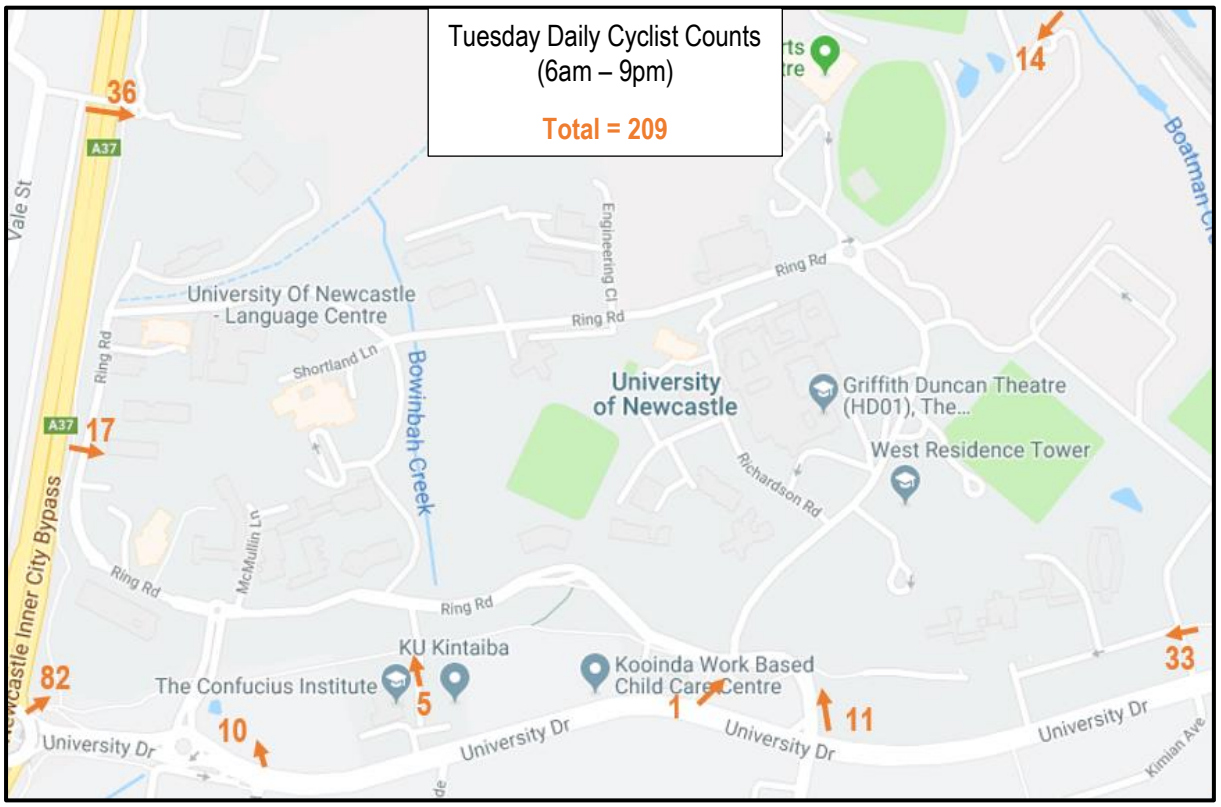


Figure 10-4 Cyclist volumes for the Callaghan campus, 6am to 9pm Tuesday 20th August 2019

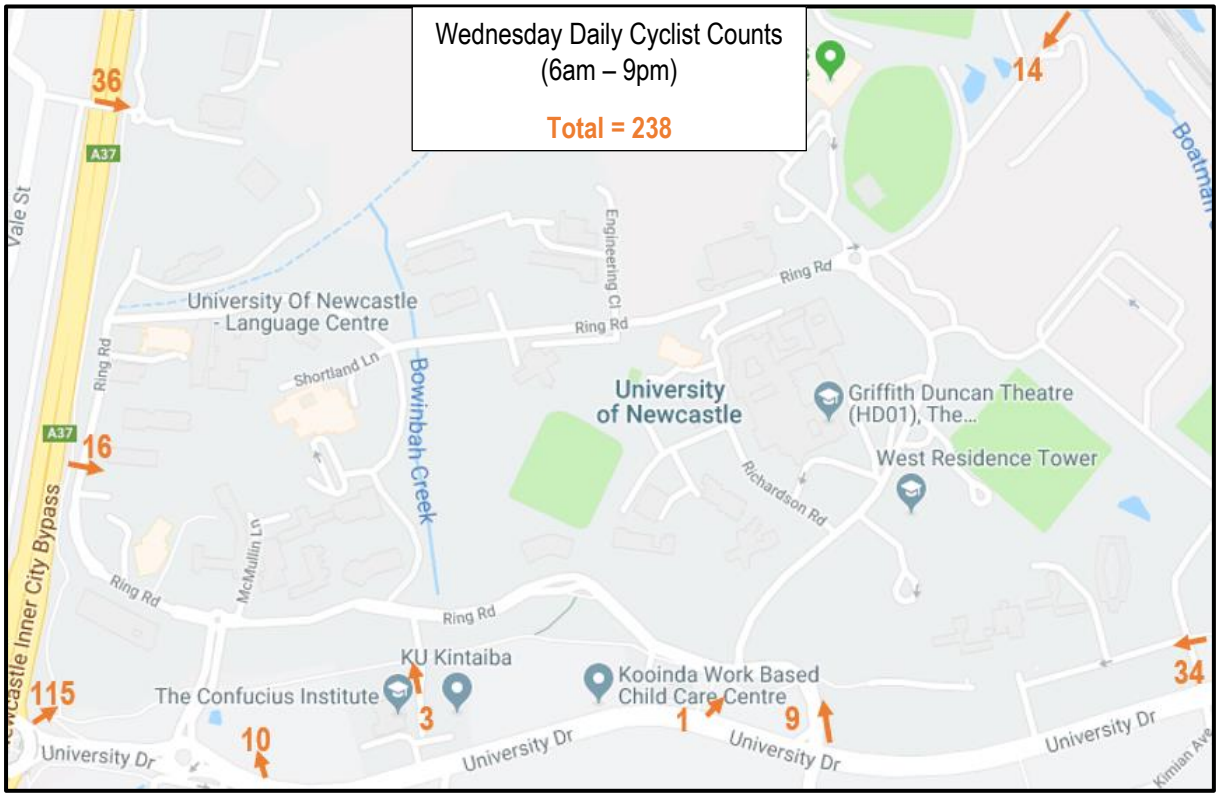


Figure 10-5 Cyclist volumes for the Callaghan campus, 6am to 9pm Wednesday 21st August 2019

As per the pedestrian data, the cyclist data broken down into five periods across the day, with the results provided in Table 10-5 and Table 10-6 for Tuesday and Wednesday respectively.

Table 10-5 Cyclist volumes for the Callaghan campus, Tuesday 20th August 2019

Time	NIER	Zebra Crossing	South West	Opposite Sunset Bvd	IFS Pathway	Wirra Cres	Traffic Signals	IDC	Total	% Daily Total
	1	2	3	4	5	6	7	8		
6am-7:30am	2	1	7	0	0	1	0	0	11	6%
7:30am-10am	20	10	33	4	0	15	2	4	88	45%
10am-4pm	8	5	33	4	1	12	6	1	70	36%
4pm-7pm	6	1	9	2	0	5	3	0	26	13%
7pm-9pm	0	0	0	0	0	0	0	0	0	0%
Total	36	17	82	10	1	33	11	5	195	100%
% Total	18%	9%	42%	5%	1%	17%	6%	3%	100%	
								Cyclists over Warabrook bridge	+ 14	
								Net cyclists	209	

Table 10-6 Cyclist volumes for the Callaghan campus, Wednesday 21st August 2019

Time	NIER	Zebra Crossing	South West	Opposite Sunset Bvd	IFS Pathway	Wirra Cres	Traffic Signals	IDC	Total	% Daily Total
	1	2	3	4	5	6	7	8		
6am-7:30am	2	0	6	0	0	5	0	1	14	6%
7:30am-10am	17	10	76	4	0	18	5	0	130	58%
10am-4pm	17	6	25	4	1	5	4	1	63	28%
4pm-7pm	0	0	7	2	0	6	0	0	15	7%
7pm-9pm	0	0	1	0	0	0	0	1	2	1%
Total	36	16	115	10	1	34	9	3	224	100%
% Total	16%	7%	51%	4%	0%	15%	4%	1%	100%	
								Cyclists over Warabrook bridge	+ 14	
								Net cyclists	238	

An additional summary of the total cyclist arrivals between 8am to 9am (Table 10-7) has been completed to allow for comparison with other modes of travel across this peak period.

Table 10-7 Cyclist arrivals 8am – 9am

	Tuesday 20th August	Wednesday 21st August
Cyclist Arrivals (8am – 9am)	45	78

The 2019 data has been compared to historical data recorded since 1999, with this shown in Table 10-8.

Table 10-8 Cyclist volumes for the Callaghan campus, 1999-2019

Year	NIER	Zebra Crossing	South West	Opposite Sunset Bvd	IFS Pathway	Wirra Cres	Traffic Signals	IDC	Wararbrook	Ring Rd at Evatt	Total
	1	2	3	4	5	6	7	8	9		
1999	23	20	148	16	-	25	79	11	41	-	363
2001	32	12	171	18	-	13	103	11	46	18	424
2002	5	23	112	11	-	19	142	19	25	15	371
2003	33	11	151	16	-	21	88	11	22	19	372
2004	35	18	116	21	-	22	109	12	52	18	403
2005	32	18	121	20	-	N/A	147	4	44	10	396
2013	65	10	177	14	-	N/A	205	6	55	0	532
2019	36	17	82	10	1	33	11	5	14	-	209
								% change 2013 to 2019			-155%
								% change 1999 to 2019			-74%

Note prior surveys included cyclists who got off the train, however these are not included in the historic totals above in order to allow for like for like comparison. This study has allowed for these travellers as train patrons as their primary mode of travel.

The above shows that the total number of cyclist arrivals has decreased by 155% between 2013 and 2019. The number of cyclist arrivals at the Campus has also decreased by 74% relative to 1999 arrivals, indicating the number of patrons accessing the campus by bike has reduced significantly.

It is recognised that cyclists who access the campus on road via the two main accesses were not included in the above volumes, however based on observations completed on site this number was minimal with cyclists using the paths provided.

10.4 Bike Parking

As part of this project, the University of Newcastle provided Seca Solution Pty Ltd with swipe card data for the two bike hubs at Callaghan Campus. In reviewing this data, several inconsistencies were highlighted which precluded a more comprehensive assessment of the typical arrival and departure patterns, including:

- Multiple swipe entries for a single student / staff card;
- Swipe card entry with no corresponding drop off or pick up. This could suggest students / staff accessing the bike hub in groups using only a single swipe card.

Accumulation across a day being significantly less than the number of bikes counted. Whilst this could also be reflective of students / staff entering in groups under a single card entry, it could also suggest that some bikes are being left in the bike hubs on an extended basis.

The survey of bike parking was conducted between 11am to 1pm on both Tuesday 20th August and Wednesday 21st August 2019. This survey included all formal bike parking provided within the campus, as well as the number of bikes parked informally. This included the designated bike hubs, Bike Hub East and Bike Hub West, as well as the Bike Store located in the EHA accommodation building. It did not include bikes parked within other buildings throughout the campus, nor the Bicycle Store located near Evatt House.

The bike parking survey data is shown in **Appendix D** with a summary of the results shown below in Table 10-9. The location of all available bike parking areas recorded is shown in **Appendix D**, with each location identified by a map code corresponding to the Newcastle University Callaghan campus map shown in **Appendix A**.

A total of 577 bike parking spaces were observed across the campus for all bike racks and storage areas noted above. Of these:

- 181 spaces were occupied during the Tuesday survey, plus a further 16 bikes parked informally
- 182 spaces were occupied during the Wednesday survey, plus a further 17 bikes parked informally

Table 10-9 - Bike Parking Summary for Tuesday 20th and Wednesday 21st August 2019

Parking For	Tuesday 20th August			Wednesday 21st August			Formal Parking Spaces
	Formal	Informal	Utilisation (%)	Formal	Informal	Utilisation (%)	
Residential	37	3	25	38	3	25	151
Non-Residential	144	13	34	144	14	34	426
Whole of Campus	181	16	31	182	17	32	577

The above table incorporates the Bike Hub utilisation. The utilisation for each hub is summarised separately below:

- Bike Hub East has a total capacity of 52 spaces, with utilisation of 41 and 43 bikes on Tuesday and Wednesday respectively. Each day also included 1 bike parked informally (not chained to a designated rack).
- Bike Hub West has a total capacity of 52 spaces, with utilisation of 44 and 43 bikes on Tuesday and Wednesday respectively. A further 3 bikes were parked informally on Tuesday, with 2 recorded on Wednesday.

Several of the bikes surveyed throughout the campus were noted to be in the same location on both the Tuesday and Wednesday counts any appeared to have remained on site overnight. Whilst some of these bikes could be staff or students who attend the same building each day, a few of the bikes observed appeared to be in disrepair, indicating that they may be abandoned.

10.4.1 Informal Bike Parking

This appears to be out of convenience, with some owners choosing to chain bikes to railings or seats closer to buildings, despite in most cases formal bike parking being available within a short distance.

10.4.2 Further Investigation

The significant reduction in cycling to the campus warrants investigation as this is a mode that has numerous benefits and is being supported by ongoing infrastructure improvements. What has changed to reduce cycling? Liaise with NUBUG.

11 Modal Split

The arrivals by the various travel modes have been compared in order to determine the Modal Split for the Callaghan campus, by expressing the arrivals per mode as a percentage of total arrivals for a nominated period.

Modal Split has been represented for the period 8am to 9am and 7:30am to 10am. Table 11-1 and Table 11-2 provide the arrivals for each mode of transport, as well as the modal split for a Tuesday and Wednesday respectively.

Table 11-1 Peak hour arrivals and modal split for each mode of transport on a Tuesday

		Vehicles	Persons per Vehicle	By Car Total	Car Driver	Car Passenger	Bus	Train	New Space Shuttle	Walk	Cycle	Total
8am – 9am	**Arrivals**	2264	1.19	2694	2264	430	162	116	53	671	45	3741
	Modal Split	-	-	72.0%	60.5%	11.5%	4.3%	3.1%	1.4%	18.0%	1.20%	100%
7:30am–10am	**Arrivals**	4195	1.19	4992	4195	797	348	245	93	1363	88	7129
	Modal Split	-	-	70.0%	58.8%	11.2%	4.9%	3.5%	1.3%	19.1%	1.2%	100%

Table 11-2 Peak hour arrivals and modal split for each mode of transport on a Wednesday

		Vehicles	Persons per Vehicle	By Car Total	Car Driver	Car Passenger	Bus	Train	New Space Shuttle	Walk	Cycle	Total
8am – 9am	**Arrivals**	2436	1.19	2899	2436	463	174	120	47	668	78	3986
	Modal Split	-	-	72.7%	61.1%	11.6%	4.4%	3.0%	1.2%	16.8%	1.9%	100%
7:30am–10am	**Arrivals**	4355	1.19	5182	4355	827	343	284	99	1359	130	7397
	Modal Split	-	-	70.1%	58.9%	11.2%	4.6%	3.8%	1.3%	18.4%	1.8%	100%

The modal split between 8am to 9am has been represented graphically below in Figure 11-1 and Figure 11-2 for both Tuesday and Wednesday respectively.

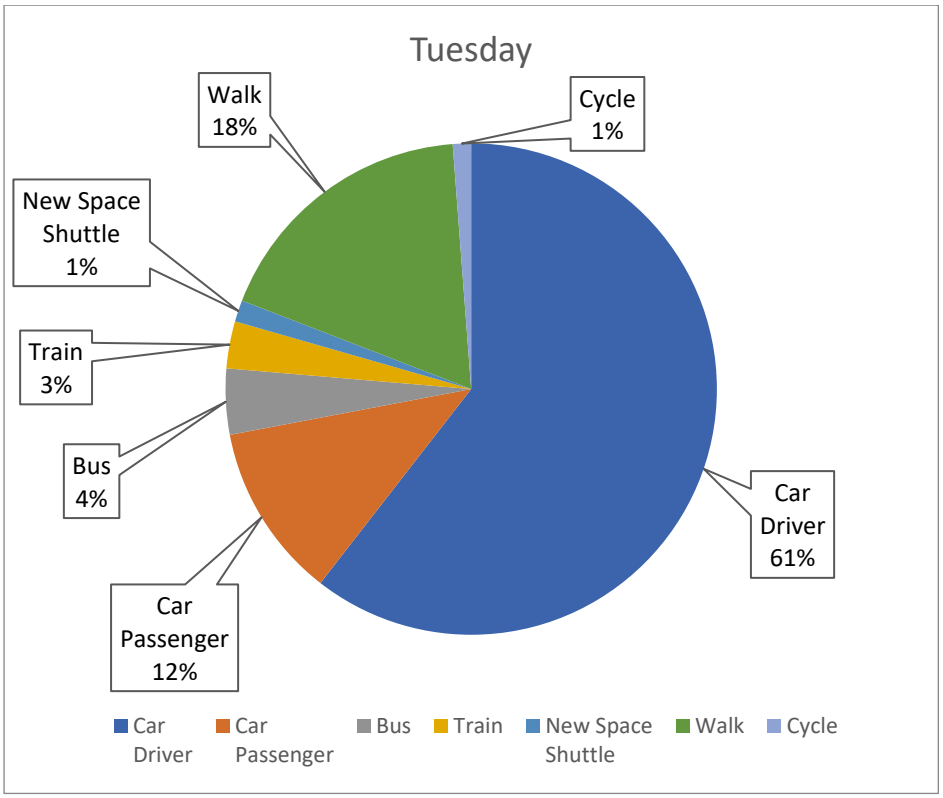


Figure 11-1 Modal Split for Peak Hour (8am-9am) arrivals on a Tuesday

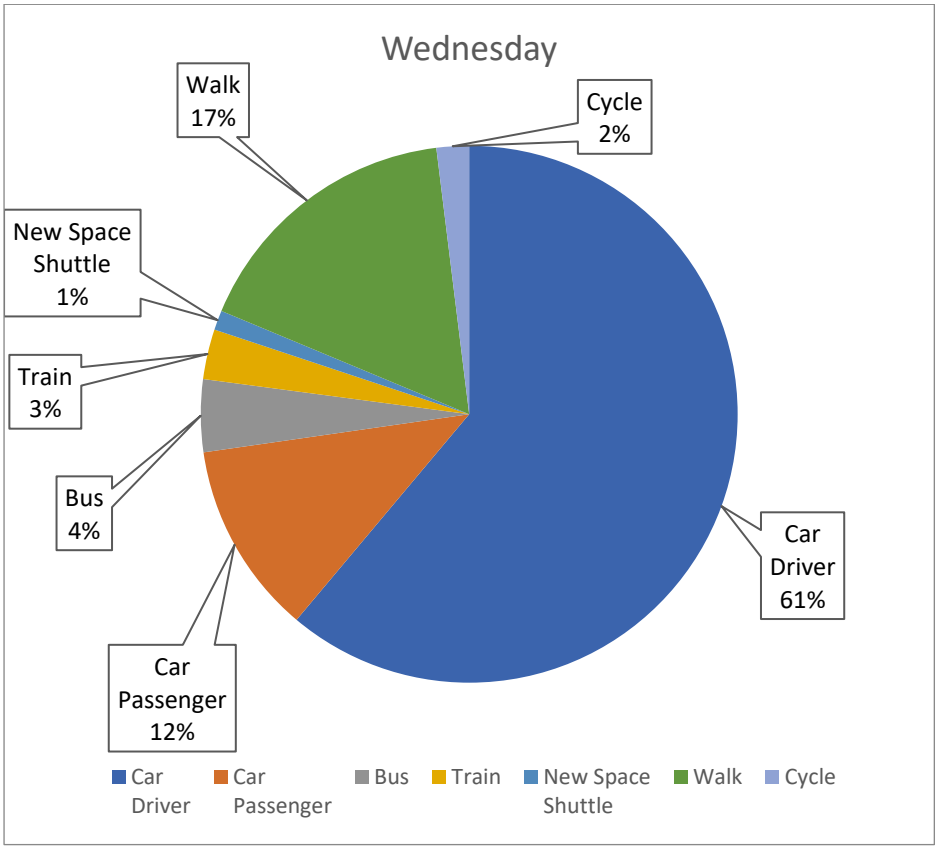


Figure 11-2 Modal Split for Peak Hour (8am-9am) arrivals on a Wednesday

The modal split between 7:30am to 10am has been represented graphically below in Figure 11-3 and Figure 11-4 for both Tuesday and Wednesday respectively.

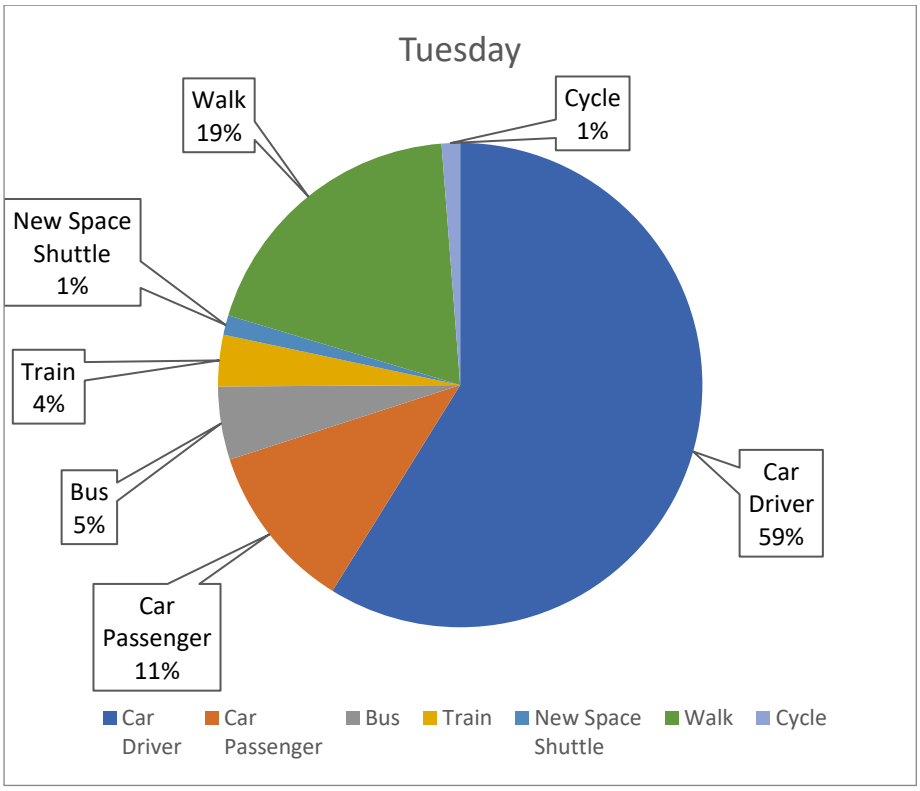


Figure 11-3 Modal Split for 7:30am-10am arrivals on a Tuesday

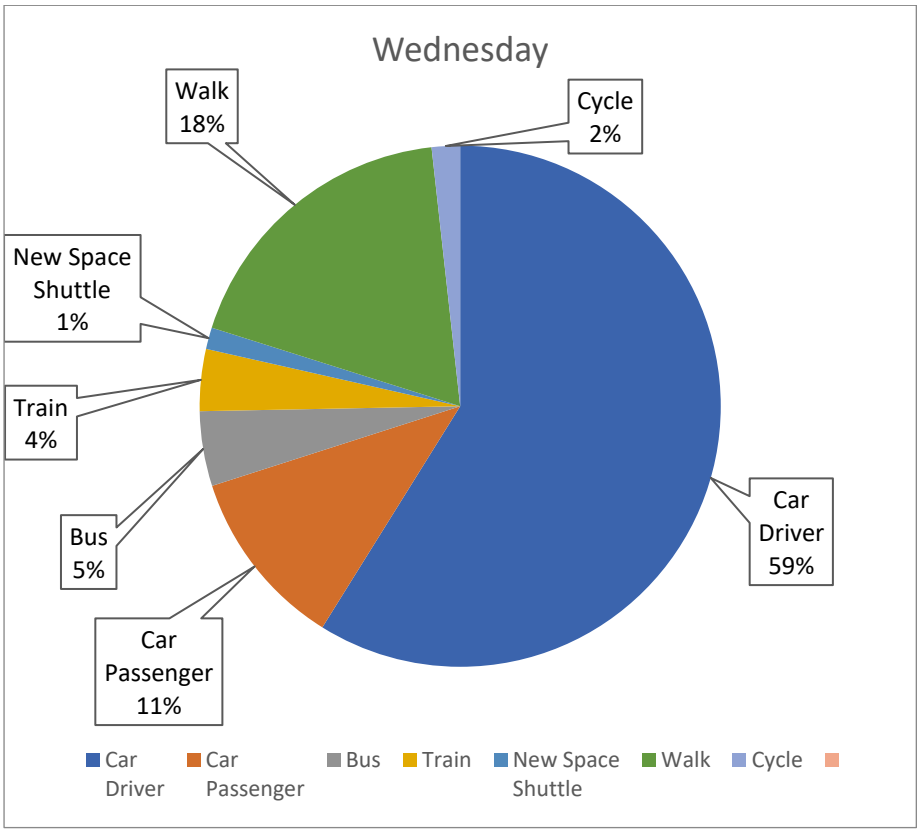


Figure 11-4 Modal Split for 7:30am-10am arrivals on a Wednesday

The figures above show a consistent demand for each mode of travel across the Tuesday and Wednesday surveys. Travel by car is the most popular transport mode, with this accounting for 69% of arrivals including 11% as passengers between 7:30am to 10am on both days. Walking is the next most popular mode, accounting for 20% of the total demands on a Wednesday, followed by train and bus at 4% each. Cycling accounts for 2%, whilst the shuttle accounts for 1%.

Prior surveys determined the modal split for all arrivals at the Callaghan Campus between 7.30am and 7.00pm on both a Tuesday and a Wednesday. This included a breakdown for the nominated three periods across the day, including 7:30am to 10am. The arrivals recorded for this time period in 2019 has been compared to this historic data, with this comparison provided in Table 11-3 below.

The total arrivals between 7:30am to 10am on Tuesday in 2013 were 8688, which is 21.9% higher than the 7129 recorded in 2019. On Wednesday, the 8276 persons recorded were 11.9% higher than the 7397 recorded in 2019.

Table 11-3 Comparison of arrivals by mode between 7:30am – 10am, 2013-2019

Tuesday	Vehicle Arrivals	Persons per Vehicle	Car	Bus	Train	Walk	Cycle	Total
2019	4195	1.19	4992	441[1]	245	1363	88	7129
2013	4771	1.2	5725	591	628	1503[2]	241	8688
Wednesday	**Vehicle Arrivals**	**Persons per Vehicle**	**Car**	**Bus**	**Train**	**Walk**	**Cycle**	**Total**
2019	4355	1.19	5182	442[1]	284	1359	130	7397
2013	4796	1.2	5755	505	590	1184[2]	242	8276

[1] It is noted that the NeW Space shuttle did not exist in 2013, as such the recorded patronage for this service has been included in the bus data for 2019 to allow for comparison.

[2] The prior reporting removed on-street pedestrians from the daily total, not individually from each of the nominated three time periods. In order to allow for a comparison, the pedestrian arrivals between 7:30am to 10am needed to have the portion of car-based pedestrians in this period removed. To achieve this, the percentage of pedestrian arrivals between 7:30am to 10am determined for the 2013 data (47%) was applied to the total on-street pedestrian figure. This determined that of the daily total of 1133 car based pedestrians, approximately 533 occurred between 7:30am to 10am. As such, 533 pedestrians were deducted from the 2013 Tuesday and Wednesday pedestrian arrivals between 7:30am to 10am.

A comparison of the modal split recorded in 2013 and 2019 during the period from 7:30am to 10am is provided in Table 11-4.

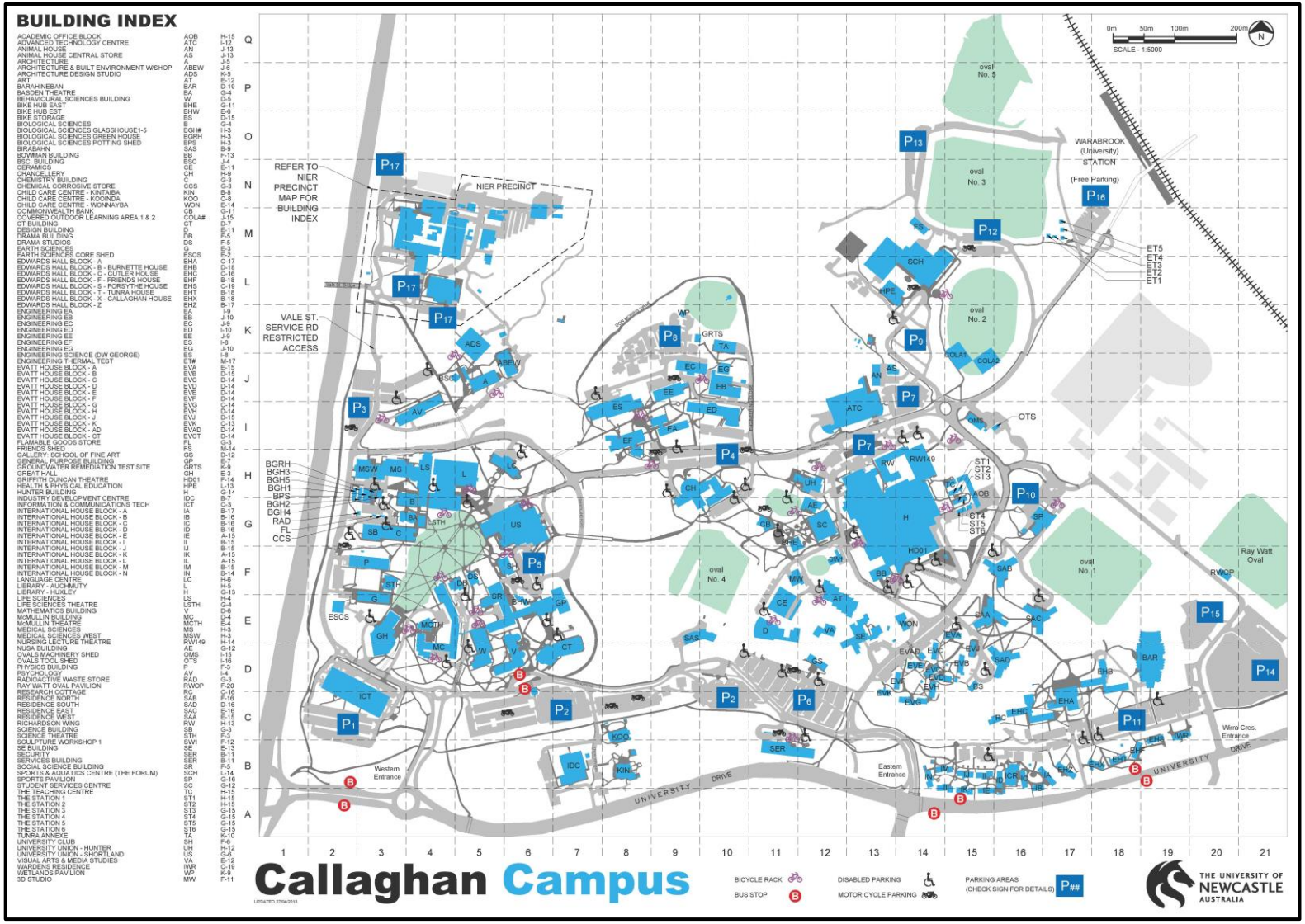
Table 11-4 Comparison of Modal Split between 7:30am – 10am, 2013-2019

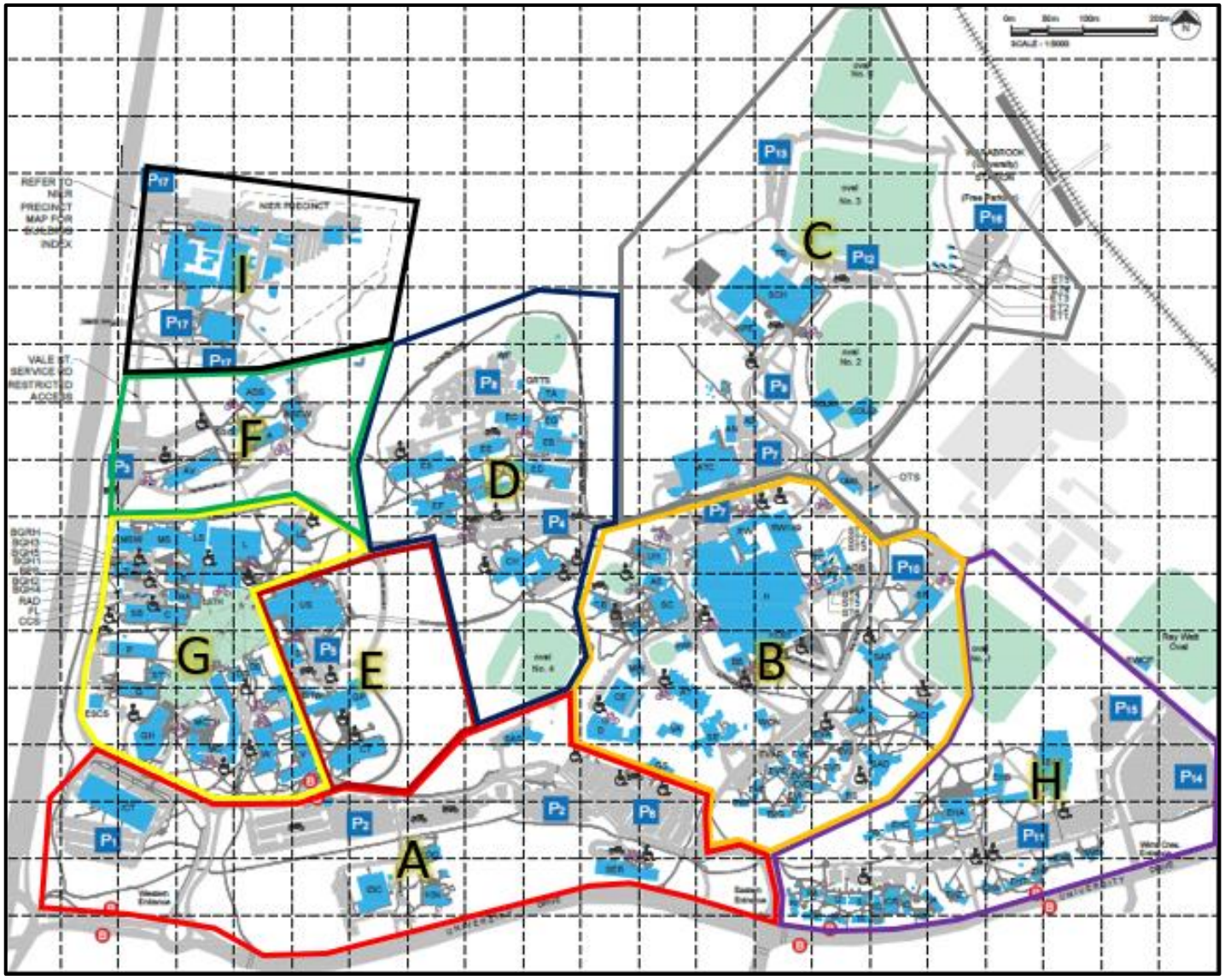
Tuesday	Total Car	Car Driver	Car Passenger	Bus	Train	Walk	Cycle
2019	70.0%	58.8%	11.2%	6.2%	3.5%	19.1%	1.2%
2013*	65.9%	54.9%	11.0%	6.8%	7.2%	17.3%	2.8%
Wednesday	**Total Car**	**Car Driver**	**Car Passenger**	**Bus**	**Train**	**Walk**	**Cycle**
2019	70.1%	58.9%	11.2%	5.9%	3.8%	18.4%	1.8%
2013*	69.5%	57.9%	11.6%	6.1%	7.1%	14.3%	2.9%

** Revised for adjusted pedestrian volumes, removing car based pedestrians parked on-street.*

It can be seen that car usage represents a higher proportion of travel than 2013, with this likely a result of the reduction in students resulting in it being easier for students to drive and find a park on campus. Other key changes include a drop in public transport patronage, in particular travel by train. There has been an increase in the percentage of pedestrian arrivals, with the increase in campus accommodation and student accommodation in the suburbs surrounding Callaghan driving this increase.

Appendix A – Newcastle University Callaghan Campus Map and Precinct Map





Appendix B – Shuttle Bus Survey Template

Answers shall be ticked in columns except for their place of origin and their comment regarding return trips at the end of the day.

AM Questions - Callaghan to City

1. Are you a student? Yes/No
2. Do you live on campus at Callaghan? If Yes write CAMPUS then go to Q2
   If No go to Q3
3. How did you get to the shuttle?
   a) Walk within campus — Complete, thank you
   b) Ride motorbike within campus — Go to Q5
   c) Drive within campus — Go to Q5
   d) Got lift
   e) Cycle/skateboard/scooter to shuttle — Complete, thank you
4. What suburb did you travel from to catch the shuttle today? SUBURB NAME — Go to Q4
5. How did you get to the campus/shuttle?
   a. Got lift with friend/family — Go to Q6
   b. Ride motorbike — Go to Q5
   c. Drive — Go to Q5
   d. Walked — Go to Q7
   e. Cycle/skateboard/scooter — Go to Q7
   f. Train to campus — Go to Q7
   g. Bus to campus — Go to Q7
   h. Taxi/Uber — Go to Q6
6. Which best describes where/how you parked?
   a. Park and Ride/Shuttle space — Go to Q7
   b. Motorbike space — Go to Q7
   c. Staff parking — Go to Q7
   d. General parking — Go to Q7
   e. Carpool space — Go to Q7
   f. Reserved parking — Go to Q7
   g. Accessible parking — Go to Q7
   h. Resident parking — Go to Q7
   i. Informally — Go to Q7
   j. Other – please specify — Go to Q7
7. Do you use Liftango car share app to get lifts? — Go to Q7
8. Do you do the same trip in reverse to go home?
   a. Yes
   b. No – note the response

Thank you for your help

AM Question City to Callaghan

1. Are you a student? Yes/No
2. What suburb did you travel from to catch the shuttle today? Note SUBURB NAME

3. What was your main mode of travel to get to the shuttle today?
   a. Got lift with friend/family — Go to Q4
   b. Ride motorbike — Go to Q3
   c. Drive — Go to Q3
   d. Walked — Go to Q6
   e. Cycle/skateboard/scooter — Go to Q5
   f. Light rail only — Go to Q6
   g. Train then walked — Go to Q6
   h. Train then light rail — Go to Q6
   i. Bus — Go to Q6
   j. Bus then light rail — Go to Q6
   k. Ferry then walked — Go to Q6
   l. Ferry then light rail — Go to Q6
4. Which best describes where/how you parked? — Go to Q6
   a) Motorbike space on street
   b) On street paid parking
   c) On street free parking
   d) Carpool space in parking station
   e) General space in Parking station (where)
   f) Accessible parking
   g) Other – please specifiy

5. Do you use Liftango car share app to get lifts? — Go to Q6
6. If you rode to the shuttle did you: — Go to Q6
   a) Park your bicycle in the hub?
   b) Bring your bike on the shuttle?
   c) Park your bike elsewhere? (where)
7. Do you do the same trip in reverse to go home?
   a. Yes
   b. No – note the response eg get lift with friend, go to gym etc

Thank you for your help

Later in the day patrons shall first be asked “Have you helped us with our survey today?” If yes then THANK YOU and move on, if no then determine if this is their first trip and then ask appropriate questions.

Appendix C – Campus Parking Utilisation by Location

Table A-1 Callaghan campus parking utilisation by location, Wednesday 15th August 2019

	General		Staff		Reserved		Accessible		Time limited		Service vehicles		Residents		Load Delivery		Ride Share		Park and Ride		Informal Cars		Fleet Vehicles		Set Down / Pick Up		Motorcycles		Informal Motorcycles		Total Formal Parked	Total Formal Vacant	Total Informal Vehicles	Formal Capacity
	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P				
CP1	32	730	6	109	26	6	3	3	0	0	3	0	0	0	1	0	5	2	0	0	0	0	0	0	0	0	4	0	0	850	76	0	926
CP2	1	488	23	139	24	17	6	2	7	4	4	2	0	0	0	0	8	6	0	120	0	9	0	0	1	1	4	0	0	2	779	74	11	853
CP3	18	245	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	246	20	1	266
CP4	0	105	2	62	40	24	3	6	7	5	0	0	0	0	0	0	2	14	0	0	0	0	0	0	0	0	6	10	0	0	216	54	0	270
CP5	10	50	0	0	33	26	3	2	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	1	20	0	0	80	49	0	129
CP6	1	292	1	48	4	5	4	1	0	0	1	4	0	0	0	0	2	2	0	0	0	1	0	0	0	0	0	1	0	0	352	13	1	365
IFS Carpark	0	0	0	0	5	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	10	6	0	0	0	2	0	0	10	16	2	26
CP7	0	0	13	283	45	42	9	6	0	0	20	7	0	0	5	2	1	3	0	0	0	12	0	0	0	2	0	4	0	0	345	93	12	438
CP8	4	226	3	37	22	4	2	1	0	0	1	7	0	0	3	0	0	0	0	0	0	64	0	0	0	0	0	0	0	0	275	35	64	310
CP9	0	0	25	15	0	0	1	5	9	65	4	1	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	1	0	0	86	39	4	125
CP10	0	72	0	12	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	84	3	0	87
CP11A	0	0	0	0	6	3	2	0	0	0	1	0	12	129	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	132	21	0	153
CP11B	0	0	0	0	0	0	4	4	0	0	6	2	0	91	7	4	0	0	0	0	0	1	0	0	0	0	2	5	0	0	101	17	1	118
CP11C	0	0	3	14	0	0	4	0	0	0	8	2	30	228	0	0	0	0	0	0	0	0	4	2	0	0	1	3	0	0	246	49	0	295
CP12	0	0	0	0	1	0	0	0	57	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	22	58	0	80
CP13	7	137	0	0	0	0	0	0	119	26	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	163	126	5	289
CP14	85	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	204	12	0	0	0	0	0	0	0	0	0	0	87	289	0	376
CP15	0	0	0	0	0	0	0	0	0	0	31	69	0	0	0	0	0	0	0	0	0	102	0	0	0	0	0	0	0	0	69	31	102	100
CP16	1	92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	0	0	0	0	0	0	0	0	92	1	37	93
CP16 INF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56	0	0	0	0	0	0	0	0	0	0	56	0
CP17	16	125	0	30	16	13	4	0	0	3	0	0	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	171	36	26	207
CP18	0	0	2	38	8	8	10	6	3	3	1	4	0	0	2	5	0	0	0	0	0	1	0	0	8	1	0	1	0	0	65	34	1	99
CP19	23	167	2	24	12	7	1	2	0	0	1	1	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	202	39	3	241
CP20 Station	0	14	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	14	2	3	16
CP21 INF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	123	0	0	0	0	0	0	0	0	0	0	123	0
Total	198	2818	80	811	242	159	62	39	202	128	83	99	42	448	21	14	18	27	204	132	0	450	14	8	9	4	24	55	0	2	4687	1175	452	5862

Table A-2 Callaghan campus parking utilisation by location, Thursday 16th August 2019

	General		Staff		Reserved		Accessible		Time limited		Service vehicles		Residents		Load Delivery		Ride Share		Park and Ride		Informal Cars		Fleet Vehicles		Set Down / Pick Up		Motorcycles		Informal Motorcycles		Total Formal Parked	Total Formal Vacant	Total Informal Vehicles	Formal Capacity
	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P	V	P				
CP1	40	722	1	114	5	27	5	1	0	0	3	0	0	0	1	0	6	1	0	0	0	0	0	0	0	0	4	0	0	865	61	0	926
CP2	5	484	16	146	22	19	6	2	8	3	4	2	0	0	0	0	11	3	0	120	0	2	0	0	0	2	4	3	0	0	781	72	2	853
CP3	17	246	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	246	20	1	266
CP4	0	105	0	64	29	35	5	4	8	4	0	0	0	0	0	0	11	5	0	0	0	0	0	0	0	0	9	7	0	0	217	53	0	270
CP5	1	59	0	0	25	34	2	3	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	23	0	3	100	29	3	129
CP6	4	289	3	46	6	3	5	0	0	0	2	3	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	341	24	0	365
IFS Carpark	0	0	0	0	2	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	9	0	0	0	2	0	0	16	10	0	26
CP7	0	0	29	267	54	33	9	6	0	0	20	7	0	0	5	2	0	4	0	0	0	5	0	0	2	0	0	3	0	0	319	119	5	438
CP8	9	221	2	38	23	3	3	0	0	0	3	5	0	0	3	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	267	43	32	310
CP9	0	0	34	6	0	0	4	2	16	58	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	66	59	0	125
CP10	2	70	1	11	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81	6	0	87
CP11A	0	0	0	0	5	4	2	0	0	0	1	0	19	122	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	126	27	0	153
CP11B	0	0	0	0	0	0	6	2	0	0	7	1	1	90	10	1	0	0	0	0	0	0	0	0	0	0	3	4	0	0	94	24	0	118
CP11C	0	0	5	12	0	0	4	0	0	0	5	5	34	224	0	0	0	0	0	0	0	0	2	4	0	0	1	3	0	0	245	50	0	295
CP12	0	0	0	0	0	1	0	0	73	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	73	0	80
CP13	48	96	0	0	0	0	0	0	128	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113	176	0	289
CP14	88	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	203	13	0	0	0	0	0	0	0	0	0	0	85	291	0	376
CP15	0	0	0	0	0	0	0	0	0	0	43	57	0	0	0	0	0	0	0	0	0	66	0	0	0	0	0	0	0	0	57	43	66	100
CP16	0	93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	0	0	0	0	0	0	0	0	93	0	37	93
CP16 INF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53	0	0	0	0	0	0	0	0	0	0	53	0
CP17	30	111	1	29	19	10	4	0	3	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	150	57	25	207
CP18	0	0	0	40	5	11	10	6	5	1	4	1	0	0	7	0	0	0	0	0	0	2	0	0	8	1	0	6	0	0	60	39	2	99
CP19	42	148	3	23	17	2	3	0	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	174	67	3	241
CP20 Station	4	10	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	6	0	16
CP21 INF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	119	0	0	0	0	0	0	0	0	0	0	119	0
Total	290	2726	95	796	212	189	75	26	241	89	100	82	54	436	28	7	32	13	203	133	0	342	9	13	10	3	26	57	0	6	4513	1349	348	5862

Appendix D – Bike Parking Survey Data

Location	Map Code	Tuesday (20/8/19)		Wednesday (21/8/19)		Spaces	Comments
		Parked	Informal	Parked	Informal		
Academic Office Block	AOB	1	0	1	0	4	
Advanced Technology Centre	ATC	N/A	2	N/A	2	-	Informal on verandah and at rear of building.
Architecture	ADS	0	0	0	0	10	
Architecture Design Studio	ADS	2	0	2	0	10	
Art	AT	2	0	2	0	5	
Auchmuty Library	L	6	0	7	0	15	
Basden Theatre	BA	N/A	0	N/A	1	-	Informal tied to rail.
Bike Hub East	BHE	41	1	43	1	52	
Bike Hub West	BHW	48	3	43	2	52	
Birabahn	SAS	0	0	1	1	4	Informal on pedestrian bridge.
Bowman Building	BB	1	0	1	1	5	Informal against post to front of School of Medicine.
Ceramics	CE	0	0	0	0	5	
Chancellery	CH	0	0	0	0	10	2x 5 bike racks

CP7	CP7	0	0	1	0	10	2x 5 bike racks
Design	D	3	0	3	0	5	
Drama Building	DB	0	0	1	0	5	
Earth Sciences	G	0	0	1	0	5	
Edwards Hall Block A Bike Store	EHA	-	0	9	0	13	
Edwards Hall Block C	EHC	N/A	2	N/A	2	-	Informal only, chained to park bench rear of EHC block
Engineering Administration	EA	3	0	2	0	22	2x 5 bike racks, 1x 12 bike rack
Engineering Classrooms	EF	4	0	3	0	10	5x U posts
Engineering Science	ES	6	0	5	0	20	4x 5 bike racks
Evatt House Block F	EHF	0	0	0	0	10	2x 5 bike racks
Gallery	GS	0	0	0	0	5	
General Purpose	GP	N/A	1	N/A	0	-	Informal, tied to pole outside Bikehub.
Great Hall / McMullin Theatre	GH/MCTH	1	0	2	0	9	
Hunter Building West	H	9	0	6	0	47	4x 8 bike racks, 3x 5 bike racks
Hunter Building North	H	0	0	0	0	4	
Hunter Building (Griffith Duncan Theatre Entry)	H	N/A	0	N/A	4	-	Informal locked to handrails in front of building entry.
International House Block 1	IA	1	0	1	0	10	2x 5 bike racks

International House Block 10	IM	0	0	0	0	15	3x 5 bike racks
International House Block 2	IB	0	0	0	0	5	1x 5 bike rack
International House Block 7	IJ	0	0	0	0	5	1x 5 bike rack
International House Block 8	IK	0	0	0	0	5	1x 5 bike rack
International House Block 9	IL	3	0	2	0	5	1x 5 bike rack
Mathematics Building	V	4	0	6	0	20	4x 5 bike racks
McMullin Building	MC	1	0	0	0	5	
Mechanical Engineering	EC	0	0	0	0	10	2x 5 bike racks
NIER Building	NIER	6	0	7	0	15	1 scooter in cage
Nusa	AE	0	0	1	0	4	
Oval No. 2	B	0	0	0	0	12	3x 4 bike racks
Research Cottage (TFAC)	RC	N/A	1	N/A	0	-	Informal only, chained to fence
Residence East	SAC	2	0	2	0	28	14x U posts
Residence North	SAB	7	0	7	0	24	12x U posts
Residence South	SAD	8	0	9	0	18	9x U posts
Residence West	SAA	7	1	8	1	8	4x U posts, Informal leaning
Richardson Wing	RW	0	0	0	0	5	

Science Theatre	STH	N/A	1	N/A	0	-	Informal, tied to rail.
Services	SER	1	1	1	1	4	Informal adjacent to bike rack (against wall) both days.
Social Science	SR	0	0	0	0	5	
Social Science / General Purpose	SR/GP	N/A	1	N/A	1	-	Informal tied to rail.
Special Education	SE	0	0	0	0	5	
Sports and Aquatic Centre	SCH	2	0	3	0	12	3x 4 bike racks
Sports Pavilion	SP	0	0	0	0	4	
Student Services	SC	N/A	1	N/A	0	-	Informal only.
Union Hunter	UH	0	0	0	0	10	2x 5 bike racks
Union Shortland	US	3	1	2	0	6	Informal, tied to pole.
Total Residential Bike Parking		**37**	**3**	**38**	**3**	**151**	**Wednesday count includes 9 bikes counted in EHA Bike Store. These bikes have also been added to Tuesday total.**
Total Bike Parking (including residential)		**181**	**16**	**182**	**17**	**577**	
Total Bike Parking (excluding residential)		**144**	**13**	**144**	**14**	**426**	