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TOTAL PROJECT SOLUTIONS

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ENGINEERING
CERTIFICATION

Deicorp Pty Ltd

Footpath Capacity Study

Col James Student Accommodation:
Precinct 3, Pemulwuy Project
83-123 Eveleigh Street, Redfern

SY170002
April 2018

Project No.	SY170002
Author	EA
Checked	GB
Approved	GB

Rev No.	Status	Date	Comments
1	Submission	19/02/2018	
2	Final	16/04/2018	

SYDNEY
Suite 603, Level 6, 12 Century Circuit
Norwest Business Park NSW 2153
P (02) 9659 0005 **F** (02) 9659 0006
E sydney@barkerryanstewart.com.au

CENTRAL COAST
Studio 5, 78 York Street
East Gosford NSW 2250
P (02) 4325 5255
E coast@barkerryanstewart.com.au

HUNTER
Unit 1, 17 Babilla Close
Beresfield NSW 2322
P (02) 4966 8388 **F** (02) 4966 1399
E hunter@barkerryanstewart.com.au

barkerryanstewart.com.au

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1 Introduction

Barker Ryan Stewart have been engaged by Deicorp Pty Ltd to investigate the footpath capacity of the surrounding streets of a student housing development at 83-123 Eveleigh Street, Redfern, to address further information requested for a Development Application submitted to the NSW Department of Planning and Environment.

The purpose of this report is to supplement the submitted Traffic & Parking Impact Assessment Report, and to further assess and address pedestrian issues generated by the proposed development. This can be briefly outlined as follows:

- The expected pedestrian generation to/from the proposed development.
- Existing footpath capacity.
- The impact of the proposed development on the pedestrian network.

2 Existing Conditions

2.1 Site Location

The site address is 83-123 Eveleigh Street, Redfern, which is bound by Eveleigh Street to the west, and the T1 railway line to the east. The southern point of the property meets Lawson Street to the south.
The Redfern railway station is immediately to the south of the site. The general area is bordered by the main roads: Cleveland Street to the north, Abercrombie Street to the west, Lawson Street to the south, and Regent Street to the east.

The figure below indicates 100m along the footpaths from the pedestrian access points. The main affected footpaths are: Eveleigh Street from Lawson Street to Vine Street, Lawson Street 50m east and west from Eveleigh Street, and Caroline Street.

Figure 1: Footpaths 100m from pedestrian access points

2.2 Existing Conditions

2.2.1 Existing Road Conditions

Eveleigh Street is a local road under the management of the City of Sydney with a 6m-wide carriageway. There is kerb and gutter, and pedestrian footpath on both sides of the street. It is a two-way street with the 50km/h default speed limit.

The carriageway at the southern end of Eveleigh Street curves to the west and forms Caroline Street. The continuation of Eveleigh Street towards Lawson Street is a shared zone with a 10km/h speed limit and pedestrian priority.

2.2.2 Existing Footpath Conditions

The streets indicated in Figure 1 all have pedestrian footpaths on both sides of the street with the exception of Caroline Lane. As there are no nature strips along these roads, the footpaths' widths are generally from building line to the back-of-kerb.

Lawson Street
Lawson is currently the main thoroughfare for train commuters to the nearby universities. The footpath within the bridge section is approximately 2.5m wide on both sides.

West of the bridge between Abercrombie Street, the footpath width narrows to generally 2m on both sides for the unobstructed sections. Along this section on both sides of the road, there are trees within the pedestrian thoroughfare which reduce the effective footpath widths to approximately 1.6m wide in isolated sections. This is the expected thoroughfare of all pedestrians from the site walking to the University of Sydney (USyd).

The following photos demonstrate the typical cross section.

Photo 1: South side of Lawson Street facing east

Photo 2: North side of Lawson Street facing east

Eveleigh Street
Eveleigh Street is the sole frontage road to the site on its northern boundary. Despite there not being much width between the building lines to the kerb on both sides of the road, the width of the footpath is generally constant at approximately 1.6m due to scarce street furniture and trees.

However at the northern end of Eveleigh Street approaching Cleveland Street, the footpath width narrows to approximately 1.2m on the eastern side and 1.5m on the western side. The majority of pedestrians travelling from the site, if heading north, are mostly assumed to have turned up Vine Street onto Abercrombie to cross Cleveland Street at the signalised intersection. The few pedestrians from the site walking up this section are likely travelling northeast over the Cleveland Street rail bridge.

The section between Lawson Street and Caroline Street is a shared zone with a variable width around 10m. The available width is likely to change following the full completion of all precincts of the Pemulwuy Project.

Caroline Street
The cross section of Caroline Street is significantly narrower than other streets surrounding Redfern. The building line of the houses on the western side are less than 1m to the kerb. To further reduce the width, the residential bins are stored directly against the building line. These sections are as narrow as 600mm.

The section adjacent to precinct 2 is a typical 1.2m-wide footpath. However, north of the Louis Street, the width is reduced to similar widths than on the western side again due to housing building lines.

It is expected that little to no pedestrians will use Caroline Street from the site. If pedestrians are walking toward the north to University of Technology Sydney (UTS), it is quicker to walk up Eveleigh to Vine Street or Cleveland Street; to the west (USyd) it's quicker up Lawson to Abercrombie Street. This is further explained in section 4.3 of this report. The pedestrian counts in Figure 2 below confirm this, as the 30 pedestrians counted were all southeast bound.

Photo 3: South side of Caroline Street

Photo 4: North side of Caroline Street

Louis Street

Louis Street runs parallel to Eveleigh Street to the north. It is expected to be a secondary route for northbound pedestrians from the site. The foot path is generally 1.7m on both sides of the street. This would be an expected connector towards Cleveland Street if there are the odd pedestrians that walk north on Caroline Street.

Photo 5: West side of Louis Street

Photo 6: East side of Louis Street

Vine Street
Vine Street is a likely connector for north bound pedestrians from the site to the signalised intersection at Abercrombie Street and Cleveland Street. Pedestrians would use Vine Street via Louis Street or Eveleigh Street. At the eastern end it is a shared zone with approximately 6m of width. West of Louis Street, the footpath width is generally 1.6m on both sides with occasional power poles reducing width slightly.

2.3 Existing Traffic Flows and Volumes

2.3.3 Pedestrian Counts

Pedestrian counts were taken 23 November 2017 during the morning peak hour between 8:30am to 9:30am along the main streets within the 100m distance from the proposed pedestrian accesses to the site. This date occurred during the university semester.

Caroline Street, Louis Street and Eveleigh Street volumes are expressed as two-way volume for both sides of the street. The expressed volumes along Lawson Street are separated by the north/south sides.

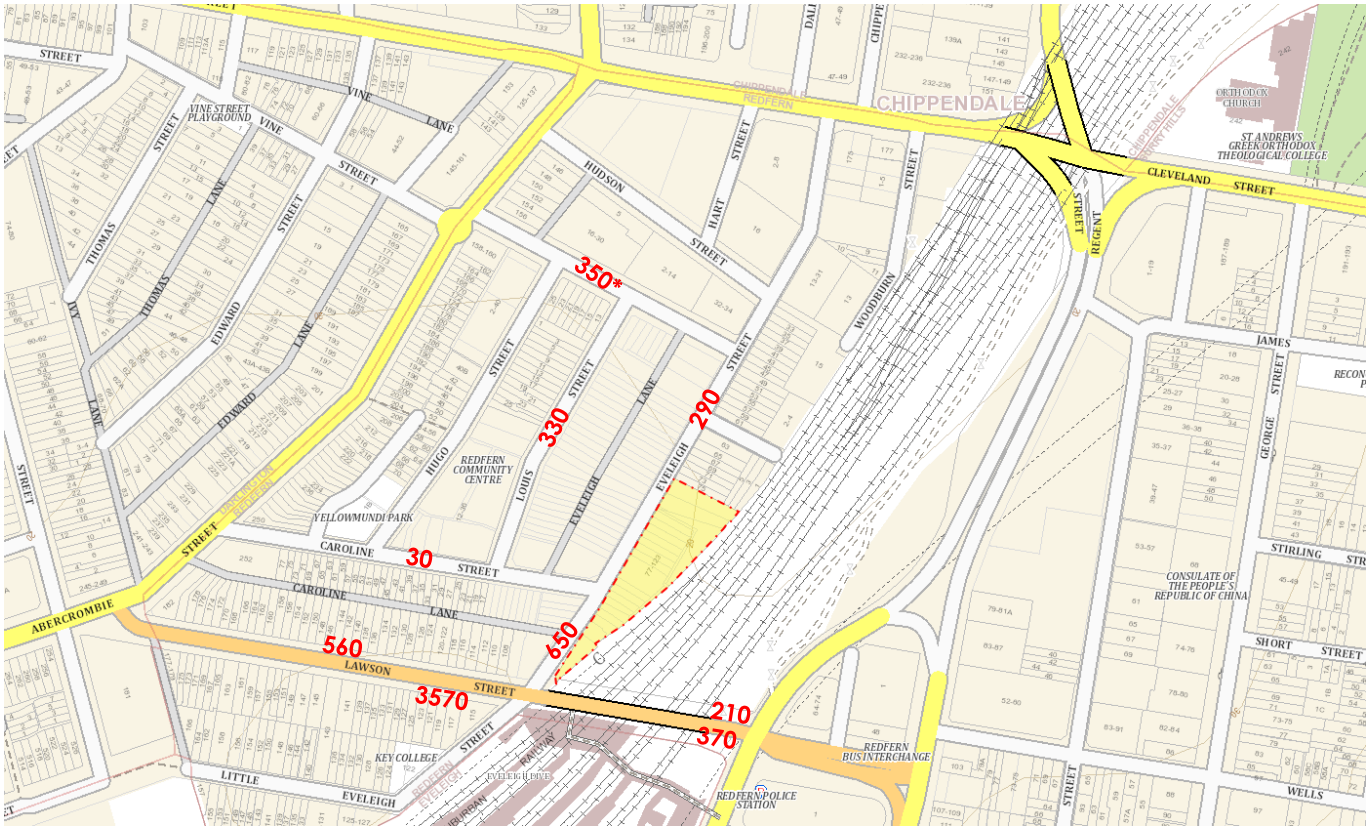


Figure 2: Pedestrian volumes

2.4 Pedestrians, Cyclists and Public Transport

The site is well located to services, with most situated within a reasonable walking distance. The pedestrian facilities are adequate for any walkable trip from the site. The estimated walking distance from the corner of Eveleigh Street and Caroline Street to main destinations are outlined below:

- Less than 100m to Redfern Railway Station.
- 540m to the University of Sydney (USyd) engineering faculties on Shepherd Street.
- 1km to University Technology Sydney (UTS), corner of Abercrombie Street and Broadway.
- 1km to the main gates of University of Sydney at the corner of City Road and Butlin Avenue.

The walking routes to the above destinations would be similar to the pedestrians alighting from a train service from the Redfern railway station. These walking routes are expected to be well trafficked by pedestrians that will maintain a level of passive security for students from the site.

3 Proposed Development

The proposed student boarding house will comprise 522 rooms, and associated facilities, across 23 levels plus plant. The rooms will include single occupancy units and multi-bedroom units to accommodate 596 students. There will be 172 bicycle spaces proposed on the lower ground floor, including 20 bike-share spaces, and 8 visitor spaces proposed in the forecourt adjacent to Lawson Street.

3.1 Pedestrians and Cyclists

Most movements from the site are expected to be foot traffic. As the site is student housing, the main destinations during peak periods are likely to be the universities nearby.

Bicycle parking for 172 bicycles is provided on the lower ground level, which is accessed from the second lobby on Eveleigh Street, with an additional 8 visitor spaces to be provided in the forecourt adjacent to Lawson Street.

Due to the building layout and location of the lift core, most of the foot traffic will access the site from the main entry of the building located on the Lawson Street, which is adjacent to the existing shared zone section of Eveleigh Street between Caroline Street and Lawson Street.

4 Footway Capacity Considerations

During the investigation of methods to find a comparative metric between the footpath network's existing use and the impacts of the proposed development, it was found that the City of Melbourne underwent a similar study to investigate available methods, which are explained in further detail in Section 4.3.

4.1 Resident Walking Routes

It is expected that the two main pedestrian trip generators from the site is USYD and UTS which will result in pedestrian traffic generally travelling north and west during the peak morning period.

Northbound pedestrians are likely to walk directly up Eveleigh Street to Cleveland Street or Vine Street, to ultimately use Abercrombie Street to cross at Cleveland Street. Some pedestrians may even use Caroline Street and Louis Street to get to Vine Street. The typical walking route to UTS is shown in Figure 3 below.

Westbound pedestrians are likely to walk westbound on Lawson Street, specifically on the northern side of the street. The typical route to USyd is shown in Figure 4 below.

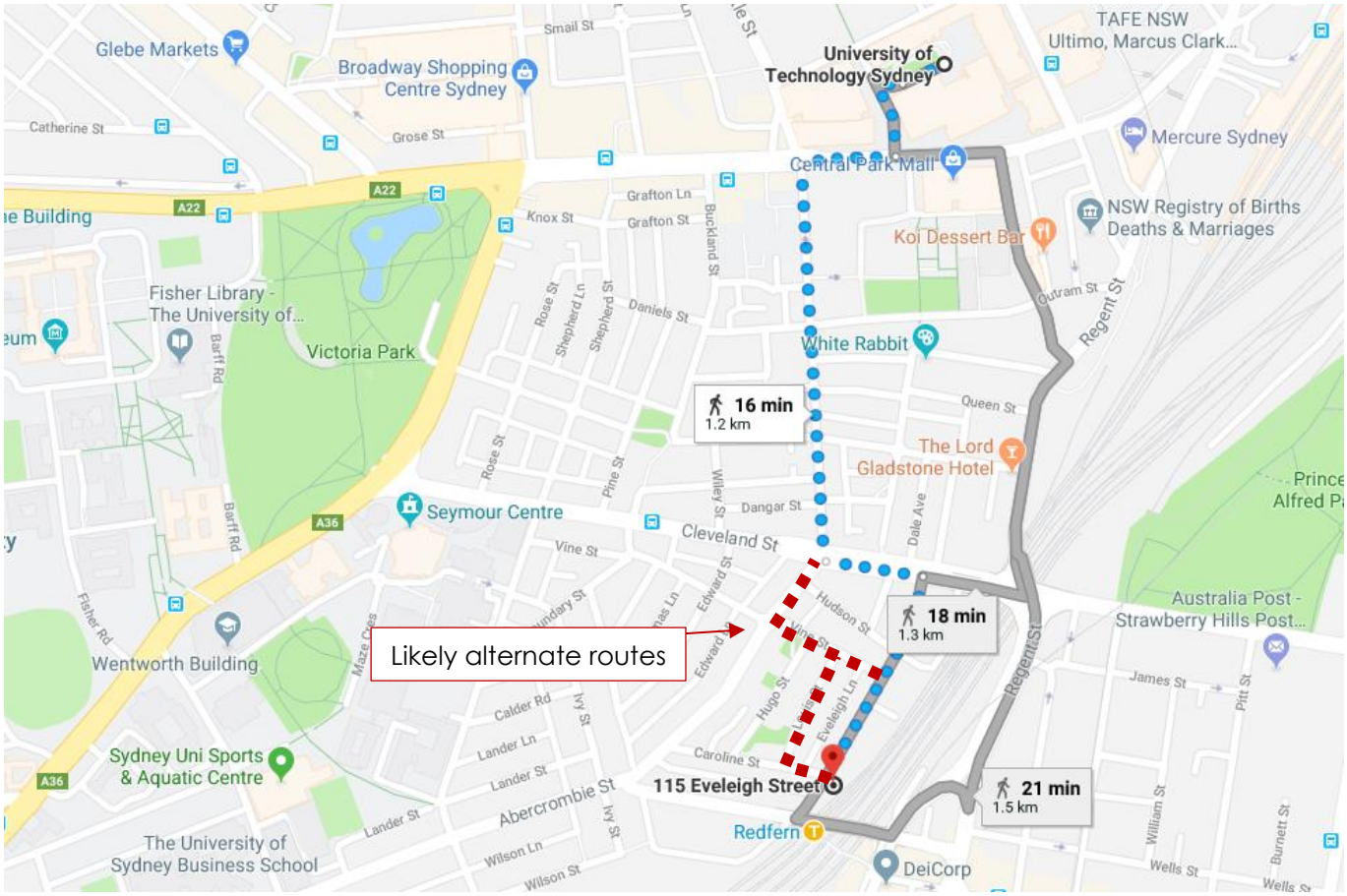


Figure 3: Northbound walking route

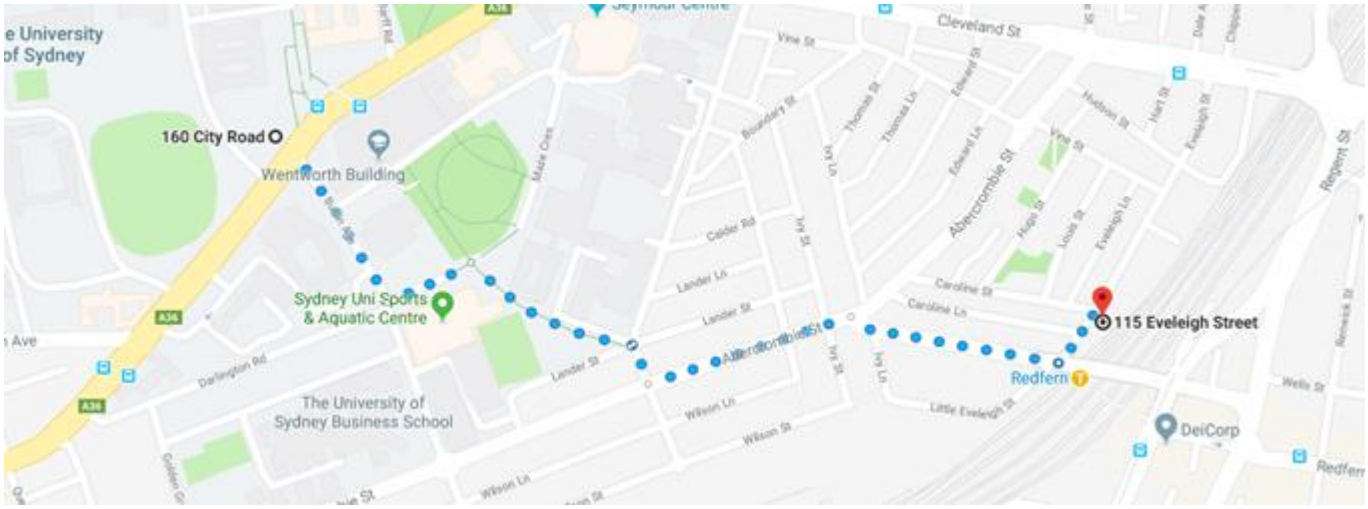


Figure 4: Westbound walking route

4.2 Pedestrian Generation Rates

Unlike vehicle trip generation rates, pedestrian trip generation rates are not usually analysed for proposed developments of this nature. As such there is little to no information on indicative rates a proposed student housing development may draw from. For the purposes of this report, assumptions were made based off the proposed 596 student places available in the proposed development. The applied additional pedestrian trips are outlined in section 5.

4.3 Level of Service

The level of service of a piece of infrastructure typically describes its effectiveness, usually in terms of its capacity against its volume. In terms of pedestrian traffic, exceeding capacity usually wouldn't necessarily result in exactly the same issues as vehicle congestion as pedestrian flows exhibit greater fluidity as conflicts between pedestrian movements have lower consequences than conflict between vehicle movements.

For the purpose of analysing the operation efficiency of the footpaths, sections of the likely walking routes have been considered as an accumulation of the footpaths on both sides of the street, with the exception of Lawson Street where that has been split between north and south side.

A report by the City of Melbourne, '*Pedestrian Level of Service and Trip Generation – International Best Practice and Its Applicability to Melbourne'* concluded, although Fruin's method is more widespread, Gehl Architect's Method is more effective for the purposes determining city footpath capacity. The main difference between the two, is Fruin's considers footpath area whereas Gehl's considers footpath width. Both methods are applied below.

Fruin's Level of Service

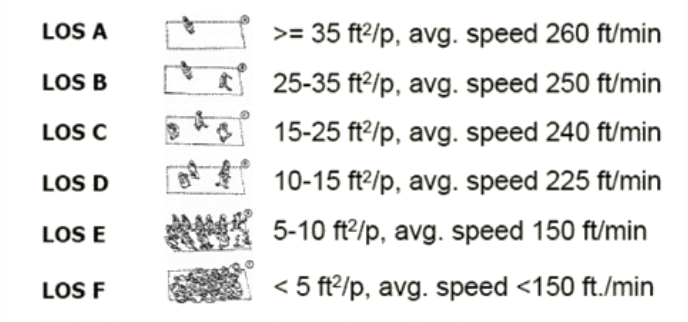
Fruin's model has been widely adopted globally. One of the biggest limitations to this method is that it doesn't account for street furniture at all, but rather the total area of footpath (width×mid-block length). The current LOS of the surrounding street network is indicated below.

Street	Width (m)	Length (m)	Area (m^2)	Area (ft^2)	Ped Volume (peds/hour)	Level of Service
Lawson Street north side	2	200	400	4,305.56	560	7.7 E
Lawson Street south side	2	175	350	3,767.37	3,570	1 F
Eveleigh Street west[1]	3.2	130	416	4,477.79	290	15.4 C
Eveleigh Street shared zone[2]	10	50	500	5,381.95	650	8.3 E
Caroline Street south[3]	1.6	130	208	2,238.89	30	74 A
Caroline Street north[4]	2.4	50	120	1,291.67	30	43 A
Louis Street	3.4	140	476	5,123.62	330	15 C
Vine Street[5]	3.2	80	256	2,755.56	350	7.8 E

Figure 5: Existing Fruin's level of service of the surrounding streets

Note:

1. Eveleigh Street between Caroline Street and Cleveland Street
2. Eveleigh Street between Caroline Street and Lawson Street
3. Caroline Street between Abercrombie Street and Louis Street
4. Caroline Street between Louis Street and Eveleigh Street
5. There were no pedestrian counts undertaken for Vine Street. A slight increase of Louis Street's volume was applied as a conservative assumption.



One foot = 0.3048m

Figure 6: Fruin's level of service

As predicted, Lawson Street (south side) under performs with a LOS F. However, the limitations of this method are apparent, as Caroline Street – narrow and long – out-performs the shared zone section of Eveleigh Street – wide but a very short section. On-site observations show that the pedestrian flow in the Eveleigh Street shared zone section is unimpeded.

Gehl Architects' Methodology

Gehl's Method defines crowding as more than 13 people per minute per meter footway width. Beyond this, pedestrians would usually look to parallel streets to avoid congestion. This method was applied in various cities world-wide, and the studies showed that this was an adequate metric to obtain the approximate threshold for pedestrian comfort.

Recommended pedestrian capacity:
13 pedestrians/minute/metre of footpath width × available footway width = no. of pedestrians/minute

The Gehl's method is the more appropriate to apply, as this considers obstructions to the path, and can be ascertained by collecting pedestrian volumes over a timed duration. Based on this methodology, the recommended pedestrian volumes for each side of the surrounding street footpaths is summarised below.

Street	Combined width (m)	Comfort threshold (peds/minute)	Comfort threshold (peds/hour)	Ped Volume (peds/hour)
Lawson Street north side	2	52	3,120	560
Lawson Street south side	2	52	3,120	**3,570**
Eveleigh Street west	3.2	41.6	2,496	290
Eveleigh Street shared zone	10	130	7.800	650
Caroline Street south	1.6	20.8	1,248	30
Caroline Street north	2.4	31.2	1,872	30
Louis Street	3.4	44.2	2,652	330
Vine Street	3.2	41.6	2,496	N/A

Figure 7: Existing Gehl's comfort level threshold for the combined footpath width

According to Gehl's method, all footpaths but for Lawson Street (south side) are operating within acceptable comfort levels.

Lawson Street south is the main route used between USyd and Redfern Station. Currently there is 1 pedestrian per second on average on this section. However, in reality the pedestrian movement comes in waves due to crowds alighting trains at the same time. An observation by the pedestrian counters was that during saturation conditions on the south side of Lawson Street, there were pedestrians that occasionally crossed to the northern side.

5 Footway Capacity Assessment

5.1 Pedestrian Trips

It should be noted that the proposed student housing development does not increase the number of students that enrol in both UTS and USyd. The development merely changes the location from which students start and finish their walking trips to and from the universitites. The proposal would ease the demand of students using Central Station and walking from UTS, and students alighting from Redfern Station and walking on the south side of Lawson Street to USyd.

Due to the irregularity of tertiary class scheduling, it is expected that not all the 596 students will have classes during the morning peak. A likely scenario would be that 20%-40% of students would have morning classes mainly due to irregular starting times and that most students have class anywhere between two to four days of the week.

However, it was assumed a conservative 80% of students would generate a pedestrian trip during the morning peak. Instead of splitting the pedestrian flows 50:50 to USyd and UTS, a conservative 60% will be applied to both directions with a total of 286 trips to the north and west.

It is noted that the westbound pedestrians will use the north side of Lawson Street.

5.2 Post Development Pedestrian Assessment

As outlined in section 5.1, a conservative application of pedestrian trips is 286 outbound movements. The additional are added to the sections of streets that are indicated in Figure 3 and Figure 4.

For the northbound routes, 286 pedestrians were added to all of the likely routes to assess the likely maximum pedestrian increase.

For the westbound route, the additional 286 pedestrians were added to the north side only.

Street	Comfort threshold (peds/hour)	Existing Ped Volume (peds/hour)	Proposed Ped Volume (peds/hour)
Lawson Street north side	3,120	560	846
Lawson Street south side	3,120	**3,570**	**3,570**
Eveleigh Street north[1]	2,496	290	576
Eveleigh Street shared zone	7.800	650	936
Caroline Street west[1]	1,248	30	30
Caroline Street east	1,872	30	316
Louis Street	2,652	330	616
Vine Street	2,496	350	636

Figure 8: Gehl's comfort level – post development

Note:

1. The south side of Lawson Street and the section of Caroline Street west of Louis Street would not have any additional pedestrian volumes post development.

5.3 Pedestrian Assessment

From the application of Gehl's method, the surrounding footpaths on the likely walking routes from the proposed development is not likely to reach the comfort level threshold. The following points also should be noted when considering the post development pedestrian assessment:

- The indicated walking routes will not cause any adverse impact to the comfort levels of the footpath network within 100m from the site.
- The westbound route will utilise the north side of Lawson Street, which is under capacity as most students to USyd travel from Redfern Station on the south side of Lawson Street.
- Further to the above, it is likely that a number of pedestrians from Redfern Station to USyd will shift to departing from the proposed development. This assumes that the overall number of students using public transit and walking to USyd rather than driving is not affected by the proposed development. The proposed development merely changes where some students will begin their trip to class. Conceivably, if this number is in the realms of 450 students, this would reduce the volume of the south side of Lawson Street to within acceptable comfort levels.
- The narrow section of Caroline Street between Louis Street and Abercrombie Street is not among any of the shortest routes to any of the main pedestrian destinations. Despite both Fruin's and Gehl's indicating that north section of Caroline Street operating satisfactorily, pedestrians from the site are not likely to walk there as it adds to the walking distance on both the north and westbound routes.
- Notwithstanding any of the above, this conservative assessment assumes that none of the students will ride bikes, for which there will be plenty of parking provided on site. Student riding bikes instead of walking would reduce the pedestrian load on footpaths as they would be compelled to use the roadway, both by law and due to pedestrian volume on the footpath.

6 Conclusion

This Footpath Capacity Study has been prepared in accordance with globally applied methods to accompany a DA to the City of Sydney for the development of student accommodation.

Applying conservative assumptions to Gehl's method, it is considered that the proposed development will not have an adverse impact to the surrounding street network. The south side of Lawson Street is the single component of the surrounding footpath network that is identified as operating outside acceptable thresholds. This will not be exacerbated by the proposed development. The narrow section of Caroline Street is not expected to be utilised much, if at all, as it is not along the identified shortest routes to the main universities.

The proposed student housing development does not increase the number of students that enrol in both UTS and USyd. The development merely changes the location from which students start and finish their walking trips to and from the universitites. The proposal would ease the demand of students using Central Station and walking from UTS, and students alighting from Redfern Station and walking on the south side of Lawson Street to USyd.

This assessment concludes that the subject site is suitable for the proposed student housing development in relation to the impact of pedestrian traffic and safety considerations.

7 References

Roads and Maritime Services, *'Guide to Traffic Generating Developments',* Version 2.2 dated October 2002.

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