Traffic Impact Assessment

Planning Proposal
31-37 Herbert Street, St Leonards

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Reference: 15.126r02v2 TIA Report
Date: 01 September 2016

Document Verification

Job Number:	15.126			
Project:	31-37 Herbert Street, St Leonards			
Client:	Aqualand St Leonard Development Pty Ltd			
Revision	**Date**	**Prepared By**	**Checked By**	**Signed**
v01	24/08/2016	Kedar Ballurkar	Vince Doan	
v02	01/09//2016	Kedar Ballurkar	Vince Doan	

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Contents

1. Introduction

TRAFFIX has been commissioned by Aqualand St Leonard Development Pty Ltd to undertake a traffic impact assessment of the development potential arising from a Planning Proposal for 31-37 Herbert Street, St Leonards. The site is located within the City of Willoughby local government area and is subject to that Council's controls.

Approval is sought to change planning controls for the subject site under the *Willoughby Local Environmental Plan 2012* to allow for permissible uses including, but not limited to, high density residential, commercial, retail and child care centre uses. This report examines the traffic impacts and parking requirements associated with an indicative development that would be compliant with the proposed planning controls.

This report should be read in the context of the Planning Proposal submission, prepared separately. The proposal relates to development potential for residential uses exceeding a threshold of 300 apartments. It should therefore be referred to the Roads and Maritime Services (RMS) under the provisions of State Environmental Planning Policy (Infrastructure) 2007.

The report is structured as follows:

- Section 2: Describes the site and its location
- Section 3: Documents existing traffic conditions
- Section 4: Describes the indicative development
- Section 5: Assesses the parking requirements for the indicative development
- Section 6: Assesses traffic impacts of the indicative development
- Section 7: Presents the overall study conclusions.

2. Location and Site

The site is located at 31-37 Herbert Street in St Leonards, at the south-eastern corner of the intersection with Ella Street and approximately 400 metres north of St Leonards Railway Station. It is legally described as Lots 1 & 2 in DP744175, Lot 3 in DP772072 and Lot 1 in DP115615.

The site roughly has a rectangular shaped configuration with a site area of 5,937m^2. It has a western frontage to Herbert Street that measures approximately 126 metres in length and a northern frontage to Ella Street that measures approximately 65 metres. The remainder of the site is bound by a railway corridor to the east for approximately 149 metres and a residential flat building development to the south that measures approximately 38 metres.

The site is a consolidation of two existing developments: a three storey commercial building at 31-35 Herbert Street and a bulky goods showroom at 37 Herbert Street. A vehicular crossover is provided for each of these developments on Herbert Street, adjacent to their shared border.

The subject site is zoned as *'Light Industrial IN2'* under the *Willoughby Local Environmental Plan 2012*. The site is also identified as being within a *'Railway Precinct Area'*, defined by the Railway Precinct Map for St Leonards under the *Willoughby Development Control Plan*.

A Location Plan is presented in **Figure 1**, with a Site Plan presented in **Figure 2**. Reference should also be made to the Photographic Record presented in **Appendix A**, which provides an appreciation of the general character of roads and other key attributes in proximity to the site.

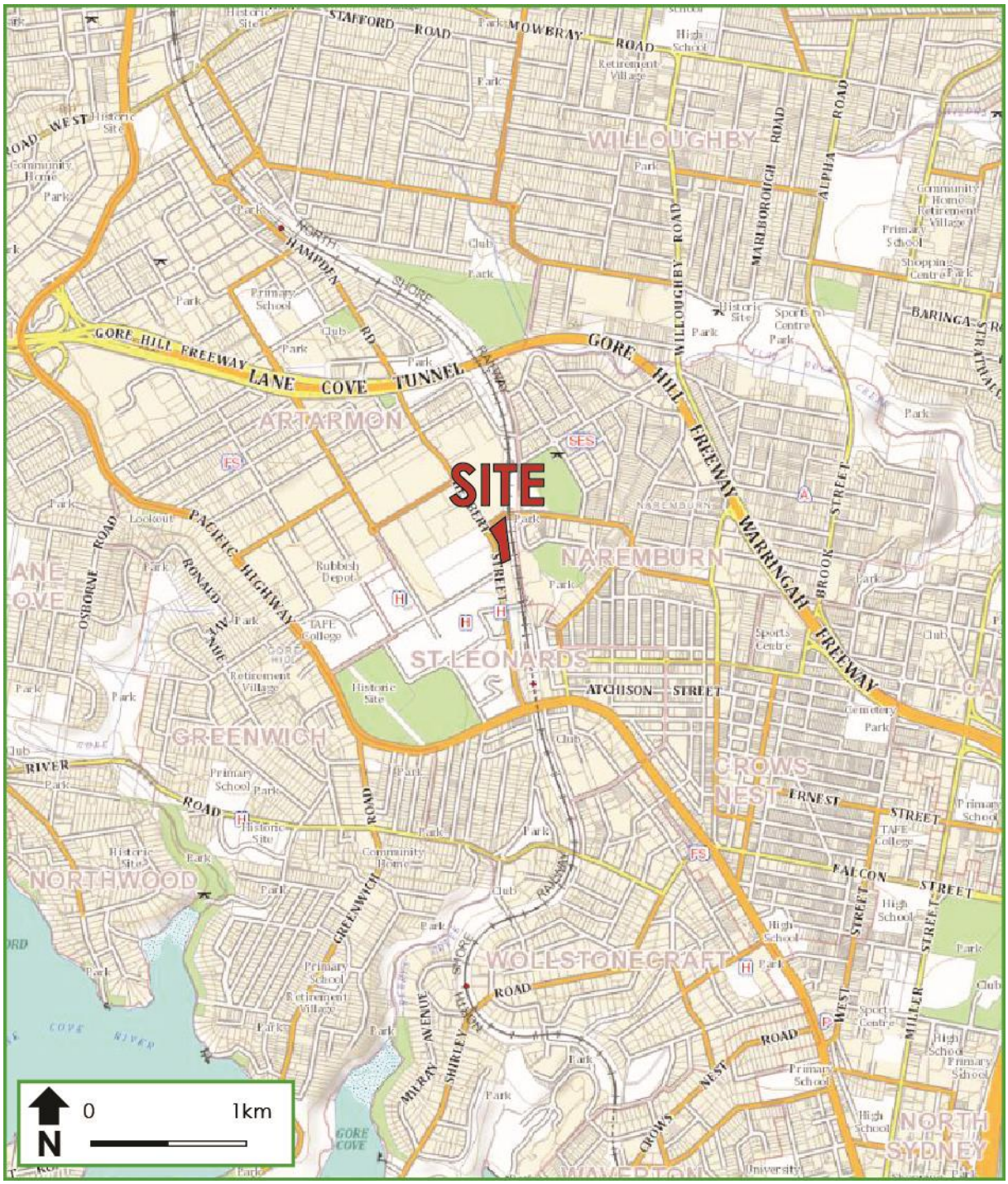


Figure 1: Location Plan

Figure 2: Site Plan

3. Existing Traffic Conditions

3.1 Road Network

The road hierarchy in the vicinity of the site is illustrated in **Figure 3**, with roads of particular interest discussed below.

- Pacific Highway: an RMS highway (HW10) that generally runs in a north-south direction between the Queensland Border at Cobaki Lakes in the north and the Warringah Freeway at North Sydney to the south. In the vicinity of the site, it carries approximately 61,000 vehicles per day (2012 AADT) and has a posted speed limit of 60 km/h. Generally across St Leonards, the Pacific Highway accommodates three lanes of traffic in either direction within a divided carriageway.

- Herbert Street: a local road that runs in a north-south direction between Punch Street in the north and the Pacific Highway to the south. It carries approximately 16,500 vehicles per day (2008 AADT) and has a posted speed limit of 50 km/h. Herbert Street generally accommodates a single lane of traffic in either direction within an undivided carriageway.

- Frederick Street: a local road that runs in an east-west direction between Herbert Street in the north and Reserve Road in the west. It generally accommodates a single lane of traffic within an undivided carriageway and has a 50 km/h speed zoning.

- Ella Street: a local road that runs in an east-west direction between Herbert Street in the west and merging into Dalleys Road to the east (which continues until Northcote Street). It accommodates a single lane of traffic within an undivided carriageway and has a 50 km/h speed zoning.

It can be seen from Figure 3 that the site is conveniently located with respect to the arterial and local road systems serving the region. It is therefore able to effectively distribute traffic onto the wider road network, minimising traffic impacts.

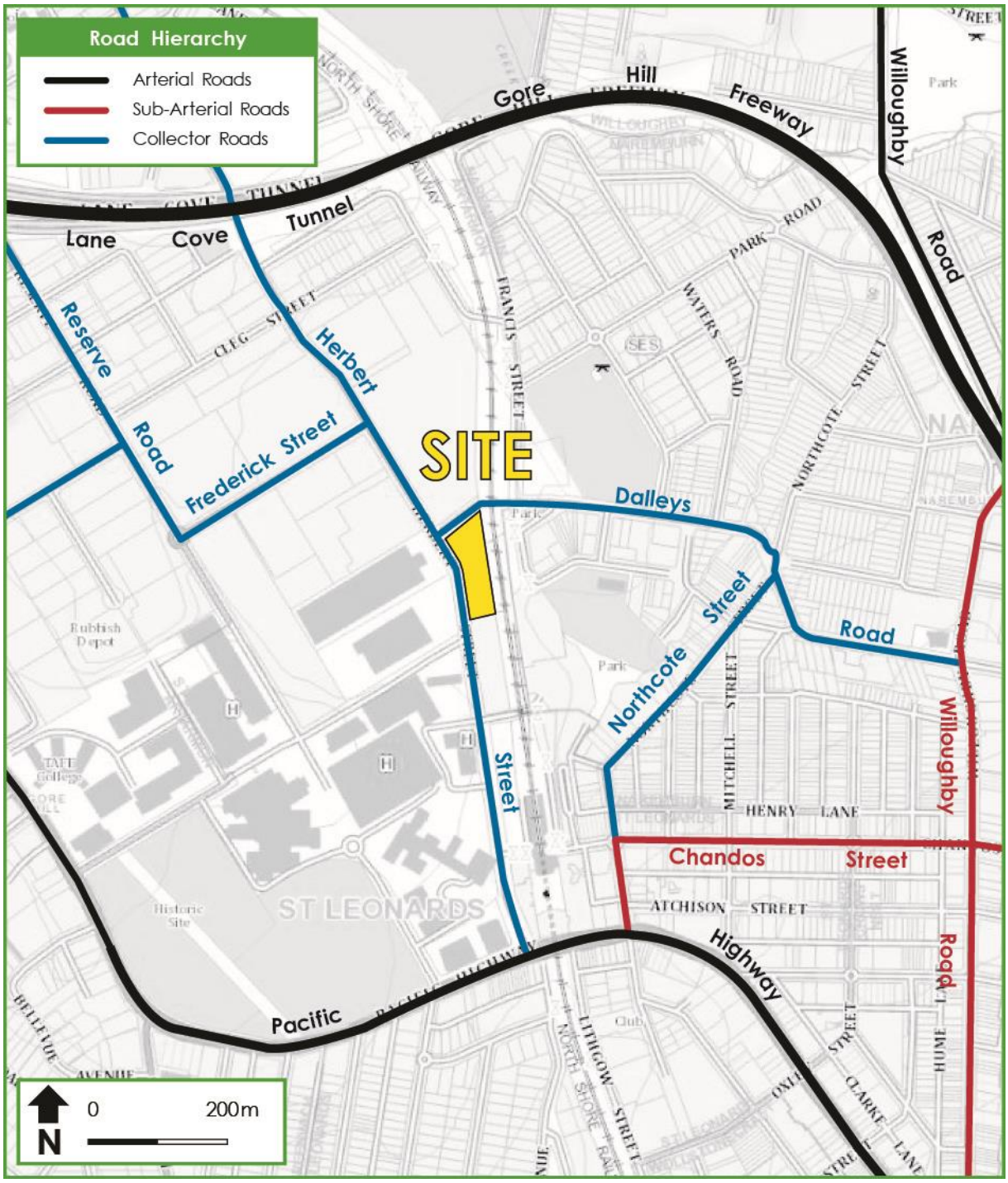


Figure 3: Road Hierarchy

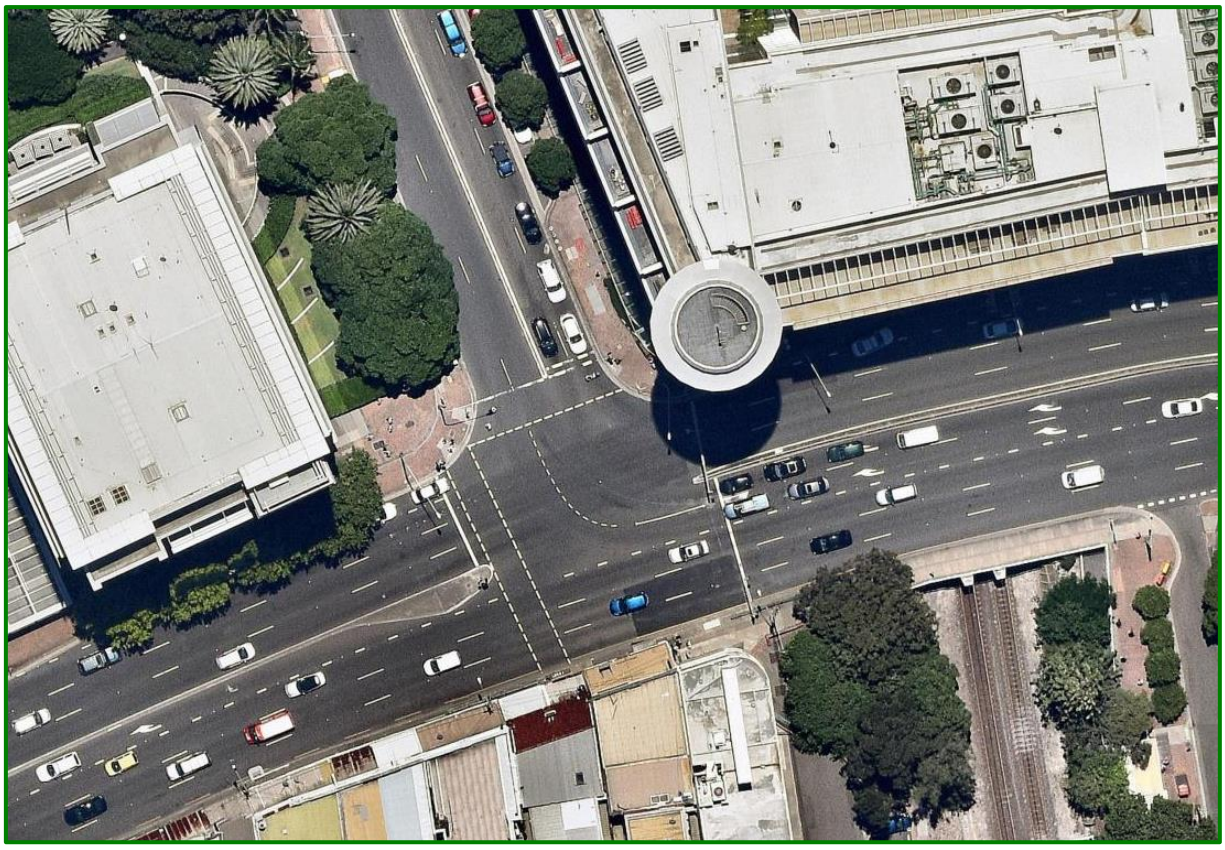
3.2 Key Intersections

The key intersections in the vicinity of the site are shown below and provide an understanding of the existing road geometry and alignment:

Source: Near Map

Figure 4: Intersection of Herbert Street and Ella Street

It can be seen from **Figure 4** that the intersection of Herbert Street and Ella Street forms a T-junction that has a Give Way priority control. Both north and south legs on Herbert Street accommodate a single lane of traffic in each direction, which is also the case with the single east leg on Ella Street.



Source: Near Map

Figure 5: Intersection of Pacific Highway and Herbert Street

It can be seen from **Figure 5** that the intersection of Pacific Highway and Herbert Street forms a T-junction that is signal controlled. Four traffic lanes including a dedicated left turn lane are provided on the west leg on Pacific Highway, whilst five traffic lanes including two dedicated right turn lanes are provided on the east leg. Two lanes of traffic in each direction are provided on the single Herbert Street north leg.

3.3 Existing Intersection Performance

To assess the performance of the surrounding road network, surveys were undertaken of the above intersections, which are considered most critical with respect to the location of the site.

These surveys were undertaken on a typical weekday in July 2016 from 7:00-9:00am during the morning period and 4:00-6:00pm during the afternoon/evening period. This survey data was analysed to determine the peak hour for both morning and afternoon/evening period. The results indicated that the peak hour occurred at 8:00am to 9:00am in the morning and 5:00pm to 6:00pm in the afternoon/evening

for the intersection of Herbert Street / Ella Street and 7:45am to 8:45am in the morning and 5:00pm to 6:00pm in the afternoon/evening for the intersection of Pacific Highway / Herbert Street. A summary of these traffic counts are provided in **Appendix B**, for both the morning and afternoon/evening peak hour periods of each intersection.

The intersections were analysed using the SIDRA computer program to determine their performance characteristics under existing traffic conditions. The SIDRA model produces a range of outputs, the most useful of which are the Degree of Saturation (DOS) and Average Vehicle Delay per vehicle (AVD). The AVD is in turn related to a level of service (LOS) criteria. These performance measures can be interpreted using the following explanations:

DOS - the DOS is a measure of the operational performance of individual intersections. As both queue length and delay increase rapidly as DOS approaches 1, it is usual to attempt to keep DOS to less than 0.9. When DOS exceeds 0.9 residual queues can be anticipated, as occurs at many major intersections throughout the metropolitan area during peak periods. For intersections controlled by roundabout or give way/stop control, satisfactory intersection operation is generally indicated by a DOS of 0.8 or less.

AVD - the AVD for individual intersections provides a measure of the operational performance of an intersection. In general, levels of acceptability of AVD for individual intersections depend on the time of day (motorists generally accept higher delays during peak commuter periods) and the road system being modelled (motorists are more likely to accept longer delays on side streets than on the main road system).

LOS - this is a comparative measure which provides an indication of the operating performance of an intersection as shown below:

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals	Give Way and Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode	At capacity and requires other control mode
F	More than 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires other control mode or major treatment.

A summary of the modelled results are provided in **Table 1** below. Reference should also be made to the detailed SIDRA outputs included in **Appendix C-1**.

Table 1: Intersection Performance - Existing Volumes

Intersection	Control Type	Period	Intersection Degree of Saturation (DOS)	Average Delay (AVD)	Level of Service (LOS)
Herbert Street / Ella Street	Priority*	AM	0.893	48.4	D
		PM	0.567	24.7	B
Pacific Highway / Hebert Street	Signals	AM	0.871	28.1	B
		PM	0.863	25.3	B

* Note: Results shown are for the movement with the highest delay in accordance with RMS Guidelines.

The results in Table 1 indicate that the critical intersections within vicinity of the site operate with no unacceptable delays. During both peak periods, the intersection of Pacific Highway and Herbert Street operates at a LOS of B, which indicates there is spare capacity available. Whilst the PM peak period

performance of the intersection of Herbert Street and Ella Street also operates with an LOS of B, the AM peak period performance has been rated at a LOS of D. This suggests that there is limited capacity during the mornings before increased delays will necessitate an intersection upgrade.

This analysis serves to provide a comparison of the relative change in the performance parameters as a result of the subject proposal. This is discussed further in Section 6.

3.4 Public Transport

The public transport services operating within the vicinity of the site are shown in **Figure 6**. It is evident that the site is within 800 metres from St Leonards Railway Station, which lies on the T1 North Shore, Northern and Western Line. Rail services to the City from St Leonards Railway Station depart every three minutes during morning peak periods and every three to six minutes during evening peak periods.

The site is also situated within 800 metres within bus stops on Pacific Highway that are serviced by routes traversing between Manly, the Sydney central business district, the Hills district as well as the surrounding region.

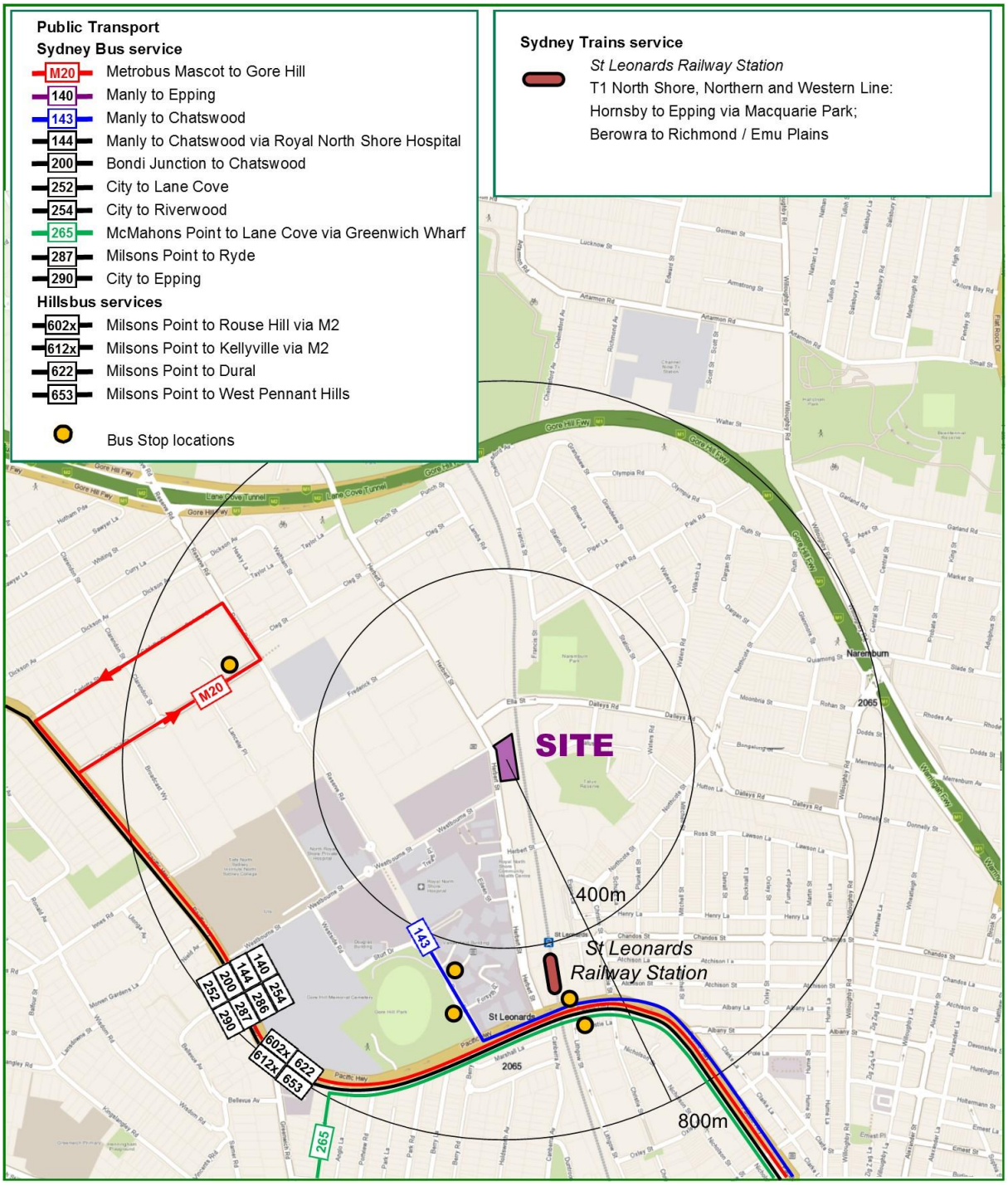


Figure 6: Public Transport

3.5 Existing Site Generation

The existing development at 31-35 Herbert Street consists of a three storey building containing approximately 6,000m^2 gross floor area (GFA) of commercial space, with two levels of basement car parking that accommodate 163 parking spaces. The RMS Technical Direction TDT 2013/04a provides traffic generation rates for commercial developments in Sydney based upon data collected in 2010. It recommends an average peak hourly trip generation rate of 1.6 vehicle trips per 100m^2 GFA during the AM peak period and 1.2 vehicle trips per 100m^2 GFA during the PM peak period. Application of the above rates results in the following estimation of the approved traffic generation for this development:

- 96 vehicle trips per hour during the AM Peak (77 in 19 out); and
- 72 vehicle trips per hour during the PM Peak. (14 in, 58 out).

The existing development at 37 Herbert Street consists of a bulky goods showroom (plumbing supply centre) that is estimated to contain approximately 1,200m^2 gross floor area. The RMS Technical Direction TDT 2013/04a also provides traffic generation rates for such developments based on data collected in 2009. It recommends an hourly trip generation rate of 2.7 vehicle trips per 100m^2 gross floor area during peak periods, whilst noting that the showroom PM peak period does not generally coincide with the network peak hour. By assuming the PM peak period generation to be half of the traffic generated during the PM peak period (as a conservative approach), application of this rate results in the following estimate of the approved traffic generation for this development:

- 32 vehicle trips per hour during the AM Peak (16 in 16 out); and
- 16 vehicle trips per hour during the PM Peak. (8 in, 8 out).

Having regard for the above volumes, the approved traffic generation for the site is estimated to be:

- 128 vehicle trips per hour during the AM Peak (93 in 35 out); and
- 88 vehicle trips per hour during the PM Peak (22 in, 66 out).

4. Description of Indicative Development

A detailed description of the planning controls sought for the site can be found in the planning proposal, prepared separately. In summary, approval is sought for permissible uses of the site to include, but not be limited to, high density residential, commercial, retail and child care centre uses. It is envisaged that the following indicative development, containing 30 storeys, would subsequently be suitable for assessment in a future development application:

- A residential component containing a total of 410 apartments, consisting of:
    - 44 x one bedroom apartments;
    - 76 x one bedroom plus study apartments;
    - 252 x two bedroom apartments; and
    - 38 x three bedroom apartments;
- A ground floor retail component containing 1,281m^2 GFA;
- Three levels of commercial space containing a total of 4,394m^2 GFA;
- A child care centre with capacity for 30 placements;
- Provision of up to five levels of basement car parking with a total of 615 parking spaces; and
- Provision of a new Herbert Street vehicle access adjacent to the southern boundary of the site.

This indicative development has formed the basis for assessing the parking requirements and traffic impacts associated with the planning controls sought in this planning proposal, and are discussed in Sections 5 and 6, respectively. Reference should also be made to the plans submitted separately to Council which are presented in **Appendix D**.

5. Parking Requirements

5.1 Council Controls

The *Willoughby Development Control Plan (DCP)* requires car parking for high density residential, commercial, retail and child care centre uses to be provided in accordance with the parking rates shown in **Table 2**, noting that specific rates apply for residential flat buildings and office uses within Railway Precincts.

Table 2: DCP Parking Rates

Type	No. / GFA	Parking Rate	Spaces Required[1]
Residential[2]			
1 Bedroom	44	1 space per dwelling	419
1 Bedroom + Study	76		
2 Bedroom	252		
3 Bedroom	38	1.25 spaces per dwelling	
Visitor	410	1 space per 4 dwellings	102
		Sub Total	**521**
Retail (Shop)	1,281m^2	1 space per 25m^2	51
Office[2]	4,394m^2	1 space[2] per 110m^2	39
Child Care Centre	30	1 space per 2 employees	15
		Sub Total	**105**
		Total	**626**

[1] Parking spaces rounded down to the nearest whole number in accordance with DCP

[2] Parking rates adopted for developments located within Railway Precincts.

It can be seen that under the DCP, the indicative development envisaged under this planning proposal would be nominally required to provide 626 parking spaces, including 521 spaces for residential use. This component is relevant in the context of comparing Council's residential parking requirement against state legislative policies, as examined below.

5.2 SEPP 65

State Environmental Planning Policy No 65 – Design Quality of Residential Apartment Development (SEPP 65) states that a consent authority must not refuse a development application should the provision of car parking comply with the parking controls specified in Part 3J of the *Apartment Design Guide*, published by the NSW Department of Planning and Environment. In turn, the guide states the following with respect to developments situated within 800 metres of a railway station:

"The minimum car parking requirement for residents and visitors is set out in the [RMS] Guide to Traffic Generating Developments, or the car parking requirement prescribed by the relevant Council, whichever is less"

Accordingly, the RMS *Guide to Traffic Generating Developments* issues the following parking rates for high density residential flat buildings shown in **Table 3**, noting that the development is considered to be located within a *Metropolitan Regional Centre*, according to the RMS' classification for centres defined in *A Plan for Growing Sydney*.

Table 3: RMS High Density Residential Parking Rates

Type	No.	Minimum Parking Rate[1]	Minimum Spaces Required[2]
1 Bedroom	44	0.4 spaces per dwelling	17.6
1 Bedroom + Study	76		30.4
2 Bedroom	252	0.7 spaces per dwelling	176.4
3 bedroom	38	1.2 spaces per dwelling	45.6
Visitor	410	1 space per 7 dwellings	58.6
		Total	**329**

[1] Parking rates for Metropolitan Regional Centres.
[2] Parking spaces rounded to the nearest whole number.

It can be seen that under SEPP 65, the indicative development is required to provide a minimum of only 329 parking spaces. As this quantum is less than Council's provision, it takes precedence as the residential parking requirement as per the *Apartment Design Guide*. As such, having regard for state legislative policies and other applicable rates from the DCP, the indicative development would be required to provide a level of parking as summarised in **Table 4**.

Table 4: Car Parking Provision

Type	No. / GFA	Parking Rate	Spaces Required	Spaces Provided
Residential[1]				615
1 Bedroom	44	0.4 spaces per dwelling	270	
1 Bedroom + Study	76			
2 Bedroom	252	0.7 spaces per dwelling		
3 Bedroom	38	1.2 spaces per dwelling		
Visitor	410	1 space per 7 dwellings	59	
		Sub Total	**329**	
Retail (Shop)[2]	1,281m^2	1 space per 25m^2	51	
Office[2]	4,394m^2	1 space^2 per 110m^2	39	
Child Care Centre[2]	30	1 space per 2 employees	15	
		Sub Total	**105**	
		Total	**434**	

[1] Parking spaces rounded to the nearest whole number. Parking rate as a minimum.

[2] Parking rates adopted for developments located within Railway Precincts.

It can be seen that the development is required to provide a minimum of 434 parking spaces, including 329 spaces for residential use and 105 parking spaces for other uses. Is it noted that Council's rates are nor a minimum or maximum rate. However, for assessment proposes the DCP rate has been adopted as a maximum rate considering that the SEPP65 rates are provided as a minimum. Therefore, it can be seen that the development is required to provide a range of 434 to 626 parking spaces, including 329 to 521 spaces for residential use and 105 parking spaces for other uses. In response, the indicative development proposes the provision of 615 spaces. In this regard, the proposed car parking provision therefore satisfies the requirement of SEPP65 and Council's DCP and is considered acceptable

5.3 Disabled Parking

With respect to residential flat buildings, the DCP requires 50% of apartments to be adaptable when the development exceeds three storeys. This equates to 205 adaptable apartments in the case of the indicative development.

The DCP requires accessible parking to be provided in proportion to the number of adaptable housing dwellings as shown by the following distribution in **Table 5**.

Table 5: Accessible Parking Requirements

Number of Adaptable Housing Dwellings	No. of Adaptable Car Spaces
1-4	1
5-9	2
10-14	3
15-19	4
(etc)	

When following the distribution as shown in Table 5, the indicative development will need to provide 51 accessible parking spaces for residential use.

With respect to the office, retail and child care components of the indicative development, the DCP issues accessible parking rates for Class 5, 6 and 9b buildings, as defined within the Disability (Access to Premises – Buildings) Standards 2010. Accessible parking for these classes of buildings must be provided in parking areas with 5 or more spaces, where the greater of the following must be provided:

- 1 accessible space; or
- 3% of the total car parking spaces

Application of the above rates results in the commercial and child care components of the indicative development requiring an allocation for one accessible space each, whilst the retail component will require two (2) accessible spaces to be allocated.

The indicative development will thus require a total of 55 accessible parking spaces in order to comply with the DCP. This can be confirmed once detailed design of the basement car park has been undertaken during a subsequent development application stage.

5.4 Motorcycle Parking

The DCP requires motorcycle parking for all development types to be provided at a rate of 1 space per 25 car parking spaces. Accordingly, whilst plans for the indicative development do not yet show any areas for motorcycle parking, a subsequent development application will need to demonstrate provision for 25 motorcycle parking spaces, based on the provision of 615 parking spaces.

5.5 Bicycle Parking

The DCP requires bicycle parking for the respective uses of the indicative development to be provided in accordance with the following rates:

- 1 bicycle parking space per 10 units for residents and 1 bicycle space per 12 units for visitors;
- 1 bicycle parking space per 600m^2 for office staff and 1 bicycle space per 2,500m^2 for visitors; and
- 1 bicycle parking space per 450m^2 for retail staff and 1 bicycle space per 150m^2 for customers.

Accordingly, whilst plans for the indicative development do not yet show areas for bicycle parking facilities, a subsequent development application will need to demonstrate provision for a total of 96 bicycle parking spaces which comprise of 41 residential spaces, 34 residential visitor spaces, 7 commercial staff spaces, 2 commercial visitor spaces, 3 retail staff spaces and 9 retail visitor spaces.

5.6 Servicing

Control C4.4 of Part C – General Development Guidelines from the Willoughby Development Control Plan states that the size and number of loading bays for commercial and retail developments is to be determined by Council whilst provision must be made for removalist vans to park, load and unload on site for all residential developments in excess of 12 units. As such, this is a matter for a subsequent development assessment stage.

Nonetheless the plans for the indicative development reveal an area on the ground floor marked for loading activities suggesting that only minor modifications to the building may be needed to accommodate the nominated design vehicle(s).

6. Traffic Impacts

6.1 Trip Generation

6.1.1 Residential

The RMS Technical Direction TDT 2013/04a provides traffic generation rates for high density residential uses based upon surveys conducted during 2012. It recommends an average Sydney trip rate of 0.19 vehicle trips per unit during the AM peak hour and 0.15 vehicle trips per unit during the PM peak hour. Application of the above rates to the 410 residential units envisioned in the indicative development results in the following traffic generation:

- 78 vehicle trips per hour during the AM peak period (16 in, 62 out); and
- 62 vehicle trips per hour during the PM peak period (50 in, 12 out).

6.1.2 Commercial

In adopting the same rates published in the RMS Technical Direction TDT 2013/04a which have been used to estimate the traffic generation for the existing commercial development on-site, the 4,394m^2 gross floor area of commercial space included within the indicative development is expected to generate the following traffic:

- 70 vehicle trips per hour during the AM peak period (56 in, 14 out); and
- 53 vehicle trips per hour during the PM peak period (11 in, 42 out).

6.1.3 Retail

The RMS Guide to Traffic Generating Developments provides traffic generation rates for secondary retail developments, which it defines as retail stores tending not to be the primary attractor to the development and thus are applicable to the retail component of the indicative development. It recommends a maximum peak hour trip generation rate of 4.6 vehicle trips per 100m^2 GFLA of retail space, occurring during the PM peak period on Thursdays. Whilst no rates are provided for AM peak hourly traffic generation, as a conservative approach, an equivalent rate has been adopted for the AM peak period. Application of the above rates to the retail component of the indicative development, assuming the 1,281m^2 GLFA to be equivalent to GFA, results in the following traffic generation:

- 59 vehicle trips per hour during the AM peak period (30 in, 29 out); and
- 59 vehicle trips per hour during the PM peak period (30 in, 29 out).

6.1.4 Child Care Centre

The RMS Guide to Traffic Generating Developments also provides trip generation rates for child care centres. It recommends a trip generation rate of 0.8 vehicle trips per child during the AM peak hourly period and 0.7 vehicle trips per child during the PM peak hourly period. Application of these rates to the child care centre component of the indicative development, which has capacity for 30 children, results in the following traffic generation:

- 24 vehicle trips per hour during the AM peak period (12 in, 12 out); and
- 21 vehicle trips per hour during the PM peak period (11 in, 10 out).

6.1.5 Combined

Having regard for the trip generation rates for the above uses, the indicative mixed use development is expected to generate the following traffic during peak periods:

- 231 vehicle trips per hour during the AM peak period (114 in, 117 out); and
- 195 vehicle trips per hour during the PM peak period (102 in, 93 out).

6.1.6 Net Traffic Impact

The above traffic generation for the indicative development will not be a net increase over existing conditions. When accounting for the existing commercial development and bulky goods showroom on-site, future development permissible under the planning controls sought within the planning proposal is estimated to result in the following net change in traffic generation:

- 103 vehicle trips per hour during the AM peak period (21 in, 82 out); and
- 107 vehicle trips per hour during the PM peak period (80 in, 27 out).

6.2 Trip Distribution

For the purpose of modelling the traffic impacts of the proposal, trip distributions will need to be assumed for the above volumes and applied to the intersections considered most critical, which are considered to be Herbert Street with Ella Street and Herbert Street with Pacific Highway.

This in part, has been predicted using 2011 Journey to Work Data, published by Transport for NSW. Based on census data, information is provided regarding the mode share of transport for employees and residents situated within travel zones, as well as the origin or destination of these journeys to their place of residence or employment.

This information is therefore relevant in the context of anticipating the split in traffic volumes for future commercial and residential uses of the site. As such, analysis has been undertaken of journey data for the origins and destinations of residents and employees situated within Travel Zone 1843 (generally bound by Pacific Highway, the northern railway line, Frederick Street and Reserve Road), which contains the site. The results indicate that traffic volumes will be distributed according to the percentages shown for the following uses:

- Residential Uses:
  - 45.5% of vehicle trips originating from and destined to Herbert Street, north of Ella Street;
  - 7.9% of vehicle trips originating from and destined to Ella Street, east of Herbert Street;
  - 12.7% of vehicle trips originating from and destined to Pacific Highway, west of Herbert Street;
  - 33.9% of vehicle trips originating from and destined to Pacific Highway, east of Herbert Street.
- Commercial Uses:
  - 41.5% of vehicle trips originating from and destined to Herbert Street, north of Ella Street;
  - 15.8% of vehicle trips originating from and destined to Ella Street, east of Herbert Street;
  - 18.0% of vehicle trips originating from and destined to Pacific Highway, west of Herbert Street;
  - 24.7% of vehicle trips originating from and destined to Pacific Highway, east of Herbert Street.

Given that future retail and child care centre uses of the site are likely to draw customers and children from a localised catchment, the split in traffic generated by these uses are estimated to be split equally across all legs of the nominated critical intersections as follows:

- Retail and Child Care Centre uses:
  - 25.0% of vehicle trips originating from and destined to Herbert Street, north of Ella Street;
  - 25.0% of vehicle trips originating from and destined to Ella Street, east of Herbert Street;
  - 25.0% of vehicle trips originating from and destined to Pacific Highway, east of Herbert Street;
  - 25.0% of vehicle trips originating from and destined to Pacific Highway, west of Herbert Street.

An equivalent assumption for the splits of traffic generated by the existing bulky goods showroom is also made, in order to properly distribute the net traffic volumes brought on by the indicative development.

Having regard for these percentage distributions, the additional traffic volumes generated by the indicative development over existing conditions are estimated to be split in accordance with the diagrammatic representation shown in **Figure 7**, during AM and PM peak periods.

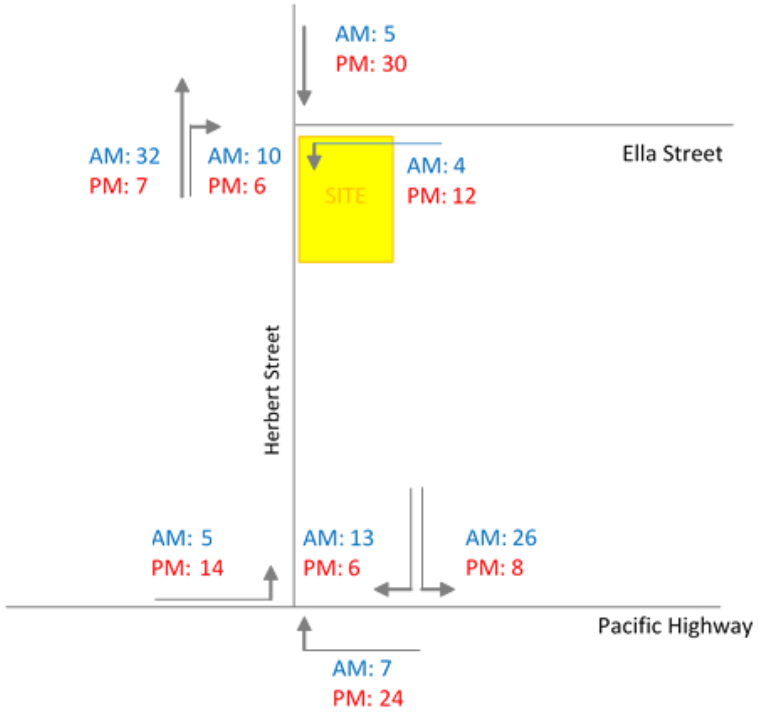


Figure 7: Trip Distribution

6.3 Peak Period Intersection Performances

6.3.1 Existing + Development Model (No Improvements)

The performance of key intersections in the vicinity of the site having regard for the additional traffic generated by the indicative development is summarised in **Table 6** below. This modelling exhibits the existing road geometry with no changes. Reference should also be made to the detailed SIDRA outputs included in **Appendix C-2**.

Table 6: Intersection Performance – Existing + Development

Intersection	Control Type	Period	Intersection Degree of Saturation (DOS)	Average Delay (AVD)	Level of Service (LOS)
Herbert Street / Ella Street	Priority*	AM	0.965	70.6	F
		PM	0.631	28.3	B
Pacific Highway / Hebert Street	Signals	AM	0.846	28.6	C
		PM	0.846	26.7	B

* Note: Results shown are for the movement with the highest delay in accordance with RMS Guidelines.

It can be seen from Table 6 that with the increased traffic volumes associated with the development will operate satisfactorily for the intersection of Pacific Highway and Herbert Street with a LOS of C or better. Whilst the PM peak period operation of the intersection of Herbert Street and Ella Street will continue to operate acceptably with a LOS of B, the AM peak period performance has worsened to experience delays of up to 70.6 seconds, thereby warranting a LOS of F. The delay, attributed to those motorists seeking to turn right onto Herbert Street from Ella Street, is therefore deemed by RMS guidelines to be unacceptable and is indicative that the intersection would be operating at excessive capacity.

6.3.2 Existing + Development with Improvements

In order for the intersection of Herbert Street and Ella Street to continue to operate at acceptable levels while accommodating the development volumes, the effectiveness of upgrades to improve capacity has been explored. With consideration to improving the flow of traffic on Ella Street, as well as for the available road geometry, the inclusion of a short lane was anticipated to be the most optimal solution. The performance of this intersection has subsequently been modelled with an additional 20 metre short

lane for left turning vehicles on Ella Street, with the results summarised in **Table 7**. Reference should also be made to the detailed SIDRA outputs included in **Appendix C-3**.

Table 7: Intersection Performance - Existing + Development with Upgrade

Intersection	Control Type	Period	Intersection Degree of Saturation (DOS)	Average Delay (AVD)	Level of Service (LOS)
Herbert Street / Ella Street	Priority*	AM	0.856	47.9	D
		PM	0.539	26.0	B

* Note: Results shown are for the movement with the highest delay in accordance with RMS Guidelines.

It can be seen from Table 7 that the introduction of a 20 metre short lane on Ella Street can improve the capacity of this intersection to achieve a LOS of D. Whilst the length of the short lane may be lengthened by Council to further decrease delays, this exercise serves to highlight the extent of upgrades necessitated by the traffic volumes contributed by future permissible development of the site. It is noteworthy that the verge on the southern side of Ella Street has sufficient width to accommodate widening of the carriageway and the impacts on pedestrian connectivity would be expected to be minimal, given that a footpath is provided only on the northern side of the bridge (over the rail corridor) to the east of the site.

7. Conclusions

In summary:

- An accompanying Planning Proposal seeks approval to modify planning controls under the *Willoughby Local Environmental Plan 2012* to permit high density residential, commercial, retail and child care uses for the subject site. An indicative development has been envisaged that would be compliant with the proposed controls, which contains 410 residential apartments, 4,394m^2 gross floor area of commercial space, 1,281m^2 gross floor area of retail space and a child care centre for 30 placements.

- The parking requirements for the indicative development has been assessed under the Willoughby Development Control Plan and SEPP 65, with a combined minimum requirement for 434 car parking spaces, including 329 spaces for residential. The proposed development is required to provide a range of 434 to 626 parking spaces. In response, the indicative development proposes the provision of 615 spaces. In this regard, the proposed car parking provision therefore satisfies the requirement of SEPP65 and Council's DCP and is considered acceptable.

- The traffic generation arising from the indicative development has been assessed as a net increase over and above existing traffic conditions to be 103 vehicle trips per hour during the AM peak period and 107 vehicle trips during the PM peak period. These volumes have been distributed across the intersections considered most critical with respect to the site, which are Herbert Street and Ella Street as well as Pacific Highway and Herbert Street.

- The traffic impacts of the above volumes has been modelled using SIDRA software, noting that both intersections were initially assessed to operate acceptably under existing conditions. Whilst the performance of the intersection of Pacific Highway and Herbert Street with development volumes continues to be satisfactory, the AM peak period performance of the intersection of Herbert Street and Ella Street with development volumes has pushed delays to unacceptable levels.

- As such, an upgraded intersection with the addition of a 20 metre short lane on Ella Street has been modelled, with results demonstrating that a LOS of D can be achieved with the development volumes. The widening of the carriageway to permit this additional lane is considered to be feasible, with an overall length to be determined by Council depending on the overall improvement in capacity desired.

On the basis of the above, the impacts of the indicative development are considered reasonable, and thus the Planning Proposal is supported on traffic planning grounds.

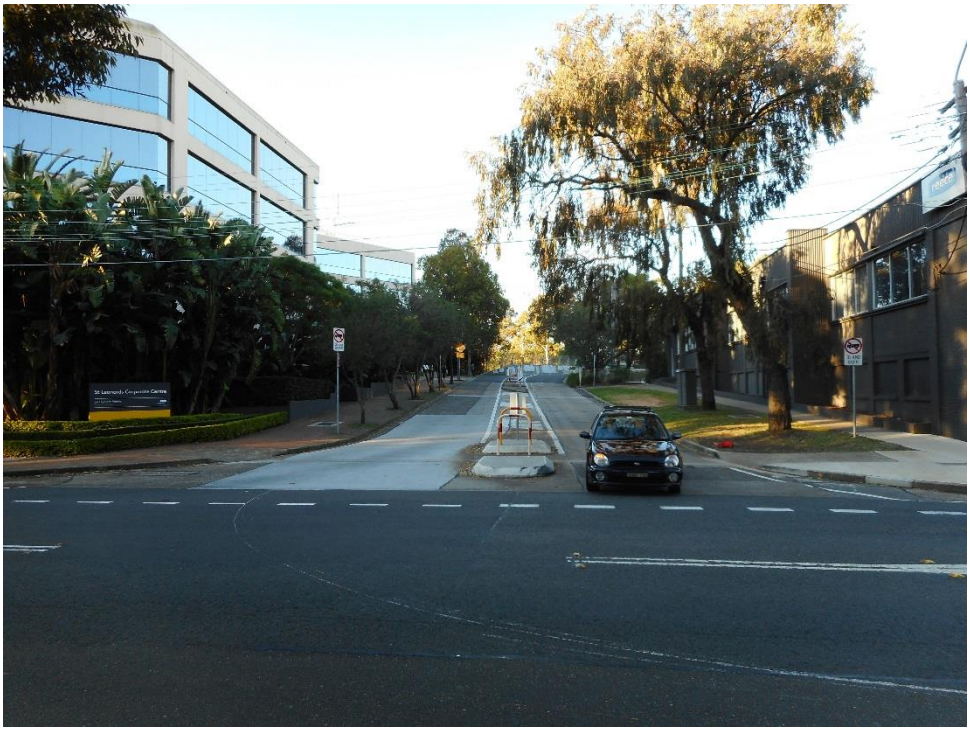
Appendix A

Photographic Record

View looking east on Hebert Street towards existing development at 37 Herbert Street

View looking south on Herbert Street with existing development at 31-35 Herbert Street on left hand side of photograph.

View looking east on Herbert Street towards existing site accesses.



View looking east on Herbert Street at the intersection with Ella Street.

View looking south on Herbert Street from the intersection with Ella Street.

View looking north on Herbert Street from the intersection with Pacific Highway.

Appendix B

Traffic Survey Counts

R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Fax 88196849, Mob.0418-239019

Client : Traffix

Job No/Name : 6139 ST. LEONARDS Herbert St

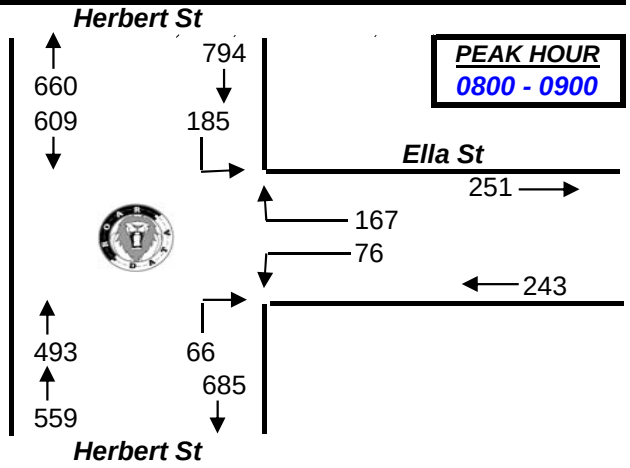
Day/Date : Wednesday 20th July 2016

All Vehicles

	NORTH		EAST		SOUTH		
	Herbert St		*Ella St*		*Herbert St*		
Time Per	**T**	**L**	**R**	**L**	**R**	**T**	**TOTAL**
0700 - 0715	111	13	23	21	9	75	**252**
0715 - 0730	145	27	33	13	15	103	**336**
0730 - 0745	161	36	33	21	16	104	**371**
0745 - 0800	171	37	37	12	20	89	**366**
0800 - 0815	161	61	42	23	15	103	**405**
0815 - 0830	123	41	42	18	15	116	**355**
0830 - 0845	176	39	37	19	19	138	**428**
0845 - 0900	149	44	46	16	17	136	**408**
Period End	**1197**	**298**	**293**	**143**	**126**	**864**	**2921**

	NORTH		EAST		SOUTH		
	Herbert St		*Ella St*		*Herbert St*		
Peak Per	**T**	**L**	**R**	**L**	**R**	**T**	**TOTAL**
0700 - 0800	588	113	126	67	60	371	**1325**
0715 - 0815	638	161	145	69	66	399	**1478**
0730 - 0830	616	175	154	74	66	412	**1497**
0745 - 0845	631	178	158	72	69	446	**1554**
0800 - 0900	609	185	167	76	66	493	**1596**

PEAK HR	**609**	**185**	**167**	**76**	**66**	**493**	**1596**

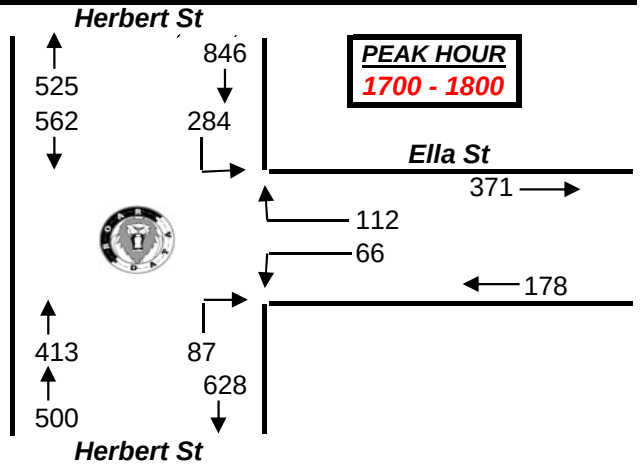


All Vehicles

	NORTH		EAST		SOUTH		
	Herbert St		*Ella St*		*Herbert St*		
Time Per	**T**	**L**	**R**	**L**	**R**	**T**	**TOTAL**
1600 - 1615	120	48	30	11	12	117	**338**
1615 - 1630	139	49	29	9	14	83	**323**
1630 - 1645	128	46	19	14	26	107	**340**
1645 - 1700	127	65	17	20	21	102	**352**
1700 - 1715	141	69	27	20	19	108	**384**
1715 - 1730	142	80	28	15	20	116	**401**
1730 - 1745	130	68	32	12	23	97	**362**
1745 - 1800	149	67	25	19	25	92	**377**
Period End	**1076**	**492**	**207**	**120**	**160**	**822**	**2877**

	NORTH		EAST		SOUTH		
	Herbert St		*Ella St*		*Herbert St*		
Peak Per	**T**	**L**	**R**	**L**	**R**	**T**	**TOTAL**
1600 - 1700	514	208	95	54	73	409	**1353**
1615 - 1715	535	229	92	63	80	400	**1399**
1630 - 1730	538	260	91	69	86	433	**1477**
1645 - 1745	540	282	104	67	83	423	**1499**
1700 - 1800	562	284	112	66	87	413	**1524**

PEAK HR	**562**	**284**	**112**	**66**	**87**	**413**	**1524**



R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Fax 88196849, Mob.0418-239019

Client : Traffix

Job No/Name : 6139 ST. LEONARDS Herbert St

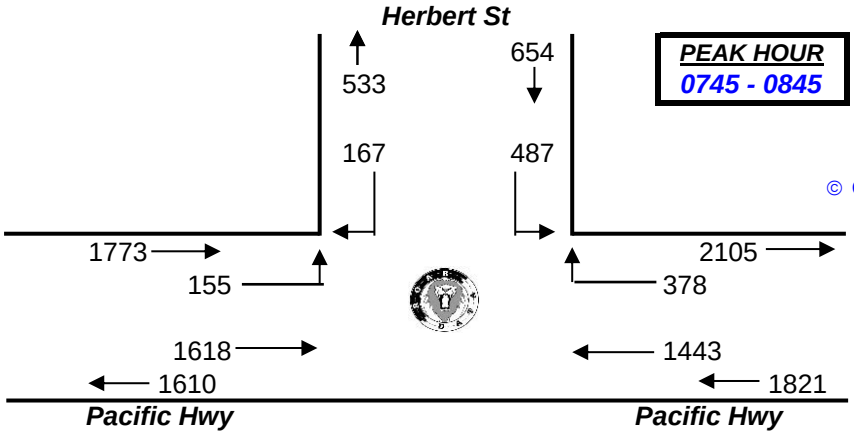
Day/Date : Wednesday 20th July 2016

All Vehicles

	WEST		NORTH		EAST		
	Pacific Hwy		*Herbert St*		*Pacific Hwy*		
Time Per	**L**	**T**	**R**	**L**	**T**	**R**	**TOTAL**
0700 - 0715	34	299	28	77	292	83	**813**
0715 - 0730	37	342	21	135	282	88	**905**
0730 - 0745	46	402	30	112	319	93	**1002**
0745 - 0800	36	462	42	115	368	90	**1113**
0800 - 0815	41	349	52	144	333	94	**1013**
0815 - 0830	43	424	25	100	409	89	**1090**
0830 - 0845	35	383	48	128	333	105	**1032**
0845 - 0900	44	431	28	109	324	98	**1034**
Period End	**316**	**3092**	**274**	**920**	**2660**	**740**	**8002**

	WEST		NORTH		EAST		
	Pacific Hwy		*Herbert St*		*Pacific Hwy*		
Peak Per	**L**	**T**	**R**	**L**	**T**	**R**	**TOTAL**
0700 - 0800	153	1505	121	439	1261	354	**3833**
0715 - 0815	160	1555	145	506	1302	365	**4033**
0730 - 0830	166	1637	149	471	1429	366	**4218**
0745 - 0845	155	1618	167	487	1443	378	**4248**
0800 - 0900	163	1587	153	481	1399	386	**4169**

PEAK HR	**155**	**1618**	**167**	**487**	**1443**	**378**	**4248**

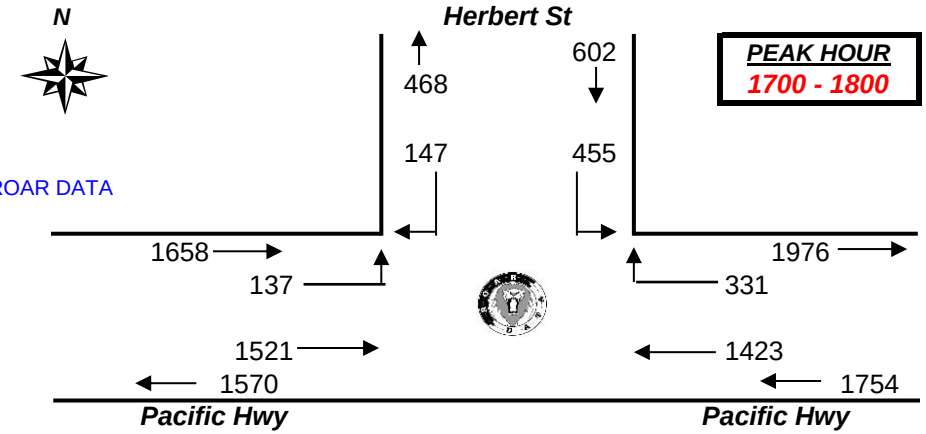


All Vehicles

	WEST		NORTH		EAST		
	Pacific Hwy		*Herbert St*		*Pacific Hwy*		
Time Per	**L**	**T**	**R**	**L**	**T**	**R**	**TOTAL**
1600 - 1615	27	280	34	106	326	100	**873**
1615 - 1630	20	279	40	115	337	73	**864**
1630 - 1645	39	305	40	106	352	83	**925**
1645 - 1700	31	316	46	102	331	92	**918**
1700 - 1715	33	390	41	92	352	82	**990**
1715 - 1730	34	357	42	107	385	86	**1011**
1730 - 1745	33	384	36	116	371	93	**1033**
1745 - 1800	37	390	28	140	315	70	**980**
Period End	**254**	**2701**	**307**	**884**	**2769**	**679**	**7594**

	WEST		NORTH		EAST		
	Pacific Hwy		*Herbert St*		*Pacific Hwy*		
Peak Per	**L**	**T**	**R**	**L**	**T**	**R**	**TOTAL**
1600 - 1700	117	1180	160	429	1346	348	**3580**
1615 - 1715	123	1290	167	415	1372	330	**3697**
1630 - 1730	137	1368	169	407	1420	343	**3844**
1645 - 1745	131	1447	165	417	1439	353	**3952**
1700 - 1800	137	1521	147	455	1423	331	**4014**

PEAK HOUR	**137**	**1521**	**147**	**455**	**1423**	**331**	**4014**



Appendix C

SIDRA Intersection Analysis

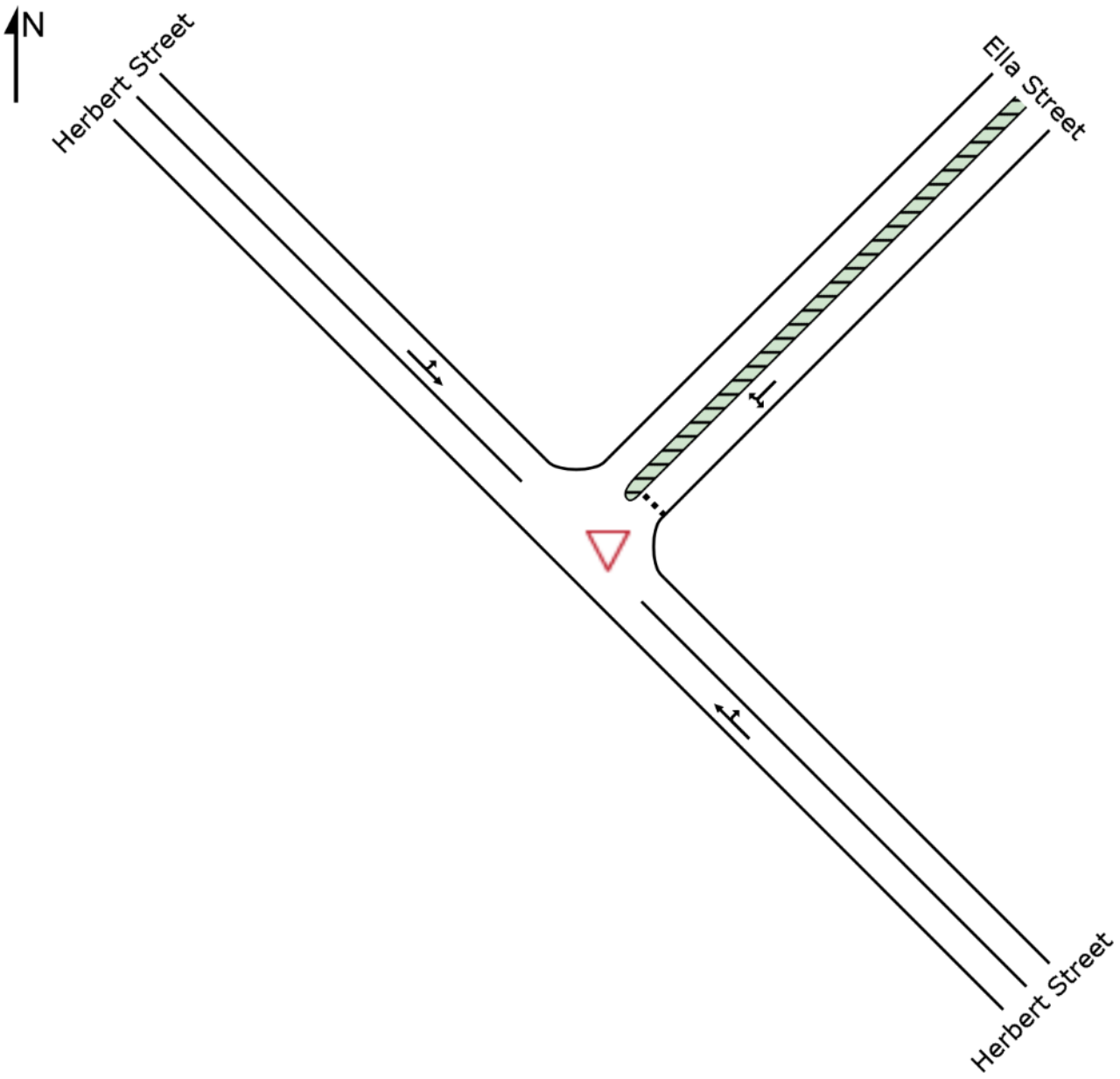
Appendix C-1

SIDRA Output - Existing

SITE LAYOUT

Site: 101 [Site 1A: Herbert Street and Ella Street - AM Peak Period - Existing]

Intersection: Herbert Street and Ella Street
Period: AM Peak
Scenario: Existing
Giveway / Yield (Two-Way)



MOVEMENT SUMMARY

Site: 101 [Site 1A: Herbert Street and Ella Street - AM Peak Period - Existing]

Intersection: Herbert Street and Ella Street
Period: AM Peak
Scenario: Existing
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Herbert Street											
2	T1	519	5.0	0.393	2.6	LOS A	2.2	15.9	0.35	0.09	46.8
3	R2	69	5.0	0.393	13.0	LOS A	2.2	15.9	0.35	0.09	46.8
Approach		588	5.0	0.393	3.8	NA	2.2	15.9	0.35	0.09	46.8
NorthEast: Ella Street											
4	L2	80	5.0	0.893	33.7	LOS C	7.1	51.9	0.94	1.66	32.1
6	R2	176	5.0	0.893	48.4	LOS D	7.1	51.9	0.94	1.66	26.0
Approach		256	5.0	0.893	43.8	LOS D	7.1	51.9	0.94	1.66	28.3
NorthWest: Herbert Street											
7	L2	195	5.0	0.448	4.6	LOS A	0.0	0.0	0.00	0.13	48.1
8	T1	641	5.0	0.448	0.0	LOS A	0.0	0.0	0.00	0.13	49.0
Approach		836	5.0	0.448	1.1	NA	0.0	0.0	0.00	0.13	48.8
All Vehicles		1680	5.0	0.893	8.5	NA	7.1	51.9	0.27	0.35	43.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Site 1B: Herbert Street and Ella Street - PM Peak Period - Existing]

Intersection: Herbert Street and Ella Street
Period: PM Peak
Scenario: Existing
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

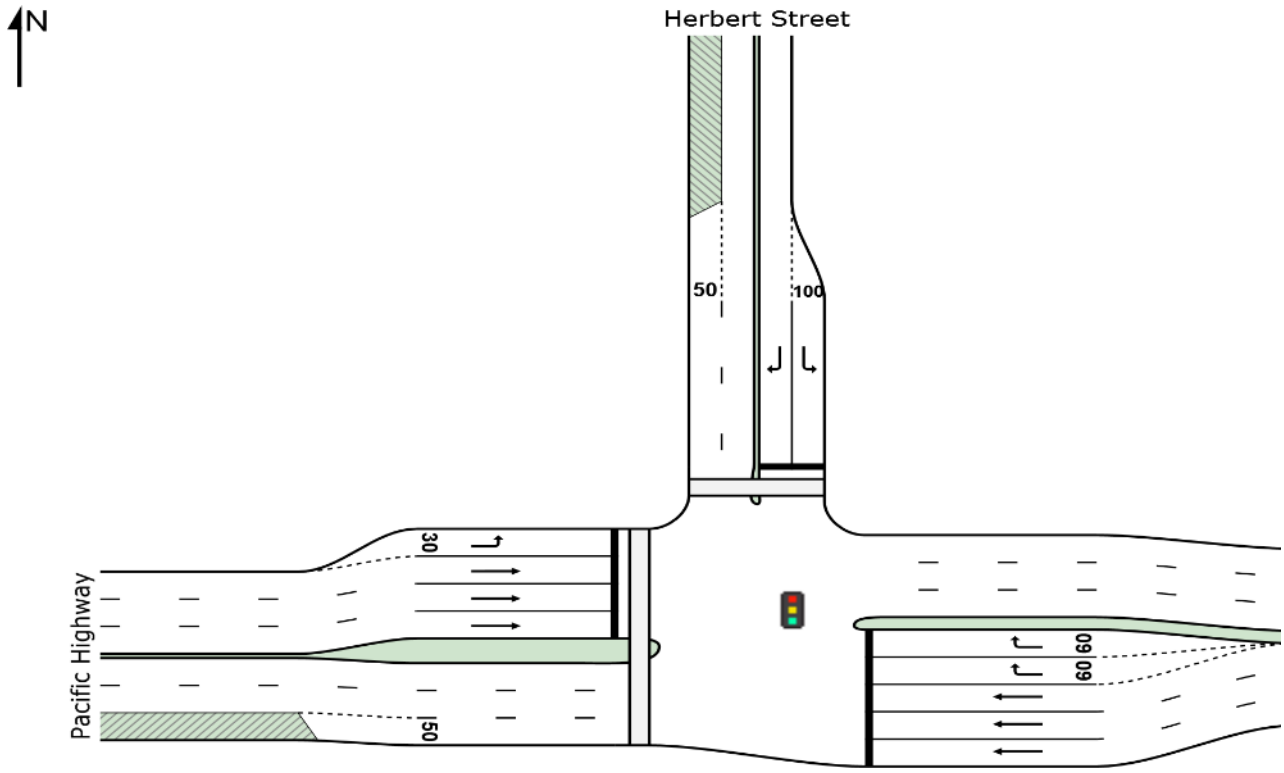
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Herbert Street											
2	T1	435	5.0	0.403	4.3	LOS A	3.0	21.6	0.51	0.15	45.2
3	R2	92	5.0	0.403	14.1	LOS A	3.0	21.6	0.51	0.15	45.7
Approach		526	5.0	0.403	6.0	NA	3.0	21.6	0.51	0.15	45.3
NorthEast: Ella Street											
4	L2	69	5.0	0.567	12.3	LOS A	2.5	18.5	0.83	1.09	39.6
6	R2	118	5.0	0.567	24.7	LOS B	2.5	18.5	0.83	1.09	34.7
Approach		187	5.0	0.567	20.1	LOS B	2.5	18.5	0.83	1.09	37.0
NorthWest: Herbert Street											
7	L2	299	5.0	0.480	4.6	LOS A	0.0	0.0	0.00	0.18	47.6
8	T1	592	5.0	0.480	0.0	LOS A	0.0	0.0	0.00	0.18	48.6
Approach		891	5.0	0.480	1.6	NA	0.0	0.0	0.00	0.18	48.3
All Vehicles		1604	5.0	0.567	5.2	NA	3.0	21.6	0.26	0.28	45.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Site 2A: Pacific Highway and Herbert Street - AM Peak Period - Existing]

Intersection: Pacific Highway and Herbert Street
Period: AM Peak
Scenario: Existing
Signals - Fixed Time Isolated



Organisation: TRAFFIX | Created: Friday, 12 August 2016 9:17:34 AM
Project: T:\Synergy\Projects\15\15.126\Modelling\15.126m01v3 TRAFFIX Herbert Street, St Leonards.sip7

MOVEMENT SUMMARY

Site: 101 [Site 2A: Pacific Highway and Herbert Street - AM Peak Period - Existing]

Intersection: Pacific Highway and Herbert Street
Period: AM Peak
Scenario: Existing
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Pacific Highway											
5	T1	1519	5.0	0.709	18.8	LOS B	25.4	185.5	0.77	0.69	27.0
6	R2	398	5.0	0.665	26.4	LOS B	9.2	67.0	0.92	0.81	40.2
Approach		1917	5.0	0.709	20.4	LOS B	25.4	185.5	0.81	0.72	32.2
North: Herbert Street											
7	L2	513	5.0	0.583	25.1	LOS B	17.8	129.8	0.77	0.82	40.6
9	R2	176	5.0	0.817	58.6	LOS E	9.4	68.3	1.00	0.93	29.0
Approach		688	5.0	0.817	33.7	LOS C	17.8	129.8	0.83	0.85	36.9
West: Pacific Highway											
10	L2	163	5.0	0.178	13.5	LOS A	2.8	20.8	0.57	0.71	47.0
11	T1	1703	5.0	0.822	33.4	LOS C	28.8	209.9	0.94	0.91	18.9
Approach		1866	5.0	0.822	31.7	LOS C	28.8	209.9	0.91	0.89	22.3
All Vehicles		4472	5.0	0.822	27.2	LOS B	28.8	209.9	0.85	0.81	29.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P3	North Full Crossing	53	25.3	LOS C	0.1	0.1	0.71	0.71
P4	West Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		105	34.8	LOS D			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Site 2B: Pacific Highway and Herbert Street - PM Peak Period - Existing]

Intersection: Pacific Highway and Herbert Street
Period: AM Peak
Scenario: Existing
Signals - Fixed Time Isolated Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Pacific Highway											
5	T1	1498	5.0	0.708	17.6	LOS B	22.7	165.5	0.78	0.70	28.0
6	R2	348	5.0	0.546	23.2	LOS B	6.9	50.5	0.88	0.79	41.8
Approach		1846	5.0	0.708	18.7	LOS B	22.7	165.5	0.80	0.72	33.0
North: Herbert Street											
7	L2	479	5.0	0.534	22.1	LOS B	14.3	104.5	0.73	0.80	42.1
9	R2	155	5.0	0.863	58.0	LOS E	7.8	56.9	1.00	0.99	29.1
Approach		634	5.0	0.863	30.9	LOS C	14.3	104.5	0.80	0.85	38.0
West: Pacific Highway											
10	L2	144	5.0	0.172	13.9	LOS A	2.4	17.9	0.61	0.72	46.7
11	T1	1601	5.0	0.816	31.9	LOS C	24.6	179.3	0.95	0.92	19.5
Approach		1745	5.0	0.816	30.4	LOS C	24.6	179.3	0.92	0.91	22.8
All Vehicles		4225	5.0	0.863	25.3	LOS B	24.6	179.3	0.85	0.81	30.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P3	North Full Crossing	53	25.0	LOS C	0.1	0.1	0.75	0.75
P4	West Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		105	32.1	LOS D			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

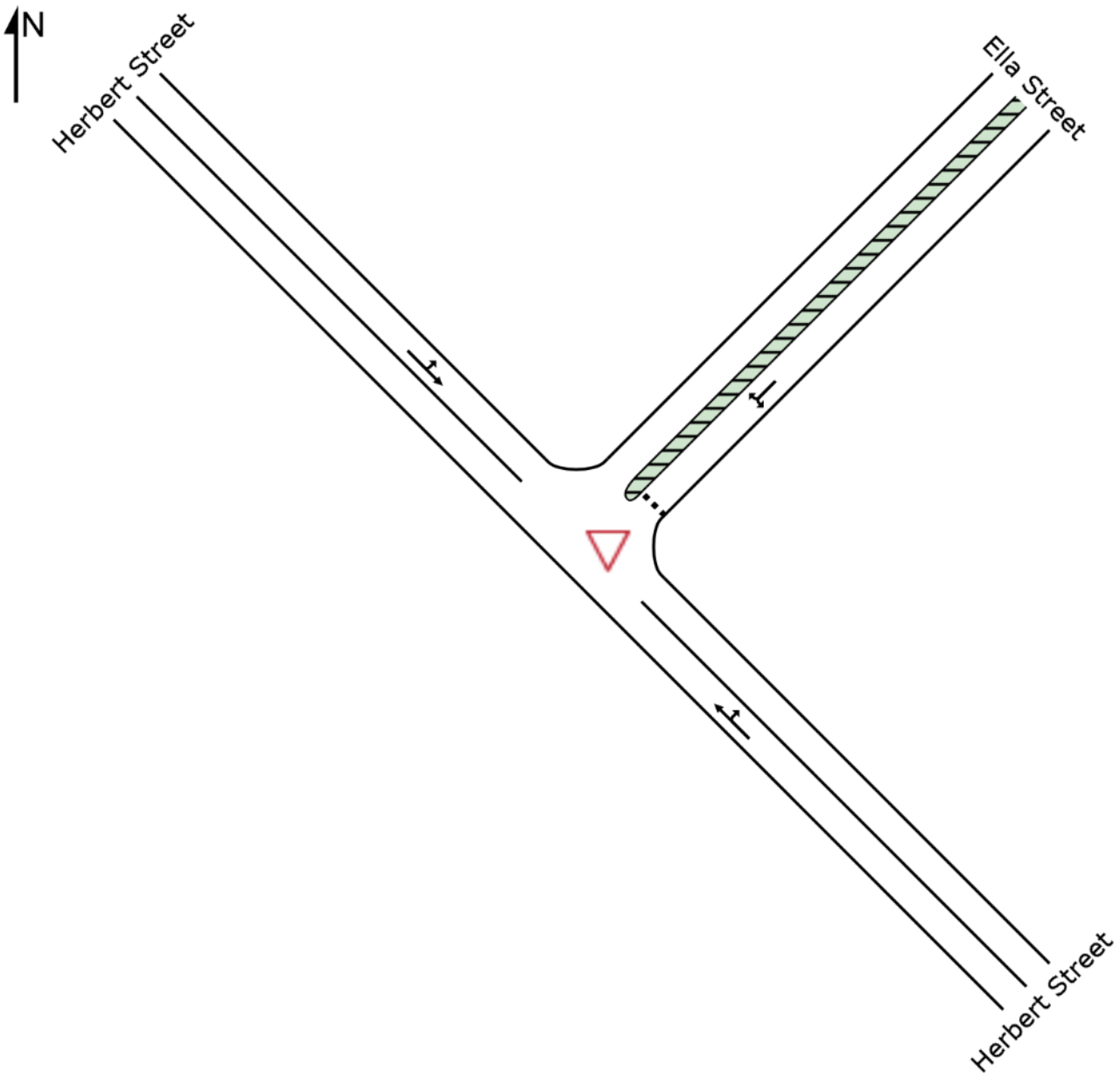
Appendix C-2

SIDRA Output – Existing + Development

SITE LAYOUT

Site: 101 [Site 1C: Herbert Street and Ella Street - AM Peak Period - Existing + Development]

Intersection: Herbert Street and Ella Street
Period: AM Peak
Scenario: Existing + Development
Giveway / Yield (Two-Way)



MOVEMENT SUMMARY

Site: 101 [Site 1C: Herbert Street and Ella Street - AM Peak Period - Existing + Development]

Intersection: Herbert Street and Ella Street
Period: AM Peak
Scenario: Existing + Development
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Herbert Street											
2	T1	553	4.7	0.428	2.9	LOS A	2.6	19.1	0.39	0.10	46.5
3	R2	80	4.3	0.428	13.5	LOS A	2.6	19.1	0.39	0.10	46.6
Approach		633	4.7	0.428	4.2	NA	2.6	19.1	0.39	0.10	46.5
NorthEast: Ella Street											
4	L2	84	4.8	0.965	54.2	LOS D	10.6	77.0	0.95	2.04	27.4
6	R2	176	5.0	0.965	70.6	LOS F	10.6	77.0	0.95	2.04	21.2
Approach		260	4.9	0.965	65.3	LOS E	10.6	77.0	0.95	2.04	23.5
NorthWest: Herbert Street											
7	L2	195	5.0	0.451	4.6	LOS A	0.0	0.0	0.00	0.13	48.1
8	T1	646	5.0	0.451	0.0	LOS A	0.0	0.0	0.00	0.13	49.0
Approach		841	5.0	0.451	1.1	NA	0.0	0.0	0.00	0.13	48.8
All Vehicles		1734	4.8	0.965	11.9	NA	10.6	77.0	0.28	0.40	41.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Site 1D: Herbert Street and Ella Street - PM Peak Period - Existing + Development]

Intersection: Herbert Street and Ella Street
Period: PM Peak
Scenario: Existing + Development
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

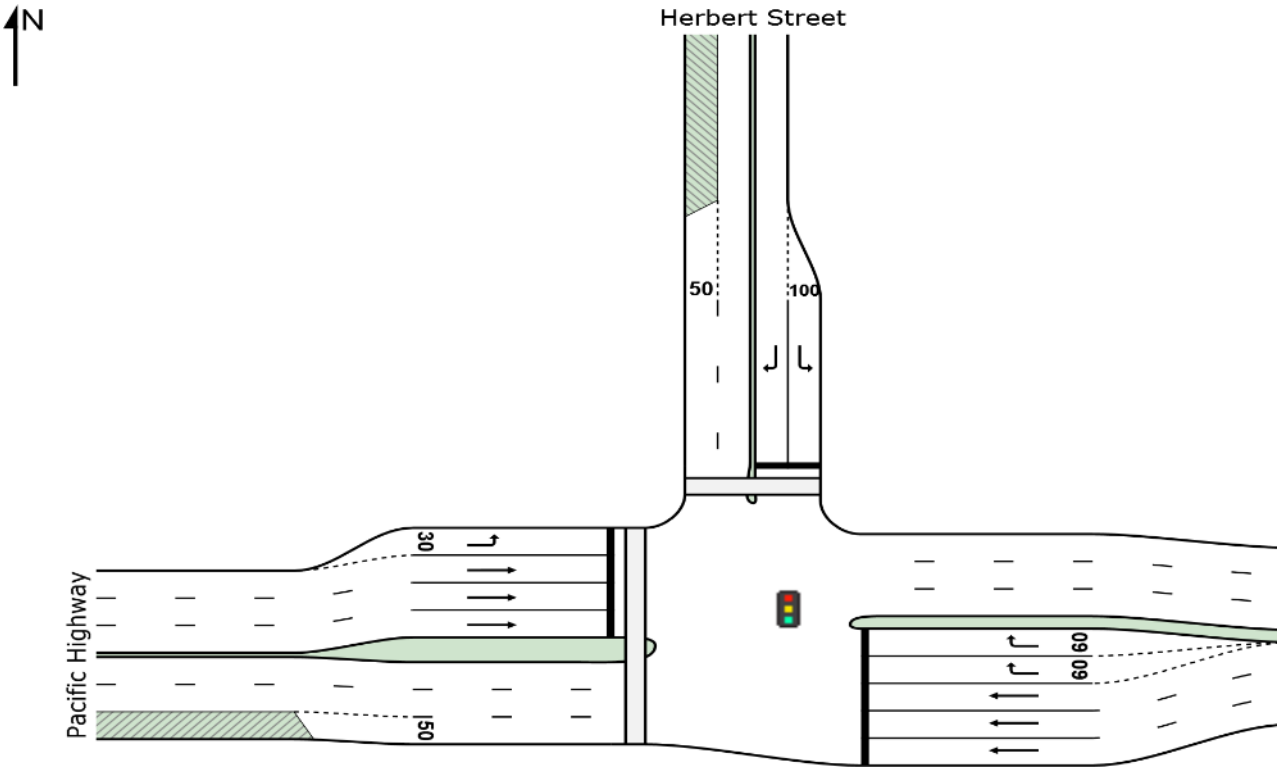
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Herbert Street											
2	T1	442	4.9	0.430	5.1	LOS A	3.4	25.1	0.55	0.16	44.5
3	R2	98	4.7	0.430	15.1	LOS B	3.4	25.1	0.55	0.16	45.2
Approach		540	4.9	0.430	6.9	NA	3.4	25.1	0.55	0.16	44.7
NorthEast: Ella Street											
4	L2	82	4.2	0.631	14.3	LOS A	3.0	21.8	0.85	1.15	38.7
6	R2	118	5.0	0.631	28.3	LOS B	3.0	21.8	0.85	1.15	33.5
Approach		200	4.7	0.631	22.6	LOS B	3.0	21.8	0.85	1.15	36.1
NorthWest: Herbert Street											
7	L2	299	5.0	0.496	4.6	LOS A	0.0	0.0	0.00	0.18	47.7
8	T1	623	4.7	0.496	0.0	LOS A	0.0	0.0	0.00	0.18	48.6
Approach		922	4.8	0.496	1.5	NA	0.0	0.0	0.00	0.18	48.3
All Vehicles		1662	4.8	0.631	5.8	NA	3.4	25.1	0.28	0.29	45.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Site 2C: Pacific Highway and Herbert Street - AM Peak Period - Existing + Development]

Intersection: Pacific Highway and Herbert Street
Period: AM Peak
Scenario: Existing + Development
Signals - Fixed Time Isolated



Organisation: TRAFFIX | Created: Friday, 12 August 2016 9:17:52 AM
Project: T:\Synergy\Projects\15\15.126\Modelling\15.126m01v3 TRAFFIX Herbert Street, St Leonards.sip7

MOVEMENT SUMMARY

Site: 101 [Site 2C: Pacific Highway and Herbert Street - AM Peak Period - Existing + Development]

Intersection: Pacific Highway and Herbert Street
Period: AM Peak
Scenario: Existing + Development
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Pacific Highway											
5	T1	1519	5.0	0.723	19.6	LOS B	26.0	189.5	0.79	0.71	26.4
6	R2	405	4.9	0.677	26.3	LOS B	9.3	67.5	0.93	0.81	40.3
Approach		1924	5.0	0.723	21.0	LOS B	26.0	189.5	0.82	0.73	31.8
North: Herbert Street											
7	L2	540	4.7	0.601	24.7	LOS B	18.7	136.5	0.77	0.82	40.8
9	R2	189	4.6	0.811	57.5	LOS E	10.0	72.8	1.00	0.93	29.2
Approach		729	4.7	0.811	33.3	LOS C	18.7	136.5	0.83	0.85	37.0
West: Pacific Highway											
10	L2	168	4.8	0.184	13.5	LOS A	2.9	21.4	0.57	0.71	47.0
11	T1	1703	5.0	0.846	36.6	LOS C	30.2	220.7	0.96	0.96	17.8
Approach		1872	5.0	0.846	34.5	LOS C	30.2	220.7	0.92	0.93	21.3
All Vehicles		4525	4.9	0.846	28.6	LOS C	30.2	220.7	0.86	0.83	29.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P3	North Full Crossing	53	26.0	LOS C	0.1	0.1	0.72	0.72
P4	West Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94
All Pedestrians		105	35.1	LOS D			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Site 2D: Pacific Highway and Herbert Street - PM Peak Period - Existing + Development]

Intersection: Pacific Highway and Herbert Street
Period: AM Peak
Scenario: Existing + Development
Signals - Fixed Time Isolated Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Pacific Highway											
5	T1	1498	5.0	0.725	18.4	LOS B	23.3	169.8	0.80	0.71	27.3
6	R2	374	4.7	0.584	23.0	LOS B	7.4	53.5	0.89	0.80	41.9
Approach		1872	4.9	0.725	19.3	LOS B	23.3	169.8	0.82	0.73	32.8
North: Herbert Street											
7	L2	487	4.9	0.531	21.4	LOS B	14.3	104.5	0.72	0.80	42.5
9	R2	161	4.8	0.807	54.1	LOS D	7.8	56.6	1.00	0.93	30.2
Approach		648	4.9	0.807	29.5	LOS C	14.3	104.5	0.79	0.83	38.6
West: Pacific Highway											
10	L2	159	4.5	0.189	14.0	LOS A	2.7	19.7	0.62	0.72	46.7
11	T1	1601	5.0	0.846	35.4	LOS C	26.2	191.0	0.97	0.98	18.2
Approach		1760	5.0	0.846	33.4	LOS C	26.2	191.0	0.94	0.95	21.7
All Vehicles		4280	4.9	0.846	26.7	LOS B	26.2	191.0	0.86	0.84	29.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P3	North Full Crossing	53	25.7	LOS C	0.1	0.1	0.76	0.76
P4	West Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		105	32.5	LOS D			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

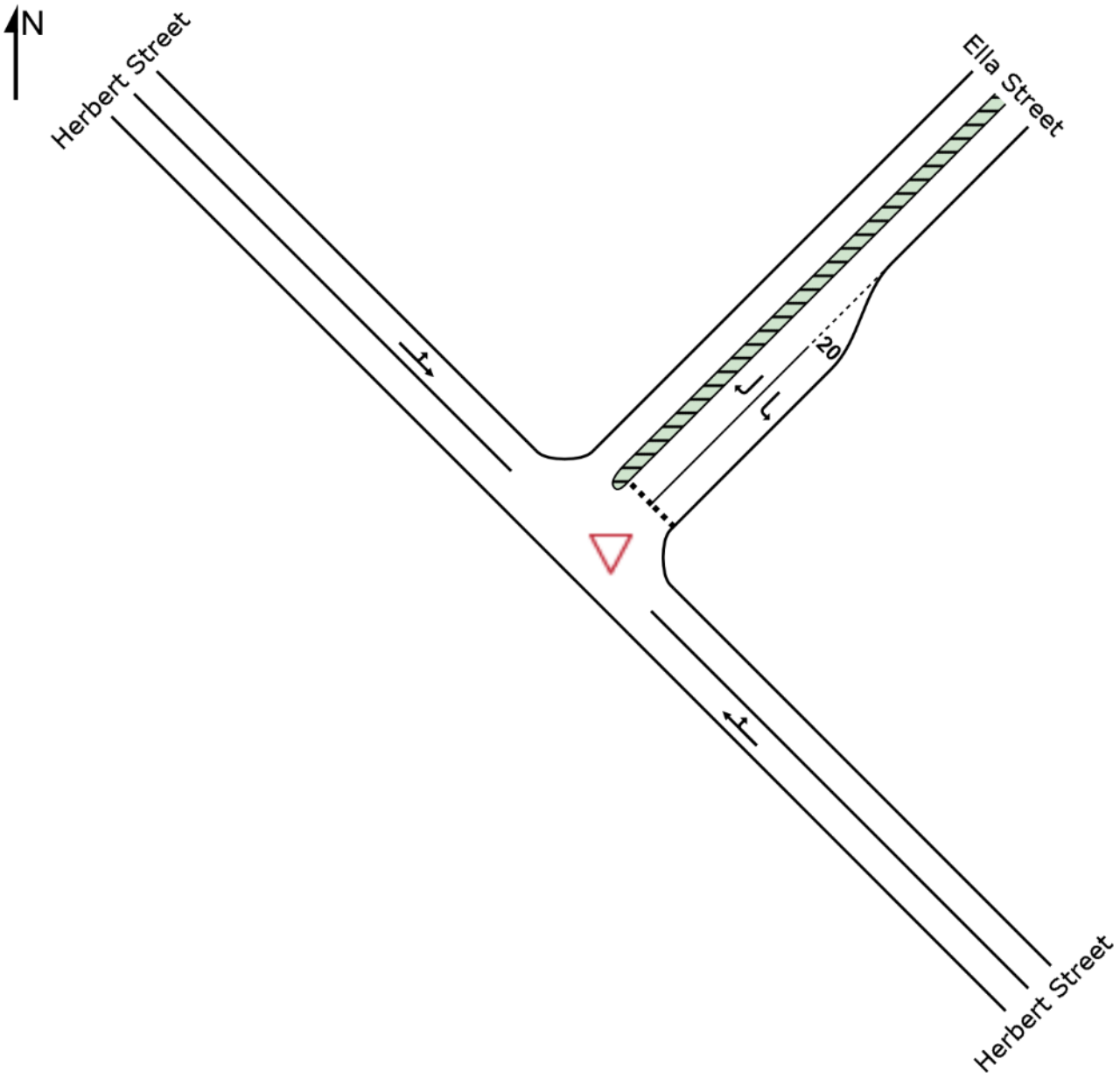
Appendix C-3

SIDRA Output – Existing + Development (Upgrade)

SITE LAYOUT

Site: 101 [Site 1E: Herbert Street and Ella Street - Upgrade - AM Peak Period - Existing + Development]

Intersection: Herbert Street and Ella Street
Period: AM Peak
Scenario: Existing + Development
Giveway / Yield (Two-Way)



Organisation: TRAFFIX | Created: Friday, 12 August 2016 9:16:13 AM
Project: T:\Synergy\Projects\15\15.126\Modelling\15.126m01v3 TRAFFIX Herbert Street, St Leonards.sip7

MOVEMENT SUMMARY

Site: 101 [Site 1E: Herbert Street and Ella Street - Upgrade - AM Peak Period - Existing + Development]

Intersection: Herbert Street and Ella Street
Period: AM Peak
Scenario: Existing + Development
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Herbert Street											
2	T1	553	4.7	0.428	2.9	LOS A	2.6	19.1	0.39	0.10	46.5
3	R2	80	4.3	0.428	13.5	LOS A	2.6	19.1	0.39	0.10	46.8
Approach		633	4.7	0.428	4.2	NA	2.6	19.1	0.39	0.10	46.6
NorthEast: Ella Street											
4	L2	84	4.8	0.109	7.9	LOS A	0.4	2.9	0.56	0.77	45.1
6	R2	176	5.0	0.856	47.9	LOS D	4.8	35.3	0.97	1.42	24.9
Approach		260	4.9	0.856	34.9	LOS C	4.8	35.3	0.84	1.21	31.0
NorthWest: Herbert Street											
7	L2	195	5.0	0.451	4.6	LOS A	0.0	0.0	0.00	0.13	48.1
8	T1	646	5.0	0.451	0.0	LOS A	0.0	0.0	0.00	0.13	49.0
Approach		841	5.0	0.451	1.1	NA	0.0	0.0	0.00	0.13	48.8
All Vehicles		1734	4.8	0.856	7.3	NA	4.8	35.3	0.27	0.28	44.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Site 1F: Herbert Street and Ella Street - Upgrade - PM Peak Period - Existing + Development]

Intersection: Herbert Street and Ella Street
Period: PM Peak
Scenario: Existing + Development
Giveway / Yield (Two-Way)

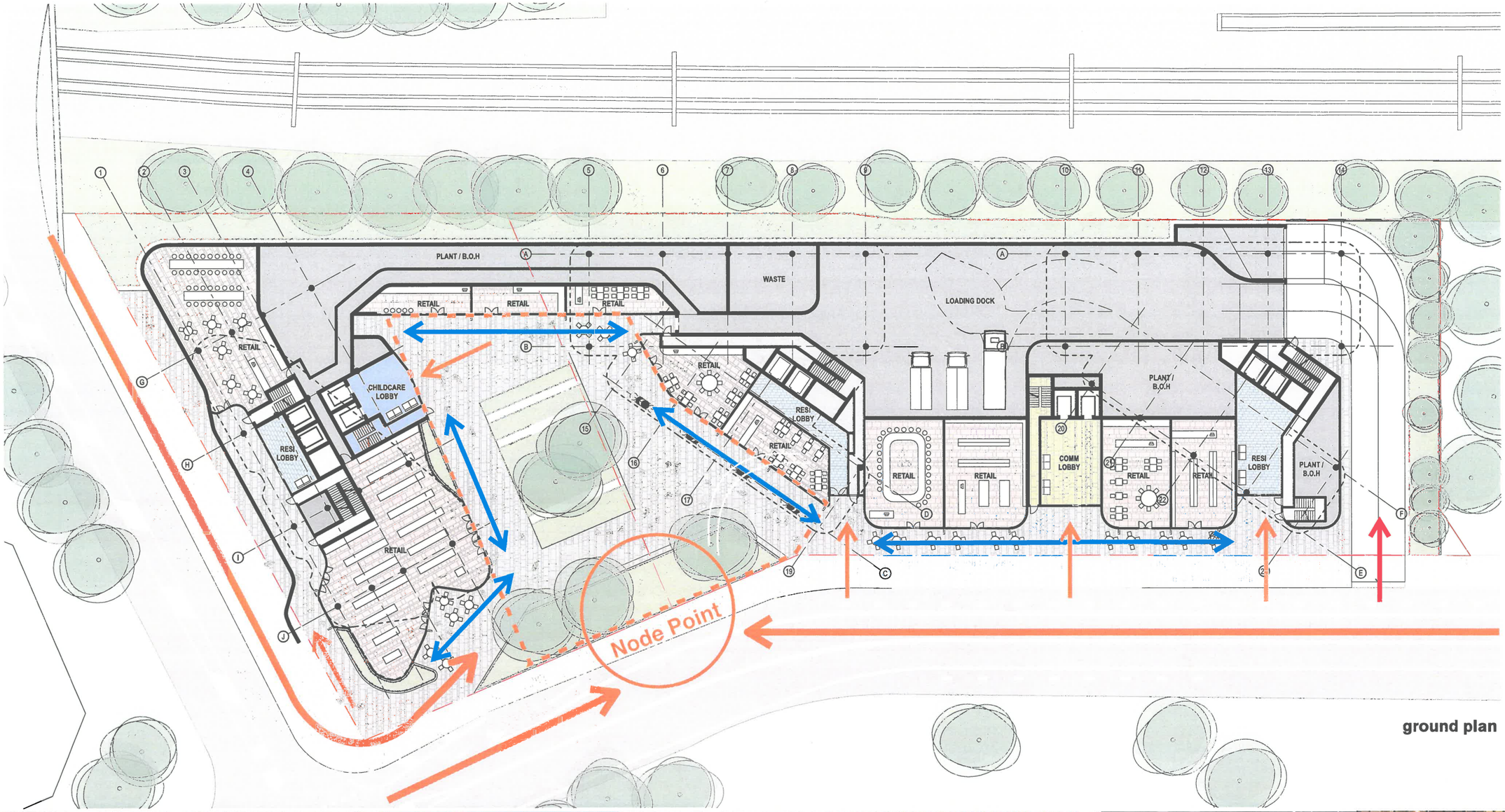
Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Herbert Street											
2	T1	442	4.9	0.430	5.1	LOS A	3.4	25.1	0.55	0.16	44.6
3	R2	98	4.7	0.430	15.1	LOS B	3.4	25.1	0.55	0.16	45.4
Approach		540	4.9	0.430	6.9	NA	3.4	25.1	0.55	0.16	44.8
NorthEast: Ella Street											
4	L2	82	4.2	0.102	7.7	LOS A	0.4	2.7	0.55	0.75	45.2
6	R2	118	5.0	0.529	26.0	LOS B	2.0	14.3	0.91	1.07	32.0
Approach		200	4.7	0.529	18.5	LOS B	2.0	14.3	0.76	0.94	37.9
NorthWest: Herbert Street											
7	L2	299	5.0	0.496	4.6	LOS A	0.0	0.0	0.00	0.18	47.7
8	T1	623	4.7	0.496	0.0	LOS A	0.0	0.0	0.00	0.18	48.6
Approach		922	4.8	0.496	1.5	NA	0.0	0.0	0.00	0.18	48.3
All Vehicles		1662	4.8	0.529	5.3	NA	3.4	25.1	0.27	0.26	45.5

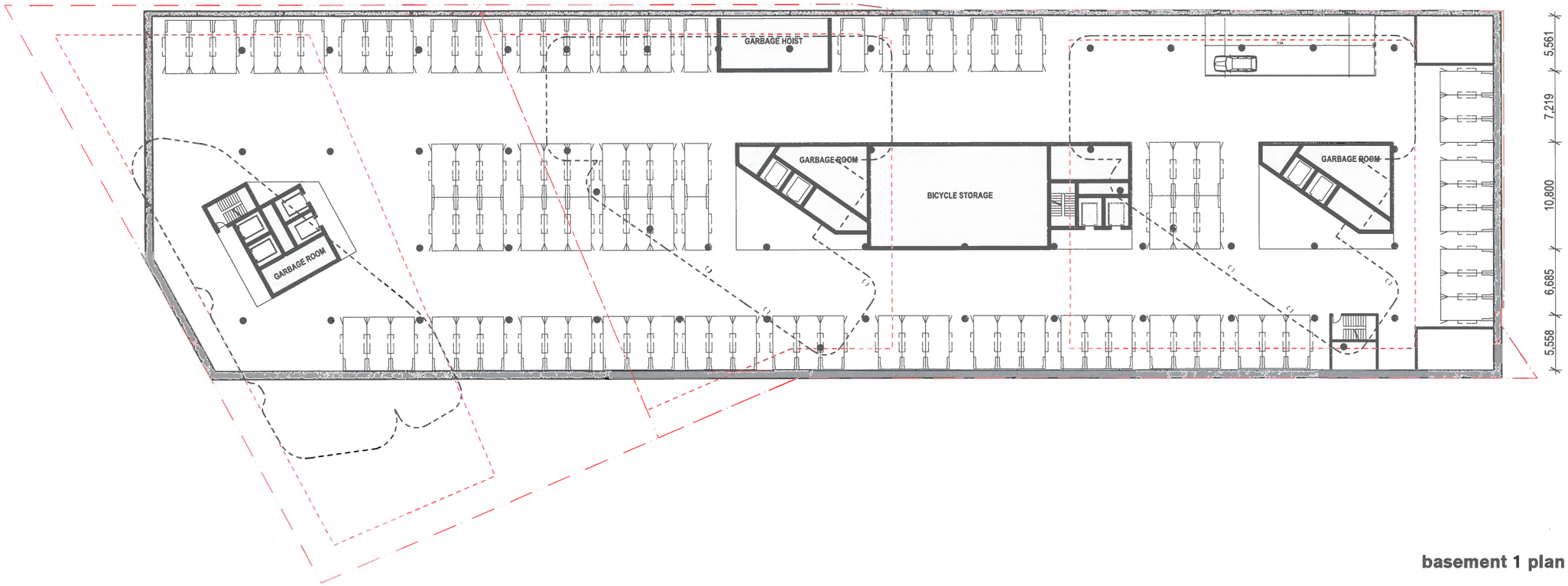
Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix D

Reduce Plans


PLANT / B.O.H
WASTE
LOADING DOCK
RETAIL
RETAIL
RETAIL
RETAIL
CHILDCARE LOBBY
RESI LOBBY
RETAIL
RETAIL
RESI LOBBY
RETAIL
RETAIL
COMM LOBBY
RETAIL
RETAIL
PLANT / B.O.H
RESI LOBBY
PLANT / B.O.H
RETAIL
Node Point

ground plan



basement 1 plan