524-542 Pacific Highway, St Leonards
Mixed Use Development
Transport Impact Assessment

Client // Grocon
Office // NSW
Reference // N139020
Date // 30/11/18

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Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
A	06/12/16	Final report	David Yu	Karen McNatty	Brett Maynard	Brett Maynard
B	13/12/16	Revised final report incorporating client comments	David Yu	Karen McNatty	Brett Maynard	Brett Maynard
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1. Introduction

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1.1 Background

A Planning Proposal is to be lodged with Lane Cove Council for a site rezoning for a mixed use development above the existing Telstra Exchange at 524-542 Pacific Highway, St Leonards. The proposed development seeks to provide off-street parking via a car stacker system with two car lifts to accommodate parking for 160 vehicles.

The existing Telstra Exchange building and associated infrastructure will be retained, together with the existing vehicle access driveways along Christie Street and the eastern Pacific Highway access.

Grocon originally engaged GTA Consultants in November 2016 to complete a transport impact assessment for the proposal. As part of changes to the design of the development in September 2018, GTA were again commissioned to revise the transport impact assessment for the proposal.

1.2 Purpose of this Report

This report sets out an assessment of the anticipated transport implications of the proposal, including consideration of the following:

i existing traffic and parking conditions surrounding the site
ii suitability of the proposed parking in terms of supply (quantum) and layout
iii service vehicle requirements
iv pedestrian and bicycle requirements
v the traffic generating characteristics of the proposed development
vi suitability of the proposed access arrangements for the site
vii the transport impact of the development proposal on the surrounding road network.

1.3 References

In preparing this report, reference has been made to the following:

- an inspection of the site and its surrounds
- Lane Cove Council Development Control Plan (DCP): Part R Traffic, Transport and Parking amended 2016
- Australian Standard/ New Zealand Standard, Parking Facilities, Part 1: Off-Street Car Parking AS/NZS 2890.1:2004
- Australian Standard, Parking Facilities, Part 2: Off-Street Commercial Vehicle Facilities AS 2890.2:2002
- Australian Standard/ New Zealand Standard, Parking Facilities, Part 6: Off-Street Parking for People with Disabilities AS/NZS 2890.6:2009
- Highway Capacity Manual 2000
- Traffic volumes sourced from 59-67 Christie Street and 46-52 Nicholson Street, St Leonards Traffic Impact Assessment (Arup, 2015) report
- other documents and data as referenced in this report.

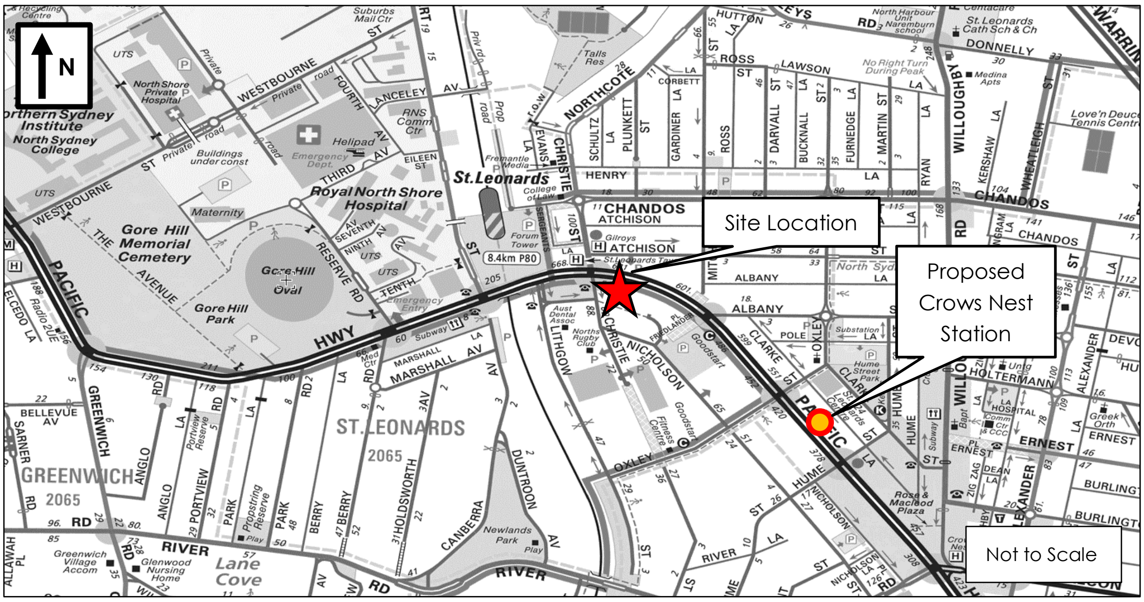
2. Existing Conditions

The subject site is located at 524-542 Pacific Highway, St Leonards and covers an area of around 1,670m[2] with a 30-metre frontage to the Pacific Highway. The site currently has a land use classification of B3 Commercial Core and is currently occupied by the Telstra Exchange building.

The surrounding properties predominantly include commercial and retail along the Pacific Highway with commercial uses to the south, although it is noted that several significant residential developments have been approved in the area. Low and medium density residential uses are located on the western side of the rail corridor. St Leonards Railway Station is located around 100 metres northwest of the site.

The location of the site and its surrounding environs is shown in Figure 2.1.

Figure 2.1: Subject Site and Its Environs



Basemap source: Sydway Publishing Pty Ltd

2.1 Road Network

2.1.1 Adjoining Roads

Pacific Highway

The Pacific Highway is a Roads and Maritime Services (Roads and Maritime) classified state road and the key road corridor through St Leonards. In the vicinity of the site, it is aligned in an east-west direction and provides three traffic lanes in each direction separated by a central median. The Pacific Highway has a posted speed limit of 60 km/h near the site.

Time restricted kerbside parking is permitted outside of the typical weekday AM and PM clearway periods.

The Pacific Highway provides convenient access to North Sydney CBD and Sydney CBD to the south, Lane Cove and Chatswood to the north and is the key link to the M1 Sydney to Newcastle Freeway and the M2 Lane Cove Tunnel/ Gore Hill Freeway.

The site fronts the Pacific Highway as shown in Figure 2.2.

Figure 2.2: Pacific Highway (looking east)

Christie Street

Christie Street is a local road and in the vicinity of the site is aligned in a north-south direction. Between the Pacific Highway and the site access point, Christie Street is one-way southbound configured with one traffic lane and parking lanes on both sides of the road. It is two-way to the south of the site access with one traffic lane and one parking lane in each direction. Christie Street provides access to the site and ends in a cul-de-sac to the south. It has a posted speed limit of 50 km/h. Christie Street road layout is shown in Figure 2.3.

Figure 2.3: Christie Street Lane Configuration

Basemap Source: SIXMAPS (accessed 14 November 2016)

2.2 Traffic Volumes

Traffic volumes have been sourced from a transport report prepared in 2015 for an adjacent development proposal[1]. The report included traffic volumes at the signalised intersection of Pacific Highway/ Christie Street immediately north-west of the site.

[1] 59-67 Christie Street and 46-52 Nicholson Street, St Leonards Traffic Impact Assessment, Arup, 2015.

The weekday AM and PM peak hour traffic volumes are reproduced in Figure 2.4 and Figure 2.5.

Figure 2.4: Existing AM Peak Hour Traffic Volumes

Basemap Source: SIXMAPS (accessed 14 November 2016)

Figure 2.5: Existing PM Peak Hour Traffic Volumes

Basemap Source: SIXMAPS (accessed 14 November 2016)

2.3 Intersection Operation

The operation of the key intersections within the study area have been assessed using SIDRA INTERSECTION[2], a computer based modelling package which calculates intersection performance.

The commonly used measure of intersection performance, as defined by the Roads and Maritime Services (Roads and Maritime), is vehicle delay. SIDRA INTERSECTION determines the average delay that vehicles encounter and provides a measure of the level of service.

Table 2.1 shows the criteria that SIDRA INTERSECTION adopts in assessing the Level of Service (LoS).

Table 2.1: SIDRA INTERSECTION Level of Service Criteria

Level of Service (LoS)	Average Delay per vehicle (secs/ veh)	Traffic Signals, Roundabout	Give Way & Stop Sign
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	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

Table 2.2 presents a summary of the existing operation of the Pacific Highway/ Christie Street intersection during weekday AM and PM peak hours, with full results presented in Appendix A of this report.

Table 2.2: Existing Operating Conditions

Intersection	Peak	Leg	Degree of Saturation (DoS) [1]	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LoS)
Pacific Highway/ Christie Street	AM	East	0.94	53	457	D
		North	0.33	30	81	C
		West	0.88	41	362	C
		Overall	**0.93**	**44**	**457**	**D**
	PM	East	0.45	9	111	A
		North	0.56	53	82	D
		West	0.58	9	166	A
		Overall	**0.58**	**13**	**166**	**A**

[1] A measure of how much demand an intersection is experiencing compared to the total capacity. Also known as the volume/capacity ratio where v/c > 1.0 represents oversaturated conditions.

On the basis of the above assessment, the intersection of the Pacific Highway and Christie Street currently operates close to capacity in the weekday AM peak and generally has good operation with spare capacity in the PM peak.

2 Program used under license from Akcelik & Associates Pty Ltd.

2.4 Public Car Parking

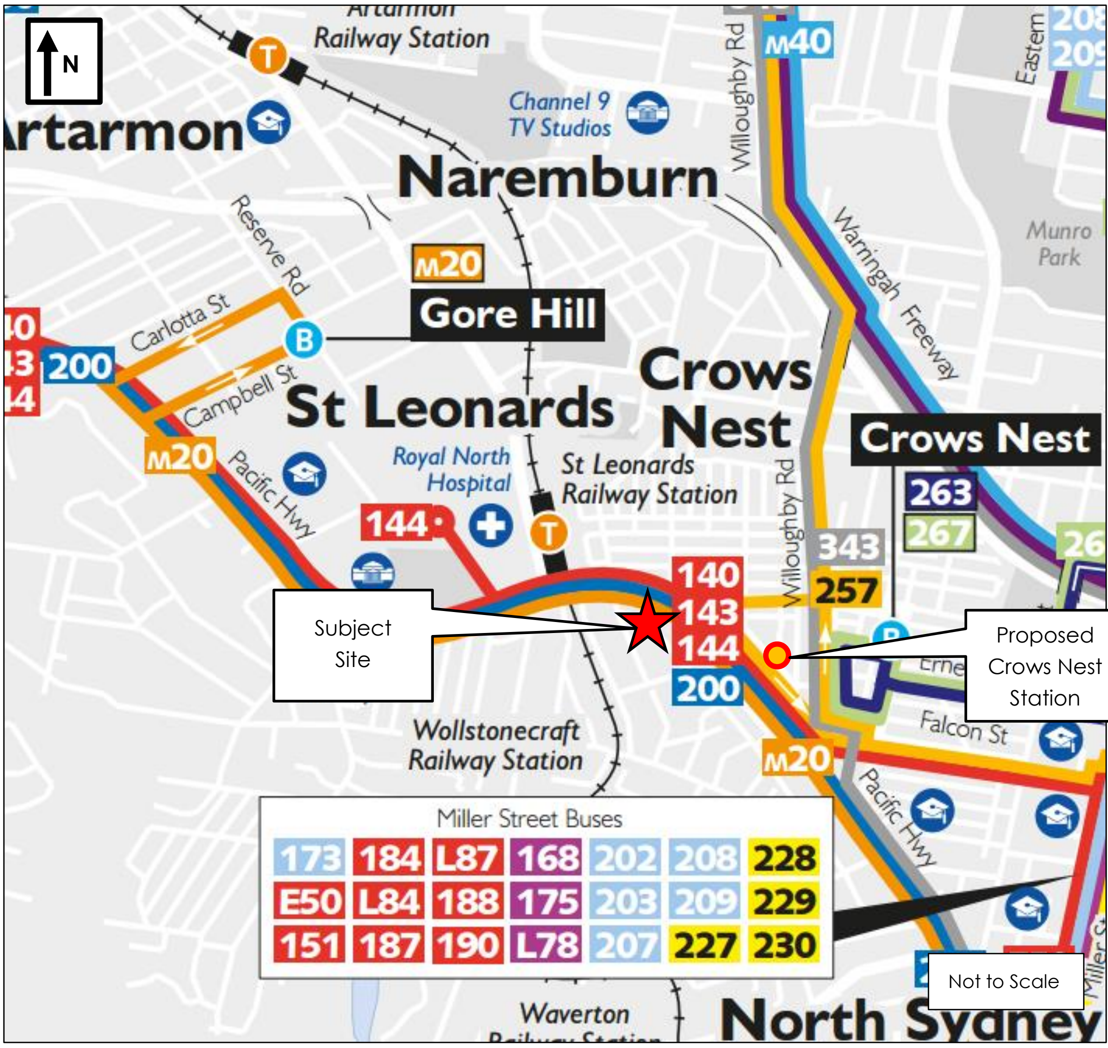
A review of publicly available car parking near the site and site observations indicates a high demand in on-street parking surrounding the site. This is particularly due to commuter parking near St Leonards railway station nearby and surrounding commercial and retail uses. There are also several off-street car parks that are available to the public in the area, with a Wilson parking station located immediately southeast of the site.

2.5 Public Transport

The subject site is well serviced by existing public transport. The St Leonards railway station is located around 100 metres west (two-minute walk) along Pacific Highway and serviced by the Central Coast & Newcastle Line, T1 North Shore, Northern and Western Line. Services at St Leonards railway station arrive about every three minutes for trains heading towards the Sydney CBD during peak periods, reducing to every 15 minutes during off-peak periods.

The site is also well serviced by buses. A map of the Sydney Buses services surrounding the site and proposed Crows Nest Station area, is shown in Figure 2.6.

Figure 2.6: Surrounding Bus Network (Sydney Buses)



Source: http://www.sydneybuses.info/routes/15326_STA_region_web_map_north_20160905.pdf (accessed 14/11/16)

The site is serviced by a bus stop located adjacent to 504 Pacific Highway (about 30m for westbound buses) and the St Leonards railway station bus stop for eastbound buses (about 100m from the site). Both Sydney Buses and Hillsbus operate services at these bus stops.

A review of the bus services available near the site is summarised in Table 2.3.

Table 2.3: Public Transport Provision

Service	Route #	Route Description
Hillsbus	602X	North Sydney to Rouse Hill
	612X	North Sydney to Riley T-way
	622	Milsons Point to Dural
	653	Milsons Pt to West Pennant Hills
Sydney Buses	140	Manly to Epping
	143	Manly to Chatswood Station
	144	Manly to Chatswood Station via Royal North Shore Hospital
	200	Bondi Junction Interchange to Chatswood station
	252	Queen Victoria Building to Lane Cove West
	254	Queen Victoria Building to Riverview
	265	McMahons Point wharf to Lane Cove
	286	Queen Victoria Building to Denistone East
	287	Milsons Point to Ryde
	290	Queen Victoria Building to Epping
	M20	Botany Bay to Gore Hill
Sydney Trains		Central Coast & Newcastle Line, North Shore, Northern & Western Line

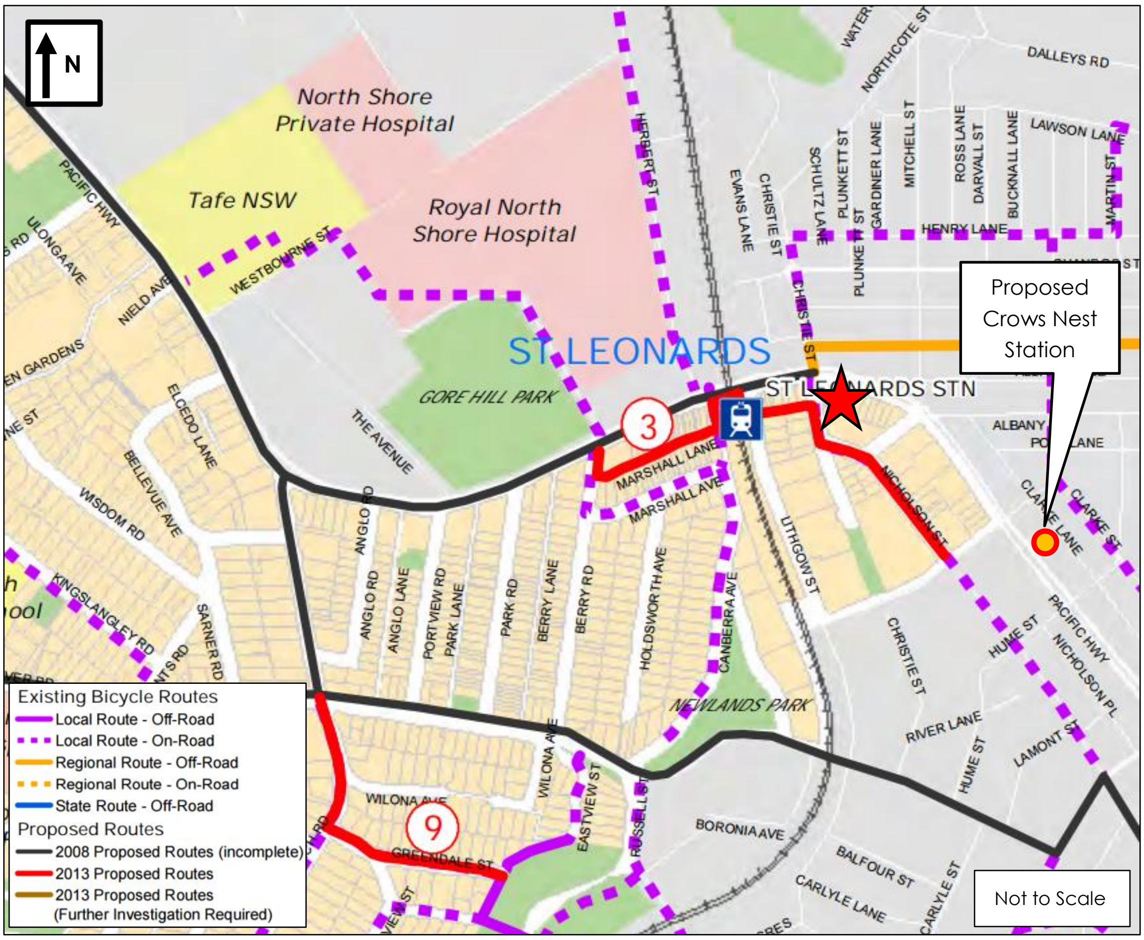
2.6 Active Transport

2.6.1 Cycling

Lane Cove Council released the Lane Cove Council Bicycle Plan 2013, indicating a new link from Marshall Lane to Nicholson Street. In relation to the site, this new link will be accessible via Christie Street to the south and will provide the site with an east-west link to several existing on-road cycling routes.

A map of the Lane Cove Council Bicycle Plan 2013, with respect to the site location, is shown in Figure 2.7.

Figure 2.7: Site Location within the Lane Cove Council Bicycle Plan 2013



Source:http://ecouncil.lanecove.nsw.gov.au/TRIM7/documents/158815480/TRIM_ADOPTED%20Lane%20Cove%20Bike%20Plan%202013_858457.PDF (accessed 14/11/16)

Currently, the site is serviced by local on-road cycling routes along local streets including Christie Street, Canberra Avenue and Herbert Street to the west, allowing connections to key destinations including Royal North Shore Hospital, TAFE NSW, North Sydney and the Sydney CBD.

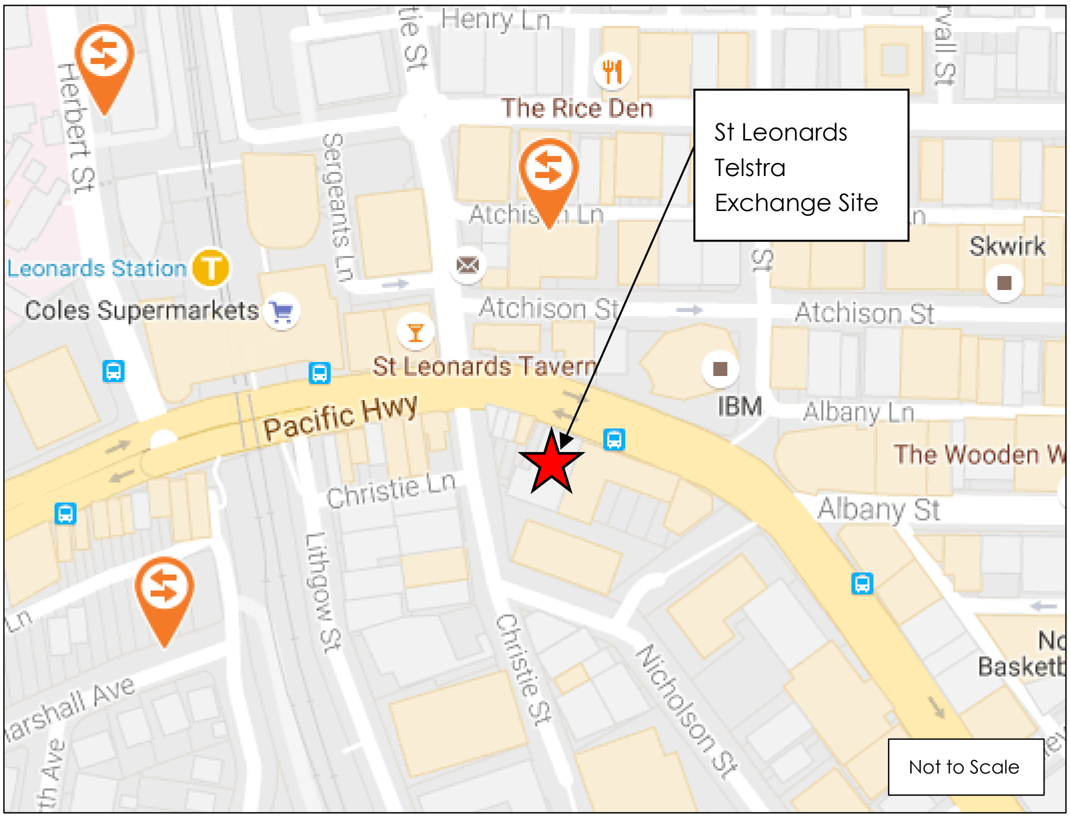
2.6.2 Walking

Local streets surrounding the site are generally provided with footpaths on both sides and consistent with CBD-type environments. Pacific Highway and Christie Street have footpaths on both sides of the road. Signalised crossings are provided along the Pacific Highway for pedestrians to safely access St Leonards Railway Station.

2.7 Local Car Sharing Initiatives

Car sharing schemes are also available at St Leonards. There are three car sharing pods located within 300 metres of the subject site (four-minute walk) at Herbert Street, Marshall Avenue and Atchison Lane, as shown in Figure 2.8.

Figure 2.8: Car Share Pod Locations

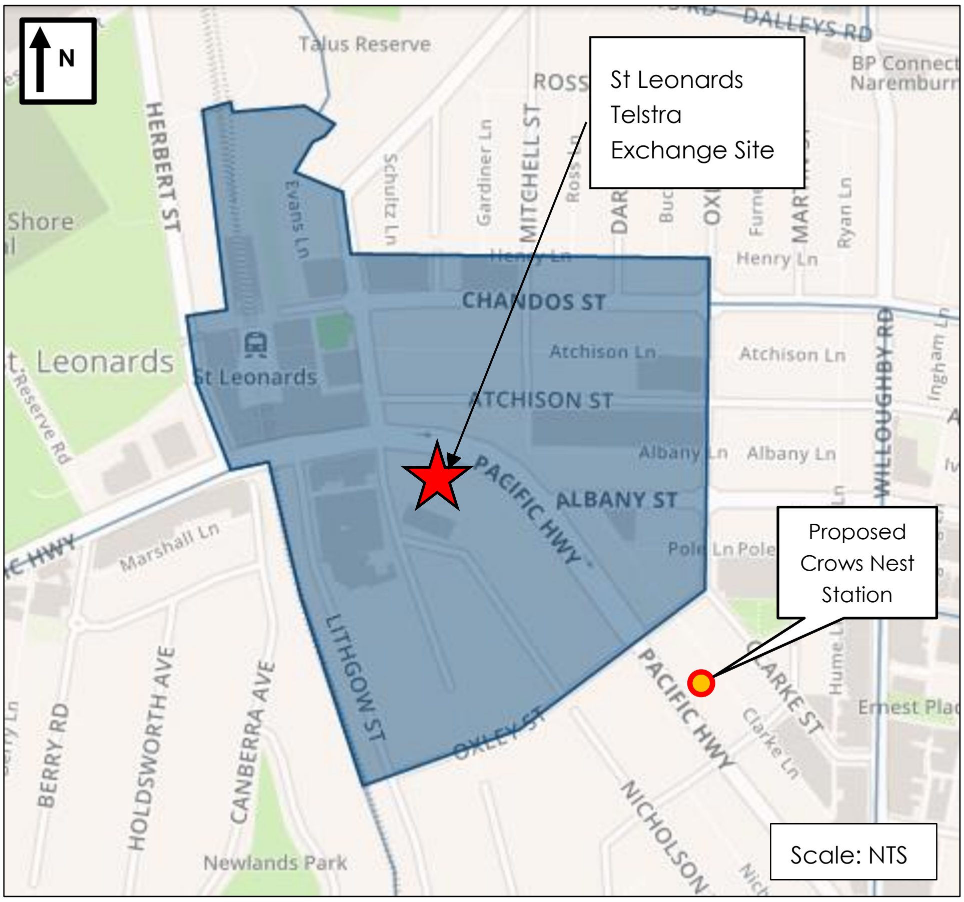


2.8 Existing Travel Modes

The Census Journey to Work (JTW) data 2011 is regarded as the most robust picture of existing commuter travel patterns to and from the surrounding area. The smallest geographical area for which JTW data is available is a Travel Zone (TZ). The 2011 JTW data was analysed for the broader area to better understand current travel patterns for people who work and live in the immediate area surrounding the site.

The analysed catchment area is shown in Figure 2.9.

Figure 2.9: 2011 Census Journey to Work Data (Travel Zone 1844, Blue)



Source: http://visual.bts.nsw.gov.au/jtwbasic/#1844

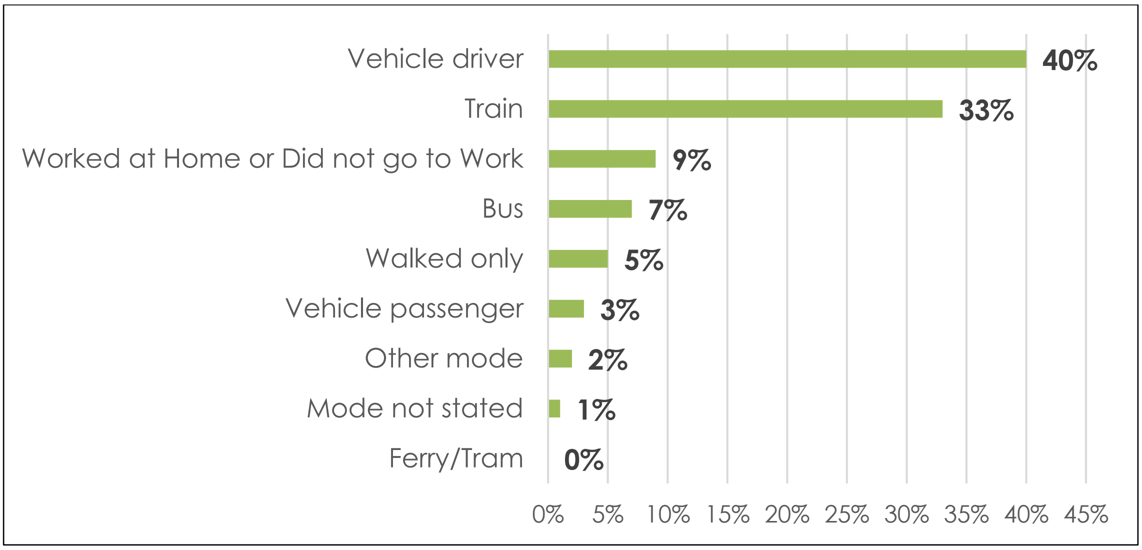
2.8.1 Travel to the St Leonards Study Area

The 2011 JTW data indicates that around 10,938 people work within the selected Travel Zone. Of those travelling to work daily, 43 per cent travel either as the vehicle driver (40 per cent) or passenger (three per cent). Public transport was widely used by workers travelling to the selected Travel Zone either by train (33 per cent) or by bus (seven per cent). In addition, five per cent of workers in the travel zone walked to work, as shown in Figure 2.10.

Figure 2.11 represents the primary origins of the 10,938 workers travelling to the selected Travel Zone. These mainly comprise the surrounding areas of Ku-ring-gai, Warringah (13 per cent of total commuters to the Travel Zone), Chatswood – Lane Cove (12 per cent of total commuters to the Travel Zone) and North Sydney – Mosman (eight per cent). There are also a significant number of workers originating from Parramatta-Ryde-Pennant Hills-Epping (nine per cent), Sydney Inner City (seven per cent) and the Eastern Suburbs (seven per cent). Aside from these areas, all other workers travel from areas broadly throughout the Sydney metropolitan area and as far as the Blue Mountains, Sutherland and Central Coast.

The data indicates higher numbers of workers from the north, however, generally there is broad representation throughout the Sydney region.

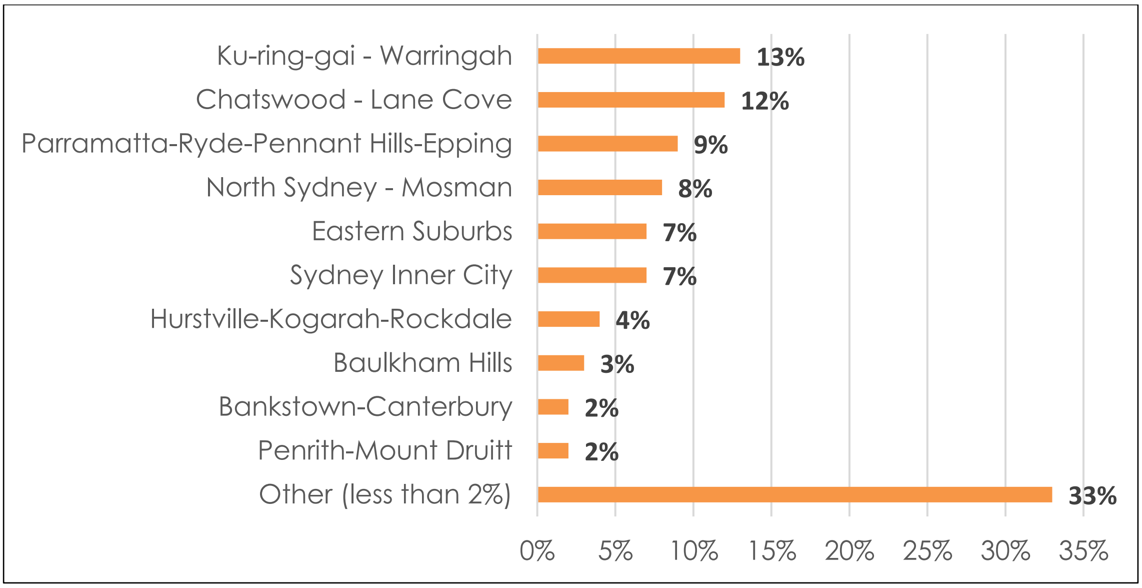
Figure 2.10: JTW Travel Modes by Workers to the Selected Travel Zone



Data Source: http://visual.bts.nsw.gov.au/jtwbasic/#1844, accessed 14 November 2016

Figure 2.10 above shows that less than half of workers that travel to St Leonards drive a vehicle to work. The train commuter percentage is slightly less than vehicle drivers.

Figure 2.11: Worker Travel Origins to the Selected TZ



Data Source: http://visual.bts.nsw.gov.au/jtwbasic/#1844, accessed 14 November 2016

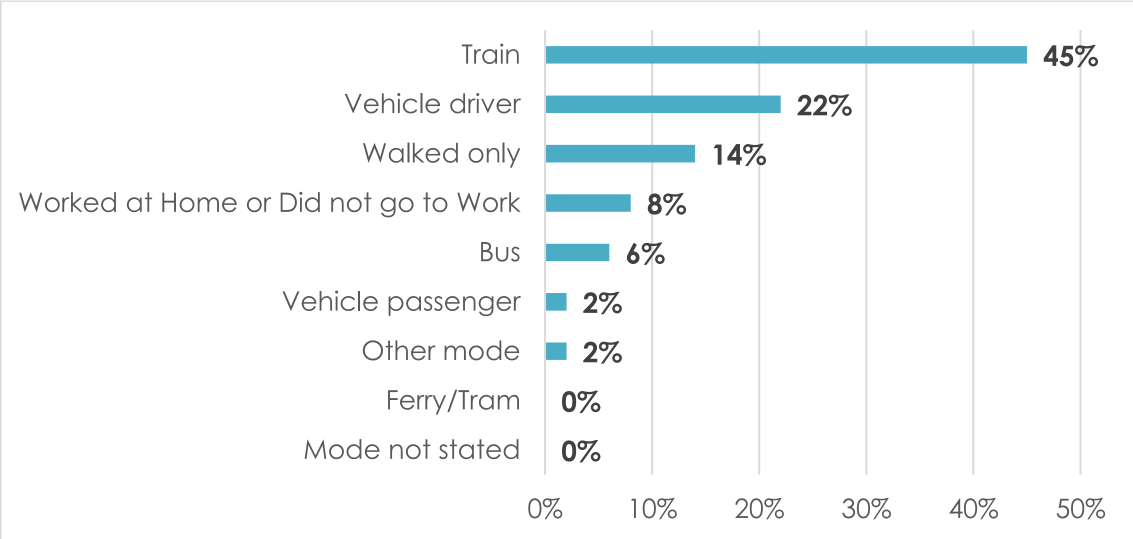
2.8.2 Travel from the St Leonards Study Area

The 2011 JTW data indicates that a total of 1,959 employed residents live within the selected Travel Zone. Figure 2.12 indicates that public transport modes such as train (45 per cent of total commuters) and bus (six per cent of total commuters) make up 51 per cent of total commuter travel modes. 24 per cent of residents travelled to work by car as the driver or passenger. There are also 14 percent of residents who walk to work.

Residents predominantly travelled to Sydney Inner City (39 per cent), Chatswood – Lane Cove (23 per cent), Ryde – Hunters Hill (eight per cent) and North Sydney – Mosman (15 per cent) to work.

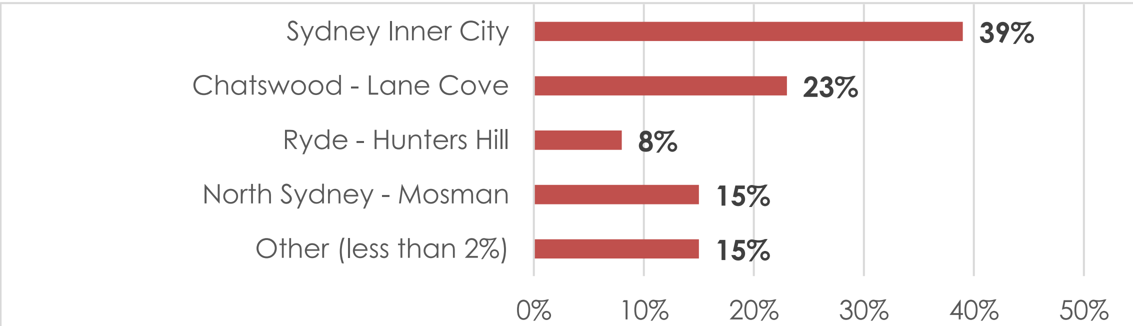
Other destinations including Parramatta, Manly, Fairfield, Liverpool and Baulkham Hills make up for 15 per cent of total commuter travel destinations. This is shown in Figure 2.13.

Figure 2.12: JTW Travel Modes by Residents from the Selected Travel Zone



Data Source: http://visual.bts.nsw.gov.au/jtwbasic/#1844, accessed 14 November 2016

Figure 2.13: Top Destination Areas for Workers Commuting from the Selected Travel Zone



Data Source: http://visual.bts.nsw.gov.au/jtwbasic/#1844, accessed 14 November 2016

3. Development Proposal

3.1 Land Uses

The proposed development consists of a single tower building incorporating some 366 residential apartments and 6,831 square metres of commercial office space, as summarised in Table 3.1.

Table 3.1: Development Schedule

Use	Dwelling Type	Size/ Number
Residential	1 bedroom	109
	2 bedroom	239
	3 bedroom	18
	Total	**366 apartments**
Commercial	-	5,471m² GFA
Child Care	-	603 m² GFA with 8 staff and potential for 32 children
Retail/ Shop	-	80m² GFA
Gymnasium	-	677m² GFA and 18 staff

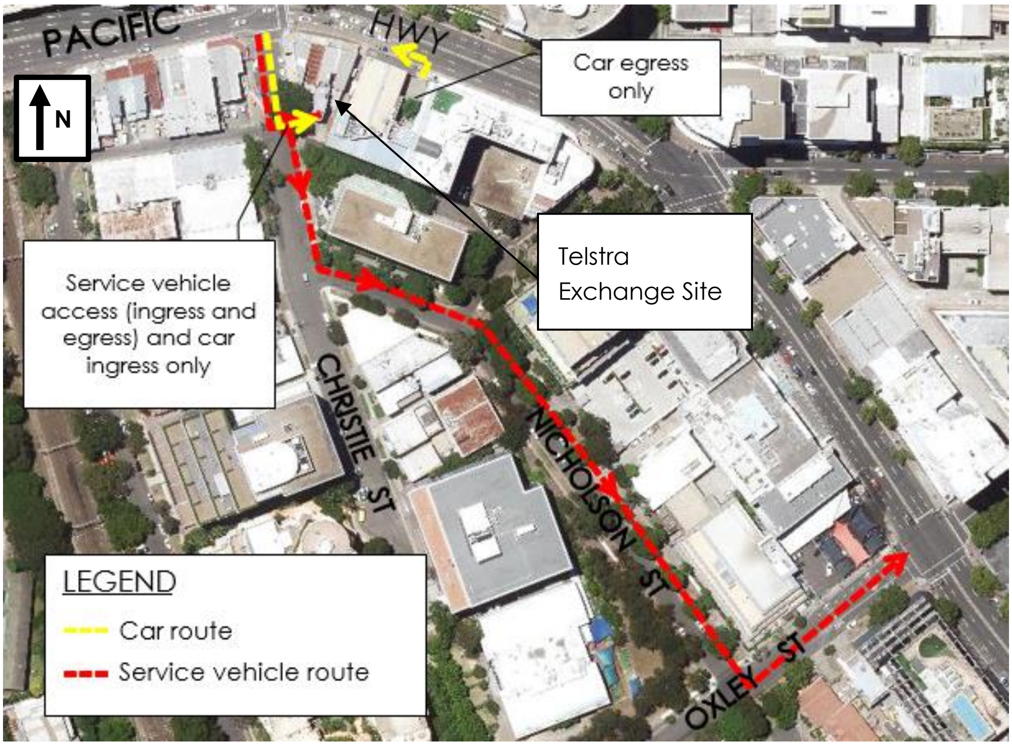
3.2 Vehicle Access

There are two site accesses for the proposed development. These are at the existing locations from Christie Street and the Pacific Highway (eastern access). The proposed access operational arrangements are as follows:

- Regular vehicle access: It is proposed that vehicles enter from the Christie Street access and exit from the Pacific Highway access.
- Service vehicle access: It is proposed that service vehicles enter left-in via the Christie Street access and exit left-out from this access, noting that Christie Street is one-way southbound at Pacific Highway.

The existing western access on Pacific Highway is proposed to be removed. This would be an improvement from the existing arrangements, due to the reduction in the number of access points from Pacific Highway. The site access configuration is shown Figure 3.1.

Figure 3.1: Proposed Site Access Locations



Basemap source: Google Maps

3.3 Car Parking

The existing Telstra exchange footprint and associated access requirements constrain the available site area for parking and car park access. As such, a car stacker system is the only feasible way to incorporate any significant on-site parking provision. There are two proposed car lifts to allow the vehicles to enter the car stacker. This parking would be used by residents and commercial tenants. It is expected that the car stacker system can accommodate 160 spaces.

Further detail on the car parking requirements of the proposal is provided in Section 4 of this report.

3.4 Pedestrian Facilities

Pedestrian access is to be directly provided to the Pacific Highway by way of a central entrance to an internal lobby area. This lobby area would provide access to the lift core and on to the residential apartments and commercial office tenancies.

3.5 Bicycle Facilities

The proposal includes provision of a bicycle storage area on the lower ground level that is accessible from the proposed site access. It is expected that this facility will be adequate to accommodate bicycle parking requirements in accordance with DCP 2016, with further details of this provision to be provided at the DA stage.

Further details of the bicycle parking and end-of-trip facility requirements are provided in Section 5 of this report.

3.6 Loading Areas

Loading is proposed at the existing Telstra loading area accessible from Christie Street. It is suitable for accommodating up to two 6.4 metre SRV vehicles. The refuse storage area is to be located adjacent to the loading area.

The suitability of the proposed loading arrangements is discussed in Section 6 of this report.

4. Car Parking

4.1 Car Parking Requirements

The car parking provision requirements for different development types are set out in the Lane Cove Development Control Plan (DCP), amended 2016. Table 2 from Part R of Lane Cove DCP 2016 have been used to generate car parking requirements as the site falls within the St Leonards Railway Station area.

A review of the car parking rates and the floor area schedule results in a DCP parking requirements as summarised in Table 4.1.

Table 4.1: DCP Car Parking Requirements

Type	Proposed	Rates	Car Parking Requirement
Commercial/ Retail	5,471m²	1 car space per 100m² GFA + 1 accessible space per 10 spaces	61 (including 6 accessible)
Residential	109 (1 bedroom) 239 (2 bedroom) 18 (3 bedroom)	0.5 spaces per 1-bedroom unit 0.9 space per 2-bedroom unit 1.4 spaces per 3-bedroom unit 1 space per 5 units for visitors	55 216 26 74
Retail/ Shop	80m²	1 car space per 110m² GFA with 1 accessible space per 20 spaces	2 (including 1 accessible)
Childcare	8 staff	1 car space per 2 employees	4
	32 children	1 car space per 6 children with 1 accessible space minimum and 1 accessible space per 50 car spaces	6 (including 1 accessible)
Gymnasium	18 staff	1 car space per 8 staff	3
	677m²	1 car space per 100m² GFA with 1 accessible space per 20 spaces	7 (including 1accessible)
Total		Note: 10% for residential visitor disabled	**454** (18 accessible)

Based on a yield of 366 apartments and 6,228 square metres of office/ retail/ gymnasium floor space and a childcare suitable for 32 children and eight staff, the proposal is required to provide 371 car parking spaces for the residential uses and 83 spaces for the commercial tenancies, with a total provision of 454 car parking spaces.

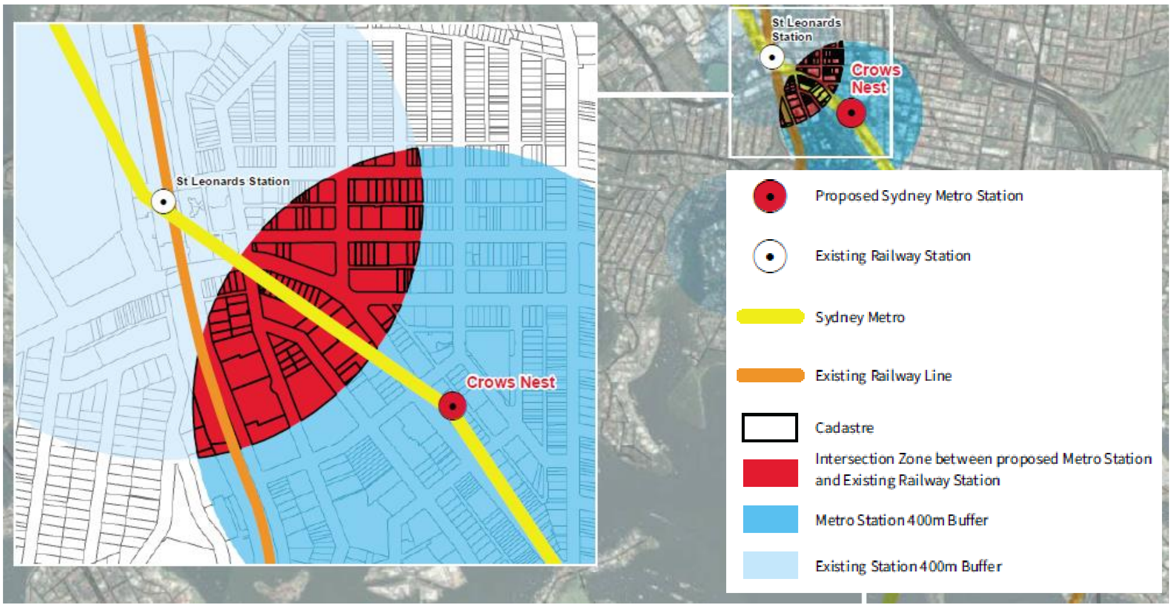
In addition, the proposal also requires one car wash bay for every 50 apartments, equating to a total requirement of eight car wash bays.

4.2 Adequacy of Parking Supply

The development proposes a total of 160 car parking spaces, with 112 residential and 48 commercial spaces. These car spaces are proposed through a car stacker and lift system. The proposed car parking numbers are below the Lane Cove Council's minimum car parking requirement of 454 car parking spaces. The justification for the car parking supply is as follows:

1. The proposed development incorporates some 366 residential apartments as well as commercial tenancies. With the full provision of car parking in accordance with the DCP rates, this proposal has the potential to be a significant traffic generator in what is already a heavily congested area that is adjacent to a key public transport corridor. A reduction in car parking provision could be reasonably expected to have a corresponding reduction in traffic generation, as a number of residents would not have access to a private vehicle when they otherwise would have. These trips would instead be accommodated by other travel modes (i.e. public transport, walking and cycling) instead of generating additional vehicle trips on the road network.
2. It is noted that the site is well located with respect to existing public transport services and is located less than a two-minute walk from St Leonards Station. The site fronts a major regional transport corridor (Pacific Highway) which is currently served by a large number of bus routes. It is also only 350 metres away from the new proposed Metro Station at Crows Nest. As such, the subject site is considered to be in an ideal location for sustainable transport options. Public transport use could be further promoted, in-line with the objectives of the DCP and State Government.
3. The Lane Cove DCP car parking rates are considered high when compared to DCPs of adjacent Local Government Areas (LGA) for sites in similarly accessible locations. The North Sydney Council LGA by comparison has generally implemented maximum car parking rates to reduce traffic congestion and parking demand and contribute to an overall shift in transport mode. A level of consistency with the north side of the Pacific Highway (North Sydney Council) is relevant in this regard.
4. As part of Sydney Metro, a new station at Crows Nest is proposed to be within 350 metres of the subject site. The site would then be within walking distance of two train stations (St Leonards and Crows Nest). The respective 400 metre walking catchments would overlap identifying a prime development location for rail accessibility (see Figure 4.1). There are only two other localities in Sydney that are within 400 metres of two heavy rail stations. The proposed development site location within this overlapping catchment area, is expected to increase the train travel mode share and decrease private car use. It is noted that the Crows Nest Metro Station would be on a new rail line, which will have direct links to Macquarie Park and Barangaroo.

Figure 4.1: St Leonards and Crows Nest Station Walking Catchments



4.2.1 Conclusion

Given the application of maximum rates in surrounding LGAs, and the availability of sustainable transport options for residents and workers within a short walking distance of two rail stations and a bus interchange, the proposed parking provision is considered supportable and acceptable from a traffic perspective for the subject site.

5. Sustainable Transport Infrastructure

5

5.1 Bicycle End of Trip Facilities

Lane Cove Council DCP 2016 contains requirements for the provision of bicycle parking facilities for the proposed land uses as detailed in Table 5.1.

Table 5.1: DCP Bicycle Parking Requirements

Description	Bicycle Parking Rate		Size/ Number	Bicycle Parking Provision	
	Resident/ Employee	Visitor/ Customer		Resident/ Employee	Visitor/ Customer
Residential	1 space/ 4 dwellings	1 rack + 1 rack/ 10 dwellings	366 apartments	92	38
Commercial/ Office	1 space/ 300 m² GFA	1 rack + 1 rack per 800 m² GFA	5,471 m²	19	8
Retail/Shop	1 space/ 50 m² GFA	2 racks + 1 rack per 200 m² over 200m² GFA	80m²	2	2
Gymnasium	1 space per 10 staff	1 rack + 1 rack per 200m² of pool/ gymnasium area	18 staff and 677 m²	2	5
Childcare	1 space per 10 staff	2 racks per centre	8 staff and 32 children	1	2
Total				116	55

Based on the above, Lane Cove Council DCP 2016 requires that the planning proposal incorporate 116 secure bicycle parking for residents and employees of the proposed, and 55 bicycle racks for visitors (i.e. publicly available parking). The proposed development is expected to provide these spaces during the design development at the Development Application (DA) stage.

The resident spaces could be accommodated as bicycle racks within a secure cage facility to improve space efficiency and usage, as well as making a provision for commercial employees in the event that supply exceeds demand. Likewise, the visitor bicycle racks could also accommodate customer demand generated in the event that they are not fully utilised by visitors to the residences.

5.2 Motorcycle Parking

Lane Cove Council DCP contains requirements for the provision of motorcycle parking facilities as detailed in Table 5.2.

Table 5.2: DCP Motorcycle Parking Requirements

Description	Motorcycle Parking Rate	Size/ Number	Motorcycle Parking Provision
All development types	1 motorcycle space/ 15 car parking spaces	160 car parking spaces	11

Based on the above, the Lane Cove Council DCP 2016 requires that the planning proposal incorporate 11 motorcycle parking spaces in total. The proposed development is expected to incorporate a level of motorcycle parking during the design development at the DA stage.

5.3 Pedestrian Network

As noted in Section 3.4, the proposal will incorporate a primary pedestrian access at Pacific Highway by way of a central entrance to an internal lobby area. This lobby area would provide access to the lift core and on to the residential apartments and commercial office tenancies.

5.4 Public Transport

The site is easily accessible by public transport with bus stops, St Leonards train station and interchange, and the proposed Crows Nest metro station all located within a short walking distance.

As the site is well located near high-quality existing and future public transport services, the site has excellent transit-oriented credentials. Its proximity to public transport is expected to encourage the use of public transport by residents and employees, and therefore discourage the use of private vehicles.

On this basis, it is strongly recommended that during detailed design, site designers be mindful of the proximity to these public transport nodes and incorporate design elements to ensure direct, safe and efficient pedestrian access to leverage public transport opportunities. It is noted that these elements have been considered in the preliminary design stage.

In addition to the above, given the constrained road network and limited on-street parking in the area, it is expected that travel by new residents and employees to and from St Leonards would have a high non-car mode share.

6. Loading Facilities

6

6.1 Loading Requirements

Given the provision of commercial uses and the proposed number of residential apartments, the Lane Cove Council DCP 2016 (DCP) requires a loading area to be provided.

The DCP specifies that one removalist truck space be provided per 100 residential units. Based on a total of 366 residential apartments, the DCP requires four removalist truck spaces.

The Roads and Maritime Services Guide to Traffic Generating Developments (Roads and Maritime Guide) specifies a minimum of one space per 4,000 square metres of commercial use. This equates to two spaces for the development.

Based on the above the total requirement for the development would be six loading spaces.

6.2 Proposed Loading Arrangements

The development proposes to provide two service vehicle spaces which is less than the DCP and the Roads and Maritime Guide recommendations. This is based primarily on the current site constraints, however is considered reasonable given the following:

1. The existing and future site constraints resulting from the Telstra Exchange limit the number of service vehicle spaces for the site as well as the maximum size of vehicles physically able to enter the site.
2. It is expected that the majority of tenants within the residential portion of the development would likely be single occupants, or persons sharing a unit. Therefore, the majority of removalist vehicles are expected to deliver small loads with short durations of stay, and likely to be limited to cars/ utes/ vans and small rigid trucks.
3. A detailed loading management plan with specifications on maximum vehicle sizes and allowable time within the service vehicle spaces would be produced to effectively manage service vehicles. This would also include management between residential and commercial service vehicles as well as understanding likely service and operations required for the Telstra Exchange.

Access for this loading area is provided via Christie Street. The residential waste area is located adjacent to this loading area. The loading bays have been designed to accommodate two 6.4 metre SRV's.

Considering the current site layout constraints; appropriate signage and management would need to be provided to restrict trucks accessing the site to a maximum 6.4 metre SRV or similar. The proposed loading bays would be managed to also accommodate commercial tenancies for day-to-day deliveries, together with accommodating removalist vehicles.

A loading dock/service bay management plan should be prepared during the detailed design stage to assist the operational efficiency between commercial and residential tenancies. The loading requirements will be developed further in conjunction with the waste management requirements in the detailed design stage.

Preliminary swept path assessment of the loading facilities indicates that SRVs will be able to enter and exit the site from Christie Street in a forward direction. Two SRVs will be able to access the loading bays interdependently as shown in Appendix B.

Detailed swept path assessment and car park compliance review would be completed during design development at the DA stage to ensure that the layout is both compliant with AS 2890.2:2002 and functions appropriately.

7. Traffic Impact Assessment

7.1 Traffic Generation

7.1.1 Design Rates

Traffic generation estimates for the proposal have been sourced from the *Guide to Traffic Generating Developments* (Roads and Maritime, 2002), Roads and Maritime *Technical Direction TDT 2013/ 04 Guide to Traffic Generating Developments Updated traffic surveys (TDT 2013/ 04)* for residential and based on first principles approach for the commercial component.

The Roads and Maritime surveys included sites at St Leonards and Chatswood. These provide a good basis for anticipated traffic generation for the car park during peak periods.

The commercial spaces are based on a conservative approach, which assumes that all these spaces would generate one vehicle trip per car space during the peak periods. Estimates of peak hour traffic volumes resulting from the proposal are set out in Table 7.1. The development proposes a total of 160 car parking spaces, with 112 residential and 48 commercial spaces.

Table 7.1: Peak Hour Traffic Generation Estimates

Land Use	Period	Traffic Generation Rates	Vehicle Movements (vehicle trips per hour)
High Density Residential Flat Dwellings (112 car spaces)	AM Peak	0.15 vehicle trips/ car space	17
	PM Peak	0.12 vehicle trips/ car space	14
Commercial (48 car spaces)	AM Peak	1 vehicle trip/ car space	48
	PM Peak		

Table 7.1 indicates that the site could generate around 65 vehicle movements during the AM peak hour and 62 vehicle movements during the PM peak hour.

7.2 Distribution and Assignment

The directional distribution and assignment of traffic generated by the proposed development will be influenced by a number of factors, including:

i configuration of the arterial road network in the immediate vicinity of the site
ii existing operation of intersections providing access between the local and arterial road network
iii configuration of access points to the site.

It is expected that the proposed development would attract users relatively evenly throughout the surrounding local and regional area.

The directional split of traffic (i.e. the ratio between the inbound and outbound traffic movements) during the peak hours is expected to be as follows:

- Residential: 20 per cent inbound and 80 per cent outbound during the AM peak hour and 80 per cent inbound and 20 per cent outbound during the PM peak hour.
- Commercial: 80 per cent inbound and 20 per cent outbound during the AM peak hour and 20 per cent inbound and 80 per cent outbound during the PM peak hour.

All development traffic is proposed to enter via the Christie Street access. Vehicles are expected to access the site from Christie Street north and Pacific Highway east. The development traffic would exit the site via the proposed Pacific Highway access. The proposed traffic distribution is shown in Table 7.2.

Table 7.2: Traffic Generation Split

Land use	Traffic Generation Estimate (trips)	AM Vehicle Trips		PM Vehicle Trips	
		In	Out	In	Out
Residential	14-17	3	14	11	3
Commercial	48	38	10	10	38
Increase	**62-65**	**41**	**24**	**21**	**41**

7.3 Other Developments

In addition to the traffic generated by the proposed development, there are several approved developments in the vicinity, which warrant consideration as part of a cumulative traffic assessment. It is understood that the approved developments are not expected to access Christie Street. However, a proportion of traffic would travel northbound and southbound along the Pacific Highway (passing through the Christie Street intersection). The approved developments are as follows:

- 88 Christie Street, St Leonards (Colston Budd Hunt & Kafes Pty Ltd, 2014)
- 1-13A Marshall Avenue, St Leonards (Traffix, 2014)
- 472-486 Pacific Highway, St Leonards (Brown Consulting, 2013)
- 504-520 Pacific Highway (Brown Consulting, 2013).

The estimated traffic generated by these developments has been obtained from the respective traffic reports and summarised in Table 7.3.

Table 7.3: Approved Developments Traffic Generation Split – Pacific Highway

Land use	AM Vehicle Trips		PM Vehicle Trips	
	Northbound	Southbound	Northbound	Southbound
88 Christie Street	0	56	0	192
1-13A Marshall Avenue	17	0	4	14
472-520 Pacific Highway	0	0	0	0
Increase	**17**	**56**	**4**	**206**

7.4 Future Traffic Impact

The anticipated traffic associated in the future base case scenario, which includes the existing traffic and approved surrounding development traffic (without the proposed development) has been examined using SIDRA INTERSECTION to assess intersection performance. The results of the analysis have been summarised in Table 7.4.

Table 7.4: **Future Operating Conditions – Base Case (without proposed development)**

Intersection	Peak	Leg	Degree of Saturation (DoS) [1]	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LoS)
Pacific Highway/ Christie Street	AM	East	0.97	66	508	E
		North	0.32	28	78	B
		West	0.90	48	393	D
		Overall	**0.97**	**53**	**508**	**D**
	PM	East	0.45	9	111	A
		North	0.56	53	82	D
		West	0.58	9	166	A
		Overall	**0.58**	**13**	**166**	**A**

The anticipated cumulative traffic associated with the proposed development and approved developments in the vicinity of the site has been examined using SIDRA INTERSECTION to assess intersection performance. The results of the analysis have been summarised in Table 7.5.

Table 7.5: **Future Operating Conditions – with Proposed Development**

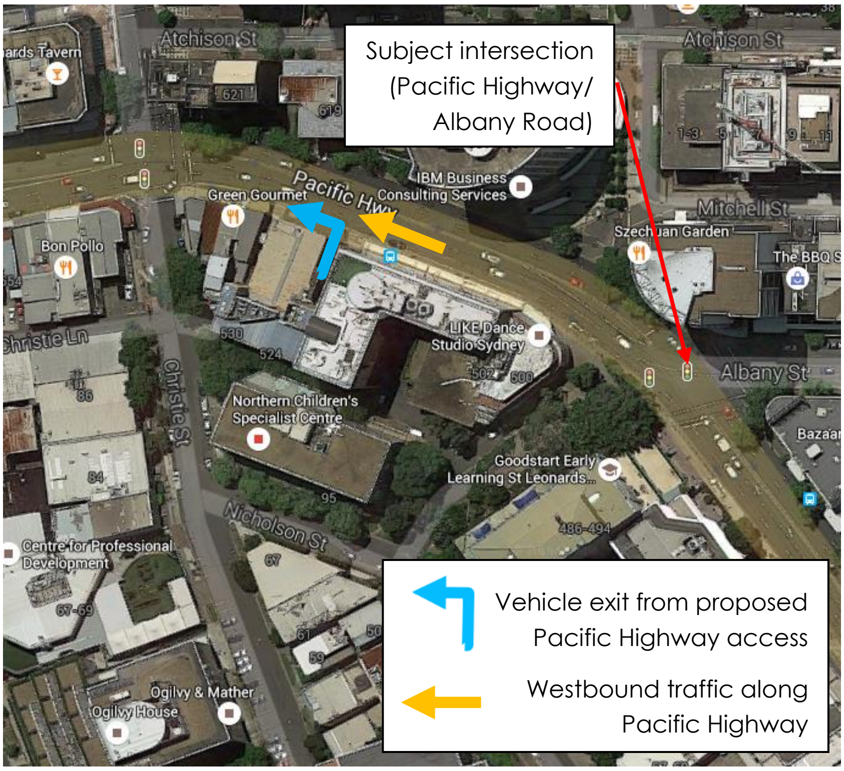
Intersection	Peak	Leg	Degree of Saturation (DoS) [1]	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LoS)
Pacific Highway/ Christie Street	AM	East	0.99	76	577	F
		North	0.34	30	85	C
		West	0.88	42	372	C
		Overall	**0.99**	**54**	**577**	**D**
	PM	East	0.52	9	138	A
		North	0.58	53	84	D
		West	0.58	9	166	A
		Overall	**0.58**	**13**	**166**	**A**

The assessment of post development traffic conditions of the site indicates that the analysed intersection would continue to operate similarly to the existing conditions. The results show that the intersection operates near capacity in the AM peak hour and generally with good operation and spare capacity in the PM peak period.

7.5 Gap Acceptance Assessment

During the site inspection on 01 April 2016 (PM peak hour), a vehicle exit gap survey was completed. This survey was assessed for the critical movement of vehicles exiting from the site driveway onto Pacific Highway. The access from Pacific Highway is proposed to be a left-out only for vehicles (protected by the existing central median). This would mean that vehicles exiting from the site would need to give-way to westbound vehicles only. The most likely intersection that would be of significant impact on the available vehicle gaps for exit, is the Pacific Highway/ Albany Road signalised intersection. This intersection is located to the east of the proposed access off Pacific Highway. Figure 7.1 shows the subject conflicting movements.

Figure 7.1: **Conflicting Vehicle Movements (from Pacific Highway)**



Basemap source: Google Maps

It is anticipated that in the peak hour there would be around 41 egress vehicle movements to the Pacific Highway with the proposed development. This is equivalent to less than one vehicle exiting per minute. The maximum cycle time expected for the intersection adjacent to the site access is 140 seconds. Based on this cycle time, it is expected that the number of vehicles exiting from the Pacific Highway access is equivalent to two vehicles during a cycle time of 140 seconds (conservative value).

A survey was undertaken for three intersection cycles at the Albany Street/ Pacific Highway intersection. The survey obtained vehicle exit gap durations in the westbound traffic movements to the east of the site access. These gap periods were available for vehicles to exit from the site access. The survey showed the following gap periods:

- Cycle Period 1: 33, 6, and 16 seconds
- Cycle Period 2: 15, 6 and 16 seconds
- Cycle Period 3: 14 and 9 seconds.

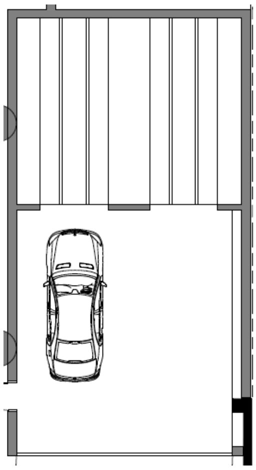
The standard gap acceptance for a left turning vehicle is around five seconds for the first vehicle and three seconds for following vehicles (in accordance with relevant guidelines). This is below all the survey gap periods listed above. The survey results above show that there was a minimum of two periods and a total duration of 23 seconds available for vehicles to exit the development onto Pacific Highway per intersection cycle. Therefore, there are sufficient periods available for the two vehicles to exit during the available 23 seconds. It is expected that no queuing issues would occur. There would also be only minor waiting periods for vehicles to exit onto Pacific Highway.

It should also be noted that during periods of queuing from the Pacific Highway/ Christie Street signalised intersection on the westbound leg (Pacific Highway), there would be additional opportunity for vehicles to exit the site. This is due to vehicle driver behaviour, whereby drivers tend to give-way by providing physical spacing for vehicles to exit from site accesses.

7.6 Queuing Assessment

The proposed car stacker includes provision for two transfer cabins to move vehicles to/ from the car stacker spaces and to ensure that the transfer cabins can service the anticipated traffic generated by the site. The proposed car stacker layout is shown in Figure 7.2.

Figure 7.2: Proposed Car Stacker Layout



An assessment has been undertaken to determine the likely queues and delays that may be experienced by users of the site during peak flow conditions. The equation for calculating queue lengths is detailed in Figure 7.3.

Figure 7.3: Equation for Calculating Queuing Lengths

Equation 17-37 is used to calculate the 95th-percentile queue.

$$Q_{95} \approx 900T\left[\frac{v_x}{c_{m,x}} - 1 + \sqrt{\left(\frac{v_x}{c_{m,x}} - 1\right)^2 + \frac{\left(\frac{3600}{c_{m,x}}\right)\left(\frac{v_x}{c_{m,x}}\right)}{150T}}\right]\left(\frac{c_{m,x}}{3600}\right)$$

where

Q_{95} = 95th-percentile queue (veh),
v_x = flow rate for movement x (veh/h),
$c_{m,x}$ = capacity of movement x (veh/h), and
T = analysis time period (h) (T = 0.25 for a 15-min period).

Source: Highway Capacity Manual 2000

The service rate of the car stacker has been determined using information provided in consultation with equipment supplier Hercules Car Parking Systems. Using Equation 17-37 in Figure 7.3 and adopting an effective service rate for the transfer cabins of 80 veh/hr ($C_{m,x}$) and a vehicle arrival rate (V_x) of 41 veh/hr, results in a 95th percentile queue of 2-3 vehicles (or 12-18 metres excluding vehicles within the transfer cabins).

This is considered a conservative estimate, given the layout of the stacker (separate parking/ retrieval locations) and that vehicles being retrieved would be queuing within the stacker.

A review of the concept plans for the development indicates an internal queuing capacity for six to nine vehicles. This is considered sufficient to cater for the anticipated demand, without queuing onto Christie Street, for residential and commercial tenants and given a yield of 366 apartments and 6,831 square metres of commercial space.

It is expected that an Operational Management Plan would be prepared and assessed in further detail at the DA stage. This would allow the management of resident and commercial tenant expectations and the mitigation of any potential queuing issues that could arise with breakdowns or other issues.

7.7 Comparative Yield Study

To understand how the proposed development compares with the extent of development that may have been assessed in developing the current planning controls for the site, a comparative yield study has been completed for two (2) development scenarios; the proposed mixed use development (Scenario 1) and an alternate full commercial development (Scenario 2). It is assumed that a total of 160 car parking spaces are provided under both scenarios.

- **Scenario 1:** Mixed Use (6,831m² GFA commercial space and 366 residential units, 112 residential car parking spaces, 48 commercial car parking spaces)
- **Scenario 2:** Commercial Use (10,836m² GFA, 160 commercial car parking spaces).

Estimates of peak hour traffic volumes resulting from the two yield scenarios are set out in Table 7.6.

Table 7.6: Traffic Generation for Scenarios

Land Use	Period	Traffic Generation Rates	Vehicle Movements (vehicle trips per hour)
Scenario 1			
High Density Residential Flat Dwellings (112 car spaces)	AM Peak	0.15 vehicle trips/ unit	17
	PM Peak	0.12 vehicle trips/ unit	14
Commercial (48 car spaces)	AM Peak	1 vehicle trips per car space*	48
	PM Peak		
Total: Scenario 1			**62-65**
Scenario 2			
Commercial (160 car spaces)	AM Peak	0.8 vehicle trips per car space	128
	PM Peak		
Total: Scenario 2			**128**

* Conservative traffic generation rate used for the proposed development

Table 7.6 indicates that the site could generate around 62-65 vehicle movements with the proposed development (Scenario 1) and approximately 128 vehicles with a full commercial development (Scenario 2). This assessment shows that a full commercial development on the subject site would generate more than twice the traffic generated from the proposed development. Hence, the proposed scheme is expected to have lower traffic impact on the external road network when compared with a full commercial development designed to maximise the site current planning controls.

8. Conclusion

Based on the analysis and discussions presented within this report, the following conclusions are made for the redevelopment of the Telstra Exchange site at 524-542 Pacific Highway, St Leonards:

i The proposed development includes the construction of some 366 apartments, commercial floor space of 6,831 square metres and a car stacker system with two lifts for 160 car parking spaces. It is proposed that vehicles access the site via Christie Street and exit via Pacific Highway.

ii The site is well located within a short walking distance of high-quality existing and future public transport services, the site has excellent transit-oriented credentials. Its proximity to public transport is expected to encourage the use of public transport by residents and employees, and therefore discourage the use of private vehicles.

iii Though the proposed development has a DCP parking requirement of 454 car parking spaces, the proposed supply of 160 car spaces is considered appropriate when considering the lower traffic impact on the road network and the close proximity of both existing and future high frequency public transport.

iv Given the application of maximum parking rates in surrounding LGAs, and the availability of sustainable transport options for residential and workers within a short walking distance of two rail stations and a bus interchange, the proposed parking provision is considered supportable and acceptable (in overall traffic terms) for the subject site.

v The queuing assessment has shown that the car stackers would not cause queuing onto Christie Street. The car stacker system is to be built in accordance with manufacturer's specifications and AS2890: 2002.

vi The current design incorporates a loading area for two service vehicles that are accessible from the existing Christie Street access.

vii The proposed parking/ access layout and service vehicle area would be designed in accordance with the Australian Standard for Off Street Car Parking (AS2890.1:2004, AS2890.2:2002 and AS2890.6:2009). Further assessment would be completed during design development at the DA stage to ensure the layout is compliant.

viii The proposed development is expected to incorporate a total of 171 bicycle spaces/ racks and 11 motorcycle spaces in accordance with the Lane Cove DCP 2016. These will be investigated further at the DA stage.

ix The proposed development is expected to generate a traffic volume of up to 65 vehicle movements in any peak hour, which is less than half of the commercial development potential under the existing planning controls.

x There is adequate capacity in the surrounding road network to cater for the traffic that would be generated by the proposed development and sufficient gaps for vehicles to exit left onto the Pacific Highway.

xi The cumulative traffic impacts associated with approved developments in the vicinity of the site, in addition to the proposed development, can be further modelled if required as part of any area-wide analysis.

Overall, the traffic and parking implications associated with the proposed mixed-use residential and commercial redevelopment of the Telstra Exchange site at 524-542 Pacific Highway, St Leonards for 366 apartments and 6,831 square metres of commercial space is considered acceptable.

Appendix A

SIDRA INTERSECTION Results

MOVEMENT SUMMARY

Site: 101 [Pacific Highway and Christie Street - Ex AM]

15S16430000 524 Pacific Highway, St Leonards
Pacific Highway and Christie Street
Signals - Fixed Time Isolated Cycle Time = 135 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows 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											
4	L2	75	2.0	0.202	29.1	LOS C	6.6	47.6	0.64	0.63	26.1
5	T1	1741	5.0	0.934	54.3	LOS D	62.6	457.0	0.98	1.04	14.8
Approach		1816	4.9	0.934	53.3	LOS D	62.6	457.0	0.97	1.03	15.1
North: Christie Street											
7	L2	75	5.0	0.327	31.1	LOS C	11.1	80.5	0.70	0.69	20.3
8	T1	107	2.0	0.327	26.5	LOS B	11.1	80.5	0.70	0.69	22.8
9	R2	340	5.0	0.327	30.6	LOS C	11.1	80.5	0.70	0.74	19.0
Approach		522	4.4	0.327	29.8	LOS C	11.1	80.5	0.70	0.72	20.1
West: Pacific Highway											
10	L2	553	2.0	0.875	40.6	LOS C	45.8	328.1	0.97	0.93	16.3
11	T1	1763	5.0	0.875	40.4	LOS C	49.6	362.1	0.98	0.95	18.2
Approach		2316	4.3	0.875	40.5	LOS C	49.6	362.1	0.97	0.95	17.7
All Vehicles		4654	4.5	0.934	44.3	LOS D	62.6	457.0	0.94	0.95	16.8

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	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	20.3	LOS C	0.1	0.1	0.55	0.55
P2	East Full Crossing	53	30.7	LOS D	0.1	0.1	0.68	0.68
P3	North Full Crossing	53	25.0	LOS C	0.1	0.1	0.61	0.61
All Pedestrians		158	25.3	LOS C			0.61	0.61

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.

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Project: \\gta.com.au\projectfiles\ProjectFilesSyd\15S1600-1699\15S1643000 524 Pacific Highway, St Leonards\Modelling\161114-15S1643000 525 Pacific Highway St Leonards - Existing.sip7

MOVEMENT SUMMARY

Site: 101 [Pacific Highway and Christie Street - Future Base AM]

15S16430000 524 Pacific Highway, St Leonards
Pacific Highway and Christie Street
Signals - Fixed Time Isolated Cycle Time = 135 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows 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											
4	L2	75	2.0	0.208	30.4	LOS C	6.9	48.6	0.66	0.64	25.5
5	T1	1741	5.0	0.965	67.7	LOS E	69.4	506.8	0.98	1.12	12.5
Approach		1816	4.9	0.965	66.1	LOS E	69.4	507.7	0.97	1.10	12.8
North: Christie Street											
7	L2	75	5.0	0.316	29.7	LOS C	10.8	78.3	0.68	0.68	20.9
8	T1	107	2.0	0.316	25.1	LOS B	10.8	78.3	0.68	0.68	23.4
9	R2	340	5.0	0.316	29.2	LOS C	10.8	78.3	0.68	0.73	19.6
Approach		522	4.4	0.316	28.4	LOS B	10.8	78.3	0.68	0.72	20.6
West: Pacific Highway											
10	L2	553	2.0	0.903	47.9	LOS D	50.2	359.8	1.00	0.97	14.4
11	T1	1763	5.0	0.903	47.7	LOS D	53.8	393.0	1.00	1.01	16.2
Approach		2316	4.3	0.903	47.8	LOS D	53.8	393.0	1.00	1.00	15.8
All Vehicles		4654	4.5	0.965	52.8	LOS D	69.4	507.7	0.95	1.01	14.8

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	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	53	21.4	LOS C	0.1	0.1	0.56	0.56
P2	East Full Crossing	53	29.4	LOS C	0.1	0.1	0.66	0.66
P3	North Full Crossing	53	26.2	LOS C	0.1	0.1	0.62	0.62
All Pedestrians		158	25.7	LOS C			0.62	0.62

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.

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Project: \\gta.com.au\projectfiles\ProjectFilesSyd\15S1600-1699\15S1643000 524 Pacific Highway, St Leonards\Modelling\161206-15S1643000 525 Pacific Highway St Leonards.sip7

MOVEMENT SUMMARY

Site: 101 [Pacific Highway and Christie Street - Cumulative AM]

15S16430000 524 Pacific Highway, St Leonards
Pacific Highway and Christie Street
Signals - Fixed Time Isolated Cycle Time = 135 seconds (User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows 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											
4	L2	93	2.0	0.213	29.3	LOS C	7.1	49.8	0.64	0.65	25.8
5	T1	1824	5.0	0.987	78.0	LOS F	78.9	575.7	0.98	1.18	11.1
Approach		1917	4.9	0.987	75.6	LOS F	78.9	576.5	0.97	1.15	11.5
North: Christie Street											
7	L2	75	5.0	0.343	31.3	LOS C	11.8	85.3	0.71	0.69	20.4
8	T1	134	2.0	0.343	26.7	LOS B	11.8	85.3	0.71	0.69	22.9
9	R2	340	5.0	0.343	30.8	LOS C	11.8	85.3	0.70	0.74	19.0
Approach		548	4.3	0.343	29.8	LOS C	11.8	85.3	0.70	0.72	20.2
West: Pacific Highway											
10	L2	553	2.0	0.882	41.9	LOS C	46.9	336.6	0.98	0.94	15.9
11	T1	1781	5.0	0.882	41.7	LOS C	50.9	371.6	0.98	0.96	17.8
Approach		2334	4.3	0.882	41.7	LOS C	50.9	371.6	0.98	0.96	17.4
All Vehicles		4799	4.5	0.987	53.9	LOS D	78.9	576.5	0.94	1.01	14.6

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
P1	South Full Crossing	53	20.3	LOS C	0.1	0.1	0.55	0.55
P2	East Full Crossing	53	30.7	LOS D	0.1	0.1	0.68	0.68
P3	North Full Crossing	53	25.0	LOS C	0.1	0.1	0.61	0.61
All Pedestrians		158	25.3	LOS C			0.61	0.61

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.

Organisation: GTA CONSULTANTS | Processed: Wednesday, 23 November 2016 9:34:57 AM
Project: \\gta.com.au\projectfiles\ProjectFilesSyd\15S1600-1699\15S1643000 524 Pacific Highway, St Leonards\Modelling\161114-15S1643000 525 Pacific Highway St Leonards - Existing.sip7

MOVEMENT SUMMARY

Site: 101 [Pacific Highway and Christie Street - Ex PM]

15S16430000 524 Pacific Highway, St Leonards
Pacific Highway and Christie Street
Signals - Fixed Time Isolated Cycle Time = 124 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows 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											
4	L2	41	2.0	0.447	14.0	LOS A	15.2	110.5	0.47	0.45	39.0
5	T1	1733	5.0	0.447	8.5	LOS A	15.2	111.2	0.47	0.43	40.5
Approach		1774	4.9	0.447	8.6	LOS A	15.2	111.2	0.47	0.43	40.4
North: Christie Street											
7	L2	54	5.0	0.561	53.3	LOS D	11.0	79.5	0.95	0.81	13.9
8	T1	52	2.0	0.561	48.7	LOS D	11.0	79.5	0.95	0.81	16.0
9	R2	296	5.0	0.561	53.2	LOS D	11.2	81.7	0.95	0.81	13.0
Approach		401	4.6	0.561	52.6	LOS D	11.2	81.7	0.95	0.81	13.5
West: Pacific Highway											
10	L2	448	2.0	0.279	6.2	LOS A	2.6	18.2	0.17	0.63	38.7
11	T1	1528	5.0	0.577	9.8	LOS A	22.7	165.7	0.54	0.50	38.7
Approach		1977	4.3	0.577	9.0	LOS A	22.7	165.7	0.46	0.53	38.7
All Vehicles		4152	4.6	0.577	13.0	LOS A	22.7	165.7	0.51	0.52	33.7

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
P1	South Full Crossing	53	6.1	LOS A	0.1	0.1	0.32	0.32
P2	East Full Crossing	53	53.4	LOS E	0.2	0.2	0.93	0.93
P3	North Full Crossing	53	8.9	LOS A	0.1	0.1	0.38	0.38
All Pedestrians		158	22.8	LOS C			0.54	0.54

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.

Organisation: GTA CONSULTANTS | Processed: Tuesday, 15 November 2016 3:54:43 PM
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MOVEMENT SUMMARY

Site: 101 [Pacific Highway and Christie Street - Future Base PM]

15S16430000 524 Pacific Highway, St Leonards
Pacific Highway and Christie Street
Signals - Fixed Time Isolated Cycle Time = 124 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows 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											
4	L2	41	2.0	0.447	14.0	LOS A	15.2	110.5	0.47	0.45	39.0
5	T1	1733	5.0	0.447	8.5	LOS A	15.2	111.2	0.47	0.43	40.5
Approach		1774	4.9	0.447	8.6	LOS A	15.2	111.2	0.47	0.43	40.4
North: Christie Street											
7	L2	54	5.0	0.561	53.3	LOS D	11.0	79.5	0.95	0.81	13.9
8	T1	52	2.0	0.561	48.7	LOS D	11.0	79.5	0.95	0.81	16.0
9	R2	296	5.0	0.561	53.2	LOS D	11.2	81.7	0.95	0.81	13.0
Approach		401	4.6	0.561	52.6	LOS D	11.2	81.7	0.95	0.81	13.5
West: Pacific Highway											
10	L2	448	2.0	0.279	6.2	LOS A	2.6	18.2	0.17	0.63	38.7
11	T1	1528	5.0	0.577	9.8	LOS A	22.7	165.7	0.54	0.50	38.7
Approach		1977	4.3	0.577	9.0	LOS A	22.7	165.7	0.46	0.53	38.7
All Vehicles		4152	4.6	0.577	13.0	LOS A	22.7	165.7	0.51	0.52	33.7

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
P1	South Full Crossing	53	6.1	LOS A	0.1	0.1	0.32	0.32
P2	East Full Crossing	53	53.4	LOS E	0.2	0.2	0.93	0.93
P3	North Full Crossing	53	8.9	LOS A	0.1	0.1	0.38	0.38
All Pedestrians		158	22.8	LOS C			0.54	0.54

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.

Organisation: GTA CONSULTANTS | Processed: Tuesday, 6 December 2016 5:23:46 PM
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MOVEMENT SUMMARY

Site: 101 [Pacific Highway and Christie Street - Cumulative PM]

15S16430000 524 Pacific Highway, St Leonards
Pacific Highway and Christie Street
Signals - Fixed Time Isolated Cycle Time = 124 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows 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											
4	L2	51	2.0	0.515	14.7	LOS B	18.8	136.8	0.51	0.48	38.3
5	T1	1993	5.0	0.515	9.1	LOS A	18.9	137.8	0.51	0.47	39.5
Approach		2043	4.9	0.515	9.2	LOS A	18.9	137.8	0.51	0.47	39.5
North: Christie Street											
7	L2	54	5.0	0.577	53.4	LOS D	11.4	82.4	0.96	0.81	13.9
8	T1	64	2.0	0.577	48.8	LOS D	11.4	82.4	0.96	0.81	16.0
9	R2	296	5.0	0.577	53.4	LOS D	11.6	84.4	0.96	0.82	13.0
Approach		414	4.5	0.577	52.7	LOS D	11.6	84.4	0.96	0.81	13.6
West: Pacific Highway											
10	L2	448	2.0	0.279	6.2	LOS A	2.6	18.2	0.17	0.63	38.7
11	T1	1533	5.0	0.578	9.8	LOS A	22.8	166.4	0.55	0.50	38.7
Approach		1981	4.3	0.578	9.0	LOS A	22.8	166.4	0.46	0.53	38.7
All Vehicles		4438	4.6	0.578	13.2	LOS A	22.8	166.4	0.53	0.53	33.6

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
P1	South Full Crossing	53	6.1	LOS A	0.1	0.1	0.32	0.32
P2	East Full Crossing	53	53.4	LOS E	0.2	0.2	0.93	0.93
P3	North Full Crossing	53	8.9	LOS A	0.1	0.1	0.38	0.38
All Pedestrians		158	22.8	LOS C			0.54	0.54

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.

Organisation: GTA CONSULTANTS | Processed: Wednesday, 23 November 2016 9:12:42 AM
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Appendix B

Swept Path Assessment

PLOTTED BY : chenlong.you ON 31/10/2018 AT 10:09:34 AM

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Melbourne	03 9851 9600
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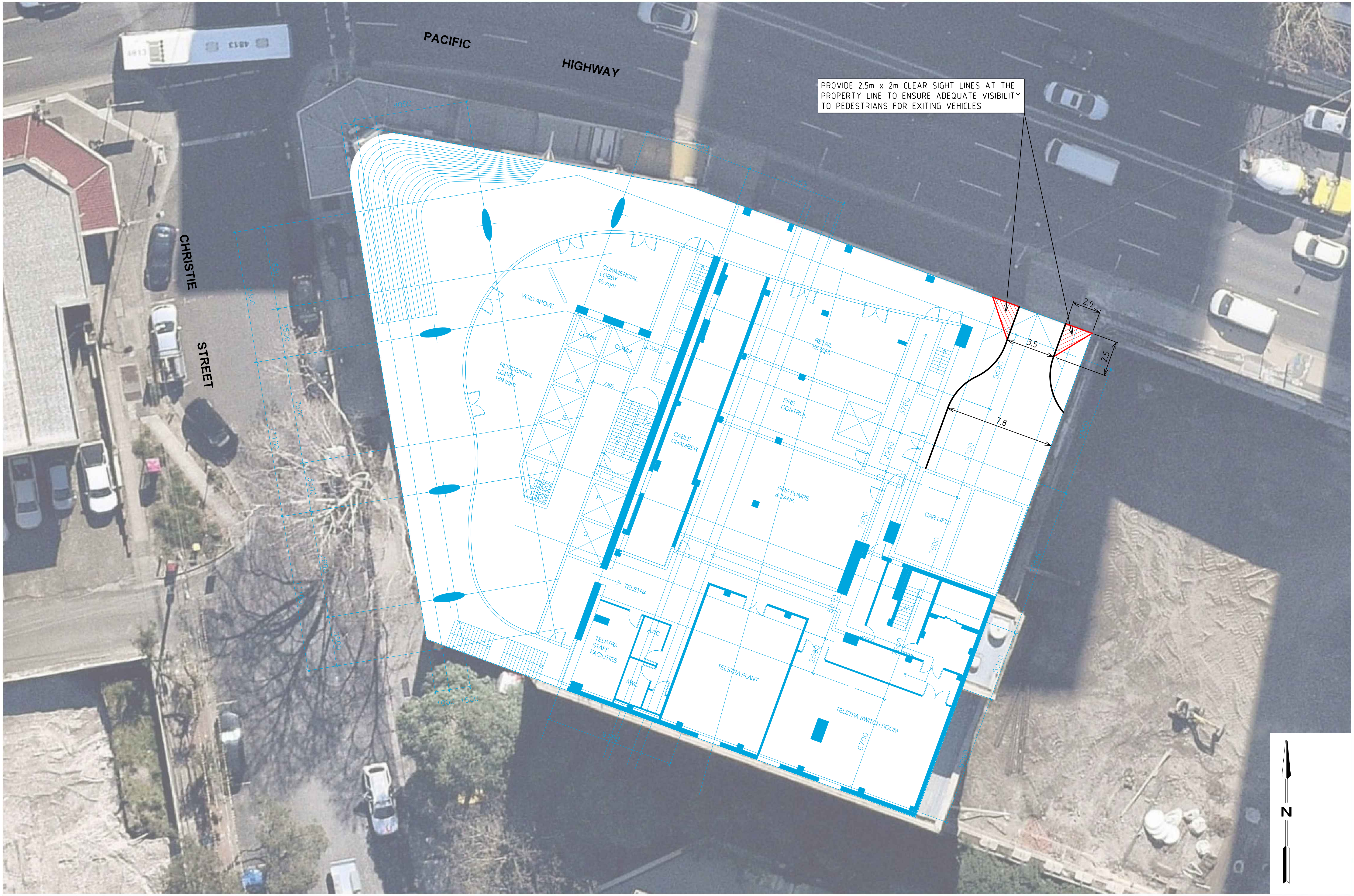
PRELIMINARY PLAN
FOR DISCUSSION PURPOSES ONLY SUBJECT TO CHANGE WITHOUT NOTIFICATION

DESIGNED C.YOU	DESIGN CHECK W.ZHENG	SCALE A3	0 2.5 5 1:250
APPROVED BY B.MAYNARD	DATE ISSUED 31 OCTOBER 2018	CAD FILE NO. N139020-01-P1.dgn	

524 PACIFIC HIGHWAY, ST LEONARDS

CAR PARK COMPLIANCE REVIEW

DRAWING NO. N139020-01-01 SHEET 01 OF 04 ISSUE P1



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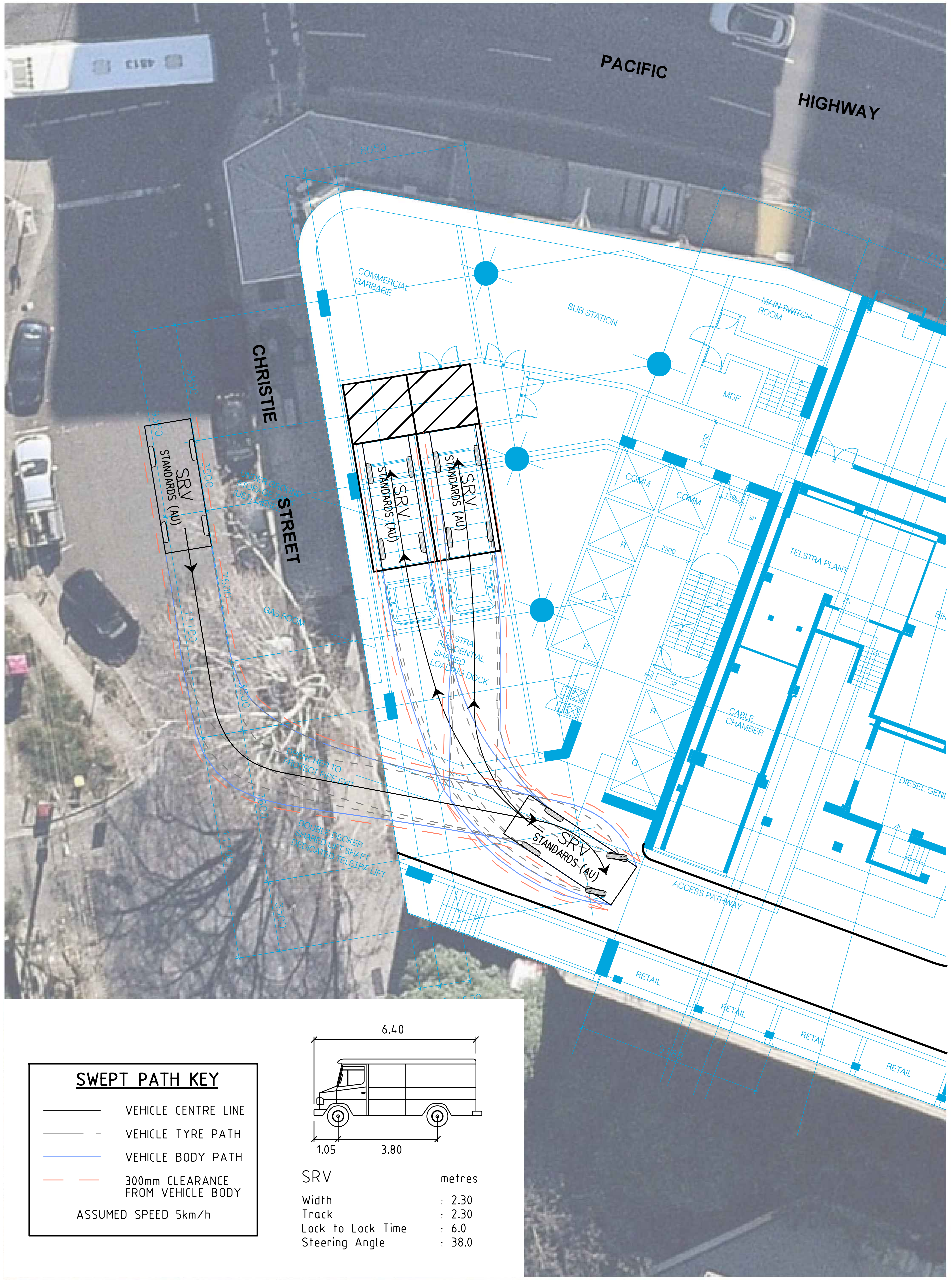
DESIGNED C.YOU
DESIGN CHECK W.ZHENG
APPROVED BY B.MAYNARD
DATE ISSUED 31 OCTOBER 2018

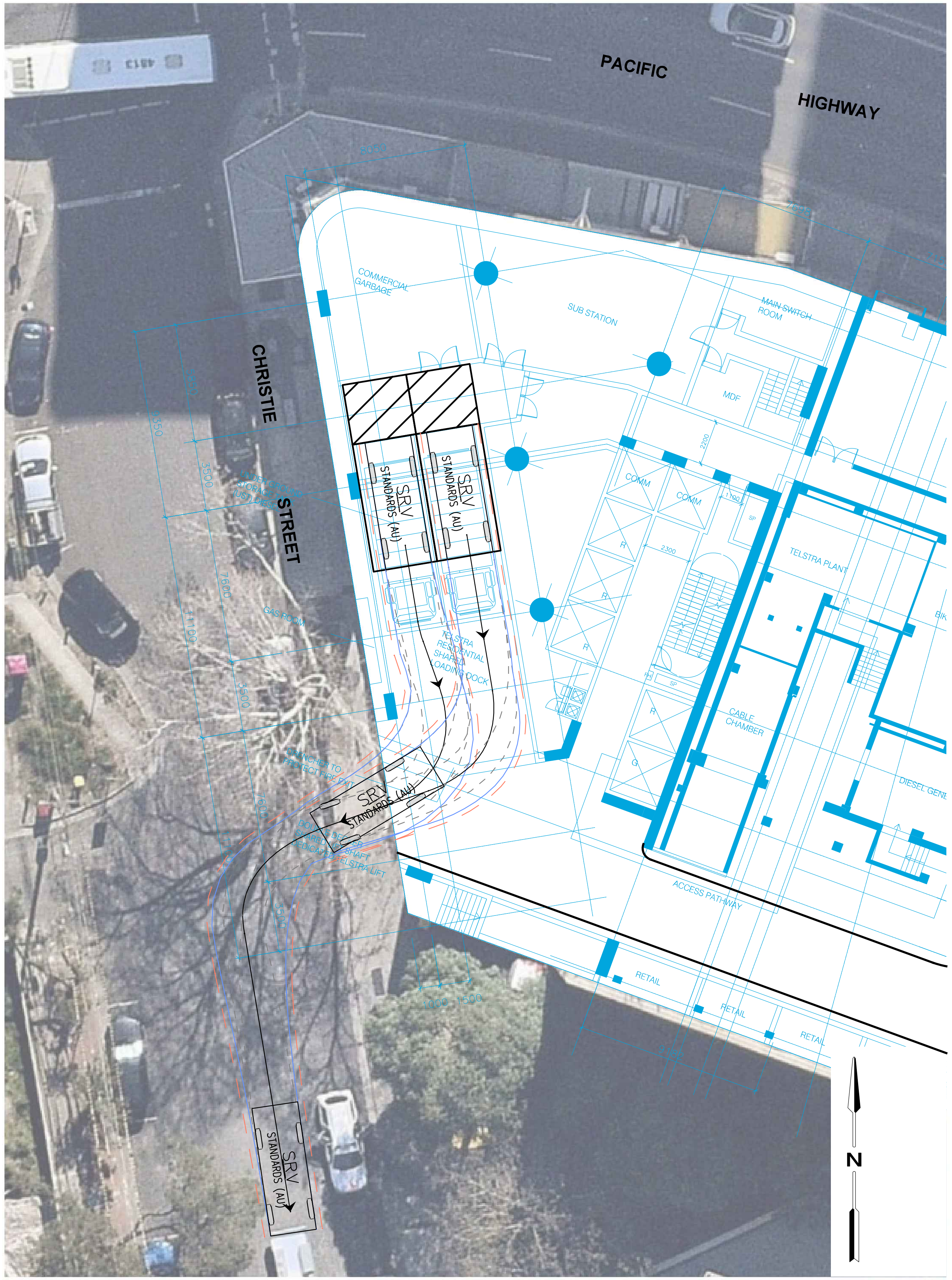
SCALE A3 0 2.5 5 1:250
CAD FILE NO. N139020-01-P1.dgn

524 PACIFIC HIGHWAY, ST LEONARDS

CAR PARK COMPLIANCE REVIEW

DRAWING NO. N139020-01-02 SHEET 02 OF 04 ISSUE P1





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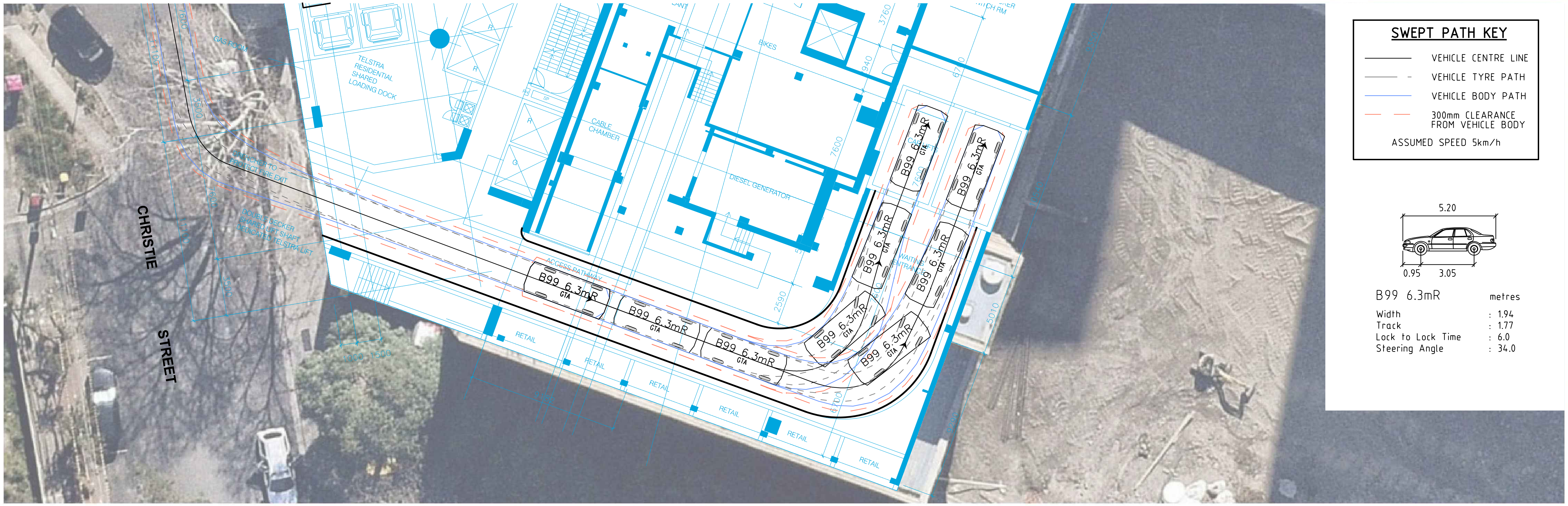
DESIGNED C.YOU	DESIGN CHECK W.ZHENG
APPROVED BY B.MAYNARD	DATE ISSUED 31 OCTOBER 2018

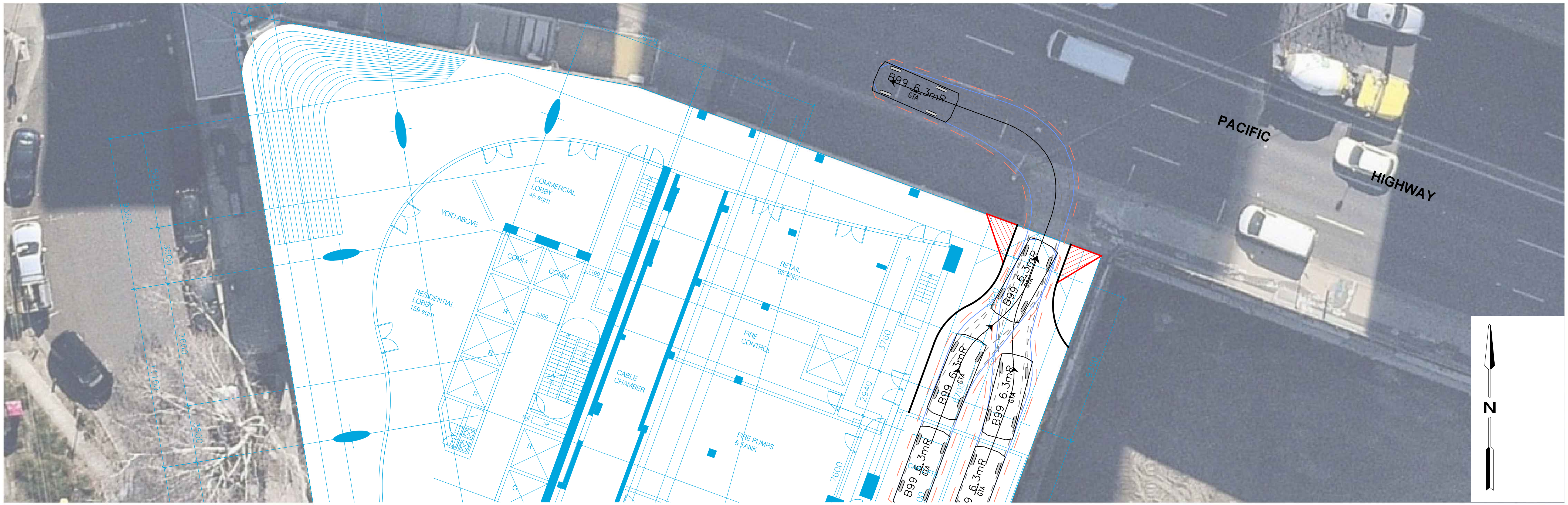
SCALE A3 0 2.5 5 1:250
CAD FILE NO. N139020-01-P1.dgn

524 PACIFIC HIGHWAY, ST LEONARDS

SWEPT PATH ASSESSMENT

DRAWING NO. N139020-01-03 SHEET 03 OF 04 ISSUE P1





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PRELIMINARY PLAN
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SCALE A3 0 2.5 5 1:250

CAD FILE NO. N139020-01-P1.dgn

524 PACIFIC HIGHWAY, ST LEONARDS

SWEPT PATH ASSESSMENT

DRAWING NO. N139020-01-04 SHEET 04 OF 04 ISSUE P1

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