



ESQ 1818: Stage 4 and 5

Traffic and Parking Impact Assessment

ESQ 1818 Stage 4 Pty Ltd / ESQ 1818 Stage 5 Pty Ltd

20 December 2021

→ The Power of Commitment



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1. Introduction

1.1 Background

GHD Pty Ltd (GHD) has been engaged by ESQ 1818 Stage 4 Pty Ltd and ESQ 1818 Stage 5 Pty Ltd to undertake a traffic and parking impact assessment for Stage 4 and Stage 5 of the ESQ 1818 at Panthers (ESQ 1818) development located at 123 Mulgoa Road, Penrith.

A Masterplan Transport Strategy for the entire Panthers Precinct has already been developed and includes parking and transport analysis of the entire precinct, including Stages 4 and 5. A Voluntary Planning Agreement (VPA) for the Panthers Development has been signed by representatives of Transport of NSW, Penrith City Council and Panthers Rugby League Club in late 2020 which outlines triggers for road upgrades associated with staging developments within the Panthers precinct.

This report has been prepared to provide a traffic impact and parking assessment for the proposed Stages 4 and 5 development (see Figure 1 below) with reference to the VPA and relevant Council Development Control Plans and Panthers Precinct Master Plan – Transport Strategy - GHD July 2014 (*Transport Strategy*).

This traffic and parking report is based on the *Transport Strategy* and uses the traffic generation rates, background growth and traffic distribution assumptions outlined within the precinct strategy. This report should be read in conjunction with the *Transport Strategy*.

This report refers directly to the Stage 4 and 5 Development Application which consists of Lot 2 within the masterplan, while also applying the traffic generation of Stage 1 (Lots 3 and 3A) and Stage 2A, 2B and 3 (Lot 2) currently approved by Penrith City Council.

Relevant previous traffic studies for the Panthers precinct are summarised in Section 1.2 below.

1.2 Previous traffic studies

The previous reports and statements prepared by GHD for this development include:

- A Masterplan Transport Strategy which comprised a parking and transport strategy for the entire Panthers Precinct (including Lot 2), (*Panthers Precinct Master Plan – Transport Strategy* referred to henceforth as the *Transport Strategy*) – July 2014.
- A Traffic Statement that analysed the changes in traffic impacts associated with the removal of the internal Riverlink Road, which was previously proposed to run in a north-south direction through the ESQ 1818 at Panthers Development – July 2016.
- A Traffic Impact Statement, which provided a comparison of the traffic impacts of the updated land uses associated with the proposed ESQ 1818 Development (for Lots 2, 3a and 3b) and the previously approved land uses (as contained in the *Transport Strategy*) – March 2016.
- A Traffic Impact Statement for the Development Application submission for Stage 1 (lots 3a and 3b) which provides the traffic impact and parking for the land uses on Lots 3a and 3b – August 2017.
- A Voluntary Planning Agreement (**VPA**) for the Panthers Development has been signed by representatives of Transport for NSW, Penrith City Council and Panthers Rugby League Club in late 2020 which outlines triggers for road upgrades associated with staging developments within the Panthers precinct.
- A Traffic Impact Statement for the proposed ESQ 1818 Stage 2A, 2B and 3 dated 27 August 2018 following minor amendments to the residential unit mix component of the proposed development.
- A Traffic Impact Statement for the proposed ESQ 1818 Stage 2A, 2B and 3 dated 13 March 2019 following service vehicle access amendments to be collected with the basement areas and the resulting alternation residential unit mix component of the proposed development.
- A Traffic Impact Statement for the proposed ESQ 1818 Stage 2A, 2B and 3 dated 13 June 2019 following updates to the service vehicle access amendments to be collected with the basement areas and the resulting alternation residential unit mix component of the proposed development.

1.3 Site location and proposed development summary

The subject site for Stage 4 and 5 (within Lot 2) development is located northwest of the corner of Retreat Drive and Ransley Street intersection. The location of Stage 4 and 5 within the context of the overall Panthers Precinct is displayed in Figure 1.

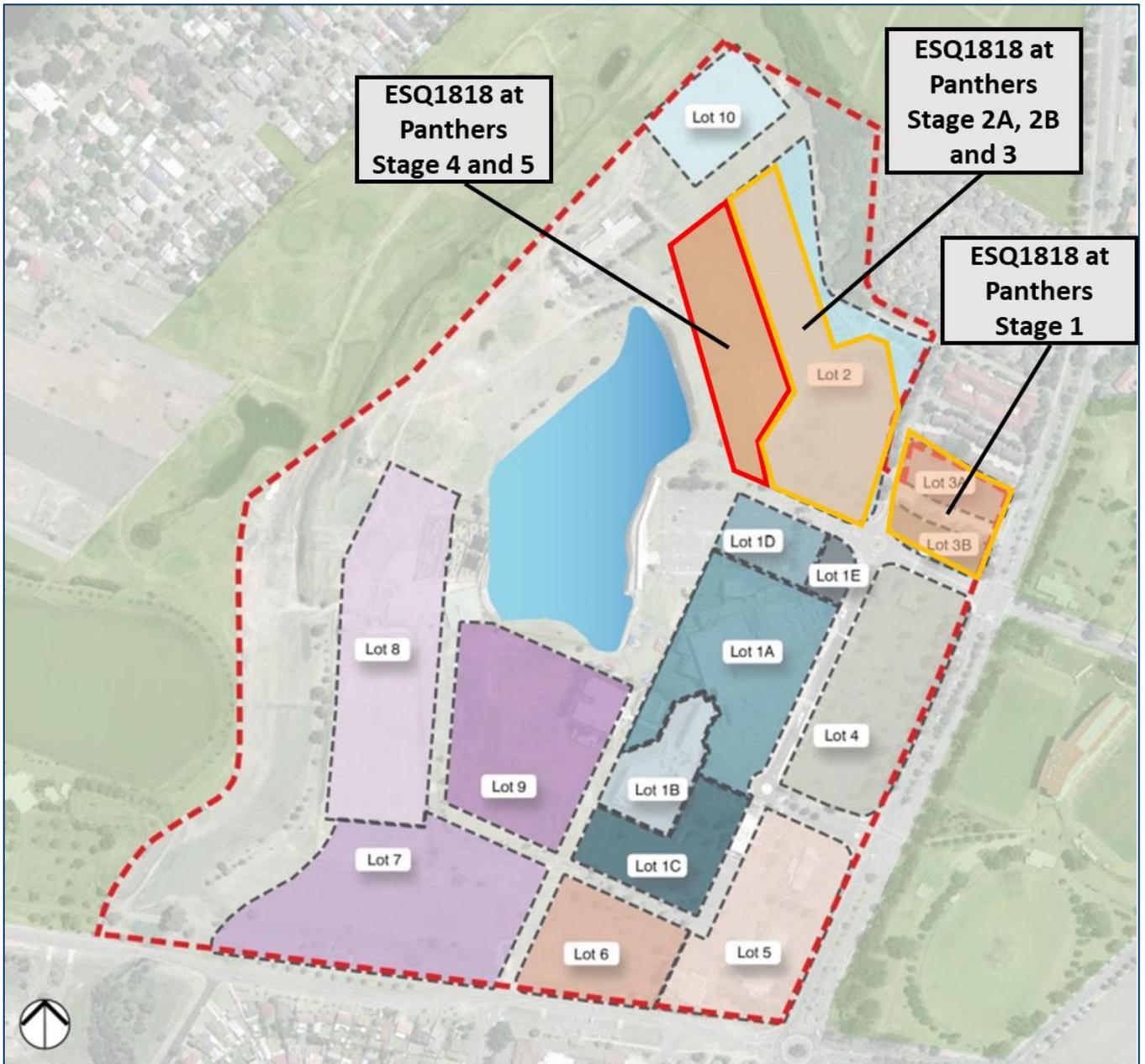


Figure 1 Panthers precinct development lots

Source: Architectus Draft Urban Design Report – modified by GHD

The proposed Stage 4 and 5 development consists of residential units and a retail component with basement parking for the use of residents and visitors as outlined in Table 1.

The development proposal includes a total of 333 residential units and retail Gross Floor Area (GFA) of 2,145 m².

Table 1 Stage 4 and 5 development key features

Stage	Use type	Number	Parking	Number
Stage 4	1-bed units	44 units	Residential Car	215 (including 17 accessible)
	2-bed units	67 units	Visitor Car	32 (including 2 accessible)
	3-bed units	31 units	Retail Car	119 (including 3 accessible)
	4-bed units	13 units	Bicycle	166 storage cages, plus 16 racks (32 bicycles)
	Total Units	155 units	Motorbike	4
	Retail	996 m ² GFA	Car Wash Bays	4
			Service vehicle bays	Up to 2 Council waste vehicles (10.5 m) and 2 SRV in tandem
			Electric Vehicle bays	2
Stage 5	1-bed units	59 units	Residential Car	222 (including 18 accessible)
	2-bed units	81 units	Visitor Car	36 (including 2 accessible)
	3-bed units	38 units	Retail Car	N/A – located in Stage 4 combined
	Total Units	178 units	Bicycle	178 storage cages, plus 18 racks (36 bicycles)
	Retail	1,189 m ² GFA	Motorbike	4
			Car Wash Bays	4
			Service vehicle bays	Up to 2 SRV
			Electric Vehicle bays	2
			<i>Note: 27 racks (equivalent to 54 bicycles) have been provided in the promenade between Stage 4 and 5</i>	
Total	Residential Units	333	Residential	437 (including 35 accessible)
	Retail GFA	2,185 m² GFA	Residential Visitor	68 (including 4 accessible)
			Retail	119 (including 3 accessible)
			<i>Excludes Car wash and service vehicle bays</i>	

In the context of the overall Panthers Precinct Masterplan, ESQ 1818 will be completed over five stages. It is proposed to consist of approximately 850 apartments and approximately 3,500 m² (GFA) of retail within Lots 2, 3a and 3b. ESQ 1818 stages are known as the following and shown in Figure 1 above:

- Stage 1 (located in Lots 3A + 3B) – completed in 2019
- Stage 2A/2B (located in Lot 2) – 180 residential units and 1,225 m² (GFA) retail currently under construction
- Stage 3 (located in Lot 2) – 148 residential units currently under construction
- Stage 4 (located in Lot 2) – 155 residential units and 996 m² (GFA) – This proposal
- Stage 5 (located in Lot 2) – 178 residential units and 1,189 m² (GFA) – This proposal.

1.4 Purpose of this report

This report provides a traffic impact assessment specifically for the ESQ 1818 Stage 4 and 5 proposal and discusses the following:

- **Existing conditions** – a review of existing road features, public and active transport and traffic volumes.
- **Proposed development** – provides details of the development proposal and a review of additional traffic generated.
- **Traffic impact assessment** – provides an assessment of the performance of the road network following the development of the site with reference to the VPA analysis undertaken.
- **Parking assessment** – a review of the parking provision and layout in relation to relevant Australian Standards (AS2890), Penrith City Council DCP requirements.

1.5 Assumptions and limitations

This report is subject to, and must be read in conjunction with, the limitations set out below and the assumptions and qualifications contained throughout the report.

This assessment for the proposed development is based upon the following assumptions:

- Architectural plans and development land use breakdown provided by Turner Studio Architects.
- Intersection survey counts for the AM and PM period conducted in 2016 (refer section 3).
- Traffic distribution assumptions in relation to arrival and departure profiles, background traffic growth rates, traffic generation and routes through the network as outlined in the VPA for the proposed development, based on the Transport Strategy previously approved traffic distribution, and Council and Roads and Maritime approvals.

This study has been limited by the following:

- The analysis is a desktop study.
- The conditions of the surrounding network are based on information either supplied by the traffic surveys, Google Maps and Streetview.
- Trip generation rates for the future developments have been taken from the approved *Transport Strategy* report.

This assessment for the proposed development is based on the following architectural drawings (refer to Table 2), produced by Turner Studio Architects.

Table 2 Development proposal drawing list

Drawing Number	Revision	Issue Date	Title
DA-110-008	00	01.12.2021 - WIP	GA Plans – Ground Level
DA-110-007	00	25.11.2021 - WIP	GA Plans – Basement 1
DA-110-006	00	25.11.2021 - WIP	GA Plans – Basement 2

2. Existing conditions

2.1 Overview

This section outlines the existing traffic and transport conditions on roads in the vicinity of the site. This includes the existing transport and accessibility conditions and the existing road network performance.

2.2 Existing site

The existing site comprises an exhibition marquee adjacent to an at-grade car park facility consisting of approximately 355 car spaces providing the opportunity to host small and large exhibitions and markets. Recently the at-grade car park has been removed to facilitate the construction of ESQ1818 Stage 2A/2B and 3. An overflow grass area is available to facilitate additional parking and exhibition area for the larger events. Vehicle access to the existing facilities is via Retreat Drive, with the major road network consisting of Mulgoa Road (north/south connection) and Jamison Road (east/west connection). Refer to Figure 2 for site location.



Figure 2 Site location

Source: Sixmaps – Modified by GHD

2.3 Existing road network characteristics

Roads within NSW are categorised in the following two ways:

- By classification (ownership)
- By the function that they perform.

Road Classification

Roads are classified (as defined by the *Roads Act 1993*) based on their importance to the movement of people and goods within NSW (as a primary means of communication).

The classification of a road allows Transport for NSW (TfNSW) to exercise authority of all or part of the road. Classified roads include Main Roads, State Highways, Tourist Roads, Secondary Roads, Tollways, Freeways and Transitways.

For management purposes, TfNSW has three administrative classes of roads. These are:

- **State Roads** – Major arterial links throughout NSW and within major urban areas. They are the principal traffic carrying roads and fully controlled by TfNSW with maintenance fully funded by TfNSW. State Roads include all Tollways, Freeways and Transitways; and all or part of a Main Road, Tourist Road or State Highway.
- **Regional Roads** – Roads of secondary importance between State Roads and Local Roads which, together with State Roads provide the main connections to and between smaller towns and perform a sub arterial function in major urban areas. Regional roads are the responsibility of councils for maintenance funding, though TfNSW funds some maintenance based on traffic and infrastructure. Traffic management on Regional Roads is controlled under delegation by local government. Regional Roads maybe all or part of a Main Road, Secondary Road, Tourist Road or State Highway; or other roads as determined by TfNSW.
- **Local Roads** – The remainder of roads are council controlled roads. Local Roads are the responsibility of councils for maintenance funding. TfNSW may fund some maintenance and improvements based on specific programs (e.g. urban bus routes, road safety programs). Traffic management on Local Roads is controlled under the delegation by local government.

Functional Hierarchy

Functional road classification involves the relative balance of the mobility and access functions. TfNSW define four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility, to high accessibility and low mobility. These road classes are:

- **Arterial Roads** – generally controlled by TfNSW, typically no limit in flow and designed to carry vehicles long distance between regional centres.
- **Sub-Arterial Roads** – can be managed by either TfNSW or local council. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to carry traffic between specific areas in a sub region, or provide connectivity from arterial road routes (regional links).
- **Collector Roads** – provide connectivity between local roads and the-arterial road network and typically carry between 2,000 and 10,000 vehicles per day.
- **Local Roads** – provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day.

The surrounding road network is shown in Figure 3.

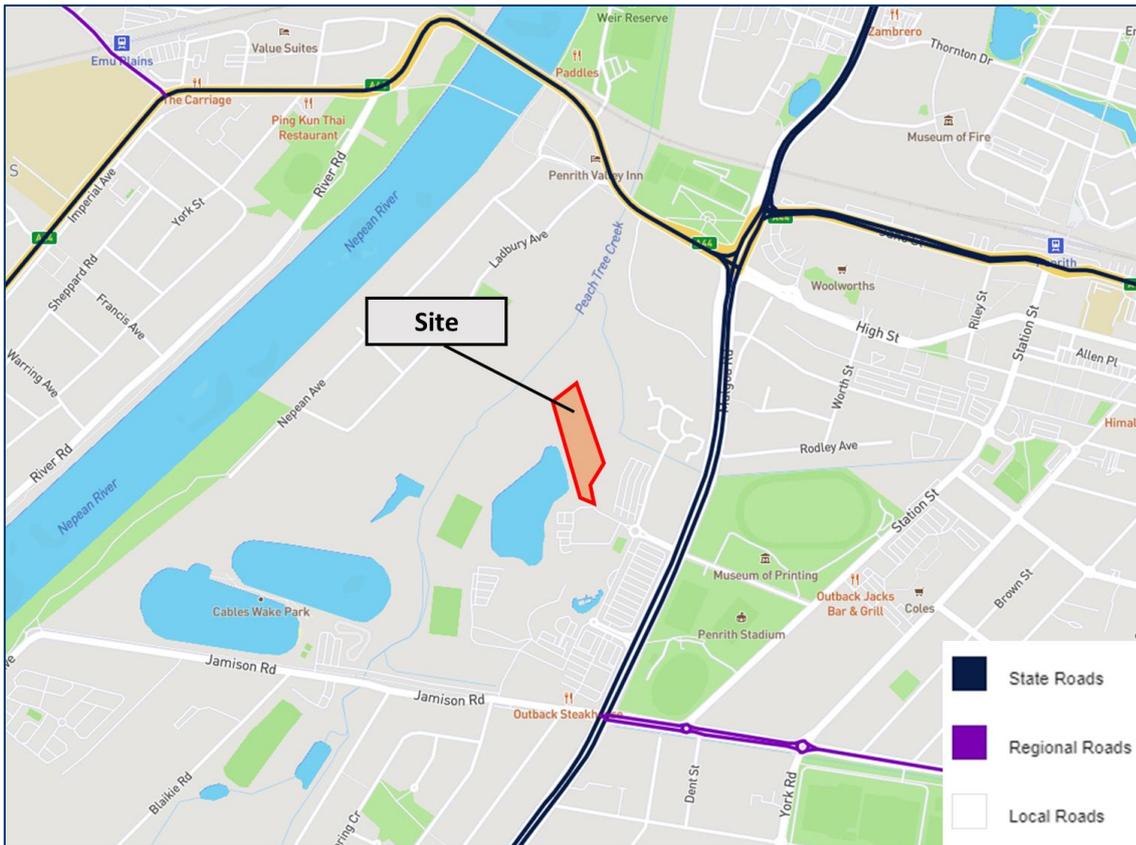


Figure 3 Surrounding road network

Source: Transport for NSW maps – Modified by GHD

The Panthers precinct and Penrith City generally are serviced by two state classified roads, namely Great Western Highway and Mulgoa Road. Further to the south, Mulgoa Road also provides access to the M4 Motorway.

2.3.1 Mulgoa Road

Mulgoa Road is a classified State Road linking the Penrith City Centre and Mulgoa Village. It is generally a four-lane divided road north of Glenmore Park, and to the south of Glenmore Park it is a two-lane undivided road. Mulgoa Road is signposted at 60 km/h through the study area and carries an average annual daily traffic volume of 38,000 vehicles per day on the section south of Preston Street, Jamisontown (based on 2016 survey data). Mulgoa Road is a main traffic route into and out of Penrith and has a number of signalised intersections along its length. Refer to Figure 4.



Figure 4 Mulgoa Road looking north

Source: Google maps Streetview (2021)

2.3.2 Retreat Drive

Retreat Drive is a private road that provides access to Penrith Panthers and Penrith Mountainview Aged Care facility. The road is two lanes divided in a north-south direction between Ransley Road roundabout within the Panthers Precinct (refer to Figure 5). It provides access to the car park facility.



Figure 5 Retreat Drive looking north

Source: Google maps Streetview (2019)

2.3.3 Ransley Street

Ransley Street is a local road that crosses Mulgoa Road. Ransley Street, east of Mulgoa Road (refer to Figure 6), provides access towards Nepean Square shopping centre located east of the site. The road is two lanes undivided in an east-west direction between Mulgoa Road and Station Street. It is signposted as a 50 km/h and conveys approximately 350 (two-way) vehicles during the peak hour periods (based on 2016 survey data).

Ransley Street, west of Mulgoa Road (refer to Figure 7), is located within the Panthers Precinct and provides access to Panthers and Penrith Mountainview Aged Care facility. The road is two lanes in an east-west direction and signposted at 10 km/h speed as it provides access to the car park facility and conveys approximately 200 vehicles during the peak hour periods (based on 2016 survey data).



Figure 6 Ransley Street (east of Mulgoa Road) looking east

Source: Google maps Streetview (2021)



Figure 7 Ransley Street (west of Mulgoa Road) looking west

Source: Google maps Streetview (2019)

2.3.4 Panthers Link Road

Panthers Link Road is an internal link road providing access between Panther Place, Retreat Drive and the at-grade parking facility (see Figure 8). The road is undivided, with typically one lane in each direction and access to kerbside drop-off and bus stop facilities. The posted speed limit is 10 km/h. There are footpaths provided on both sides of the road and facilitates dropping off and picking up of patrons to the club facilities.



Figure 8 Panthers Link Road looking north

Source: Google maps Streetview (2019)

2.3.5 Jamison Road

Jamison Road is a regional road that provides east-west access between Mulgoa Road and Parker Street/Northern Road (2.4 km to the east). Jamison Road consists of a mix of divided and undivided road sections with typically two lanes each way, east of Mulgoa Road (refer to Figure 9). It is signposted at 60 km/h within proximity of the site. There are footpaths on both side of the road with No Stopping restrictions on the approach to the intersection with Mulgoa Road.

Jamison Road to the west of Mulgoa Road is a local road providing access to the Nepean River. This segment generally consists of a single lane each way undivided road and unrestricted kerbside parking (refer to Figure 7). It is signposted at 60 km/h within proximity of the site. There are no formalised pedestrian footpaths.



Figure 9 Jamison Road looking east

Source: Google maps Streetview (2021)



Figure 10 Jamison Road looking west

Source: Google maps Streetview (2021)

2.4 Public transport and active transport

In reviewing the site and its accessibility to public transport opportunities, reference is made to the NSW Planning Guidelines for Walking and Cycling (2004). This document outlines a recommended walkable distance of 400 m to 800 m to public transport and other local amenities or a 1.5 km bicycle riding distance. Details of the accessibility to public transport, walking and bicycle riding access is provided in the following sections.

2.4.1 Bus services

As indicated in Figure 11, the nearest bus stops to the site are located approximately 150 m south of the site at the Penrith Panthers Leagues Club stop. An additional bus stop is located approximately 300 east of the site in Ransley Street and bus stops in the Mountain View Retreat Retirement Village are approximately 350 m north of the site. A summary of the bus service operating from these bus stops is provided in Table 3. These bus stops are considered to be within a suitable (400 m) walking distance from the site.

Table 3 Bus services

Route	Frequency	Route Description
688	Weekday: Nominally 60-minute intervals Weekend: Saturday: 60-minute intervals Sunday: 120-minute intervals	Penrith to Emu Heights (Loop Service)
689	Weekday: Nominally 60-minute intervals	Penrith to Leonay (Loop Service)

Route	Frequency	Route Description
	Weekend: Saturday: 60-minute intervals Sunday: 120-minute intervals	
690P	Weekday: Nominally 60-minute intervals Saturday: Four services nominally 120-minute intervals Sunday: Two services	Springwood to Penrith
691	Weekday: Four services nominally 120-minute intervals Weekend: Three services	Mount Riverview to Penrith
S13	Weekday: Four services Weekend: No service	Penrith via Mountainview Village



Figure 11 Bus stops

Source: Google maps – Modified by GHD

2.4.2 Train services

Penrith station is located approximately 1.9 km walking distance northeast of the site. Penrith Station is serviced by the T1 North Shore, Northern and Western Line and Blue Mountains train services providing regular service to Blacktown, Parramatta and the Sydney CBD. Access to the train services is considered to be within a suitable cycle distance from the site (refer to Figure 12).

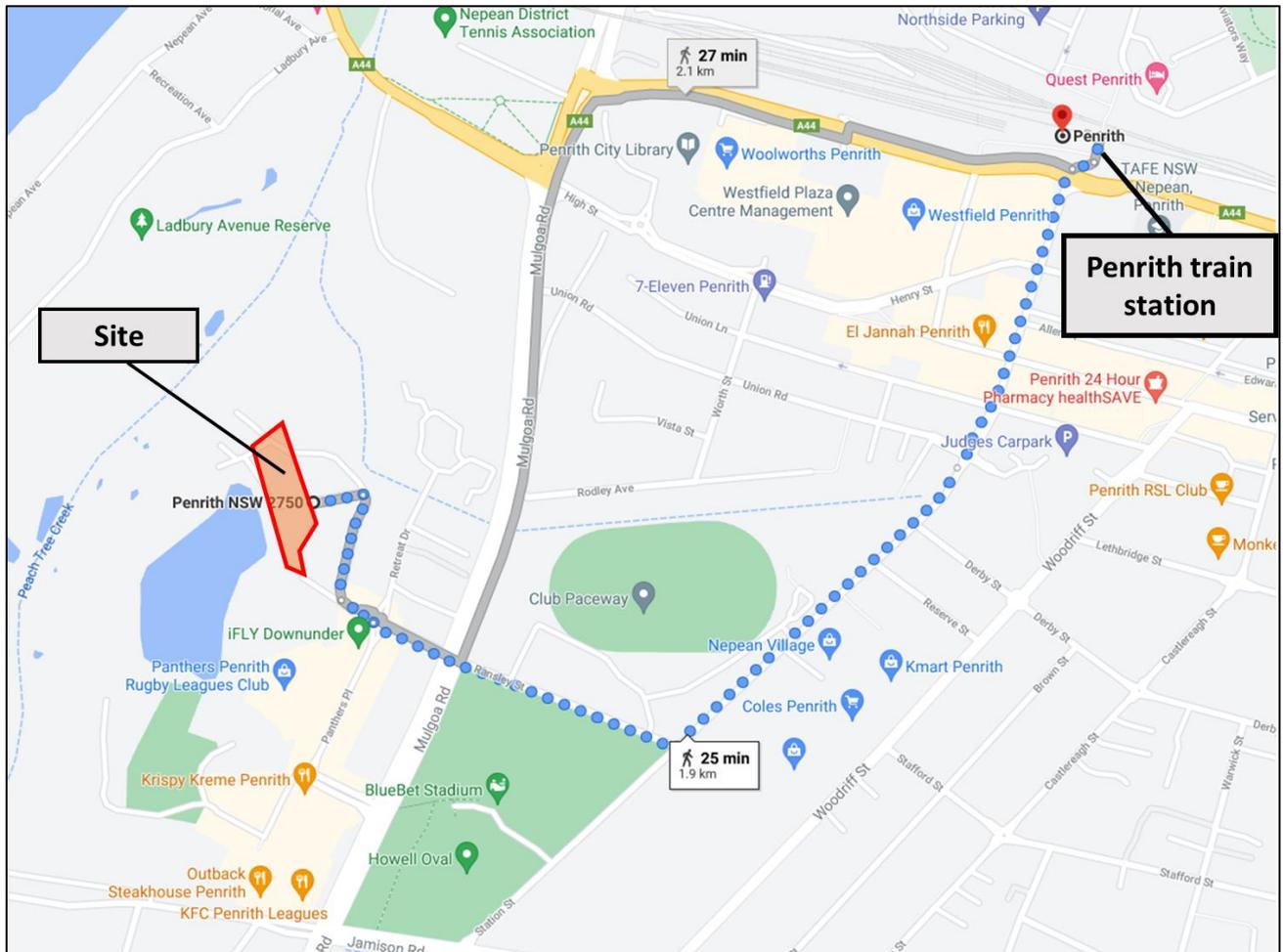


Figure 12 Location of Penrith train station

Source: Google maps – Modified by GHD

2.4.3 Bicycle access

The existing bicycle routes within the vicinity of the proposal site are shown in Figure 13 as identified from the Transport for NSW Cycleway Finder website.

As shown, there are currently off-road bicycle routes within close proximity to the site along Mulgoa Road and provides designated cycle ways to Penrith CBD and other surrounding areas.

According to the Panthers website, there is no formal bicycle parking currently provided within the site boundaries.

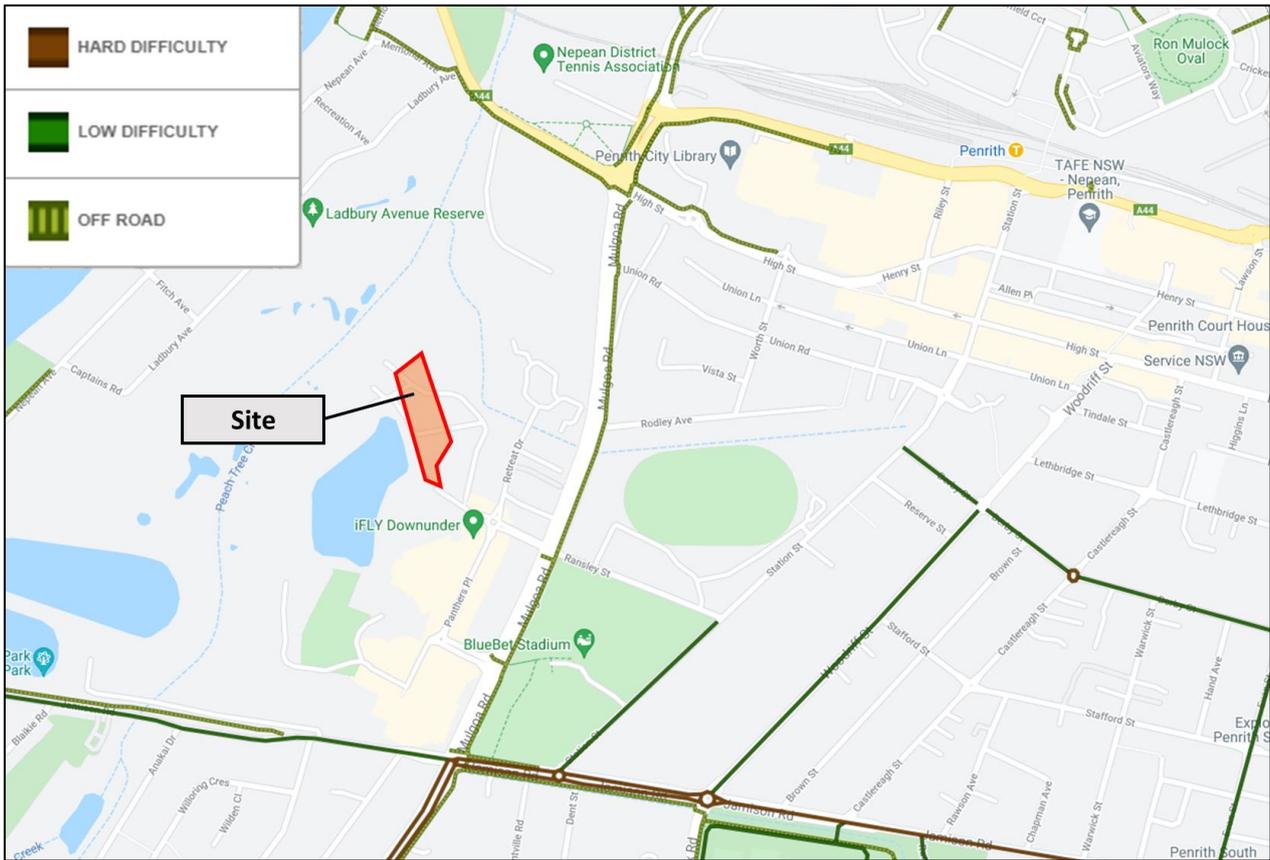


Figure 13 Existing bicycle network

Source: Transport for NSW Cycleway Finder – Modified by GHD

2.4.4 Walking access

The pedestrian network is reasonably well developed, with footpaths provided along all roads within the vicinity of the subject site. Signalised pedestrian crossing facilities are provided at the Mulgoa Road, Ransley Street intersection and a marked foot crossing mid-block on Ransley Street between Mulgoa Road and the Retreat Drive roundabout.

3. Assessment of traffic conditions

3.1 Traffic surveys

In order to obtain traffic data in conjunction with the overall Panthers Precinct Master Plan – Transport Strategy, and VPA, Matrix Traffic and Transport Data completed traffic turning counts for the AM and PM peak periods on Wednesday 6th April 2016 at the following locations:

- Mulgoa Road / Great Western Highway / High Street;
- Mulgoa Road / Ransley Street / Retreat Drive;
- Retreat Drive Roundabout;
- Mulgoa Road / Panther Place;
- Mulgoa Road / Jamison Road; and
- Jamison Road / Harris Street

The surveys were undertaken at the following times to identify the AM and PM peak hours of road network activity:

- 7:00 am – 9:00 am
- 4:00 pm – 6:00 pm.

The PM peak hour surveys were undertaken to identify the change in traffic volumes/growth between 2011 and 2016 on the road network in proximity to the subject site.

3.2 Comparison of 2011, 2015 and 2016 PM peak hour traffic data

As part of the VPA traffic analysis, in order to identify the changes in traffic growth over the preceding five years (from 2011) in PM peak periods, the 2016 survey data was compared to the 2011 surveys (undertaken to support the analysis in the *Transport Strategy*).

Additionally, GHD sourced traffic survey counts collected by Transport for NSW in May 2015 on the roads in proximity to the development subject site to provide an additional point of context.

A comparison between the total traffic volumes at Mulgoa Road and Retreat Drive intersection for 2011, 2015 and 2016 in the PM peak hour, are displayed in Figure 14.

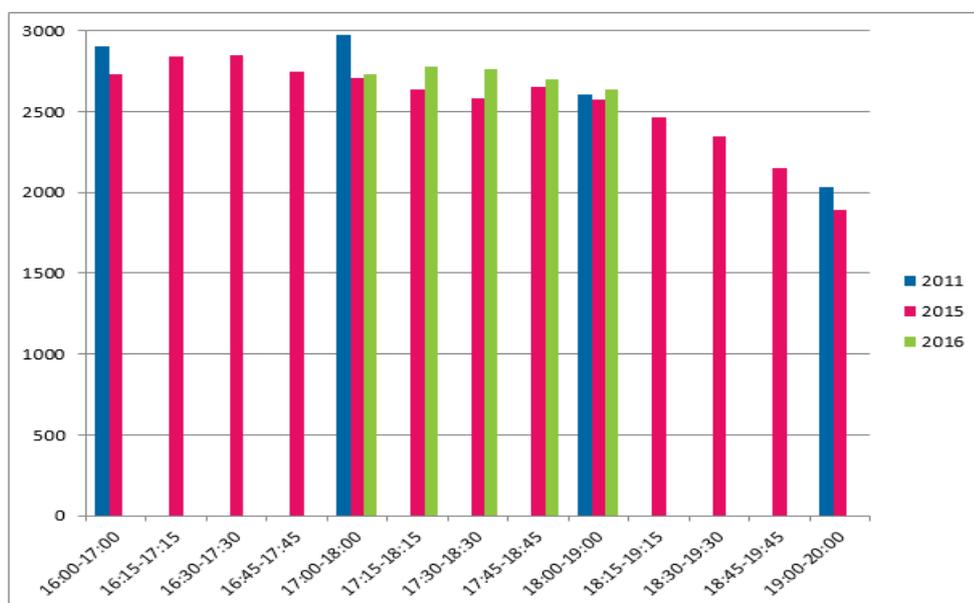


Figure 14 Total PM traffic at the Mulgoa Road and Retreat Drive intersection

Figure 14 indicates that the traffic volumes on the road network in proximity to the subject site have typically decreased between 2011 and 2015/2016.

The changes in traffic (both in terms of volume and percentage) at the intersection of Mulgoa Road, Ransley Street and Retreat Drive as detailed in the available data sources are displayed in Table 4.

Table 4 Changes in peak hour traffic volume (2011 – 2016)

Peak Hour		2011	2015	2016
16:00 - 17:00	Traffic Volumes	2905	2,735	-
	% Change	-	-6%	-
17:00 - 18:00	Traffic Volumes	2973	2,710	2728
	% Change	-	-10%	-9%
18:00 - 19:00	Traffic Volumes	2607	2,575	2639
	% Change	-	-1%	1%
19:00 - 20:00	Traffic Volumes	2033	1,893	-
	% Change	-	-7%	-

The data in Table 4 indicates that there has been a reduction in traffic volumes of up to 10% in the PM peak traffic volumes on the road network in proximity to the subject site when comparing the 2015/2016 traffic data to the 2011 traffic data.

A review of the video provided by the survey company (for the 2016 surveys) indicates that vehicles typically cleared the intersection within their allocated phase times and there were no observed tail backs from adjoining intersections interrupting traffic flows. Accordingly, there is no evidence to indicate that congested conditions (associated with increased traffic demand) are suppressing traffic throughput and we are unable to identify the reasons for the reduction in traffic volumes between 2011 and 2015/2016.

However, in order to be conservative (where appropriate) the turning movements of the 2016 traffic volumes were scaled up to match the 2011 traffic volumes. This was undertaken to be conservative on the basis that the available data indicates that the 2011 volumes represent the “worst case” scenario.

The traffic analysis for the Panthers Precinct (including (ESQ1818 Stage 4 and 5), as part of the Voluntary Planning Agreement (VPA), further included a two percent per annum background traffic growth rate for the agreed future scenario/ development stage conditions (as defined in Appendix A). The background traffic, growth rate and proposed development within the Panthers Precinct determined the stages of road network improvements and associated triggers.

3.3 Intersection operational performance

The performance of a road network is largely dependent on the operating performance of key intersections, which are critical capacity control points. SIDRA intersection modelling software was used to assess the proposed peak hour operating performance of intersections of interest on the surrounding road network. The criteria for evaluating the operational performance of intersections is provided by the Roads and Maritime Services Guide to Traffic Generating Developments (2002) and reproduced in Table 5. The criteria for evaluating the operational performance of intersections is based on a qualitative measure (i.e. Level of Service), which is applied to each band of average vehicle delay. Typically, a Level of Service (LOS) of D or better is considered acceptable.

Table 5 Level of service criteria for intersections

Level of Service	Average Delay (s)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control modes	At capacity, requires other control mode
F	> 70	Over Capacity Unstable operation	Over Capacity Unstable operation

As part of the VPA for the Panthers Precinct proposed developments, an intersection analysis has been undertaken on key intersections within proximity of the site including:

- Mulgoa Road / Great Western Highway / High Street;
- Mulgoa Road / Ransley Street / Retreat Drive;
- Retreat Drive Roundabout;
- Mulgoa Road / Panther Place;
- Mulgoa Road / Jamison Road; and
- Jamison Road / Harris Street

The analysis for the VPA includes a comparison of the existing and future intersection operations and upgrades incorporating traffic generation for future developments within the precinct (with the inclusion of ESQ 1818 Stage 4 and 5). The VPA assumes a set of upper-limit estimated design parameters and traffic distribution as outlined in Appendix A with the objective to meet overall network intersection operational performance of LoS D, or better, and minimise intersection vehicle queue lengths to reduce the impact on adjoining intersections.

The VPA assessment for the ESQ 1818 Stage 4 and 5 was based on an assumed upper-limit residential apartment provision, retail Gross Floor Area (GFA) and the Council agreed traffic generation rates. Penrith City Council is familiar with the VPA assessment, which should be read in conjunction with this report.

Table 6 Stage 4 and 5 trip generation composition with VPA

Stage	Land Use	Trip Generation rate	VPA Assessment Provision	VPA Trip Generation	Proposed provision (Turners Studio Architects)	Proposed Trip Generation
4/5	Residential	0.5 trips / dwelling	368 dwellings	184	333 dwellings	167
	Retail	2 trips / 100 m ² GLFA (GLFA=0.75 x GFA)	2,208 m ² GFA	33	2,185 m ² GFA	33
Total Trip (peak)				217		200

Based upon the comparison trip generation outlined in Table 6, it can be seen that the trip generation for the proposed Stage 4 and 5 development by Turners Studio Architects is less than the VPA assessment. Therefore, the VPA assessment aligns with future intersection operations and required roadworks outlined within the VPA assessment report. Reference is to be made to the VPA assessment report for any required road upgrades to support additional traffic generation resulting from the ESQ 1818 Stage 4 and 5 and surrounding future development proposals within the Panthers Precinct and background traffic growth.

4. Parking provision

4.1 Car parking provision

Since the development of the Transport Strategy, Council has produced a revised Development Control Plan and associated parking rates. This traffic and parking impact assessment reviews the parking component of the ESQ 1818 Stage 4 and 5 at Panthers development based on the Penrith City Council Development Control Plan 2014 (DCP) Part C10 Transport, Access and Parking. Table 7 provides a comparison to the minimum DCP parking requirements and the proposed parking provisions. The DCP outlines the following minimum parking requirements:

- Studio units – not specified
- One and two bedroom units: one space per unit.
- Three or more bedroom units: two spaces per unit.
- Visitor parking: one space per five units.
- Retail parking: 1 space per 30 m²

Table 7 ESQ 1818 Stage 4 and 5 development parking

Stage	Land Use	Use Type	Number	DCP(2014) Rate	Minimum Parking Provision	Proposed Parking Provision	
4	Residential	1-bed units	44 units	1 space per unit	44		
		2-bed units	67 units	1 space per unit	67		
		3-bed units	31 units	2 spaces per unit	62		
		4-bed units	13 units	2 spaces per unit	26		
				<i>subtotal</i>	199	215 (incl. 17 accessible)	
			Visitors	155 units	1 space per 5 units	31	32 (incl. 2 accessible)
		Retail	Retail	996 m ² GFA	1 space per 30 m ²	33	119 (incl. 6 accessible)
Subtotal					263	368	
5	Residential	1-bed units	59 units	1 space per unit	59		
		2-bed units	81 units	1 space per unit	81		
		3-bed units	38 units	2 spaces per unit	38		
					<i>subtotal</i>	178	222 (incl. 18 accessible)
			Visitors	178 units	1 space per 5 units	36	36 (incl. 2 accessible)
		Retail	Retail	1,189 m ² GFA	1 space per 30 m ²	40	N/A – located in Stage 4
	Subtotal					254	258
Total					517	626	

The proposal includes a total of 437 residential spaces and 68 residential visitor spaces to meet the relevant statutory minimum parking requirement for both the residential and residential visitor components. The total provision of 119 spaces for retail parking meets the relevant statutory minimum parking requirement and has been combined in the one area within Stage 4, to facilitate ease of access to public retail parking, minimising the need for retail parking to utilise the cul-de-sac road network located north of the development and to maximise the opportunity to separate the residential parking from retail parking where possible. Furthermore, sufficient parking has been provided to align with the relevant statutory minimum parking requirement for residential visitor parking provision.

Additionally, within the precinct, kerbside on-street parking has been provided, which could be utilised by visitors in the area in conjunction with the retail component.

It is further recommended that a Transport Access Guide (TAG) be established, which summarises alternate transport options to access the development, outlining where and how these services can be accessed, and the frequency of the services. This could include, but not limited to:

- Public transport locations (bus /train).
- Active transport (cycle/walking) opportunities.
- Bicycle infrastructure facilities.

Staff, residents and visitors should be encouraged to utilise such facilities, with the TAG advised as part of staff inductions for new employees and raised at regular team meetings for the retail component placing the TAG in prominent locations (i.e. as notice boards) within the buildings. The TAG should also incorporate the monitoring of the bicycle parking demand, with additional bicycle parking provided, if required.

4.2 Accessible parking

The Penrith City Council DCP has the following requirement for accessible parking:

Accessible car spaces should be provided in accordance with Premises Standards, Building Code of Australia and AS2890.

With reference to the above, the proposed development should provide:

- One space per each adaptable dwelling; and
- Visitor parking: Two percent of the total spaces.

A summary of the minimum and proposed accessible parking provision is outlined in Table 8.

Table 8 Accessible parking provision

Land Use	Total parking provided	Required Accessible Spaces	Accessible Spaces Provided
Residential	437	33 (assuming 10% adaptable units)	35
Residential Visitor *	68	3	4
Retail Visitor	119	3	3
Total	624	39	42

() A minimum of 1 accessible space has been provided in each Stage of the ESQ 1818 development*

The proposed development is required to provide a total minimum of 39 accessible car spaces to meet the DCP requirement. The proposal includes a total of 42 accessible car spaces within Stage 4 and 5 to meet the DCP requirement.

4.3 Car wash bay

The Penrith City Council DCP has the following requirement for a car wash bay:

- For residential flat buildings one space for car washing for every 50 units, up to a maximum of four spaces per building.

A summary of the car wash bay requirements and provision is outlined in Table 9. The proposal includes a provision of 8 car wash bays located within the basement level car park areas to meet the DCP requirement.

Table 9 Car wash bay provision

Stage	Number of units	Required Car Wash Spaces	Car Wash Provided
4	155	4	4
5	178	4	4
Total	333	8	8

4.4 Bicycle parking facilities

Penrith City Council DCP provides the bicycle parking suggested rates be in accordance with “Planning Guidelines for Walking and Cycling” (NSW 2004). This document outlines the suggested provision of:

- Residential:
 - Resident bicycle parking: 20-30 percent of the proposed number of units; and
 - Visitor Parking: 5-10 percent of the proposed number of units.
- Retail:
 - Staff Parking: 3-5 percent of the proposed number of staff; and
 - Visitor Parking: 5-10 percent of the proposed number of staff.

Information on staffing provision has yet to be established, therefore to assist in the guidance of the retail bicycle parking component, it has been based on Austroads Cycling Aspects of Austroads Guides, which outlines for shops as:

- Staff Parking: 1 space per 300 m² GFA; and
- Visitor Parking: 1 space per 500 m² GFA.

For the proposed development of 333 units, 2,145 m² GFA for retail and based upon the above rates, the suggested minimum total bicycle parking provision is outlined in Table 10.

Table 10 Bicycle parking provision

Stage	Land Use	Number of units / GFA	Minimum Recommended Bicycle Parking *		Bicycle Parking Provided	
			Residential	Staff / Visitor	Residential / Staff	Staff / Visitor
4	Residential	155 units	31-47	8-16	166 individual storage cages	
	Retail	996 m ²		5		16 racks (equiv. 32 bicycles)
5	Residential	178 units	36-54	9-18	178 individual storage cages	
	Retail	1,189 m ²		7		18 racks (equiv. 36 bicycles)
Total			67-101	29-34	344 individual storage cages	34 racks (equiv. 68 bicycles)

(* Based on the minimum rates outlined in Planning Guidelines for Walking and Cycling” (NSW 2004)

To encourage alternate sustainable transport options, the proposal includes the provision of new bicycle parking facilities to accommodate the bicycles in the residential individual storage cages. Additionally, bicycle racks within the basement areas are provided for the use of staff and visitors to the development. It is noted there is an opportunity to expand and provide additional bicycle parking within the basement areas should the demand exceed the bicycle parking supplied.

Furthermore, bicycle racks in the order of some 27 racks (equivalent to 54 bicycles) have been provided in the promenade between Stage 4 and 5. These bicycle racks offer increased accessibility for visitors to the area and provide a mechanism to support active transport options to/from and around the development.

It is recommended that in conjunction with the Transport Access Guide to be developed, the bicycle parking demand be monitored, with additional bicycle parking provided, if required.

4.5 Service vehicle parking (including Loading Docks)

The Panthers Master Plan focuses on a pedestrian oriented, quality-landscaped and urban public domain that will provide for equitable access for all modes of travel throughout the study area. In designing the internal road network for the proposed development, the specific needs of service vehicles and emergency vehicles has been provided.

Service vehicles will park in a loading bay located as close as possible to their destination point within the development.

A combined loading dock located on the ground floor within Stage 4 has been provisioned to minimise the need for heavy vehicles associated with deliveries and waste collection to utilise the cul-de-sac road network north of the development (refer to the separate waste management plan for detail of waste transfer between Stage 4 and 5). This loading dock has been designed to accommodate up to two x 10.5 m long vehicles (equivalent to the Council waste collection vehicle) for independent operation (refer to Figure 15). The loading dock length of approximately 19 m does provide the functionality of tandem vehicle arrangement of up to two x 10.5 m long, plus two x 6.4 m Small Ridge Vehicle (SRV) in the event such demand is needed.

In addition to the designated loading dock in Stage 4, an additional parking area on the ground floor of Stage 5 has been provisioned to accommodate two x 6.4 m SRV (refer to Figure 15). This can assist in supporting short term deliveries, maintenance vehicles to the development and assisting in parking for residents moving in and out of the development.

Each loading dock layout has been developed to allow for the design vehicle to enter and exit the development in a forward direction, providing improved safety associated with improved visibility when travelling in a forward direction.

It recommended that a loading dock management plan should be in place to manage the use and operations of the loading docks. The management plan will outline the operation of the loading dock (in Stage 4) and provide an opportunity to pre-arrange vehicular access to the loading dock and supporting parking area in Stage 5, such as deliveries or waste collection vehicles. Such a plan will assist in managing the arrival and departures of the vehicles, thereby minimising the potential risk of vehicles exceeding the on-site parking provision. The plan should also include activated signage at ground level prior to access. Such signage should advise drivers when the loading dock is occupied and not to enter the facility.

Additionally, convex mirrors should be installed in areas where sightlines maybe somewhat restricted, notably on ramp access areas and egress points from the loading dock. An example is shown in Figure 15.

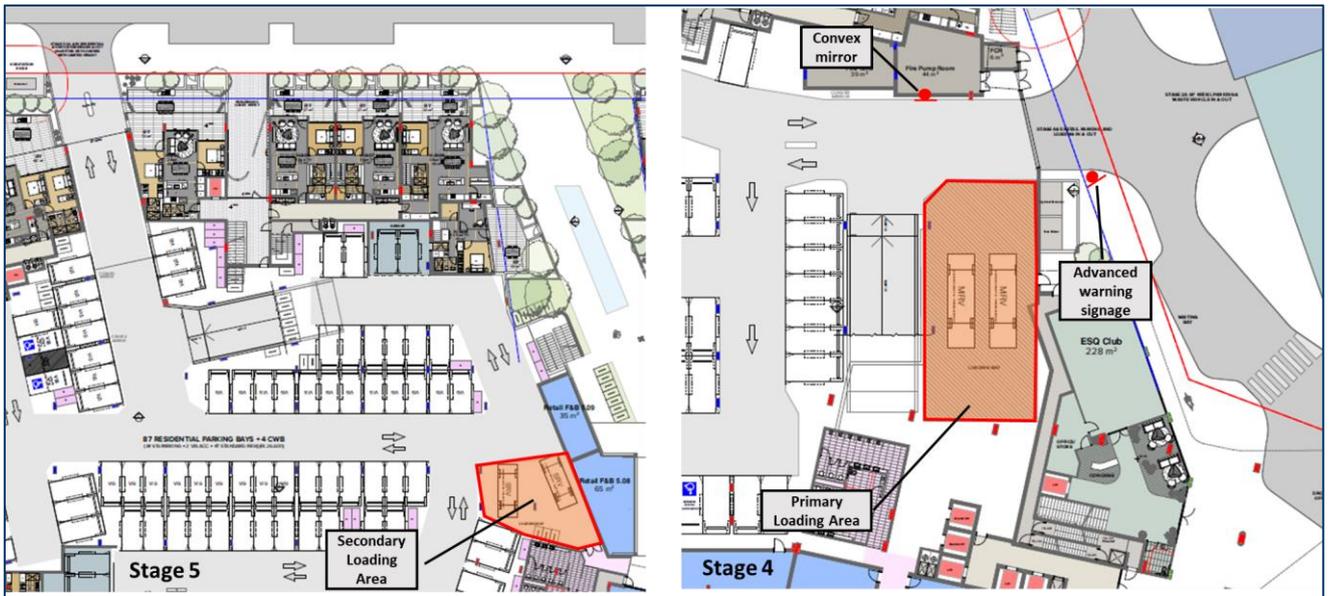


Figure 15 ESQ 1818 Stage 4 and 5 Service vehicle areas

Within Stages 4 and 5, there are eight car wash bays, as outlined in Section 4.3, which can facilitate small service vehicles such as utes and vans for supplementary general maintenance vehicles for the development.

Appendix B provides the turning path plans for 6.4 m SRV, 8.8 m MRV and 10.5 m service vehicle to access the proposed service vehicle loading docks, which shows the manoeuvrability within the site to allow the design vehicle to enter and exit the site in a forward direction. Additionally, the tuning path plans show the turn paths for a B99/B85 vehicle (light vehicles) as key areas such as circulation ramps within the development.

The turning path plan review indicates a minor encroachment on the kerblines on the external road connecting to the site access/egress to Stage 4 and within close proximity of the internal wall opposite the loading dock. Such amendments to accommodate the minor encroachment should be addressed in future design stages. Access for an SRV into Stage 5 will require the vehicle to travel for a short distance across the road centre line, to negotiate the turn. This area will have slow traffic speed and clear visibility to oncoming traffic in order to facilitate the manoeuvre into the site for such vehicle type.

4.6 Other parking provisions

The development also includes the provision of eight motorcycle parking spaces to aid in alternate transport options and for four electric vehicle parking spaces to support the opportunity for electric vehicle use and minimisation of environmental impacts.

5. Parking layout and access review

5.1 General layout

An assessment of the car parking has been undertaken using *AS2890.1 – Off Street Car Parking*. Table 1.1 of AS2890.1 which presents a number of car park classifications applicable to different land-uses. According to the table, the car park will comprise a Class 1A facility suitable for residential use, and Class 2 facility, which is suitable for the use of generally medium-term parking (visitors). The parking space dimensions and associated aisle widths for each facility classification are presented in AS2890.1: Figure 2.2 include:

- Class 1A facility (residential):
 - Spaces: 2.4 m x 5.4 m; and
 - Aisle Width: 5.8 m
- Class 2 facility (retail):
 - Spaces: 2.5 m x 5.4 m; and
 - Aisle Width: 5.8 m

A review of the parking layout has been completed within the proposed development. The basement parking consists of residential parking spaces with minimum dimensions of 2.4 m x 5.4 m (typically 2.5 m wide) and aisle widths of minimum 5.8 m and visitor/retail parking space dimensions with dimensions of 2.5 m x 5.4 m and aisle widths of minimum 5.8 m.

The proposed parking spaces and aisle dimensions provided align with AS2890.1 user classes.

Appendix B provides turning path plans for a B85/B99 design vehicles at ramp locations to advise on the desirable turn path requirements. It was identified there is encroachment of the turn path in Stage 4 from Basement 1 to Basement 2 (at the top of ramp) with ramp wall blades potential restricting the passing of vehicles unobstructed.. Such amendments should be accommodated in future design stages and may include traffic management to minimise the concurrent passing of vehicles, a splay of the ramp wall blades and/or shifting of the adjoining car spaces the facilitate assisting in the vehicle clearances.

5.2 Car park circulation

5.2.1 Stage 4 Residential Component

The residential parking for Stage 4 is located in Basement 1 and Basement 2. A separate access to the residential parking has been provided on the northern road network, from the retail access on the eastern side road network, refer to Figure 16. The basement level parking provides visitor parking provision within immediate proximity to the basement access. Circulation is available throughout the basement to allow vehicles to exit and enter the basement in a forward direction. Clockwise vehicle circulation is available within the visitor parking area to allow vehicles to exit in a forward direction when leaving the site or in the event of full occupancy of the visitor car parking.

It is recommended clear signage be provided on the location of the visitor parking area and identify the area where residential parking is only provided past a specific point. Convex mirrors are to be provided in areas where sight visibility may be somewhat restricted between the conflicting movements to aid in circulation. Key locations have been identified in the architectural plans, which predominately occur at ramp / aisle interfaces and parking aisles where acute angles are proposed.

Furthermore, consideration should be given to parking identification measures to be provided within the visitor parking area and be linked in real-time to a sign at the entry to the car park to advise motorists prior to entering the car park whether visitor parking is available.

5.2.2 Stage 5 Residential Component

The ground floor and basement car parking in Stage 5 consists of two-way circulation throughout the parking module. The basement level parking provides visitor parking provision within immediate proximity to the basement access and parking aisle. Circulation is available throughout the basement to allow vehicles to exit and enter the basement in a forward direction, however it will require a three-point turn utilising the nearby aisle. It is therefore recommended that parking identification measures are provided within the visitor parking area and linked in real-time to a sign at the entry to the car park to advise motorists prior to entering the car park whether visitor parking is available. Furthermore, convex mirrors are to be provided in areas where sight visibility may be somewhat restricted between the conflicting movements to aid in circulation. Key locations have been identified in the architectural plans, which predominately occur at ramp / aisle interfaces and parking aisles where acute angles are proposed.

5.2.3 Stage 4 and 5 Retail Component

The retail parking for the development has been combined in a single location on the ground floor and Basement 1 under Stage 4 for with a designated access from the eastern roadway. This will minimise the need of traffic associated with retail demand travelling in the cul-de-sac road network north of the development.

The retail car park consisting of generally of a one-way circulation aisle which will enable ease of recirculation within the car park. There is a two-way blind aisle in Basement 1 which will utilise an end-bay turning facility. Clear delineation and signage are to be provided, restricting parking within the turning area. Furthermore, this parking area within the blind aisle can be dedicated to staff parking and be identified as such prior to the entry to the two-way blind aisle area. This will reduce the risk of general retail associate vehicles entering this area and having the need to turn around in the event of the parking area being fully utilised.

Convex mirrors are to be provided in areas where sight visibility may be somewhat restricted between the conflicting movements to aid in circulation. Key locations have been identified in the architectural plans, which predominately occur at ramp / aisle interfaces and parking aisles where acute angles are proposed.

Consideration should be given to parking identification measures to be provided within the retail parking area and be linked in real-time to a sign at the entry to the car park to advise motorists prior to entering the car park whether retail parking is available.

5.3 Site access review

The sight distance requirements are described in Section 3.2 of AS2890.1 and are prescribed on the basis of the signposted speed limit or 85th percentile vehicle speeds along the frontage road.

Egress from the development sites is via the proposed new access road, which is anticipated to have a speed limit of up to 40 km/h. The ESQ 1818 precinct is in a low-speed environment with on-street parking, narrow road environment and traffic control measures to assist in maintaining traffic speeds. AS2890.1 sight distance requirements are provided for speeds from 40 km/h. The sight distance at 40 km/h requires a desirable visibility distance of 55 m and a minimum distance of 35 m. The proposed driveway access to each development is located on a straight section of the road alignment with no anticipated permanent obstructions to affect the visibility from the driver when exiting the site.

5.4 Road network

The road network within the ESQ 1818 precinct provides a connection to the existing Retreat Drive via a priority controlled intersection and the Ransley Street roundabout. A central road (6.5 m wide) provides two-way access and kerbside side parking (2.5 m wide), generally in line with DCP 2014 E13 Part B Panthers Precinct secondary streets with Parking (Road Type 2a). A minor one-way road (4.6 m wide) provides circulation north Stage 3. It is proposed to provide a one-way link (4.6 m wide) east of Stage 4, primarily aimed as a pedestrian area, while still providing vehicular access to the car park facility. Refer to Figure 16.

Additionally, it is proposed to create a roundabout at the intersection with the new eastern road and existing access to the aqua golf car park and a small loading area to the rear of the club (refer to Figure 17). The

roundabout is proposed to maintain access to the existing and future developments, reduce the speed of vehicles and minimise the risk of serious injury crashes by reducing the angle of impact in the event of a crash. This roundabout will need to be designed in line with relevant guidelines and standards and provide a sufficient turn path for the design vehicle of the proposed development's design vehicle (10.5 m waste collection vehicle) and the existing loading facility associated with the club (vehicle size unknown, but anticipated to align with a vehicle similar to the council waste collection vehicle)

Short term drop off/pick up layby facilities are proposed on the eastern road north of the roundabout (refer to Figure 17). Such facilities should limit parking to short term either designated as "No Parking" (where the vehicle is to remain parked for up to two minutes and the driver must remain within 3 m of the vehicle) or alternatively P5 minute, which permit the vehicle to park for up to five minutes and allow the driver to leave the vehicle unattended during this time to add in short term deliveries.

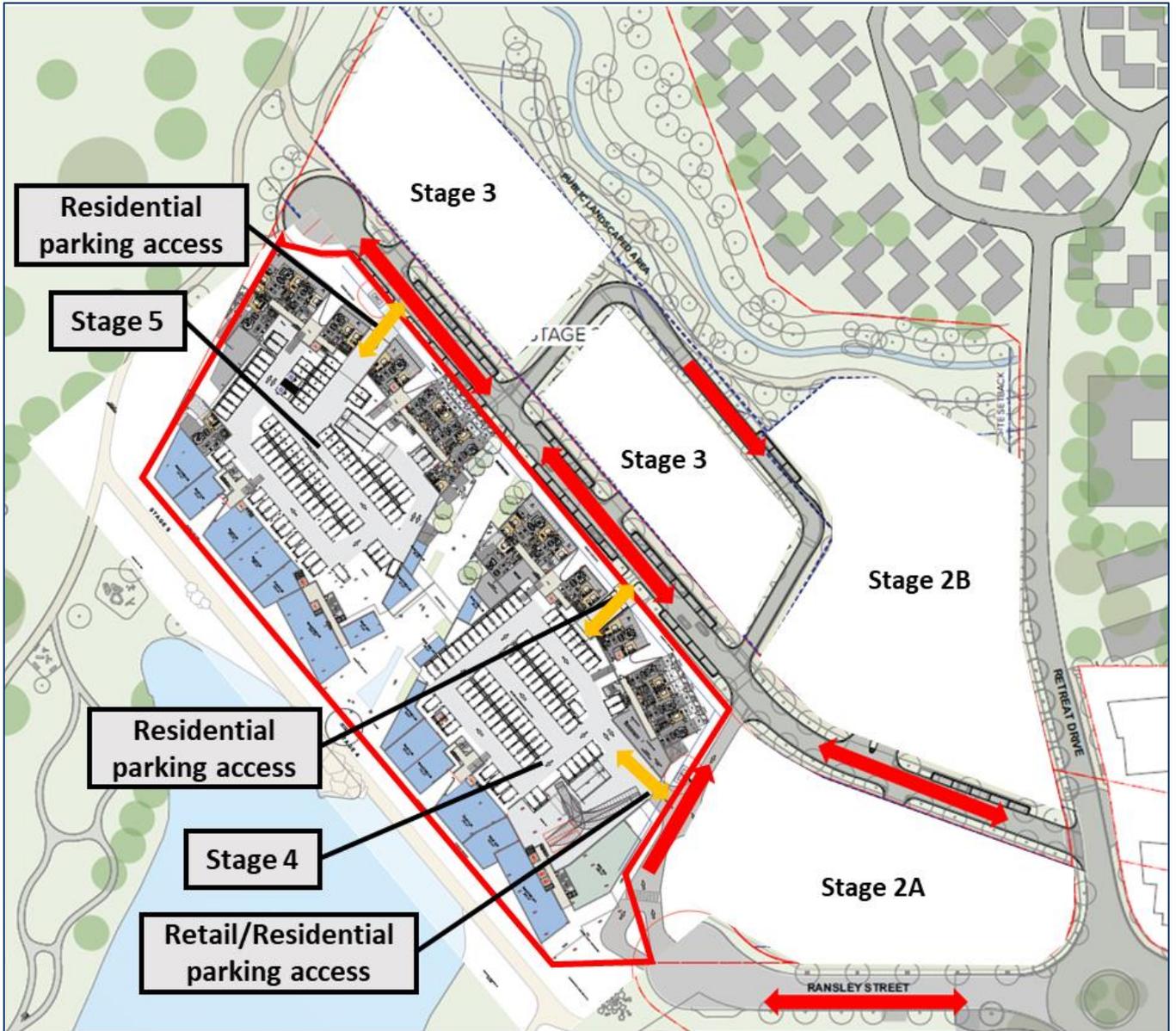


Figure 16 ESQ 1818 external road network and parking access

5.5 Pedestrian network

Designated formed footpaths are proposed along the internal road network to generally align with the DCP 2014 E13 Part B Panthers Precinct. Key connective paths are provided to attraction nodes, such as the lake foreshore and promenade between Stage 4 and 5. Pedestrian crossing facilities should be provided to key link areas to the development (refer Figure 18) to promote safer active transport alternatives. Such pedestrian crossings should incorporate raised “wombat” crossings and be designed in line with relevant guidelines and standards. The raised crossing aid in the mobility of pedestrians as well as slowing vehicles on approach and through the facility.

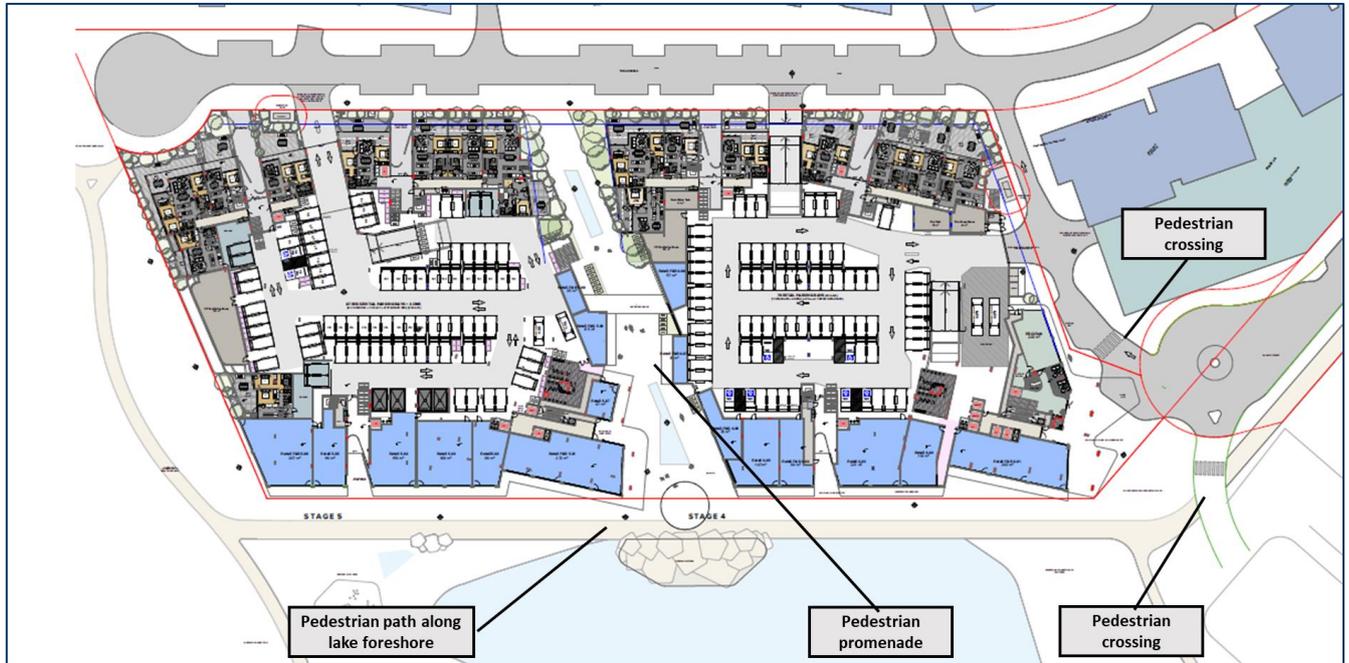


Figure 18 ESQ 1818 pedestrian network

6. Summary and conclusion

6.1 Proposed works

This traffic and parking impact assessment statement outlines the traffic, transport, parking and access impacts as a result of the proposed residential development for ESQ 1818 Stage 4 and 5 Lot 2 within the Penrith Panthers Precinct, which comprises of:

- Residential apartments: 333 units
- Retail space: 2,185 m² GFA
- Car parking spaces:
 - Residential: 437 spaces (including 35 accessible spaces)
 - Visitor: 68 spaces (including 4 accessible spaces)
 - Retail: 119 spaces (including 3 accessible spaces)
- Bicycle parking:
 - 344 individual storage cars for residents that can store bicycles
 - 34 rack (equivalent to 68 bicycles) in basement areas
 - 27 racks (equivalent to 54 bicycles) have been provided in the promenade between Stage 4 and 5
- Motorcycle parking: 8 spaces
- Car wash facilities: 8 car wash bays
- Electric vehicles: 4 spaces

Service vehicle parking:

- A combined loading dock located on the ground floor within Stage 4 to accommodate up to two x 10.5 m long vehicles (equivalent to the Council waste collection vehicle) for independent operation. The loading dock length of approximately 19 m does provide functionality of tandem vehicle arrangement of up to two x 10.5 m long, plus two x 6.4 m Small Ridge Vehicle (SRV).
- An additional parking area in ground floor of Stage 5 has been provisioned to accommodate two x 6.4 m SRV to assist in supporting short term deliveries, maintenance vehicles to the development and assisting in parking for residents moving in and out of the development.
- Additional there are eight car wash bays within the basement that can supplement maintenance vehicles such as utes/vans if required.

6.2 Traffic impact

The broad conclusions of the traffic impact assessment within the report are as follows:

- The traffic generation of the proposed development based on the agreed trip generation rates is 200 trips, which is compatible with the 217 trips assessed as part of the VPA analysis. Therefore the intersection operation and required roadworks are to align with the VPA requirements.
- Reference is to be made to the VPA report for any required road upgrades to support additional traffic generation resulting from the Stage 4 and 5 development, surrounding future development proposals within the Panthers Precinct and background traffic growth.

6.3 Parking provision and layout

The broad conclusions of the parking assessment within the report are as follows:

- An assessment of the statutory parking requirement against the Penrith City Council DCP indicates that the proposed development meets the minimum requirements for the residential, residential visitor and retail components.

- Accessible parking is provided in line with the Penrith City Council DCP minimum requirements
- The layout of the basement car park is generally in accordance with AS2890.1, AS2890.2, and AS2890.6,
- An assessment of the loading dock facility accommodating up to two x 10.5 m long vehicles (equivalent to the Council waste collection vehicle) for independent operation. The loading dock length of approximately 19 m does provide the functionality of tandem vehicle arrangement of up to two x 10.5 m long, plus two x 6.4 m SRV.
- Turning path plan review indicates a minor encroachment on the kerbline on the external road connecting to the site access/egress to Stage 4 and within close proximity of the internal wall opposite the loading dock. Such amendments to accommodate the minor encroachment should be addressed in future design stages
- A total of two SRV designated spaces are provided in Stage 5 in addition to the total of eight car wash bays provided within the development can facilitate small service vehicles such as utes and vans for supplementary general maintenance vehicles (if required).
- Turning path plan review indicates encroachment of the turn path in Stage 4 from Basement 1 to Basement 2 (at the top of ramp) with ramp wall blades potential restricting the passing of vehicles unobstructed. Such amendments should be accommodated in future design stages and may include traffic management to minimise the concurrent passing of vehicles, a splay of the ramp wall blades and/or shifting of the adjoining car spaces the facilitate assisting in the vehicle clearances.
- Vehicles are able to enter and exit the site in a forward direction.

6.4 Mitigation measures

It is recommended that the following key mitigation measures be implemented for the development:

- A loading dock management plan to manage the arrival and departures of service vehicles to the site reducing the potential of multiple service vehicle arrivals, with activated advance warning signage prior to entry to the development to advise drivers that the loading docks are occupied and not to enter the facility and convex mirrors to improve visibility.
- Convex mirrors should be provided in areas where sight visibility may be somewhat restricted between the conflicting movements to aid in circulation.
- A Transport Access Guide (TAG) to identify alternate travel options for residents, visitors and staff to encourage sustainable transport and reducing parking demand. The TAG should incorporate monitoring of the bicycle parking demand, with additional bicycle parking provided, if required.
- Parking identification (and directional signage) measures for the retail and residential visitor components be implemented to advise motorists prior to entering the car park whether parking is available.

6.5 Conclusion

Based on the assumptions and investigations undertaken by GHD and the conclusions drawn above, it is considered that the proposed Stage 4 and 5 development satisfies the planning requirements on traffic engineering grounds with regards to Penrith City Council DCP requirements the forecast traffic generation associated with the proposed development aligns with the VPA analysis.

Appendix A

Panthers Precinct VPA Parameters

Panthers Precinct Modelling Parameters

Table 1 - Summary of Scenarios for traffic modelling

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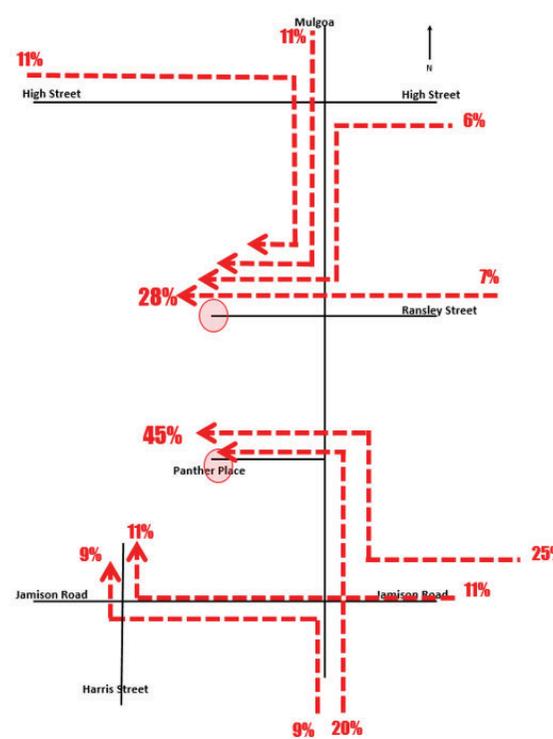
Scenario	Year of modelling	Lot	Development Stage/ Land Use	Number (units/dwelling)	Number GFA (m ²)	Trip Generation Rate
Existing	2016 base model	1A	Existing Club Expansions	N/A	N/A	N/A – Included in existing Base Traffic model ^
		1B	Existing Chifley Hotel	N/A	N/A	N/A – Included in existing Base Traffic model ^
		1E	lfly	N/A	N/A	N/A – Included in existing Base Traffic model ^
		Lot 8	NRL Academy	N/A	N/A	N/A – Included in existing Base Traffic model ^
1	2019	Lot 6	Seniors Living	151 dwellings	25,488 m ²	0.4 trips / dwelling
2	2020	Lot 3A + 3B	ESQ Stage 1 – Residential	152 dwellings	12,975 m ²	0.5 trips / dwelling
		Lot 2	ESQ Stage 2A/2B – Residential	186 dwellings	16,070 m ²	0.5 trips / dwelling
			ESQ Stage 2A/2B – Retail	N/A	1,225 m ²	2 trips/100 m ² GLFA (GLFA = 0.75 x GFA)
3 (Stage 1)	2021	Lot 4	<i>Western Sydney Conference and Community Centre</i>			
			• Conference Centre	1000 seats	3,034 m ²	0.32 trips per seat *
			• Community Centre	N/A	1,244 m ²	AM Peak: 2.81 trips /100 m2 GFA * PM Peak: 2.5 trips /100 m2 GFA *
			• Panther Retail	N/A	141 m ²	2 trips/100 m ² GLFA (GLFA = 0.75 x GFA) *
			• Hotel	190 rooms	9,500 m ²	0.5 trips / room *
• Serviced Apartments	137 rooms	11,100 m ²	0.5 trips / room *			
3 (Stage 2)	2021	Lot 4	<i>Western Sydney Conference and Community Centre</i>			
			• Hotel	190 rooms	12,079 m ²	0.5 trips / room *
3 (Stage 3)	2021	Lot 4	<i>Western Sydney Conference and Community Centre</i>			
			• Serviced Apartments	145 rooms	9,980 m ²	0.5 trips / room *
			• Panther Retail	N/A	1,170 m ²	2 trips/100 m ² GLFA (GLFA = 0.75 x GFA) *
4	2022	Lot 2	ESQ Stage 3 – Residential	144 dwellings	12,135 m ²	0.5 trips / dwelling
5	2024	Lot 2	ESQ Stage 4/5 – Residential	368 dwellings	34,000 m ²	0.5 trips / dwelling
			ESQ Stage 4/5 – Retail	N/A	2,208 m ²	2 trips/100 m ² GLFA (GLFA = 0.75 x GFA)
		Lot 1C	Entertainment Leisure Centre	N/A	2,600 m ²	0.6 trips/100 m ² GFA
			Retail	N/A	1,200 m ²	2 trips/100 m ² GLFA (GLFA = 0.75 x GFA)
		Residential	48 dwellings	4,100 m ²	0.5 trips / dwelling	
Lot 1A	Existing Club – Future Expansion	N/A	5,000 m ²	1 trip/100 m ² GFA		
6	2025	Lot 9	<i>Commercial Office and indoor recreation</i>			
			• Commercial office	N/A	7,500 m ²	AM Peak: 1.6 trips /100 m2 GFA # PM Peak: 1.2 trips /100 m2 GFA
		• Indoor Recreation	N/A	7,500 m ²	0.5 trips/100 m ² GFA	
Lot 7	Car Park	N/A		N/A: Parking area only – No additional traffic flow has been assumed.		
7	2026	Lot 1D	• Serviced Apartments	84 dwellings	6,495 m ²	0.5 trips / room
			• Retail	N/A	900 m ²	2 trips/100 m ² GLFA (GLFA = 0.75 x GFA)
			• Car Park	N/A	N/A	N/A – traffic generation associated with land use
8	2031	Lot 5	Residential	300 dwellings	25,500 m ²	0.5 trips / dwelling

Notes:

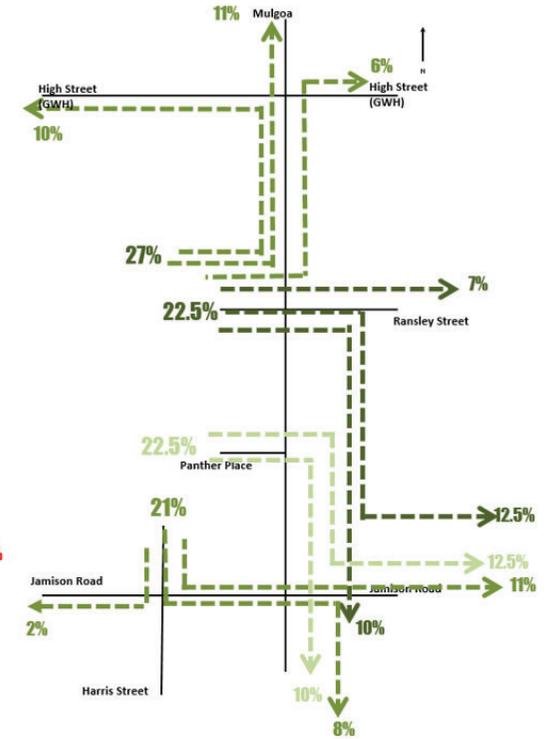
- (*) Lot 4 rates for Western Sydney Community and Conference Centre (based on ITE and first principles) and rates for Hotel/Service apartment/retail components Panthers Prescient Masterplan. Approved by Council email from Joel Carson dated 15/1/2018.
- (#) RMS TDT 2013/04a: Guide to Traffic Generation Developments – Updated traffic surveys
- (^) The masterplan traffic generation not applicable as these developments were completed prior to the base model of 2016. As agreed at Council meeting with Joel Carson and Walter Sinnadurai (29/1/2018)
- Trip generation rates as per Table 1 above is agreed by Council via email from Joel Carson dated 29/1/2018
- Lot 10 (planned zone substation) is no longer proceeding



Lot location map – Penrith Panthers site



Traffic Distribution To/From the Penrith Panthers Site

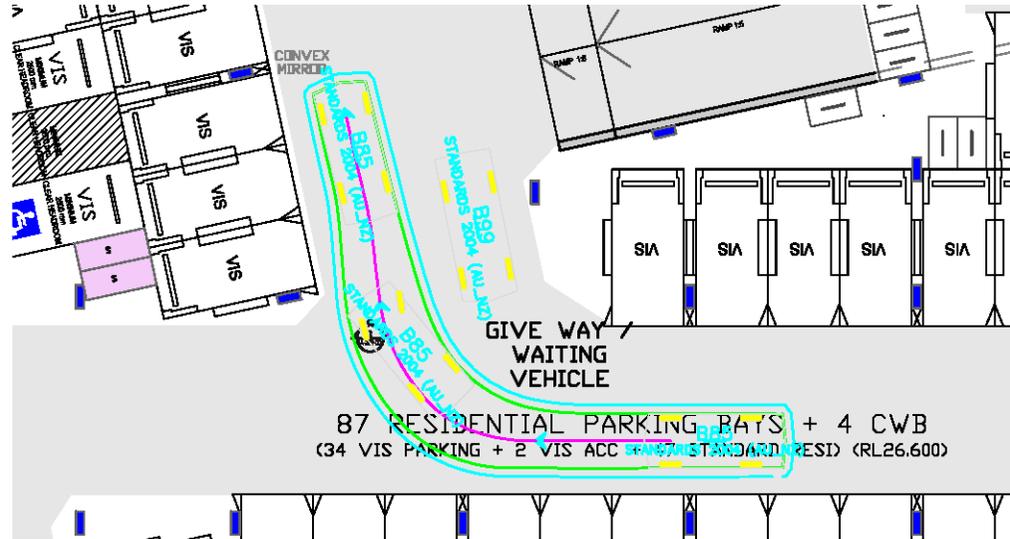


Appendix B

Turning Path Plans

Ground Level Turn Paths

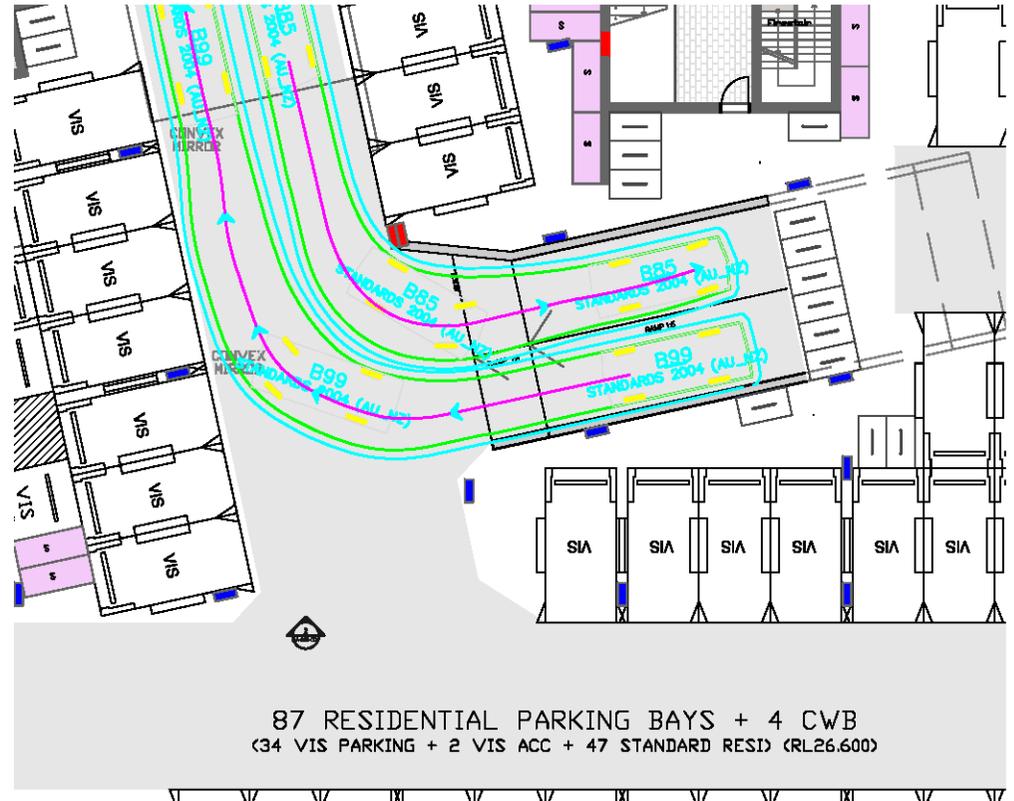
Stage 5 - Turn Paths including Give Way



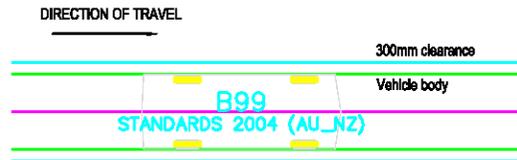
Stage 5 - Turn Paths not including Give Way



Stage 5 - Turn Paths at Ramp



LEGEND



VEHICLE PROFILES (NOT TO SCALE)

Vehicle	Width (meters)	Track (meters)	Lock to Lock Time	Steering Angle
B85	1.87	1.77	6.0	34.1
B99	1.94	1.94	6.0	33.9



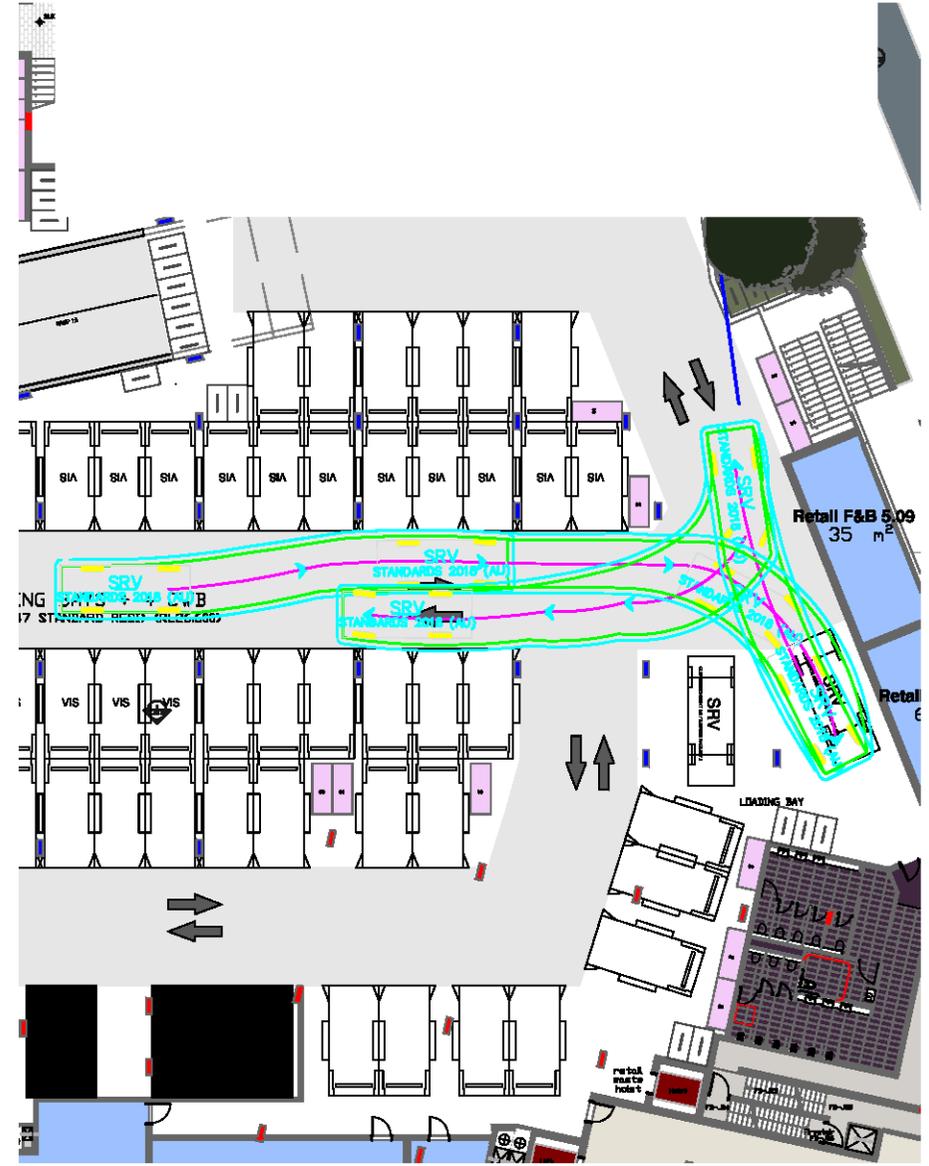
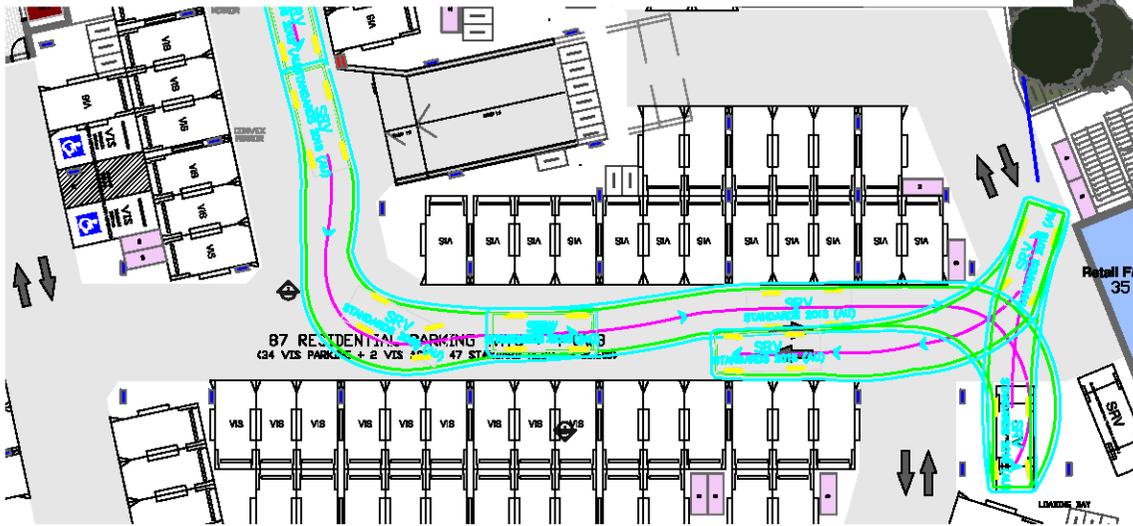
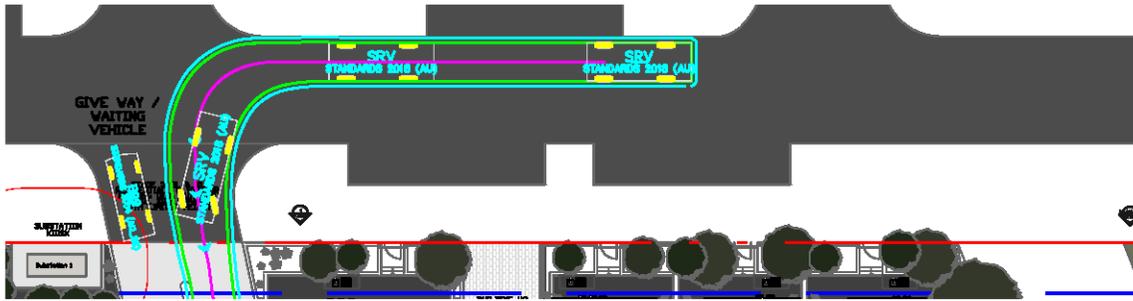
FOR DA SUBMISSION

TURNER STUDIO ARCHITECTS
 PROPOSED MIXED DEVELOPMENT, PANTHERS NORTH PRECINCT, PENRITH
 TURN PATH ANALYSIS - B85 and B99 Vehicles
 GROUND LEVEL (STAGE 5)

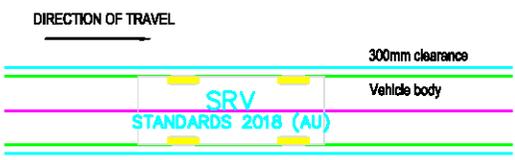
DA-110-008

REV 02

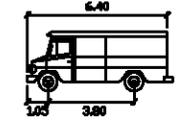
17/12/2021



LEGEND



VEHICLE PROFILE (NOT TO SCALE)



SRV

	metres
Width	2.30
Track	2.30
Lock to Lock Time	5.0
Steering Angle	38.1

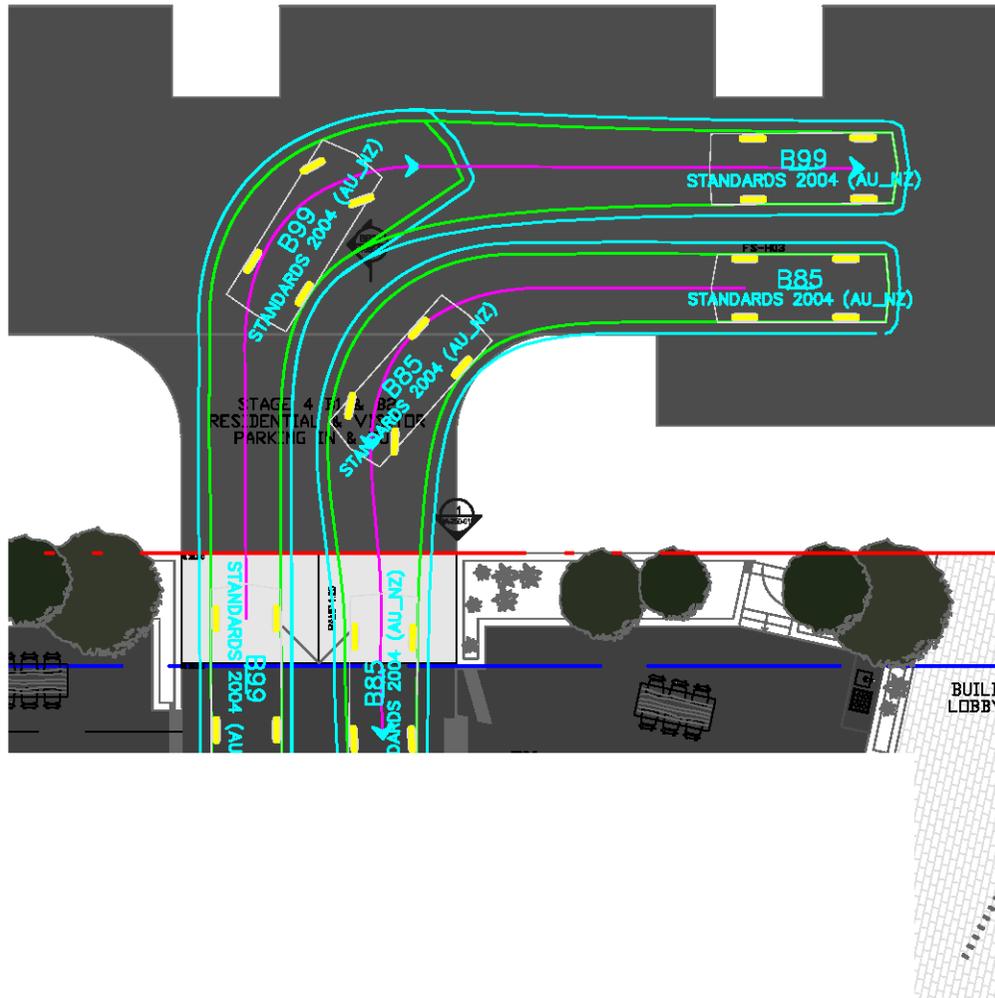


FOR DA SUBMISSION

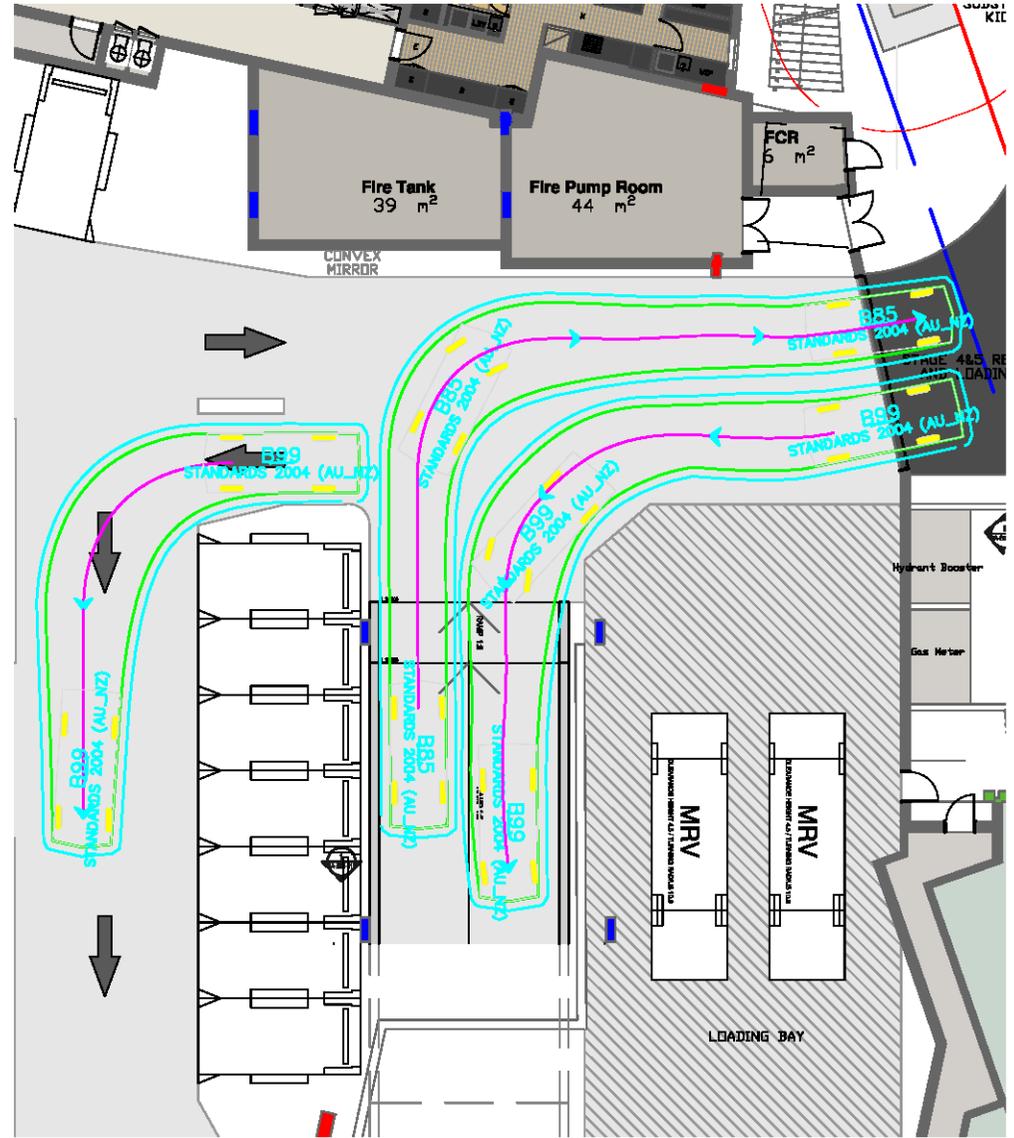
TURNER STUDIO ARCHITECTS
 PROPOSED MIXED DEVELOPMENT, PANTHERS NORTH PRECINCT, PENRITH
 TURN PATH ANALYSIS - SRV Vehicle
 GROUND LEVEL (STAGE 5)

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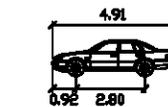
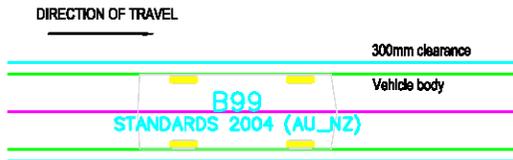
Turn Paths - Residential and Visitor Parking



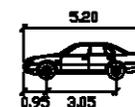
Turn Paths - Retail Parking



VEHICLE PROFILES (NOT TO SCALE)



B85		units
Width	4.91	meters
Track	2.80	meters
Lock to Lock Time	6.0	seconds
Steering Angle	34.1	degrees



B99		units
Width	5.20	meters
Track	3.05	meters
Lock to Lock Time	6.0	seconds
Steering Angle	33.9	degrees



FOR DA SUBMISSION

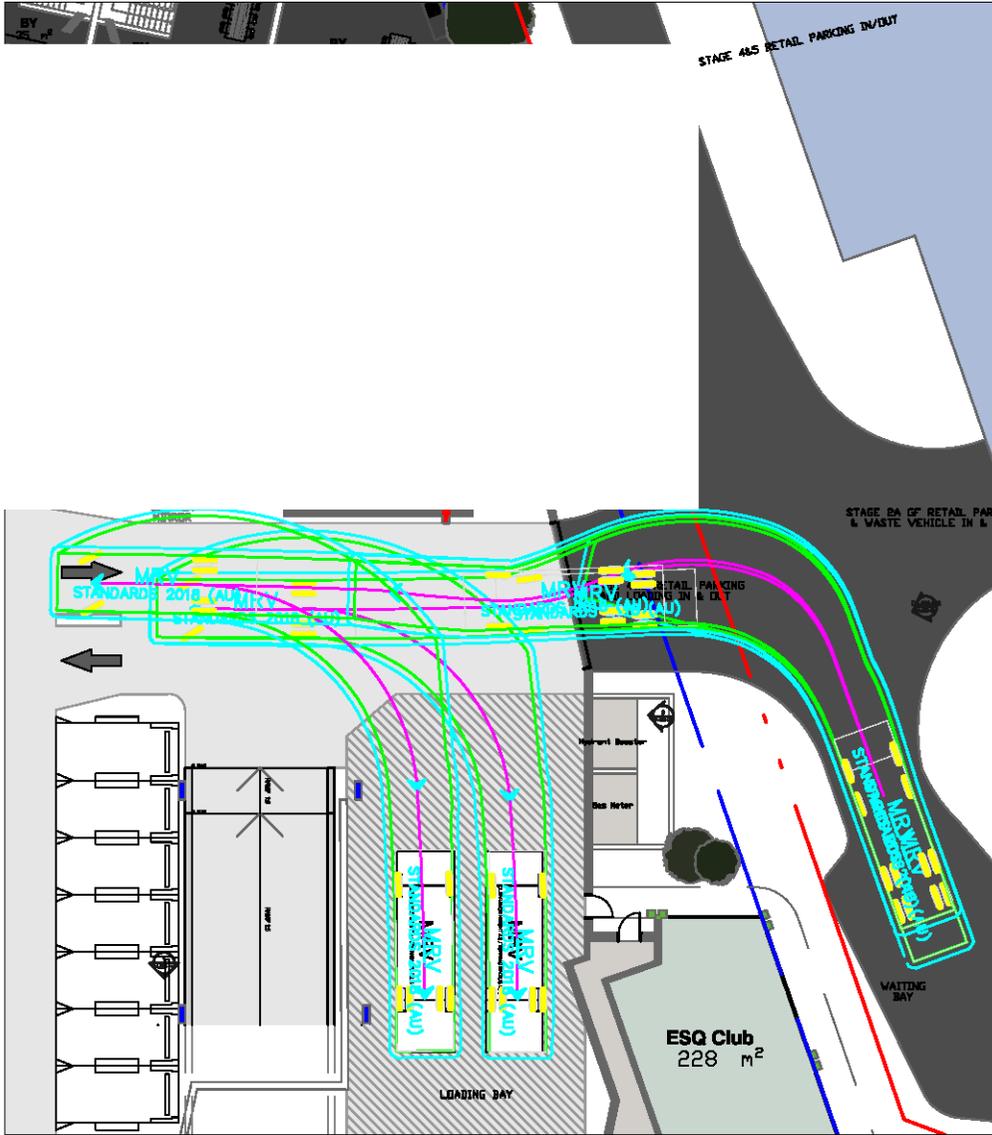
TURNER STUDIO ARCHITECTS
 PROPOSED MIXED DEVELOPMENT, PANTHERS NORTH PRECINCT, PENRITH
 TURN PATH ANALYSIS - B85 and B99 Vehicles
 GROUND LEVEL (STAGE 4)

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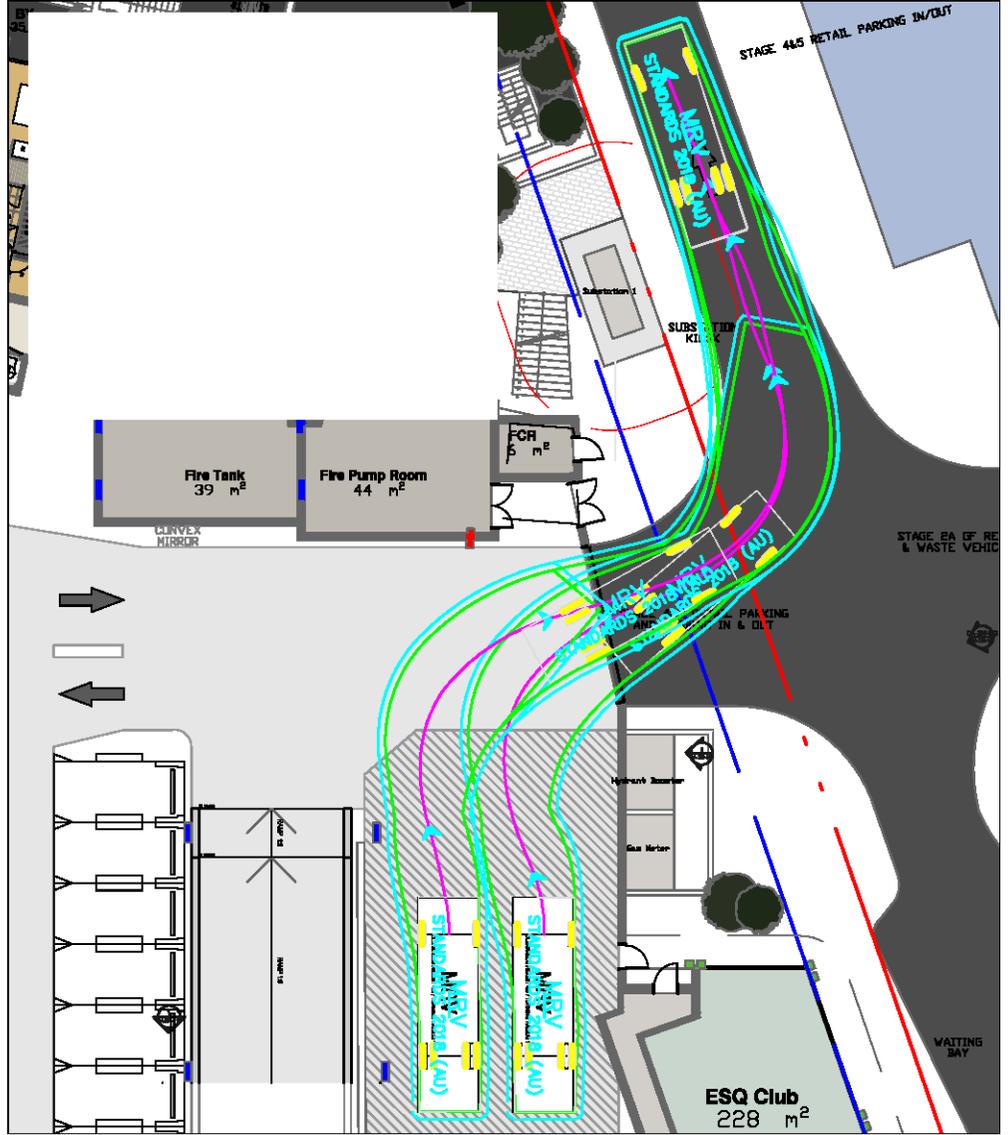
REV 02

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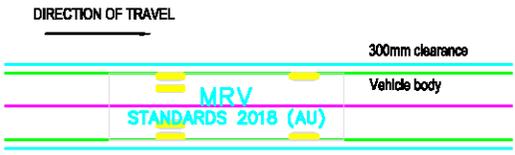
Entry Turn Paths - 8.8m MRV



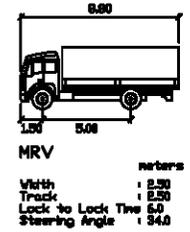
Exit Turn Paths - 8.8m MRV



LEGEND



VEHICLE PROFILES (NOT TO SCALE)



FOR DA SUBMISSION

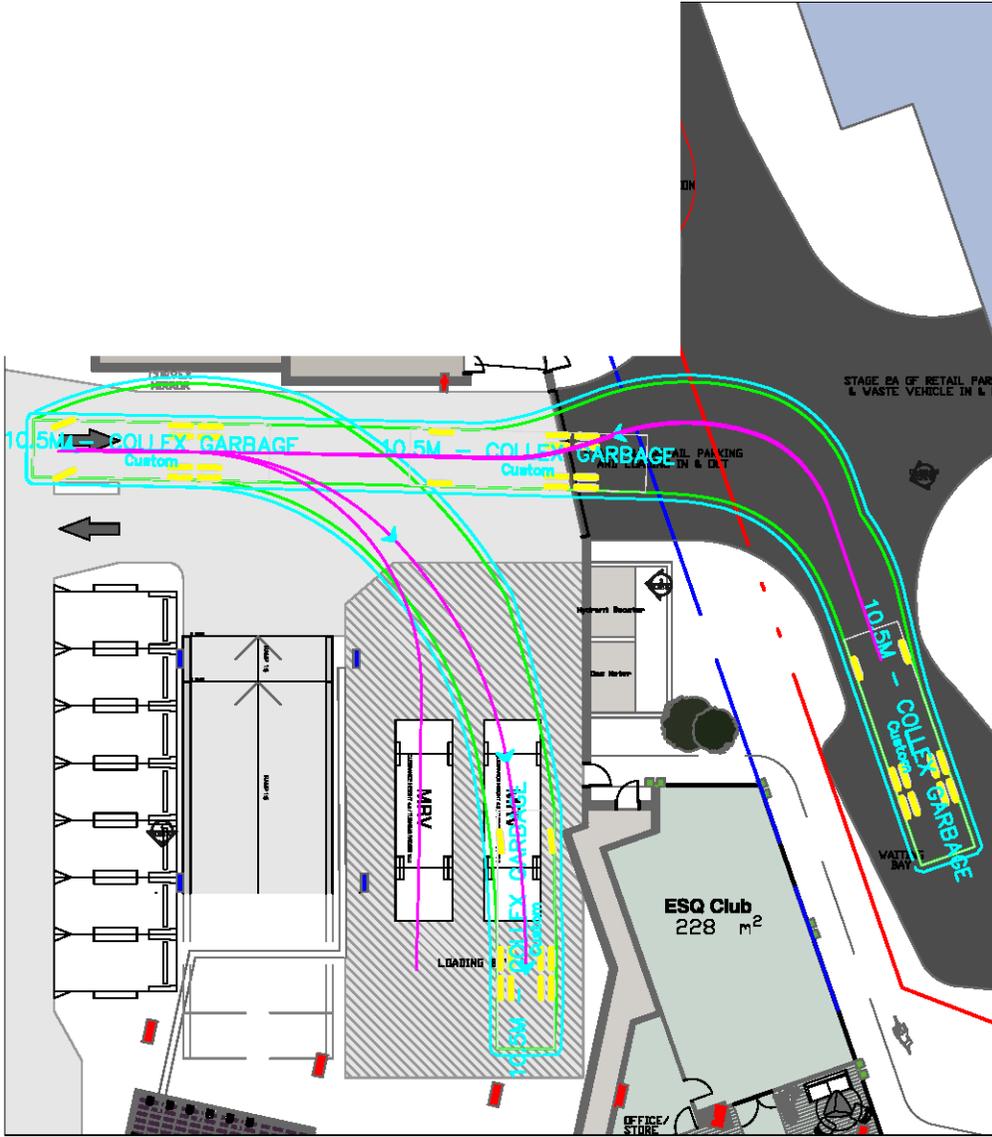
TURNER STUDIO ARCHITECTS
 PROPOSED MIXED DEVELOPMENT, PANTHERS NORTH PRECINCT, PENRITH
 TURN PATH ANALYSIS - MRV Waste Vehicle
 GROUND LEVEL (STAGE 4)

DA-110-008

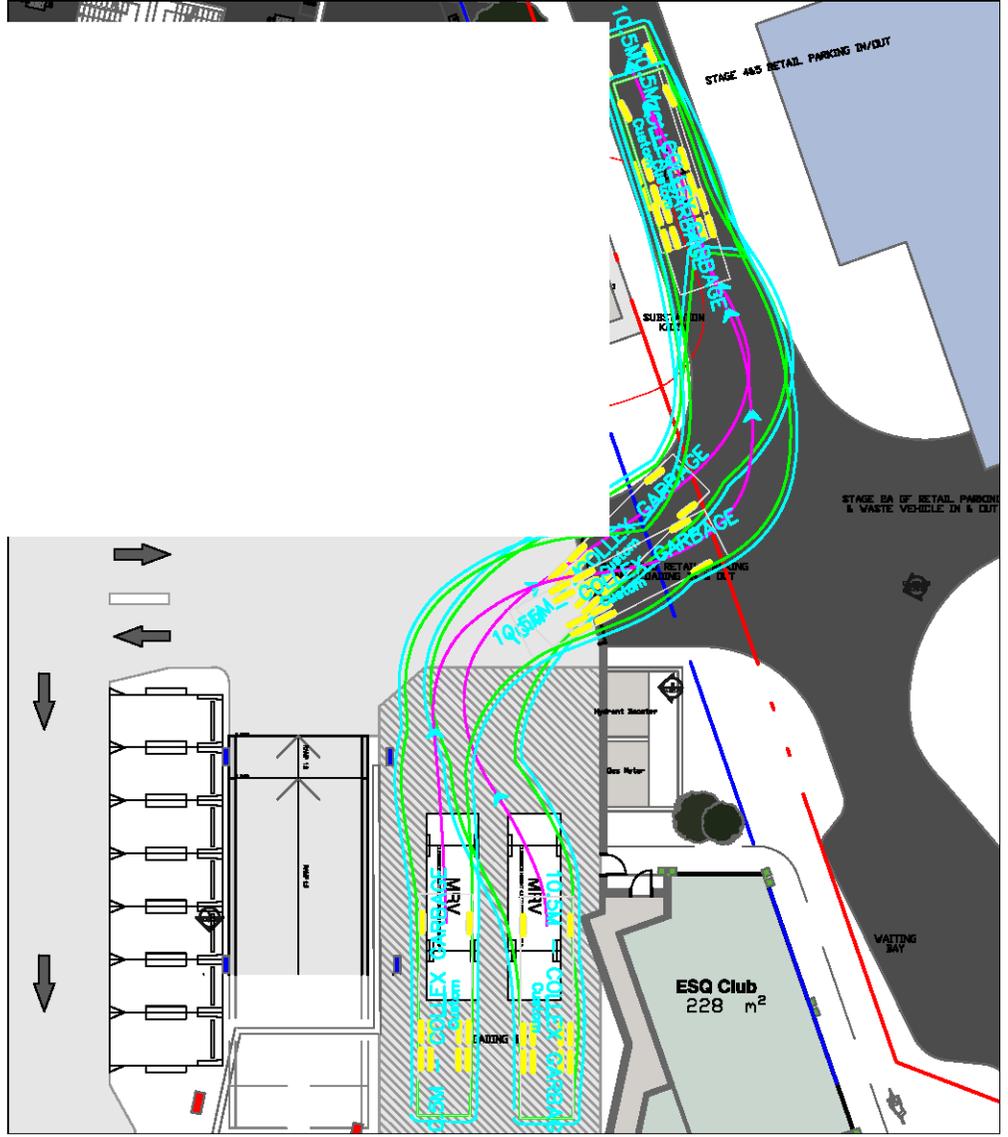
REV 02

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Entry Turn Paths - 10.5M Waste Vehicle



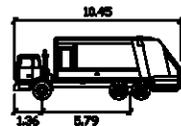
Exit Turn Paths - 10.5M Waste Vehicle



LEGEND



VEHICLE PROFILES (NOT TO SCALE)



10.5M - COLLEX GARBAGE	
meters	
Width	2.30
Track	2.30
Lock to Lock Time	6.3
Steering Angle	36.6



FOR DA SUBMISSION

TURNER STUDIO ARCHITECTS
 PROPOSED MIXED DEVELOPMENT, PANTHERS NORTH PRECINCT, PENRITH
 TURN PATH ANALYSIS - 10.5M Waste Vehicle
 GROUND LEVEL (STAGE 4)

DA-110-008

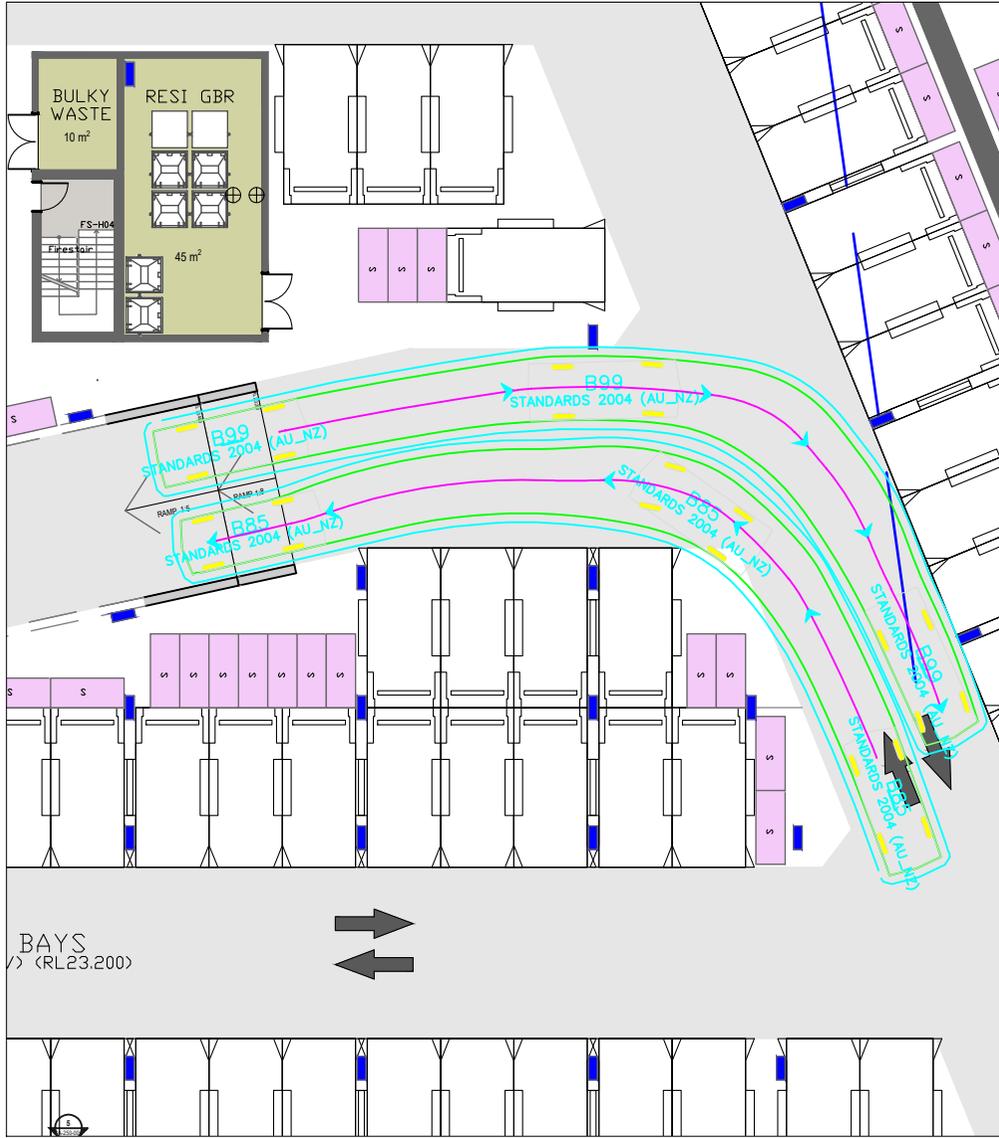
REV 02

17/12/2021

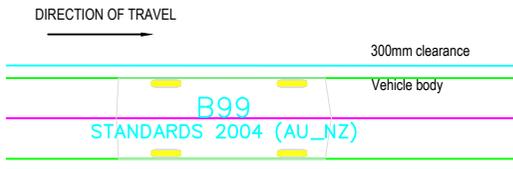
Basement Level 01

Turn Paths

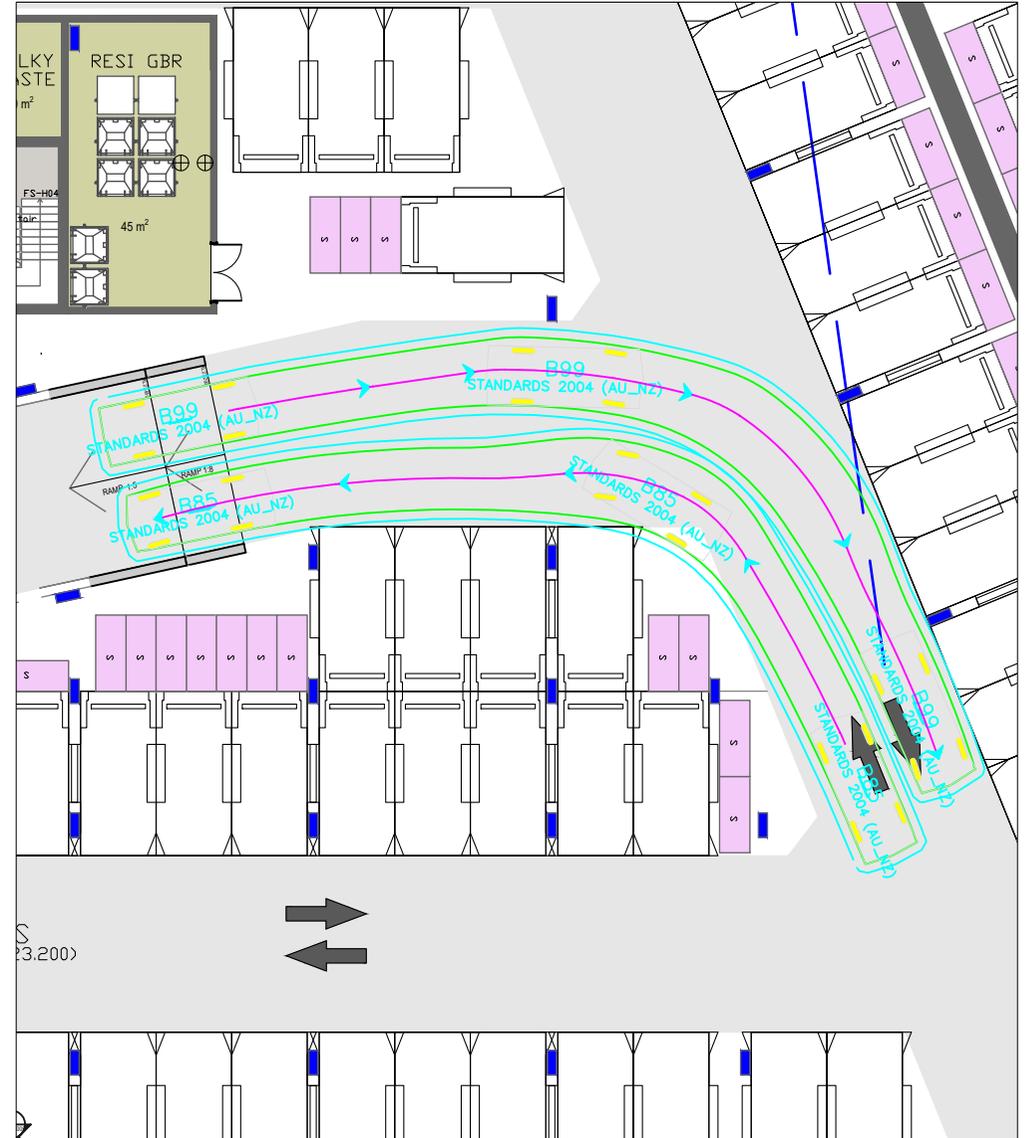
Turn Path "hugging" east of ramp



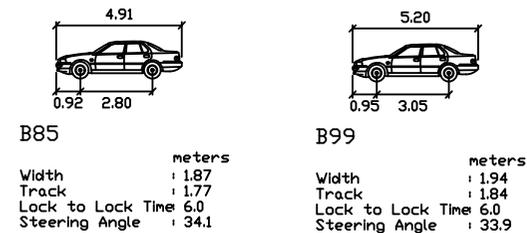
LEGEND



Turn Path "hugging" west of ramp



VEHICLE PROFILES (NOT TO SCALE)



FOR DA SUBMISSION

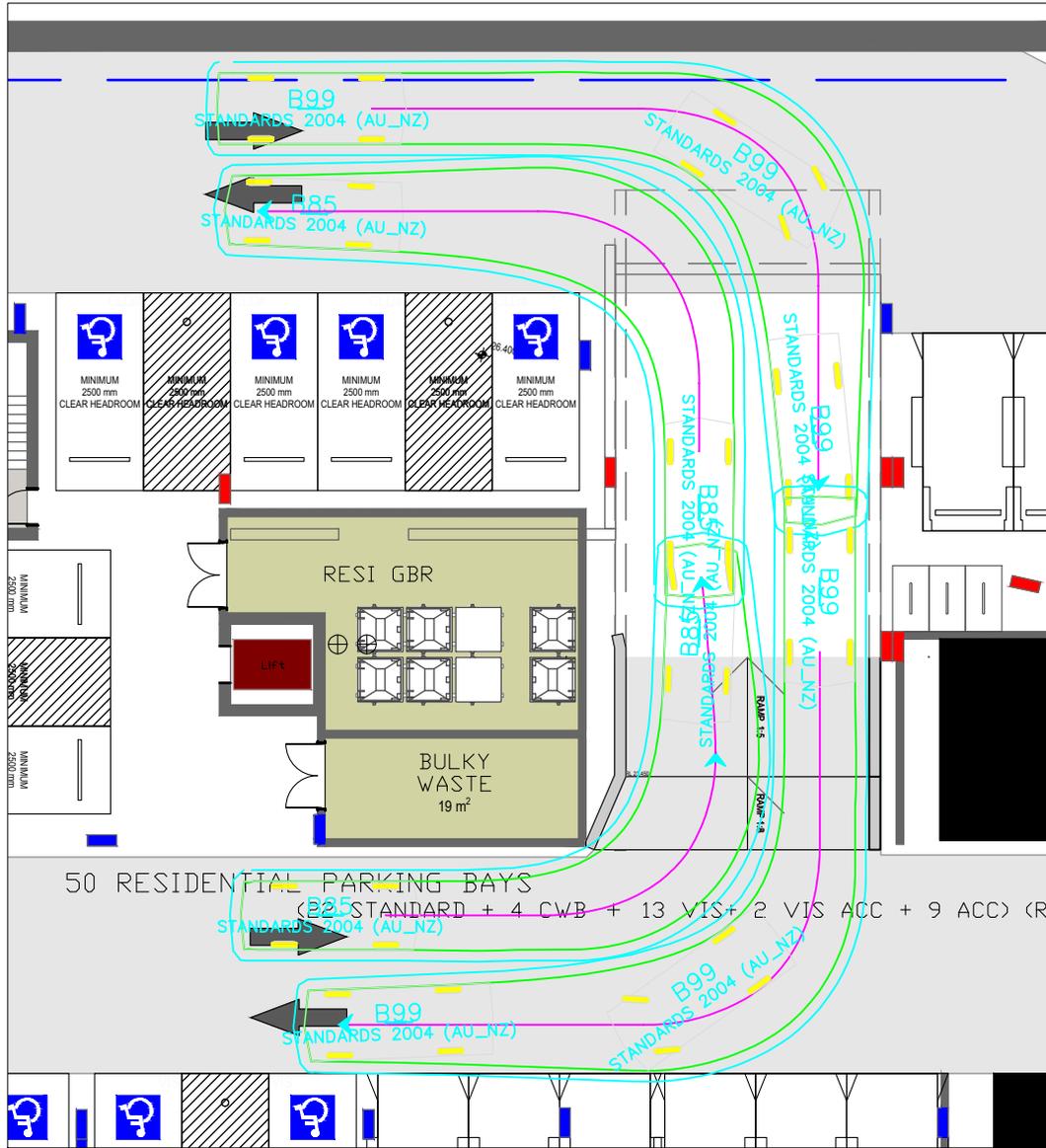
TURNER STUDIO ARCHITECTS
 PROPOSED MIXED DEVELOPMENT, PANTHERS NORTH PRECINCT, PENRITH
TURN PATH ANALYSIS - B85 and B99 Vehicles
 BASEMENT LEVEL 01, STAGE 5

DA-110-007

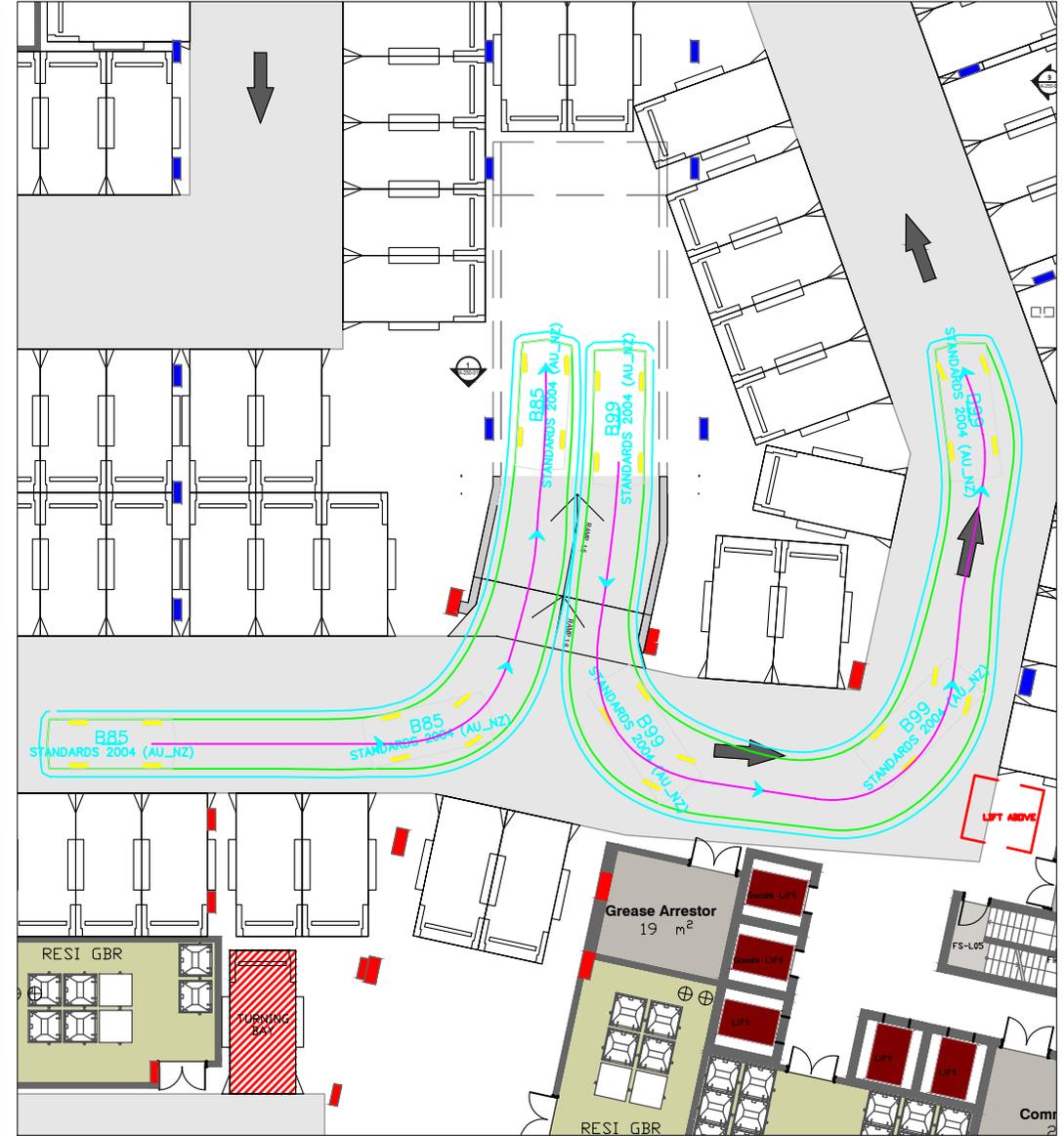
REV 01

17/12/2021

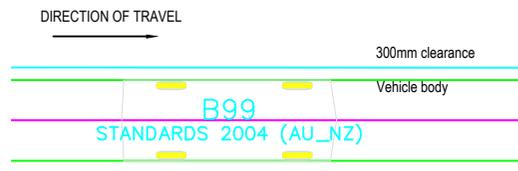
Stage 4 (EAST)



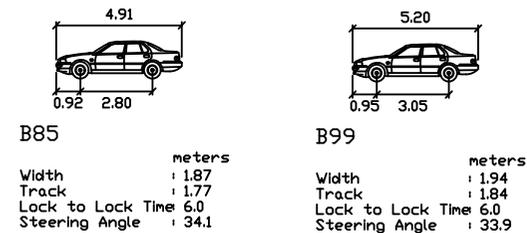
Stage 4 (SOUTH)



LEGEND



VEHICLE PROFILES (NOT TO SCALE)



FOR DA SUBMISSION

TURNER STUDIO ARCHITECTS
 PROPOSED MIXED DEVELOPMENT, PANTHERS NORTH PRECINCT, PENRITH
 TURN PATH ANALYSIS - B85 and B99 Vehicles
 BASEMENT LEVEL 01, STAGE 4

DA-110-007

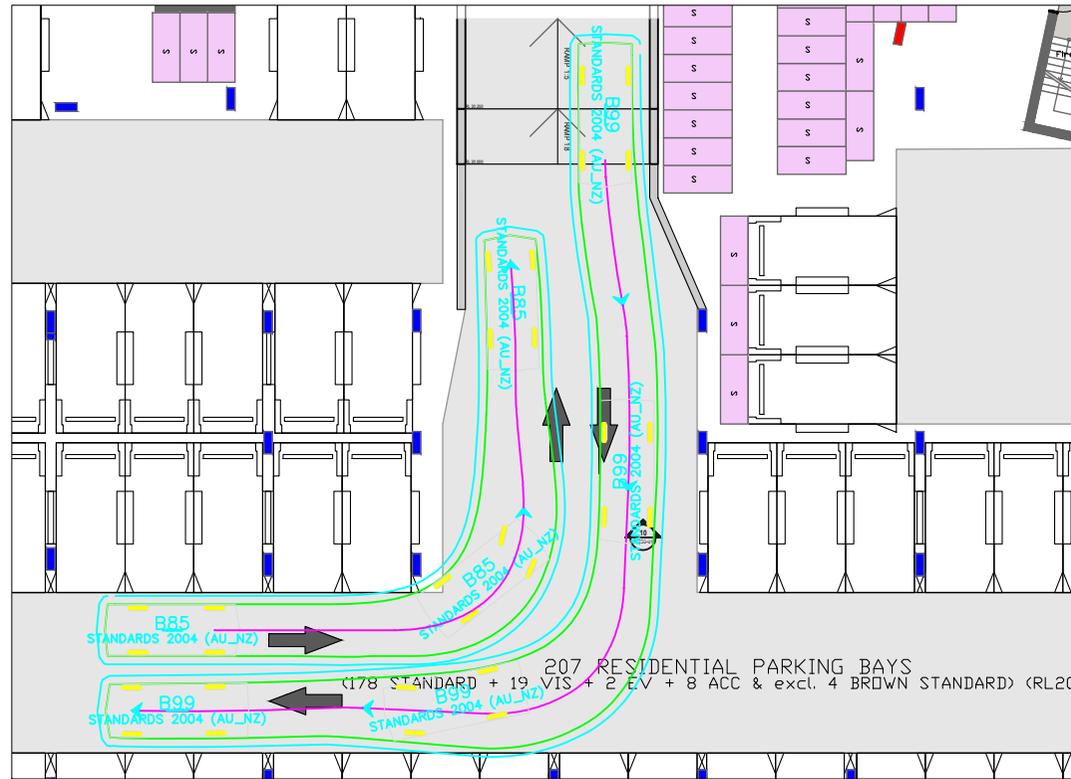
REV 01

17/12/2021

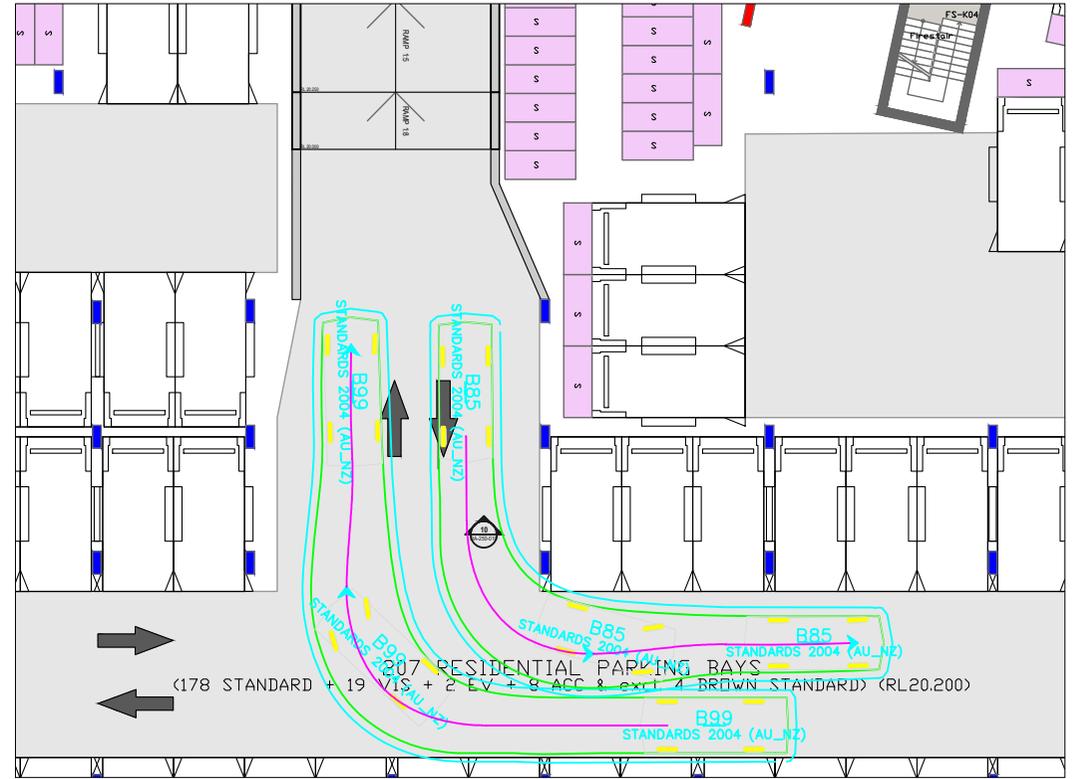
Basement Level 02

Turn Paths

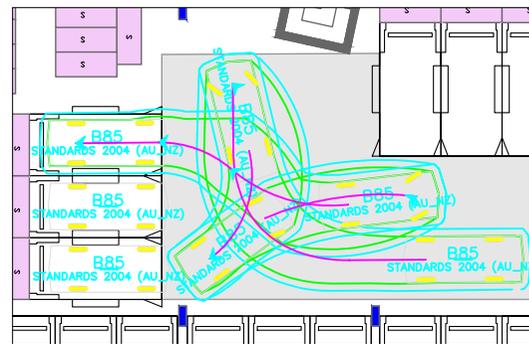
Turn Path Pair 1



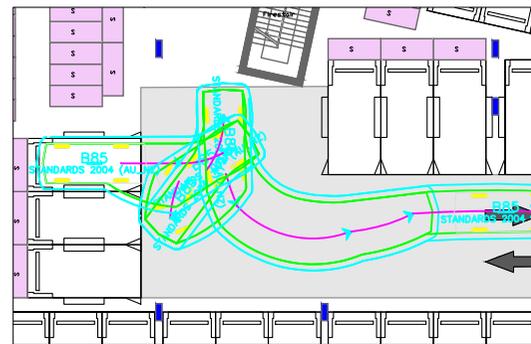
Turn Path Pair 2



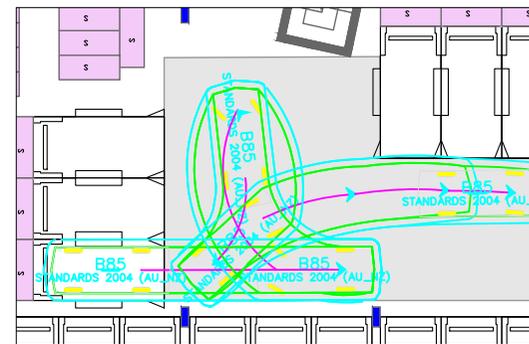
Rear in only (at least 4 manoeuvres)



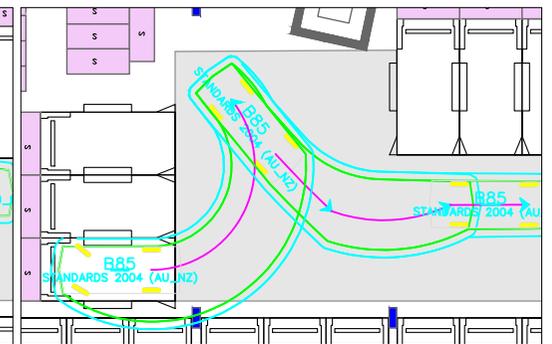
Forward in (at least 3 manoeuvres)



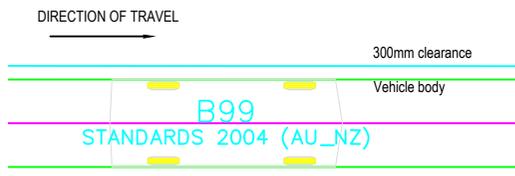
Forward in (at least 2 manoeuvres)



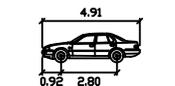
Forward in (at least 2 manoeuvres)



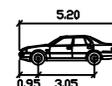
LEGEND



VEHICLE PROFILES (NOT TO SCALE)



B85		meters	
Width	4.91	Track	2.80
Lock to Lock Time	6.0	Steering Angle	34.1



B99		meters	
Width	5.20	Track	3.05
Lock to Lock Time	6.0	Steering Angle	33.9



FOR DA SUBMISSION

TURNER STUDIO ARCHITECTS
 PROPOSED MIXED DEVELOPMENT, PANTHERS NORTH PRECINCT, PENRITH
 TURN PATH ANALYSIS - B85 and B99 Vehicles
 BASEMENT LEVEL 02

DA-110-006

REV 01

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