971 Richmond Road, Marsden Park (NSW)

Traffic & Car Parking Assessment Report

Client: C&S Partners Mortgage & Insurance Pty Ltd

Prepared by

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Rev E

1. INTRODUCTION

1.1 Purpose of this report

This report sets out an assessment of the traffic and parking implications of the proposed development, with specific consideration of the following:

- the existing conditions and a description of the proposal;
- an assessment of the development's car and bicycle parking requirements;
- adequacy of the on-site car parking supply to accommodate the proposal's car and bicycle parking requirements;
- an assessment of the adequacy of the car park layout; and
- the traffic impact of the proposal.

1.2 Referenced documents

This report has been based upon a number of sources and references. These include:

- Discussions with the applicant and town planning officers at the City of Blacktown;
- Information provided by Transport for NSW and Council's Traffic Engineering department;
- Nearmap, Google maps and Melways online and Blacktown Bike Plan (2016);
- Blacktown City Council's web site, Blacktown City Council, Growth Centre Precincts, DCP (2018) and Blacktown City Council, DCP (2015);
- Blacktown City Council Child Care Centre Guide (2016);
- SIDRA computer software for the intersection modelling assessment;
- www.transportnsw.info and State Environmental Planning Policy (Infrastructure) (2007);
- Australian Standards AS 2890.5 (1993), AS 2890.1 (2004), AS 2890.2 (2018), AS 2890.3 (2015) and AS 2890.6 (2009);
- Traffic Authority of NSW, Guide to Traffic Generating Developments (Oct 2002); and
- Layout plans prepared by Architex, Job 2435, Dwg 00 (Issue E), Dwg 1a (Issue F), Dwg 1b (Issue C), Dwg 2 (Issue G), Dwg 3 (Issue E), Dwg 4 (Issue E), Dwg 5 (Issue F), Dwg 6 (Issue G) and Dwg 51 (Issue B), dated 15 July 2021.

2. EXISTING CONDITIONS

2.1 Location and Land use

The subject site is located on the north-east corner of Richmond Road and South Street. The location of the subject site is shown in **Figure 2.1**.

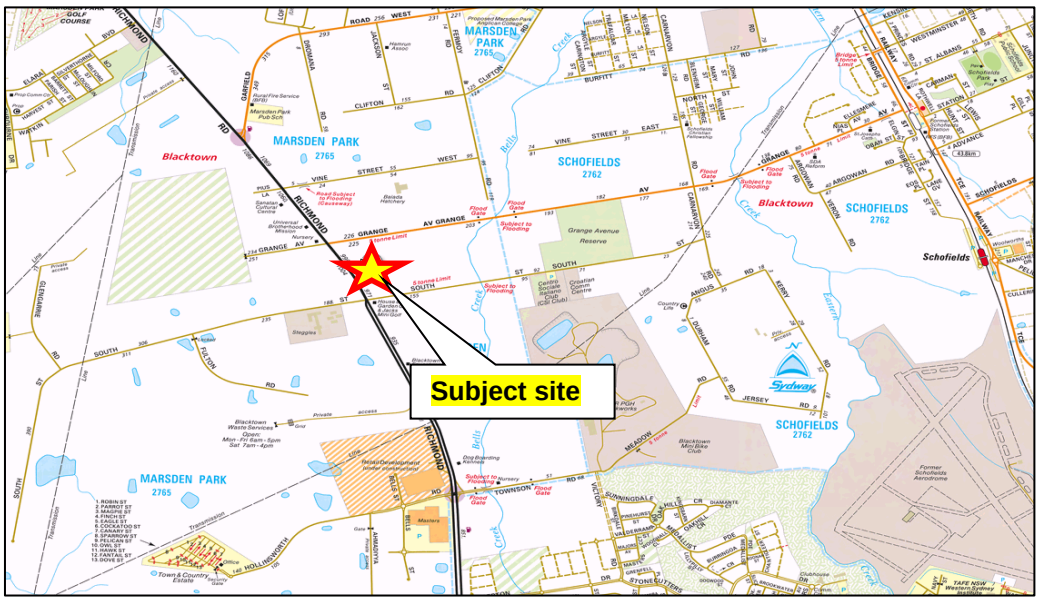

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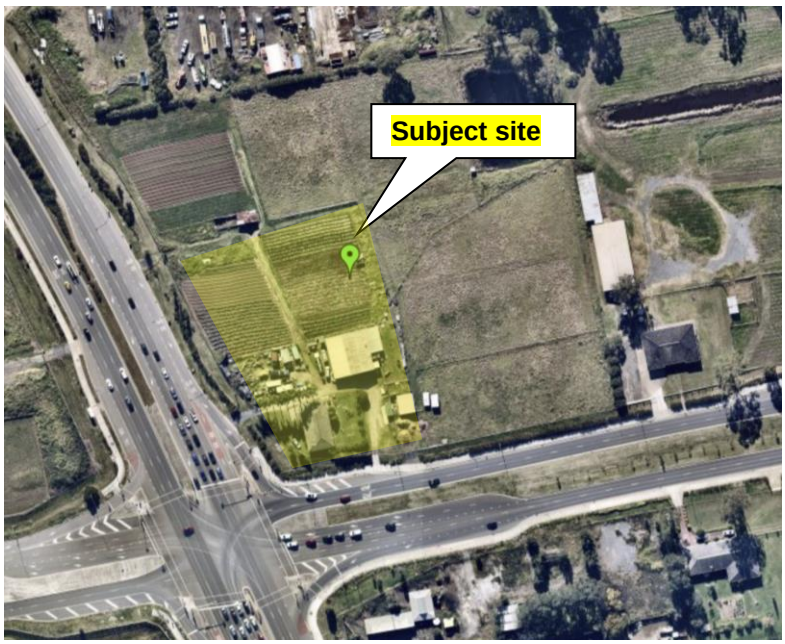
Figure 2.1: Aerial view of the subject site and surrounding area

The site is currently occupied by a residential dwelling. The surrounding area is semi-rural in nature and comprised of a mixture of lightly populated residential dwellings. The site is located within the Marsden Park precinct associated with the North-West Growth Centre. The nature of the subject site and surrounds is shown in **Figure 2.2.**



Source: nearmap (image taken 5 June 2021)

Figure 2.2: Nature of the subject site and surrounds

2.2 Road Network

Richmond Road, adjacent to the site, contains a divided cross section with two to three traffic lanes in each direction. A grassed verge exists along either side of the roadway. A speed limit of 80 km/hr applies along the roadway.

Images showing the cross section of Richmond Road looking to the north and south are shown in **Figures 2.3** and **2.4,** respectively.

Source: google maps street view

Figure 2.3: Richmond Road looking north

Source: google maps street view

Figure 2.4: Richmond Road looking south

South Street, adjacent to the site, contains a divided cross section with two to three traffic lanes in each direction. A grassed verge exists along either side of the roadway. A speed limit of 70 km/hr applies along the roadway.

Images showing the cross section of South Street looking to the east and west are shown in **Figures 2.5** and **2.6,** respectively.

Source: google maps street view

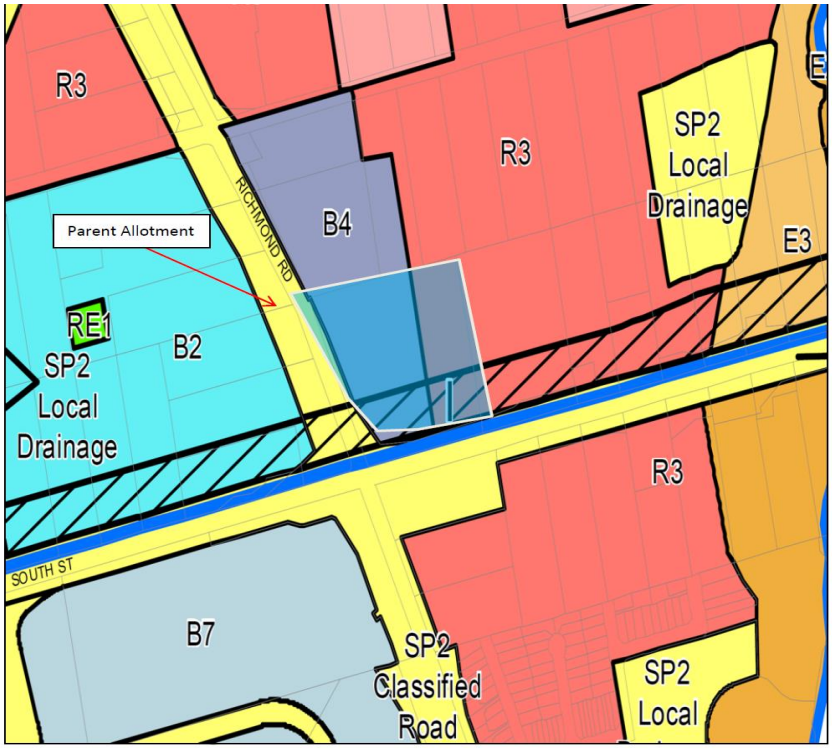
Figure 2.5: South Street looking east

Source: google maps street view

Figure 2.6: South Street looking west

2.3 Land Use Zoning

The development is subject to split zoning with the majority of the site at its western side zoned as B4 Local Centre and the eastern portion zoned as R3 Medium Density Housing Development, as shown in **Figure 2.7.**



Source: Think Planners (Dec 2019)

Figure 2.7: Land Use Zoning of the site

2.4 Sustainable Transport Modes

2.4.1 Public Transport

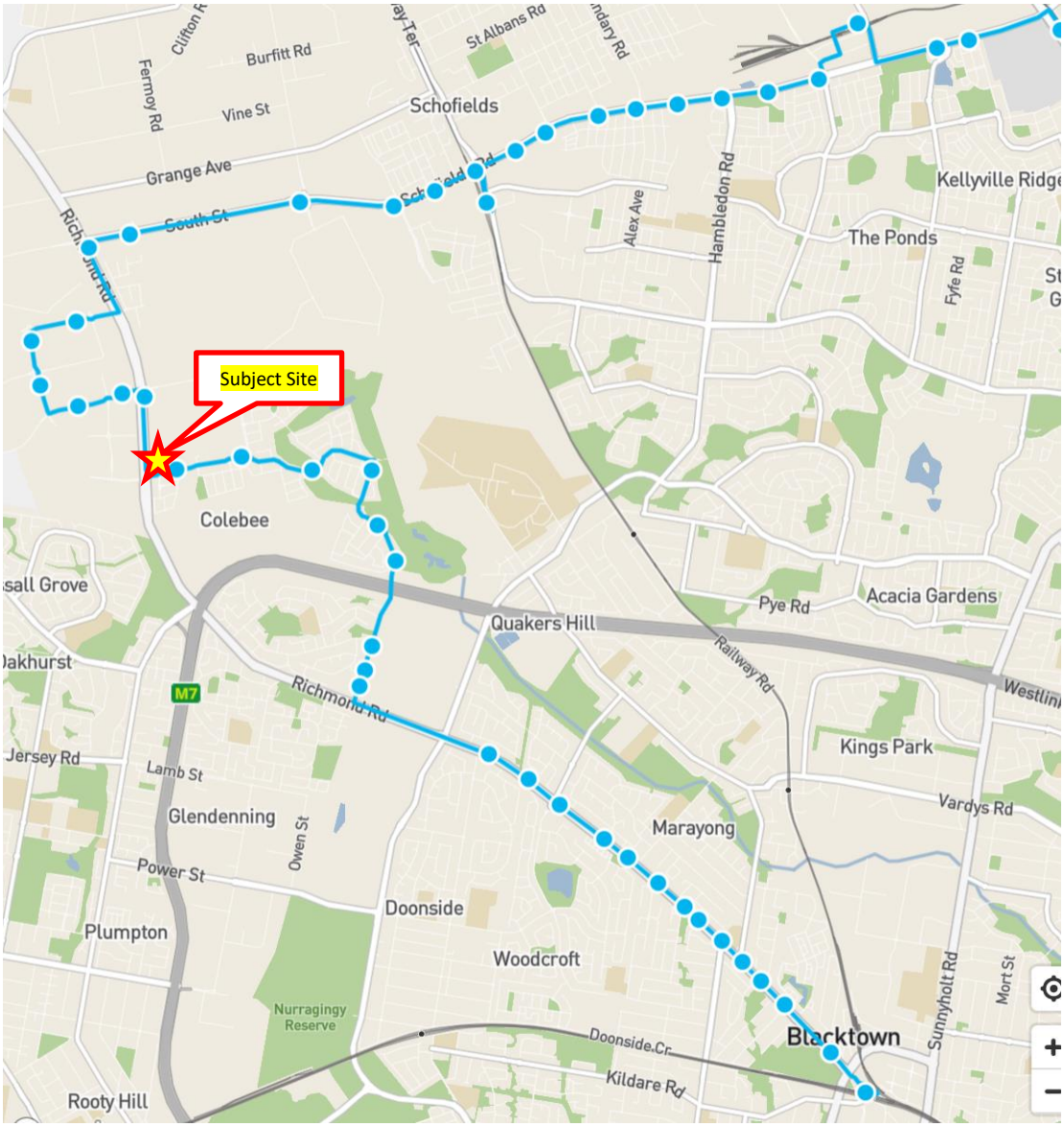
Public transport services in the vicinity of the site include two bus services which operate in close proximity to the site.

The bus services include:

Bus route 751

The bus route operates along South Street adjacent to the site. Bus route 751 operates between Rouse Hill Town Centre and Blacktown.

The bus route is shown in **Figure 2.8**.



Source: busways

Figure 2.8: Public transport service for bus route 751

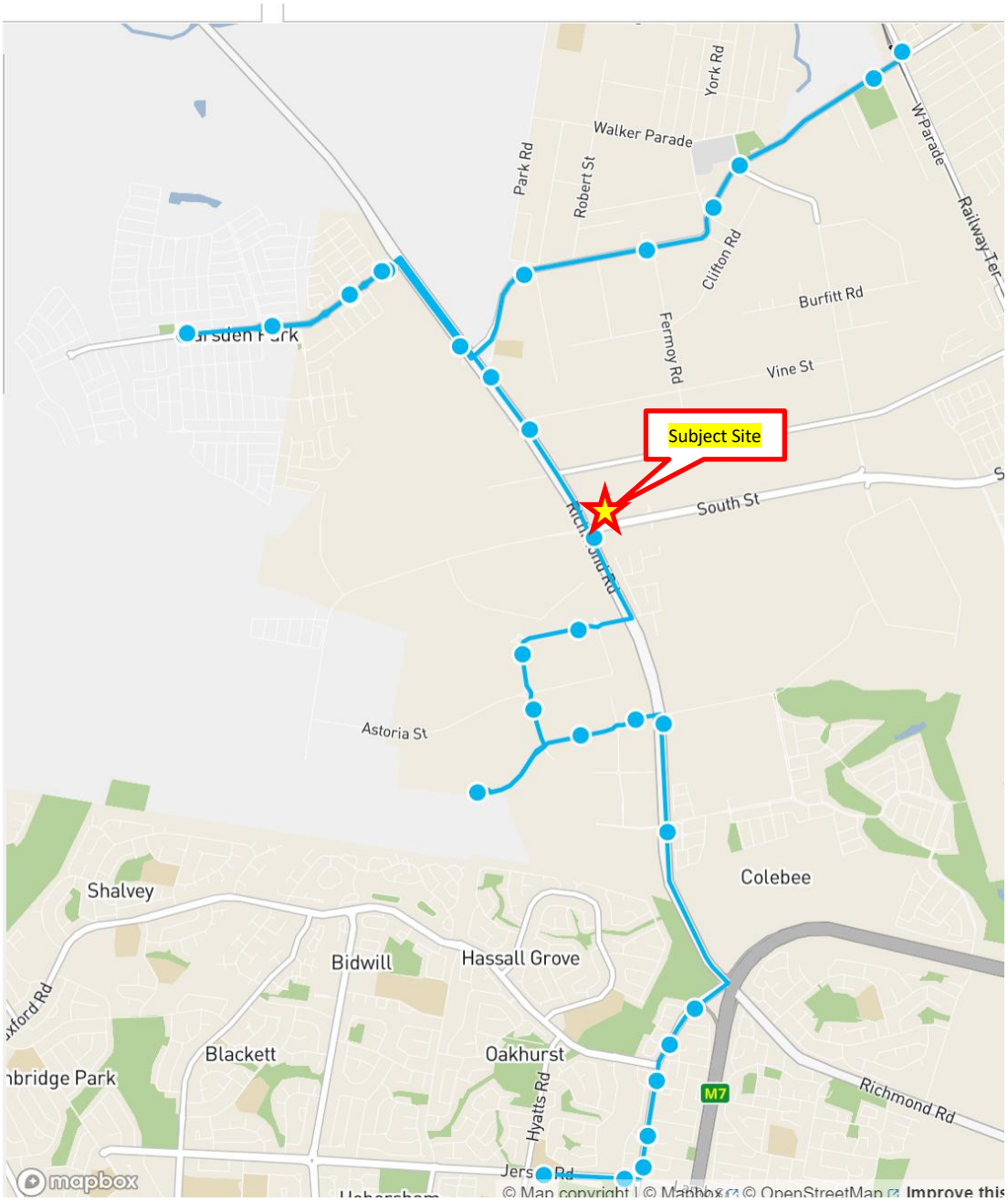
Bus route 757

The bus route operates along Richmond Road, 350 m west of the site. Bus route 757 operates between Mt Druitt and Riverstone railway station via Rooty Hill and Plumpton.

The public transport services in close proximity to the site are shown in **Figure 2.9**.

Reference to the bus timetable indicates that the bus services operate on both weekdays and weekends which could be utilised by occupiers and visitors associated with the proposed residential development.

In addition, the Marsden Park Industrial Estate precinct, to be developed in the near future, indicates a substantial provision of bus routes, and other transport links, located 800 m south-west of the subject site.



Source: transport nsw

Figure 2.9: Public transport service for bus route 757

2.4.2 Bicycle Facilities

The City of Blacktown is well serviced by an extensive on- and off-road bicycle network linking the municipality with the surrounding municipalities.

The formal sustainable transport network is inclusive of the cycle movement link proposed along Richmond Road.

The existing and proposed bicycle routes in the vicinity of the site are shown in **Figure 2.10**.

Source: Blacktown Council Bike Plan (2016)

Figure 2.10: Existing and proposed bicycle routes

In addition, a shared path route has been provided along the north side of South Street east of Richmond Road, adjacent to the site as shown in **Figure 2.11.**

Source: google maps street view

Figure 2.11: Shared path route along north side of South Street

It is noted that limited pedestrian pathways exit in the surrounding area, which are expected to be constructed with increasing new development in the area.

2.5 Existing Operating Conditions

An assessment was undertaken of the existing operation of the signalised intersection at Richmond Road and South Street during the late afternoon commuter peak hour.

The assessment was undertaken using the SIDRA intersection analysis computer program (Version 9). Intersection performance is generally reported by the intersection degree of saturation (x), which provides a measure of the relationship of volume to capacity for all movements at the intersection.

The relationship between level of service criteria and degree of saturation for the various intersection types are summarised in **Table 2.1.**

Table 2.1: Relationship between level of service and degree of saturation (x)

Level of Service		Intersection Degree of Saturation (x)		
		Unsignalised intersections	Roundabouts	Signalised intersections
A	Excellent	<=0.6	<=0.6	<=0.6
B	Very good	0.6 – 0.7	0.6 – 0.7	0.6 – 0.7
C	Good	0.7 – 0.8	0.7 – 0.85	0.7 – 0.9
D	Acceptable	0.8 – 0.9	0.85 – 0.95	0.9 – 0.95
E	Poor	0.9 – 1.0	0.95 – 1.0	0.95 – 1.0
F	Very poor	>=1.0	>=1.0	>=1.0

The intersection layout plan, traffic volume and signal phasing data was provided by Transport for NSW for the intersection of Richmond Road and South Street for Wednesday 12 May 2021.

A summary of the intersection geometry, traffic volumes and signal phasing for the late afternoon peak hour (5 pm – 6 pm) are shown summarised in **Attachment A.**

For the purpose of the analysis, the number of heavy vehicles were assumed to correspond to 5 % of the total traffic volumes, a cycle length of 140 seconds and 25 pedestrians crossing on each intersection approach.

The existing performance of the intersection was assessed using the SIDRA computer program, with the intersection layout and performance measures of critical degrees of saturation, average vehicle delay and 95 th % ile queue lengths shown in **Attachment B** and summarised in **Table 2.2**.

Table 2.2: Existing Performance: Richmond Road and South Street (pm peak hour)

Peak Hour	Intersection Performance			
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)
PM PEAK	Richmond Rd South (T)	0.836	43.2	296.8

Note: # L Left, T Through, R Right

On the basis of the above analysis, the intersection currently operates at a good level of operation during the pm commuter peak hour.

3. THE PROPOSAL

It is proposed to construct six buildings as part of an eight storey mixed use development comprising of the following land use components:

- 14 Retail tenancies (total GFA of 2,641 sqm)

  - 1,211 sqm correspond to retail tenancies with floor areas > than 200 sqm
  - 1,430 sqm correspond to retail tenancies with floor areas < than 200 sqm.

- Child Care facility with 17 staff & 100 children (Building E, Ground floor)

- Gymnasium (Ground floor, Building B, 404 sqm)

- Residential: 236 dwellings (including 25 adaptable dwellings)

  - 43 x one bedroom dwellings
  - 145 x two bedroom dwellings
  - 38 x three bedroom dwellings
  - 10 x four bedroom dwellings

A total of 512 parking spaces are provided in two separate car parks which are apportioned as:

- Residential dwellings (occupiers): 283 spaces
- Residential dwellings (visitors): 48 spaces (B1/B2)
- Residential accessible: 26 bays (B1/B2/B3)
- Child Care: 34 spaces - 17 spaces (staff) and 16 spaces (parents), one accessible space (B1)
- Retail (staff/customers): 101 spaces and three accessible spaces (B1/B3)
- Gym: 16 spaces and one accessible space (B1)

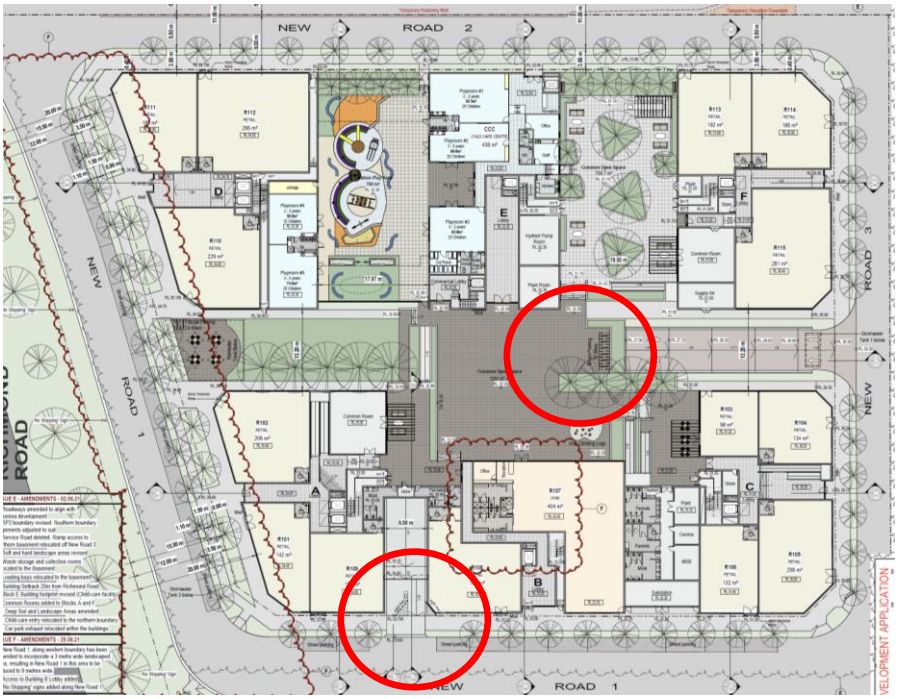
In addition, 14 motorcycle bays, two courier/loading bays, two car wash bays and two electric vehicle charge spaces have been provided on levels B1/B2.

In addition, it is proposed to provide 110 bicycle spaces of which 94 bicycle spaces will be provided within the basement car parking levels and 16 bicycle spaces provided at ground level.

New roads are proposed to be constructed around the periphery of the site and as part of an internal road system abutting future residential subdivisions to the south, east and north of the site.

Access to the on-site car parking areas is provided via a central east-west roadway and via an access ramp located on the north side of an east-west roadway abutting the site's southern boundary to the as shown in **Figure 3.1**.

The layout of the car parking areas and cross sections of the access ramps for the two car parking structures are shown in **Attachment C**.



Source: Architex

Figure 3.1: Car park access points

4. CAR PARKING CONSIDERATIONS

4.1 Car Parking Requirements

The car parking requirements for the residential, retail and child care land use components of the proposed development are set out in the Blacktown City Council, Growth Centre Precincts, DCP (2018).

Residential

Reference to the Blacktown City Council, Growth Centre Precincts, DCP (2018), specifically, Section 4.3.5, Table 4-10, indicates that, for residential flat buildings in R3 or B4 zones, the car parking requirements are:

- 1 space per one or two bedroom dwellings;
- 1.5 spaces per 3 or more bedroom dwelling; and
- One visitor space per 5 dwellings.

Further, reference to Blacktown City Council, Growth Centre Precincts, DCP (2018), specifically Section 4.3.5, Control 4 states that '*in all residential flat developments containing 10 dwellings or more, a minimum of 10 % of all apartments are to be designed to be capable of adaption for access by people with all levels of mobility*'.

As a result of the above, 10 % of the car parking provision for the residential dwellings are to be provided as accessible spaces.

This corresponds to a requirement to provide 24 accessible spaces. Reference to the layout plans indicate that 26 accessible spaces have been provided which exceeds the required number of accessible spaces.

Retail

Reference to Blacktown City Council, Growth Centre Precincts, DCP (2018), specifically Section 5.2.7, Table 5.1 which indicates the following:

- Retail shops (< 200 sqm): 1 space per 30 sqm Gross Floor Area
- Retail shops (> 200 sqm): 1 space per 22 sqm Gross Floor Area

Further, reference to the Building Code of Australia requires that retail uses are required to provide accessible parking bays at the rate of 1 accessible space per 50 spaces or part thereof.

Child Care Centre

Reference to Blacktown City Council, Growth Centre Precincts, DCP (2018), specifically Section 4.4.2, which indicates the following car parking requirements:

- Staff car parking: 1 space per employee
- Parents: 1 space per 6 children

Further, reference to the Building Code of Australia requires that child care centres provide accessible a parking bay.

Gym

Given that there is no specified parking requirement for gymnasiums in the Growth Centres DCP (2018), reference was made to the Blacktown City Council, DCP (2015), specifically Part A, Section 6.2, which indicates that a gymnasium has a parking requirement of 1 space per 25 sqm Gross Floor Area.

Further, reference to the Building Code of Australia requires that gymnasiums all provide accessible parking bays at the rate of 1 accessible space per 50 spaces or part thereof.

Application of the above car parking rates to the development's land use components results in the following car parking requirements.

Residential

Dwelling Occupiers

188 x one and two bedroom dwellings	188 x 1 =	188 spaces
38 x three bedroom dwellings	38 x 1.5 =	57 spaces
10 x four bedroom dwellings	10 x 1.5 =	15 spaces
Total		260 spaces

Visitors 236 / 5 = 48 spaces

Accessible parking spaces: 10 % of number of dwellings (236/10) = 24 spaces

Child Care

17 staff = 17 staff spaces
100 children: 100/6 = 17 parent spaces.

Accessible parking: 1 space per 100 spaces or part thereof: 1 space (included above)

Retail

Retail areas less than 200 sqm: 1,430 sqm	48 spaces
Retail areas greater than 200 sqm: 1,211 sqm	56 spaces
Total	104 spaces

Accessible spaces: 1 per 50 spaces or part therefor: three spaces (included above)

Gymnasium

Application of the parking rate of 1 space per 25 sqm to the gymnasium floor area (404 sqm) results in a parking requirement of 17 spaces.

Accessible spaces: 1 per 50 spaces or part therefor: three spaces (included above)

(Note: Parking calculations have been rounded up to the nearest whole number in accordance with that stipulated in City of Blacktown DCP (2015), Section 8.3.7.)

Reference to the car park layout plans indicate that the following car parking spaces have been provided in comparison to the car parking requirements for the development's land use components, as summarised below:

Land Use	**Requirement**	**Provision**
Residential dwellings (occupiers)	260 spaces	283 spaces
Residential dwellings (visitors)	48 spaces	48 spaces
Residential Accessible spaces	25 spaces	26 spaces
Child Care: Staff	17 spaces	17 spaces (staff)
Child Care: Parents	17 spaces	17 spaces (parents)
Child Care Accessible		(1 space) incl. above
Retail (staff/visitors)	104 spaces	104 spaces
Retail Accessible		3 spaces (incl. above)
Gymnasium	17 spaces	17 spaces
Gymnasium Accessible		1 space (incl. above)

Reference to the layout plans indicate that the car parking requirements for the development's land use components comply with the parking requirements stipulated in Blacktown City Council, Growth Centre Precincts, DCP (2018), Blacktown City Council, DCP (2015) and Building Code of Australia.

4.2 Bicycle Parking Requirements

The bicycle parking requirements for the land use components of the proposed development are set out in the Blacktown City Council, Growth Centre Precincts, DCP (2016), specifically, Section 4.3.5, Table 4-10, which stipulates a bicycle parking requirement of 1 bicycle space per three dwellings.

Application of the rate to the proposed dwellings results in a requirement to provide 79 bicycle spaces.

Reference to the layout plans indicate that a total of 110 bicycle spaces are proposed to be provided, of which 94 bicycle spaces are provided in the basement car parking levels and 16 spaces at ground level.

Further, the Australian Standard AS 2890.3 (2015) requires that 20 % of bicycle parking be at ground level (horizontal) bicycle parking devices in any bicycle parking facility.

Therefore, at least 16 bicycle spaces must be designed using a horizontal bicycle parking space. Eg a bicycle hoop.

Reference to the layout plans indicate that 16 bicycle spaces are proposed to be provided on the ground level which complies with AS 2890.3 (2015).

Further, it is considered that storage areas provided for the dwellings will also be able to safely accommodate a bicycle.

4.3 Assessment of Car Park Layout

The user classes for staff/visitors of the respective land uses are summarised as follows:

- Residential occupier and visitor (class 1/1a)
- Child Care staff (user class 1), Child Care parents (user class 3/3a)
- Retail staff (user class 1), Retail customer (user class 3/3a)
- Gym staff (user class 2), Gym member (user class 2)

Reference to the legend provided on the layout plans indicate that the widths of the car parking bays and adjacent aisles have been provided commensurate with the respective user classes stated in Table 1 and the dimensions stated in Figure 2.2 of AS 2890.1 (2004).

The dimensions of the parking bays are annotated on the car park layout plans, an extract of which is shown in **Figure 4.1.**

Source: Architex

Figure 4.1: Dimensions of land use parking bays

4.3.1 Dimensions of car accommodation

Reference to the layout plans show that the perpendicular parking bays are generally provided at the dimensions varying between 2.4 m and 2.6 m in width and a minimum length of 5.4 m with an adjacent aisle width varying between 5.8 m and 6.6 m, which comply with the requirements stipulated in AS 2890.1:2004.

The parallel bays have been provided at an overall width of 2.4 m and an adjacent offset clearance of 300 mm to the adjacent walls. Further, the bays have been provided at a length of 6.6 m.

For parallel bays which are obstructed at each end, such as the bays located in the northern car park at the eastern end, where columns are provided adjacent to both sides of the parking bays, the length of the bay are technically required to be 6.9 m in length.

The swept path analysis undertaken (refer **Figure 4.2**) indicates that motorists can safely enter and exit these parallel bays which have been provided at a length of 6.6 m.

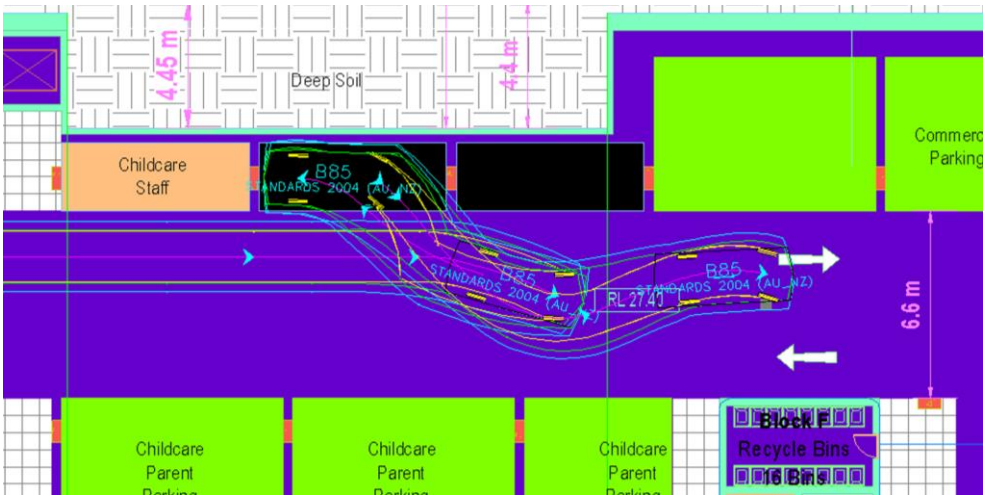


Figure 4.2: Swept path analysis for parallel bay with obstructions on both ends

The disabled bays have been provided at widths of 2.4 m with a minimum length of 5.4 m and an aisle width varying between 5.8 m and 6 m. It is noted that the central bollards within the shared spaces have been positioned at an off-set distance of 800 mm from the accessway. The width of the shared space is 2.4 m, which accords with Clause 2.4 of the Australian Standards, AS 2890.6 (2009).

Reference to the layout plans further show that on-street parking bays have been provided abutting the development's western and southern boundaries.

To comply with AS 2890.5 (1993), and assuming that the on-street bays will be subject to short term parking restrictions and cater for visitors/customers, it is recommended that the on-street bays be re-dimensioned to provide parking bays with a width of 2.3 m and end bays with a length of 5.4 m and intermediate bays with a minimum width of 6.4 m to comply with the requirements stated in Clause 2.4 of AS 2890.5 (1993).

The motorcycle bays have been provided at a width of 1.2 m and a length of 2.5 m which complies with the requirements set out in AS 2890.1:2004.

4.3.2 Dimensions of bicycle accommodation

Reference to the layout plans indicate that bicycle space modules have been provided at a length of 1.8 m and at a length of 1.2 m with a minimum access aisle of 1.5 m.

To comply with the requirements of AS 2890.3 (2015), it is recommended that a bicycle hoop be adopted for bicycle modules with a 1.8 m length and a wall mounted 'Ned Kelly' style of bicycle rack be provided for bicycle modules with a length of 1.2 m.

An example of a 'Ned Kelly' style of bicycle rack is shown in **Attachment D**.

4.3.3 Access to/from car accommodation spaces

The swept paths of a vehicle entering and exiting the proposed on-site car spaces on the development site have been assessed with the use of the AutoTURN swept path computer software for a B85 motor car which indicates that motorists can safely enter and exit the on-site parking bays and exit from the development site in a forward manner.

The analysis was repeated to examine the ability for two opposing cars passing each other around each of the bends within the basement car parks and at the top of the access ramps.

The analysis was undertaken with the use of the AutoTURN swept path computer software for a B85 and B99 motor car, the analysis of which is shown in **Attachment E,** and indicated that motorists can travel in opposing directions around the car parking accessways and at the top of the access ramps.

4.3.4 Width of accessways

Reference to Clause 3.2 of AS 2890.1:2004 indicates that, for a user class 3/3A with a car park containing greater than 100 spaces with the access abutting a local road, the width of the access is required to be 6 m.

Reference to the layout plans indicate that the width of the access ramp to the southern car park has been provided at a width of 6.3 m with 300 mm kerbs on either side of the ramp and the width of the access ramp to the northern car park has been provided at widths 3.23 m with 300 mm kerbs on either side (for each direction) of the access ramp which complies with AS 2890.1 (2004).

Intermediate ramps between basement car parking levels have been provided at widths of 3.3 m with 300 mm kerbs on either side of the ramp (for each direction), which complies with AS 2890.1 (2004).

4.3.5 Gradient of access ramps

Reference to the section plans indicate that the following gradients have been provided for each of the northern and southern car parking blocks:

Northern Car Park (Blocks D, E and F)

Ramp from Ground level to Basement 1 (to loading bay area)

Based upon RL of 30.3 at top of ramp:

- Initial gradient of 1:20 (5 %) for 6 m; RL = 30.0
- Transition gradient of 1:9 (11.11 %) for 7 m; RL = 29.23
- Intermediate gradient of 1:7.5 (13.33 %) for 7 m; RL = 28.3
- Transition gradient of 1:8 (12.5 %) for 7 m; RL = 27.43
- Transition gradient of 1:16 (6.25 %) for 7 m; RL = 27.0

Ramp between basements 1 and 2 and between basements 2 and 3

To be provided/assessed

Southern Car Park (Blocks A, B and C)

Ramp from ground level to basement 1

Based upon RL of 33.7 at top of ramp

- Initial gradient of 1:20 (5 %) for 6 m: RL = 33.4
- Transition gradient of 1:8 (12.5 %) for 2 m; RL=33.15
- Intermediate gradient of 1:4 (25 %) for 14.2 m; RL= 29.6
- Transition gradient of 1:8 (12.5 %) for 2.4 m; RL= 29.3

Ramp between basements 1 and 2

Based upon an RL of 29.3 at the top of the ramp:

- Transition gradient of 1:8 (12.5 %) for 2 m; RL = 29.05
- Intermediate gradient of 1:4 (25 %) for 9.8 m; RL = 26.6
- Transition gradient of 1:8 (12.5 %) for 2.4 m; RL= 26.3

In addition, gradients have been provided along the accessways adjacent to the perpendicular parking bays at a maximum gradient of 1:16 and adjacent to the parallel bays at a maximum gradient of 1:18.5.

To accord with the requirements of AS 2890.1:2004, it is recommended that the gradients along the accessways adjacent to the parallel parking bays be provided at a maximum gradient of 1:20.

4.3.6 Columns

Any columns adjacent to car parking bays within the car parking areas are required to be located between 0.75 m and 1.75 m from the edge of the access aisle, to accord with the requirements of Figure 5.2 of AS/NZS 2890.1:2004.

Reference to the layout plans indicate that the columns have been offset at a distance of 750 mm from the edge of the access aisle with a column length of 800 mm.

4.3.7 Headroom clearance

To accord with the relevant Australian Standards, the headroom clearance along the access ramps and within the basement car parks are required to be a minimum of 2.2 m with a minimum headroom clearance of 2.5 m above the disabled bays.

Reference to the layout plans indicate that the minimum headroom clearance along the access ramps is 2.41 m along the access ramp to B1 and a headroom clearance of 2.8 m along the access ramp to B2.

In addition, reference to the layout plans indicate that the disabled bays have generally been annotated to show an unobstructed head height of 2.5 m.

It is recommended that the annotations of 'unobstructed head height of 2.5 m' be provided for all disabled bays and that the cross section plans be annotated to show the minimum headroom clearance within each basement car parking level.

4.3.8 Sight lines for exiting motorists (to pedestrians)

Figure 3.3 of the Australian Standard for off-street car parking, AS 2890.1:2004 specifies that the minimum sight lines for pedestrian safety along a circulation driveway or domestic driveway.

The minimum sight lines are specified as clear sight line triangles which extend along the frontage road from the edge of an exit lane and 2.5 metres along the exit lane from the frontage.

The sight line triangles are required to be clear of visual obstructions to provide the exiting motorist with a clear view of pedestrians on the footpath of the frontage road (and vice versa).

Reference to the layout plans indicate that sight line triangles have been provided on either side of the accessway from the northern and southern car park accesses to enable exiting motorists to be able to sight to any pedestrians on the adjacent footpath (and vice versa), as required by AS 2890.1 (2004).

Any obstructions or vegetation placed within the sight line triangles are required to be less than 900 mm in height.

4.3.9 Sight lines for exiting motorists (to motorists)

The assessment of available sight lines for exiting motorists from a development access to approaching motorists along the intersecting roadway is outlined in Section 3.2.4 in AS 2890.1:2004.

Assuming that the intersecting roadways, that is new road 3 abutting the main car park access and new road 1 abutting the southernmost car park access are signed at a default speed limit of 50 km/hr.

Assuming this is the case and reference to AS 2890.1:2004 (Figure 3.2) indicates that a minimum SSD of 45 m is required to be provided at the car park access points.

Reference to the development layout plans indicate that the available sight distance at the:

- main car park access to motorists approaching along New Road 3 is well in excess of 45 m; and
- southernmost car park access to approaching motorist approaching from the east is excess of 45 m and a sight distance of 35 m to the bend west of the access point.

Having regard to the above, it is recommended that Stop Line pavement makings and associated signage be installed at the access driveways.

If the speed limit of New Road 1 was reduced to 40 km/hr, then the minimum SSD would be 35 m.

If there is an opportunity for the speed limit to be reduced to 40 km./hr along New Road 1, this would be preferable to maximise the level of safety for motorists and pedestrians circulating in this area.

5 COMMERCIAL VEHICLES

5.1 Refuse

The refuse bins are proposed to be stored in a loading bay area on basement level 1 between the northern and southern buildings and will be serviced by Council's refuse vehicles.

The loading bay have been provided at a width of 6 m and a length of approximately 14 m and the turning bay has been provided at a width of 5.95 m and a minimum length of 9.6 m.

It is understood from discussions with the applicant, that the maximum sized truck anticipated to access the loading bay area is an 8.8 m Medium Rigid Vehicle (MRV).

Two MRV trucks can be accommodated within the loading bay area at any one time, that is, one truck within the turning bay and one truck within the loading bay area.

Reference to the AS 2890.2 (2018) indicates that the width of the accessway is required to be a minimum of 3.5 m. Further, the loading bays are required to be a minimum width of 3.5 m and a length of 8.8 m which has been provided.

Reference to the layout plans indicate that the headroom clearance within the loading bay area is 4.5 m which accords with the requirements stipulated in AS 2890.2 (2018).

5.2 Accessibility

Discussions with the applicant indicate that the loading bays will be restricted to a Medium Rigid Vehicle (MRV) which is 8.8 m in length.

The ability for a truck to enter and exit the loading bay area was undertaken with the use of the AutoTURN swept path computer software for an 8.8 m long Medium Rigid Vehicle (MRV), the analysis of which is shown in **Attachment F.**
The analysis indicates that an 8.8 m long MRV refuse trucks can safely enter the loading bay area, manoeuvre on site to then exit the loading bay in a forward manner.

5.3 Gradients along accessway

The requirements in AS 2890.2 (2018), which stipulate, amongst other things, that the maximum gradient for an MRV is 1:6.5 (15.4 %) with a maximum change of gradient of 1:16 (6.25 %) over a length of 7 m.

Reference to the layout plans indicate that the gradients along the access ramp between the ground level and the basement level 1 loading dock area have been provided along the access ramps in accordance with AS 2890.2 (2018).

A ground clearance assessment has been undertaken with the use of the AutoTURN computer software to examine whether an 8.8 m MRV truck would scrape its underside along the ramp.

The swept path analysis, which is shown in **Attachment G**, indicates that an 8.8 m MRV refuse truck can safely traverse along the access ramp in both directions between the ground level and the loading bay area without scraping the underside of the truck.

6 TRAFFIC IMPACT

6.1 Traffic Generation Characteristics

The impact of the proposed development can be assessed having regard to the anticipated number of vehicle movements likely to be generated at the development accesses during the commuter peak periods.

The traffic generation anticipated to be generated at the respective access points are assessed as follows:

Blocks A, B and C: Southern Car Park Access

The proposed residential component of the development provides access to 104 dwellings, in accordance with the following breakdown:

- 20 x one bedroom dwellings
- 72 x two bedroom dwellings
- 2 x three bedroom dwellings
- 10 x three bedroom dwellings

Reference to RTA Guide for Traffic Generating Developments (Vers 2.2, 2002) indicates that, for high density residential flat buildings, the development is expected to generate an average of 0.29 vehicle trips per dwelling.

On this basis, it is anticipated that the dwellings within the southern car park within the residential development will generate 30 vehicle movements during the am and pm peak hours.

The directional distribution of these movements is based upon surveys undertaken by consultants which indicate that during the am peak hour, 80 % of traffic will exit the site and 20 % will enter and during the pm peak hour, 30 % of traffic will exit the site and 70 % will enter.

This corresponds to 6 entry and 24 exit movements during the am peak hour and 21 entry and 9 exit movements during the pm peak hour.

Blocks D, E and F: Northern Car Park Access

The northern car park access provides access to 132 dwellings, in accordance with the following breakdown:

- 23 x one bedroom dwellings
- 73 x two bedroom dwellings
- 36 x three bedroom dwellings

As well as the child care, retail, gymnasium staff and visitor spaces.

The total vehicle movements anticipated to be generated by the proposed development's land use components at the northern car park access are summarised as follows:

Residential

Reference to RTA Guide for Traffic Generating Developments (Vers 2.2, 2002) indicates that, for high density residential flat buildings, the development is expected to generate an average of 0.29 vehicle trips per dwelling.

On this basis, it is anticipated that the dwellings within the southern car park within the residential development will generate 38 vehicle movements during the am and pm peak hours.

Based upon the directional distributions stated above, this corresponds to 8 entry and 30 exit movements during the am peak hour and 27 entry and 11 exit movements during the pm peak hour.

Child Care

Reference to RTA Guide for Traffic Generating Developments (Vers 2.2, 2002) indicates that, for long day care child care centres, the proposed child care centre is expected to generate an average of 0.8 vehicle trips per child during the am peak period and 0.7 vehicle trips per child during the pm peak period.

On the basis of the above, the proposed child care centre is anticipated to generate 80 vehicle movements in the am peak hour (40 entry vehicle movements and 40 exit vehicle movements) and 70 vehicle movements during the pm peak hour (35 entry vehicle movements and 35 exit vehicle movements).

Retail

As the specific nature of the retail tenancies are not known at this stage, it is assumed that the retail component will typically comprise of specialty shops.

Reference to RTA Guide for Traffic Generating Developments (Vers 2.2, 2002) indicates that retail specialty shops are expected to generate 122 vehicle movements during the pm peak hour, which is expected to be distributed evenly between arriving and departing trips, that is, 61 entry vehicle movements and 62 exit vehicle movements.

During the am peak hour, the vehicle movements will typically comprise of staff movements travelling to their retail tenancies. Conservatively assuming that say half of the 104 spaces are allocated to staff, and assuming that 80 % of staff will arrive by car as single occupants, then this corresponds to around 42 vehicle movements arriving during the am peak hour.

Gymnasium

The peak periods for the gymnasium are typically during the early weekday peak period, that is, between 6 am and 9 am and during the weekday evening period, that is, between 6 pm and 8 pm.

It is expected that the manager of the gymnasium will market the gym to the dwelling occupiers, staff of the retail shops and child care centre for parents visiting after the child drop off or before the child pick up and staff of the child care centre, who will all arrive to the gymnasium as part of a multi-purpose trip.

It is therefore anticipated that there will be a minimal amount of traffic generated by the gymnasium during the commuter peak periods. For the purpose of the analysis, the gymnasium is anticipated to generate say 10 exit vehicle trips during the am peak hour and 10 entry vehicle trips during the pm peak hour.

The total number of trips therefore anticipated to be generated at the northern car park access is summarised as follows:

	No. of vehicle movements	
	Entry	**Exit**
AM peak hour	95	75
PM peak hour	128	112

The level of traffic anticipated to be generated at the development accesses is considered to be able to safely enter and exit the northern car park access safely and will, in turn, be able to then exit to the intersecting eastern (north-south) local road with minimal delays.

On the basis of the above, the traffic anticipated to be generated at the respective car park accesses is not considered represent any adverse impact upon the operation of the surrounding road network.

6.2 Directional Distribution

The directional distribution and assignment of traffic is derived based upon a number of factors.

This corresponds to the extent of surrounding residential development, configuration and operation of the surrounding arterial and local road network and location of access points to the proposed development.

For the purpose of the analysis, it is assumed that the level of traffic generated to and from the site is distributed equally to all surrounding quadrants, that is, 25 % to/from the north-west, 25 % to/from the north-east, 25 % to/from the south-east and 25 % to/from the south-west.

Application of the directional distribution rates to the number of vehicle movements anticipated to be generated by the proposed development during the pm peak hour, that is, 128 entry movements and 112 exit movements per hour, results in the following additional traffic flows at the intersection of Richmond Road and South Street.

- Richmond Road South approach: 48 right turners
- South Street East approach: 32 left turners

In addition, it is understood that a mixed-use development has been approved to the immediate north of the development site at 999 Richmond Road.

This development contains 861 apartments, 973.8 sqm of retail floor area and 3,939.2 sqm of commercial floor area.

Access to the main car parking area is located along Grange Avenue abutting the site's northern frontage.

Reference to RTA Guide for Traffic Generating Developments (Vers 2.2, 2002) was used to estimate the number of vehicles anticipated to be generated by the approved development, which indicated that there would be 197 entry movements and 159 exit movements at the car park accesses during the pm peak hour.

The above principles of directional distribution were applied to estimate the number of vehicle movements anticipated to be generated by this approved development upon the intersection of Richmond Road and South Street.

The analysis indicates the following number of forecast vehicle movements would be generated at the intersection of Richmond Road and South Street for the pm peak hour:

- Richmond Road North approach: 67 through vehicles
- Richmond Road South approach: 84 through vehicles

6.3 Future Operating Conditions

6.3.1 Base Case (existing + approved development)

The base case conditions can be established by superimposing the traffic volumes anticipated to be generated by the approved development (999 Richmond Road) onto the existing traffic volumes for the late afternoon peak hour.

An assessment can be undertaken to assess the impact of the approved development upon the operation of the intersection at Richmond Road and South Street during the late afternoon commuter peak hour.

The intersection of Richmond Road and South Street was assessed using the SIDRA intersection computer program having regard to the resultant traffic distributions for the base case, with the performance measures of critical degrees of saturation, 95 th % ile queue lengths and average delay are shown in **Attachment H** and summarised in **Table 6.1.**

Table 6.1: Base Case Performance: Richmond Road and South Street (pm peak hour)

Peak Hour	Intersection Performance			
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)
PM PEAK	Richmond Rd South (T)	0.855	44.1	323.0

Note: # L Left, T Through, R Right

On the basis of the above analysis, the intersection is forecast to operate at a good level of operation for the base case during the pm peak hour.

6.3.2 Future Case (Base case + proposed development)

The future case conditions can be established by superimposing the traffic volumes anticipated to be generated by proposed development upon the base case traffic volumes for the late afternoon peak hour.

An assessment can be undertaken to assess the impact of the proposed development upon the operation of the intersection at Richmond Road and South Street during the late afternoon commuter peak hour.

The intersection of Richmond Road and South Street was assessed using the SIDRA intersection computer program having regard to the resultant traffic distributions for the proposed development, with the performance measures of critical degrees of saturation, 95 th % ile queue lengths and average delay are shown in **Attachment J** and summarised in **Table 6.2**.

Table 6.2: Future Case Performance: Richmond Road and South Street (pm peak hour)

Peak Hour	Intersection Performance			
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)
PM PEAK	Richmond Rd South (T)	0.888	51.1	350.1

Note: # L Left, T Through, R Right

On the basis of the above analysis, the intersection is forecast to operates at a good level of operation for the future case scenario during the pm peak hour.

6.3.3 Future Growth (2022 Volumes) + Approved development

The future growth case scenario can be established by applying a growth factor to the existing traffic volumes and superimposing the impact of the approved development at 999 Richmond Road to establish the future operating conditions at the intersection Richmond Road and South Street for the late afternoon peak hour.

For the purpose of the analysis, a growth a factor of 2 % per annum was applied to the existing volumes factored up to the year 2031.

The intersection of Richmond Road and South Street was assessed using the SIDRA intersection computer program with the performance measures of critical degrees of saturation, 95 th % ile queue lengths and average delay are shown in **Attachment K** and summarised in **Table 6.3**.

Table 6.3: Future Growth (2031 volumes) + approved development (999 Richmond Rd): Richmond Road and South Street (pm peak hour)

Peak Hour	Intersection Performance			
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)
PM PEAK	Richmond Rd South (T)	1.035	116.8	636.9
	Richmond Rd South (R)	1.016	125.0	263.4

Note: # L Left, T Through, R Right

On the basis of the above analysis, the operation of the intersection in 2031 with the additional traffic superimposed from the approved development would operate at a very poor level of operation during the pm commuter peak hour.

6.3.4 Future Growth (2022 volumes) + Approved development + Proposed development

The future impact of the proposed development upon the intersection of Richmond Road and South Street can be assessed by superimposing the number of vehicles anticipated to be generated by the approved development (999 Richmond Road) and the proposed development (971 Richmond Road) upon the existing traffic flows which have been factored to the year 2031.

The intersection of Richmond Road and South Street was assessed using the SIDRA intersection computer program having regard to the above scenario, with the performance measures of critical degrees of saturation, 95 th % ile queue lengths and average delay are shown in **Attachment L** and summarised in **Table 6.4.**

Table 6.4: Future Growth (2031 volumes) + approved development (999 Richmond Rd) + proposed development: Richmond Road and South Street (pm peak hour)

Peak Hour	Intersection Performance			
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)
PM PEAK	Richmond Rd South (T)	1.055	130.9	670.9
	Richmond Rd South (R)	1.049	145.3	307.2

Note: # L Left, T Through, R Right

On the basis of the above analysis, the intersection is forecast to operate at a similar level of operation to the future growth scenario with the approved development at 999 Richmond Road.

A comparison between the two scenarios indicates that the proposed development is forecast, in the year 2031, to result in an additional queue length of 34 m to the through movement on the Richmond Road South approach and an additional queue length of 36 m to the right turn movement on the Richmond Road South approach.

As a result of the above assessment, it is considered that the proposed development will have a minimal impact upon the operation of the intersection of Richmond Road and South Street upon completion of the development in the future forecast year of 2031.

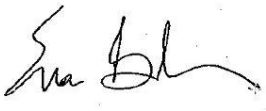
7 CONCLUSIONS AND RECOMMENDATIONS

Having regard to the above, it is concluded that the:

- car parking requirements for the development's land use components comply with the parking requirements stipulated in Blacktown City Council, Growth Centre Precincts, DCP (2018), Blacktown City Council, DCP (2015) and Building Code of Australia;
- car park layout has been generally designed in accordance with the requirements of the Australian Standards AS 2890.2 (2018), AS 2890.3 (2015), AS 2890.5 (1993), AS 2890.1 (2004) and AS 2890.6 (2009);
- the traffic anticipated to be generated at the respective car park accesses is not considered to represent any adverse impact upon the operation of the surrounding road network; and
- the proposed development will have a minimal impact upon the operation of the intersection of Richmond Road and South Street upon completion of the development in the future forecast year of 2031.

Further, it is recommended that:

- the on-street bays be re-dimensioned to provide parking bays with a width of 2.3 m and end bays with a length of 5.4 m and intermediate bays with a minimum width of 6.4 m to comply with the requirements stated in Clause 2.4 of AS 2890.5 (1993);
- a bicycle hoop be adopted for bicycle modules with a 1.8 m length and a wall mounted 'Ned Kelly' style of bicycle rack be provided for bicycle modules with a length of 1.2 m;
- the gradients along the accessways adjacent to the parallel parking bays be provided at a maximum gradient of 1:20;
- the annotations of 'unobstructed head height of 2.5 m' be provided for all disabled bays and that the cross section plans be annotated to show the minimum headroom clearance within each basement car parking level;
- Any obstructions or vegetation placed within the sight line triangles are required to be less than 900 mm in height.



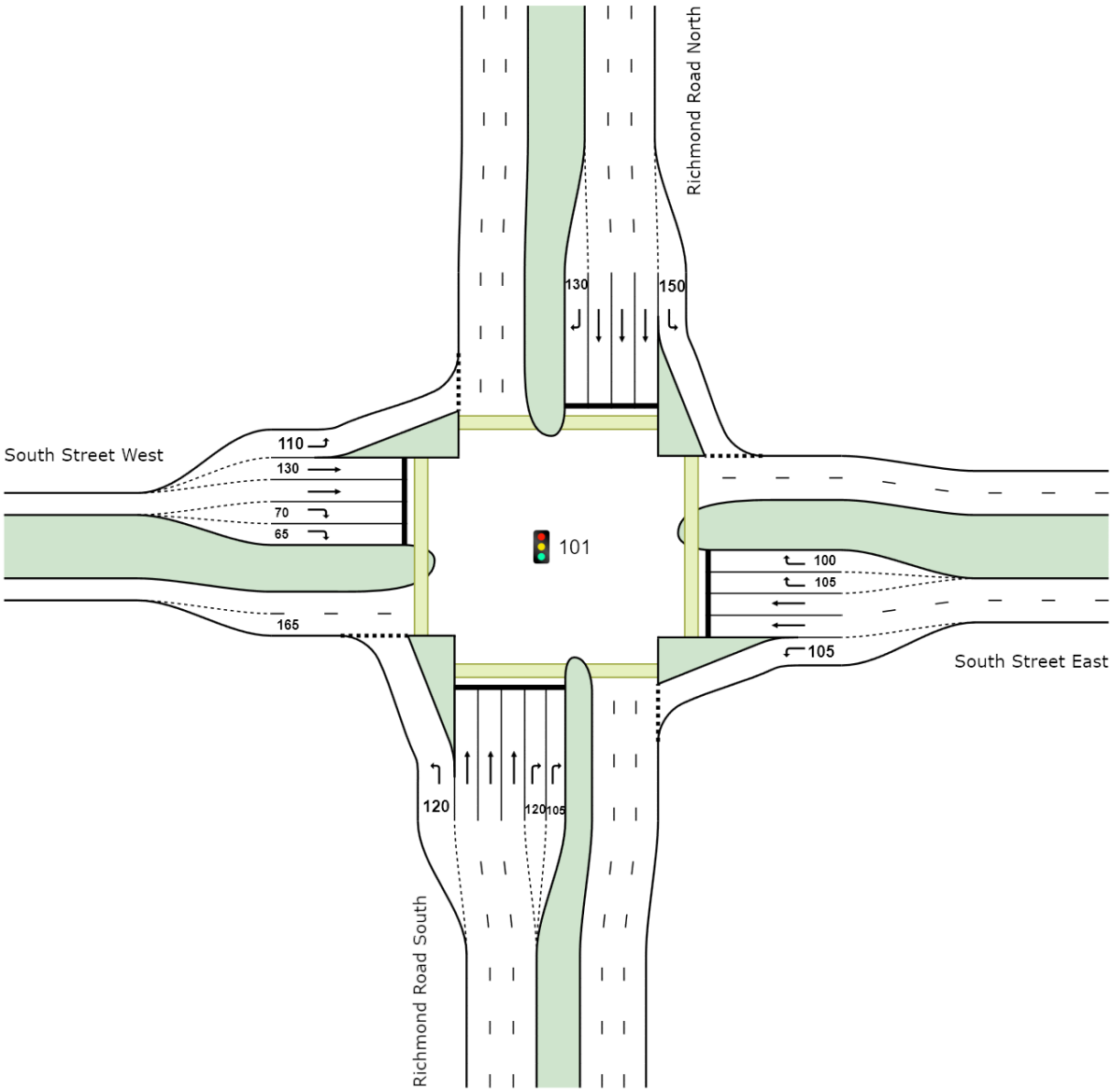
Evan Boloutis
Director
EB Traffic Solutions Pty Ltd

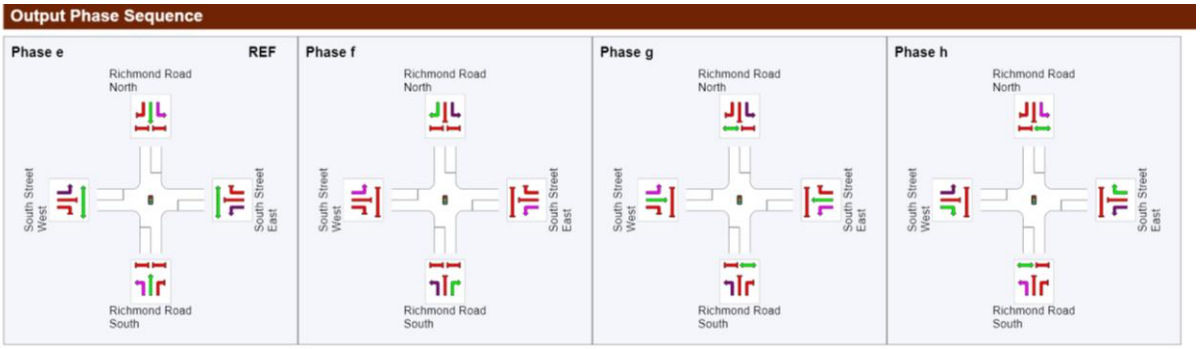
B.Eng (Civil), MEng Sc (Traffic), MBA

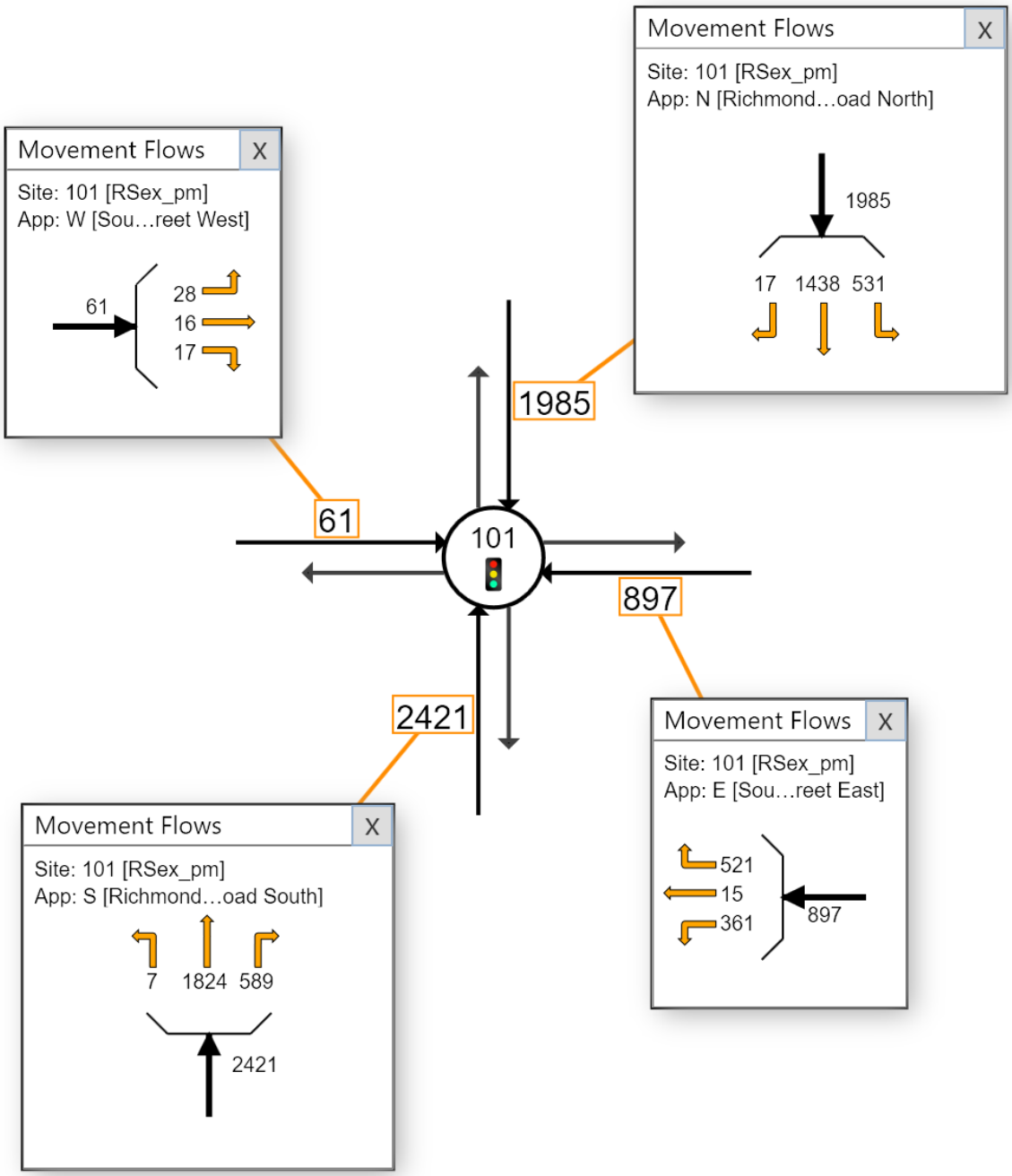
ATTACHMENT A

EXISTING GEOMETRY, PHASING AND LAYOUT OF INTERSECTION

RICHMOND ROAD/SOUTH STREET




Output Phase Sequence
Phase e
REF
Phase f
Phase g
Phase h
Richmond Road North
South Street West
South Street East
Richmond Road South


Movement Flows
Site: 101 [RSex_pm]
App: W [Sou…reet West]
61
28
16
17
Movement Flows
Site: 101 [RSex_pm]
App: N [Richmond…oad North]
1985
17 1438 531
61
1985
101
897
2421
Movement Flows
Site: 101 [RSex_pm]
App: S [Richmond…oad South]
7 1824 589
2421
Movement Flows
Site: 101 [RSex_pm]
App: E [Sou…reet East]
521
15
361
897

ATTACHMENT B

EXISTING OPERATING CONDITIONS

RICHMOND ROAD/SOUTH STREET

PM PEAK HOUR (5-6 PM)

Vehicle Movement Performance

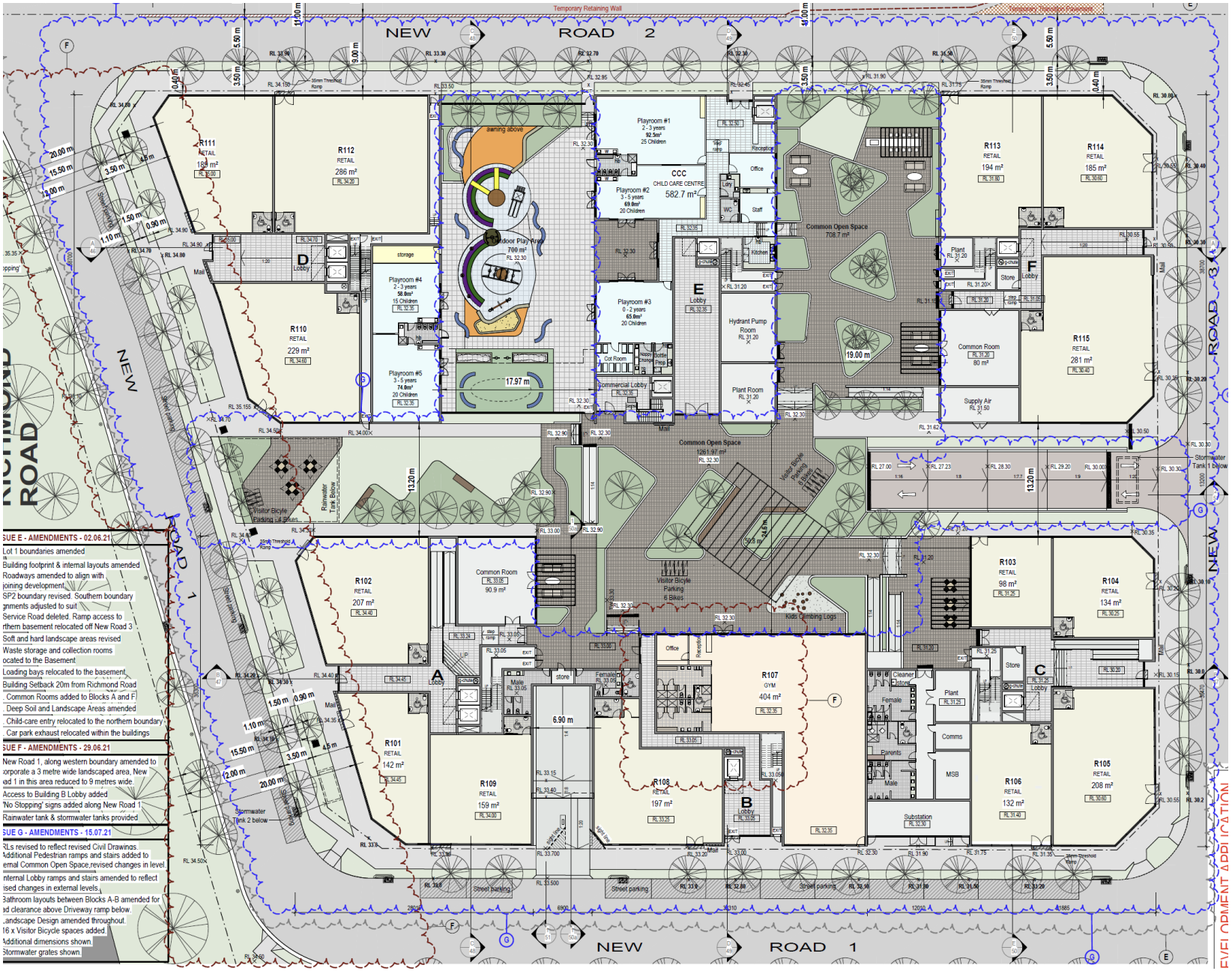
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	7	5.0	7	5.0	0.005	7.7	LOS A	0.0	0.2	0.10	0.62	0.10	61.1
2	T1	1733	5.0	1824	5.0	*0.836	43.2	LOS D	40.7	296.8	0.95	0.89	1.00	41.4
3	R2	560	5.0	589	5.0	*0.804	69.0	LOS E	20.5	149.7	1.00	0.89	1.11	30.5
Approach		2300	5.0	2421	5.0	0.836	49.4	LOS D	40.7	296.8	0.96	0.89	1.02	38.1
East: South Street East														
4	L2	343	5.0	361	5.0	0.497	13.9	LOS B	9.6	69.7	0.48	0.73	0.48	54.6
5	T1	14	5.0	15	5.0	0.091	72.7	LOS E	0.5	3.7	0.99	0.65	0.99	29.6
6	R2	495	5.0	521	5.0	*0.816	72.0	LOS E	18.4	134.6	1.00	0.90	1.14	29.5
Approach		852	5.0	897	5.0	0.816	48.6	LOS D	18.4	134.6	0.79	0.83	0.87	36.2
North: Richmond Road North														
7	L2	504	5.0	531	5.0	0.404	12.1	LOS B	10.9	79.7	0.39	0.72	0.39	56.9
8	T1	1366	5.0	1438	5.0	0.628	35.8	LOS D	25.9	189.3	0.86	0.76	0.86	45.1
9	R2	16	5.0	17	5.0	0.045	54.8	LOS D	0.9	6.7	0.83	0.70	0.83	34.5
Approach		1886	5.0	1985	5.0	0.628	29.6	LOS C	25.9	189.3	0.73	0.75	0.73	47.6
West: South Street West														
10	L2	27	5.0	28	5.0	0.048	24.7	LOS C	1.0	7.0	0.56	0.68	0.56	47.1
11	T1	15	5.0	16	5.0	*0.098	72.8	LOS E	0.5	4.0	0.99	0.65	0.99	29.6
12	R2	16	5.0	17	5.0	0.026	57.3	LOS E	0.5	3.4	0.85	0.67	0.85	33.5
Approach		58	5.0	61	5.0	0.098	46.2	LOS D	1.0	7.0	0.75	0.67	0.75	37.2
All Vehicles		5096	5.0	5364	5.0	0.836	41.9	LOS D	40.7	296.8	0.85	0.83	0.89	40.7

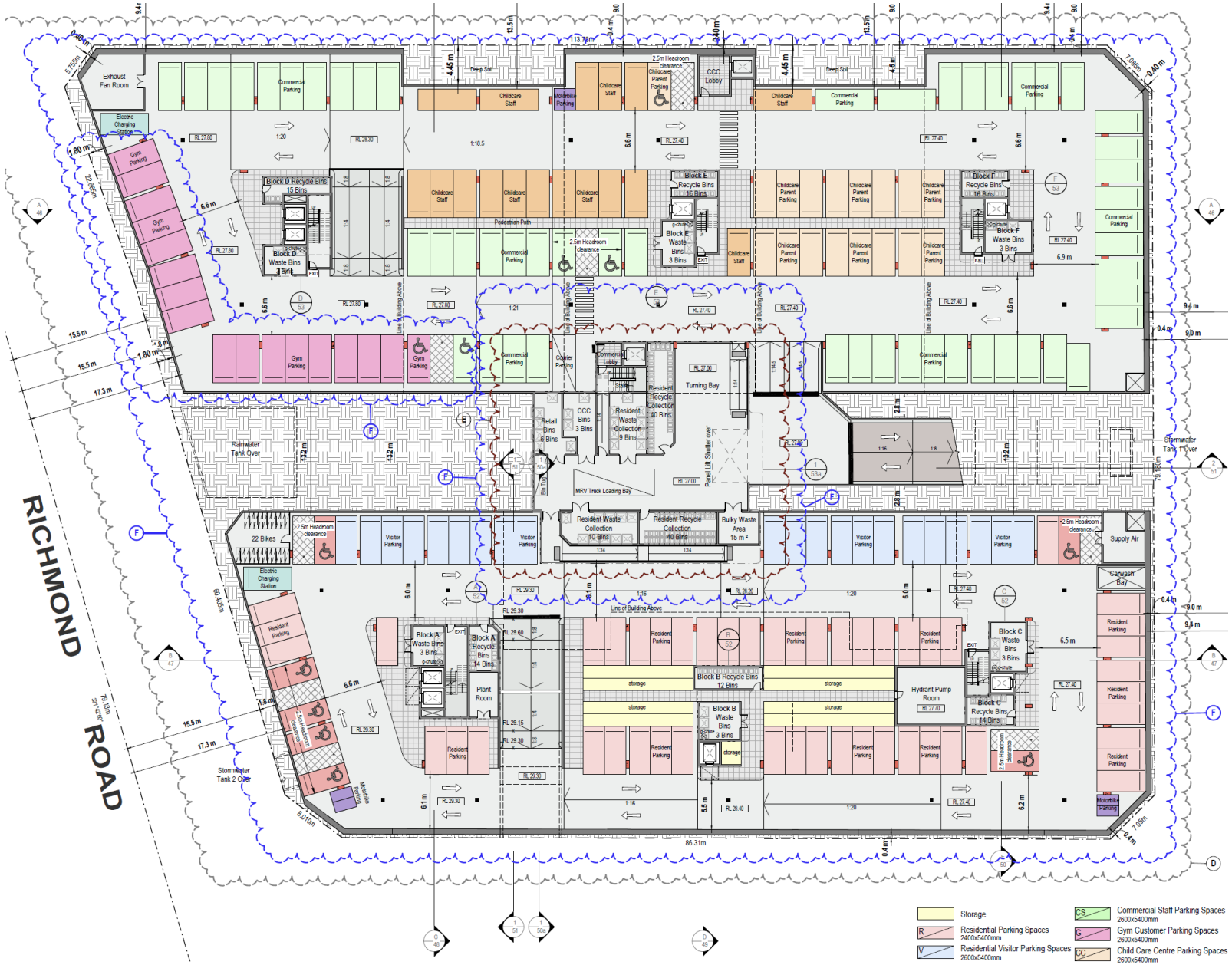
ATTACHMENT C

CAR PARK LAYOUT AND ACCESS ARRANGEMENTS FOR DEVELOPMENT SITE

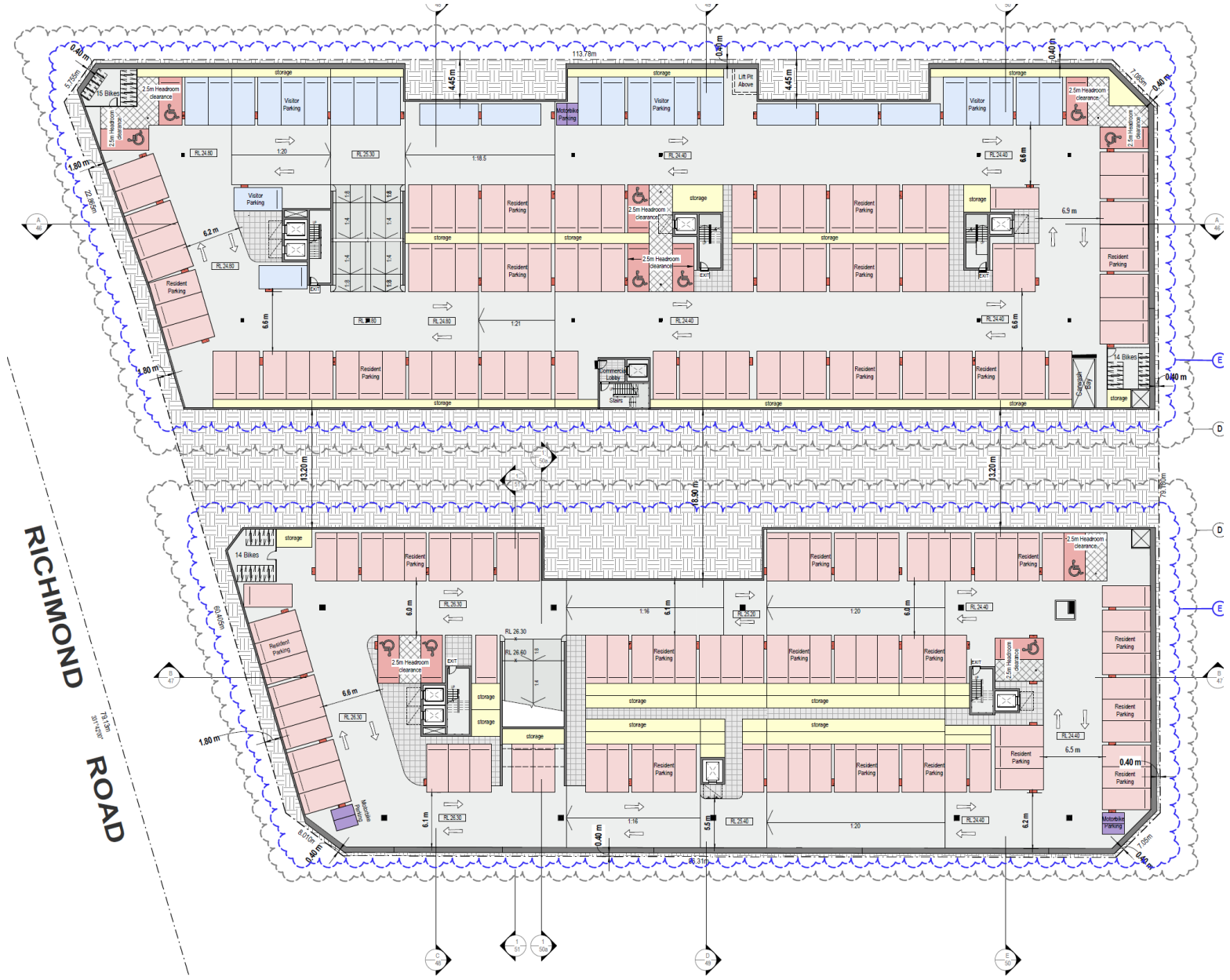
1 Lot 1 - Staging Plan
1 : 1000 @A3


Temporary Retaining Wall
Temporary Transition Pavement
NEW ROAD 2 (11m wide)
NEW ROAD 3 (11m wide)
NEW ROAD 4 (11m wide)
NEW ROAD 1 (9m wide)
NEW ROAD 1 (11m wide)
Lot 1
9,698.9 sqm
Lot 2
3,553.3 sqm
Lot 3
SP 2 zoned land
8,106.1sqm
Lot 4
3,342.3 sqm
Lot 10
Sec. J
DP 193074
Lot 1
DP 1205982
Temporary Basin
refer to civil engineers drawings
Common Open Space
Stormwater Tank 1 below
Stormwater Tank 2 below
Rainwater Tank Below
Crossover for maintenance vehicle access into the Temporary Basin
Tailout to existing Dar refer to civil engineers drawings
9.0m kerb Radius Temporary Cul-De-Sac
Part of Future Road to be provided by Lot 1 Neighbouring Development
Future Roads
Retaining Wall refer to civil engineers drawings
'No Stopping' Sign
RICHMOND ROAD
A
B
C
D
E
F

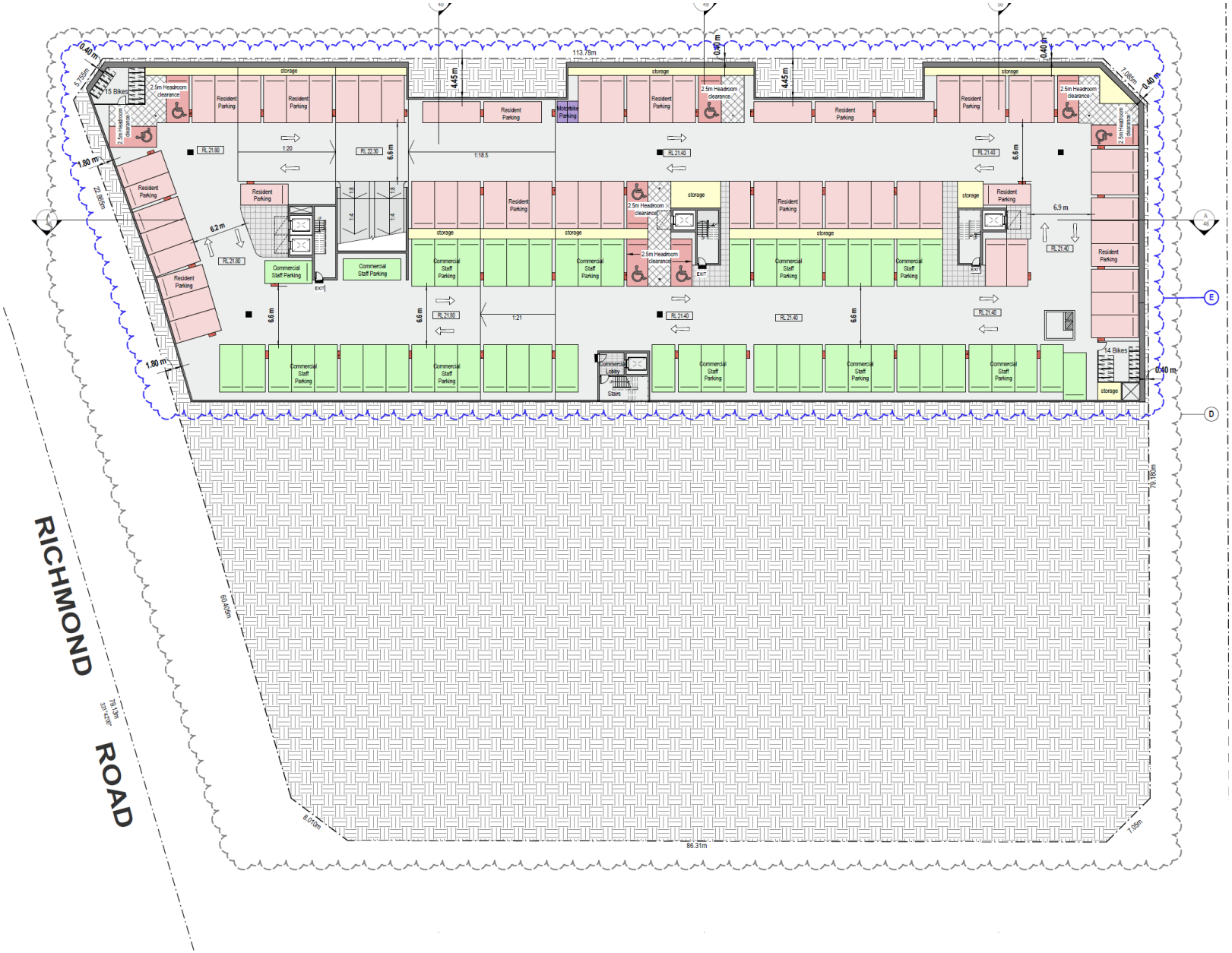

NEW ROAD 2
NEW ROAD 1
NEW ROAD 3
RICHMOND ROAD
R101 RETAIL 142 m²
R102 RETAIL 207 m²
R103 RETAIL 98 m²
R104 RETAIL 134 m²
R105 RETAIL 208 m²
R106 RETAIL 132 m²
R107 GYM 404 m²
R108 RETAIL 197 m²
R109 RETAIL 159 m²
R110 RETAIL 229 m²
R111 RETAIL 188 m²
R112 RETAIL 286 m²
R113 RETAIL 194 m²
R114 RETAIL 185 m²
R115 RETAIL 281 m²
CCC CHILD CARE CENTRE 582.7 m²
Playroom #1 2 - 3 years 92.5m² 25 Children
Playroom #2 3 - 5 years 69.8m² 20 Children
Playroom #3 0 - 2 years 65.0m² 20 Children
Playroom #4 2 - 3 years 58.8m² 15 Children
Playroom #5 3 - 5 years 74.8m² 20 Children
Outdoor Play Area 700 m²
Common Open Space 708.7 m²
Common Open Space 1261.97 m²
Common Room 90.9 m²
Common Room 80 m²
Visitor Bicycle Parking 6 Bikes
Visitor Bicycle Parking 14 Spaces
Kids Climbing Logs
Hydrant Pump Room
Plant Room
Commercial Lobby
Cot Room
Nappy Change
Bottle Prep
Rainwater Tank Below
Stormwater Tank 1 Below
Stormwater Tank 2 below
Supply Air
Substation
Temporary Retaining Wall
Temporary Pedestrian Pavement
SUE E - AMENDMENTS - 02.06.21
Lot 1 boundaries amended
Building footprint & internal layouts amended
Roadways amended to align with joining development
SP2 boundary revised. Southern boundary ignments adjusted to suit
Service Road deleted. Ramp access to rthern basement relocated off New Road 3
Soft and hard landscape areas revised
Waste storage and collection rooms ocated to the Basement
Loading bays relocated to the basement
Building Setback 20m from Richmond Road
Common Rooms added to Blocks A and F
Deep Soil and Landscape Areas amended
Child-care entry relocated to the northern boundary
Car park exhaust relocated within the buildings
SUE F - AMENDMENTS - 29.06.21
New Road 1, along western boundary amended to corporate a 3 metre wide landscaped area, New ad 1 in this area reduced to 9 metres wide
Access to Building B Lobby added
'No Stopping' signs added along New Road 1
Rainwater tank & stormwater tanks provided
SUE G - AMENDMENTS - 15.07.21
RLs revised to reflect revised Civil Drawings
Additional Pedestrian ramps and stairs added to ernal Common Open Space,revised changes in level
nternal Lobby ramps and stairs amended to reflect ised changes in external levels.
Bathroom layouts between Blocks A-B amended for ad clearance above Driveway ramp below.
Landscape Design amended throughout.
16 x Visitor Bicycle spaces added.
Additional dimensions shown.
Stormwater grates shown.
DEVELOPMENT APPLICATION



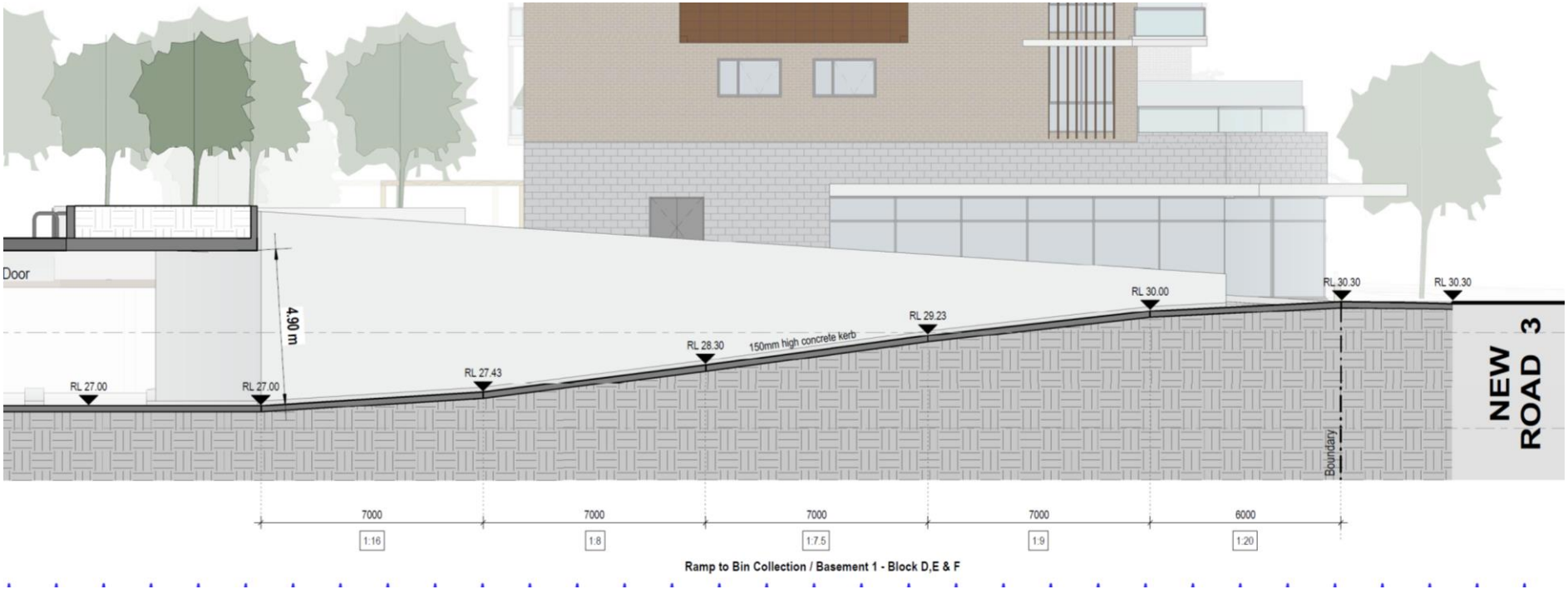
1 BLOCK 1-2 - BASEMENT LEVEL 1 1:400 @ A3



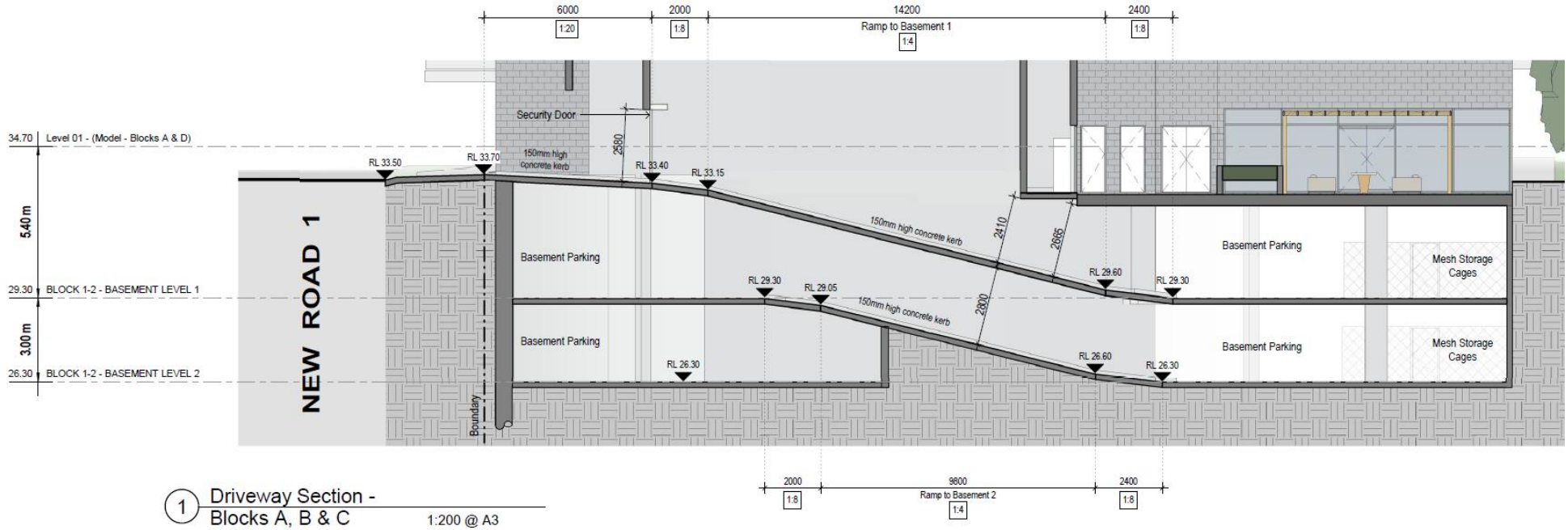
1 BLOCK 1-2 - BASEMENT LEVEL 2 1:400 @ A3



1 BLOCK 1-2 - BASEMENT LEVEL 3 1:400 @ A3



Ramp to Bin Collection / Basement 1 - Block D,E & F



1 Driveway Section - Blocks A, B & C 1:200 @ A3

ATTACHMENT D

NED KELLY STYLE OF BICYCLE RACK

Ned Kelly – Hang your bike

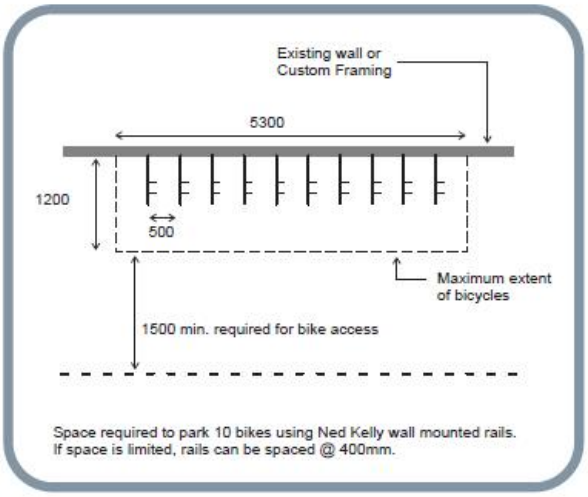
Ned Kelly bicycle parking rails are ideal for locations where there are space constraints. They can be mounted on solid or hollow masonry walls, or to Bicycle Victoria's custom framing.

Features

- Staggered heights and vertical hanging of bicycles makes best use of space
- Smooth and durable powder coating looks smart
- Front wheel and frame are easily locked
- Two hooks evenly support the front wheel without bending spokes
- Options: For narrow spaces Ned Kelly rails can be mounted on 45° angle brackets (2 per rail)

Basic dimensions required for installation

- Recommended rail spacing 500mm. Minimum spacing 400mm. Optional 45° angle brackets require spacing of 600mm
- Rails alternate in height 1750mm and 2050mm
- Minimum ceiling height 2200mm
- Bicycles will extend 1200mm from the wall or custom framing.
- Bicycles will extend only 850mm if using optional 45° angle brackets
- Minimum access corridor width 1500mm

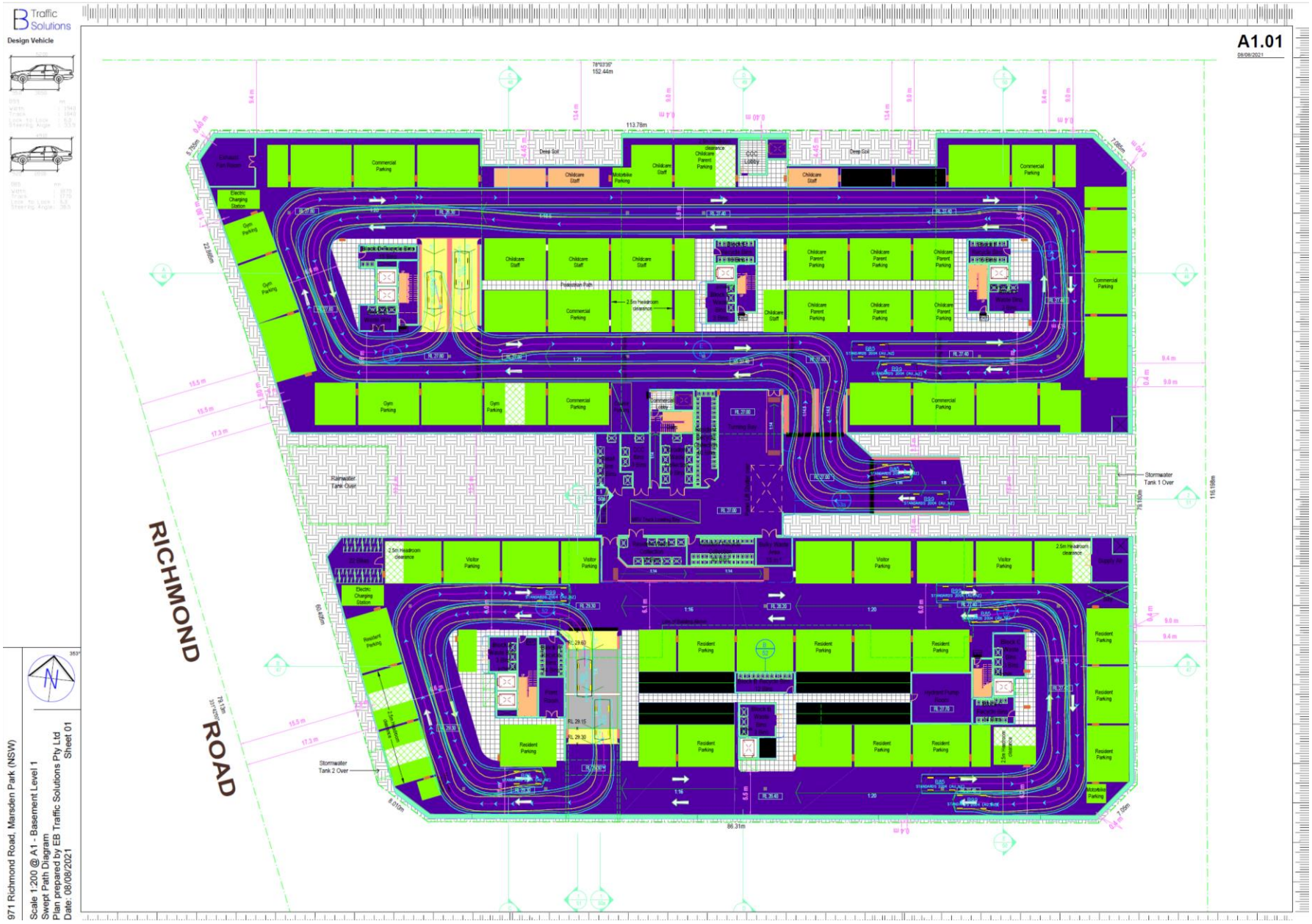


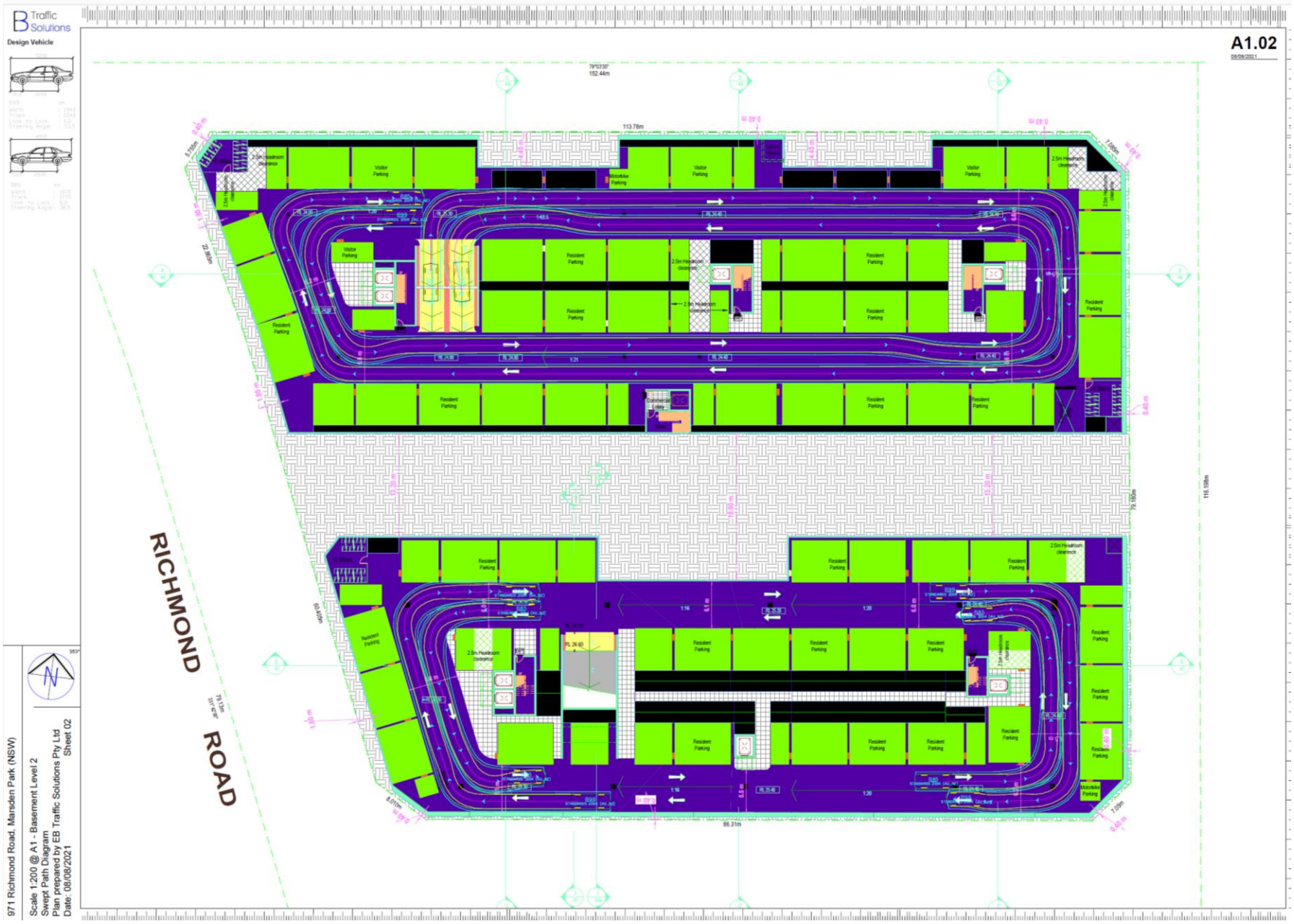
Space required to park 10 bikes using Ned Kelly wall mounted rails.
If space is limited, rails can be spaced @ 400mm.

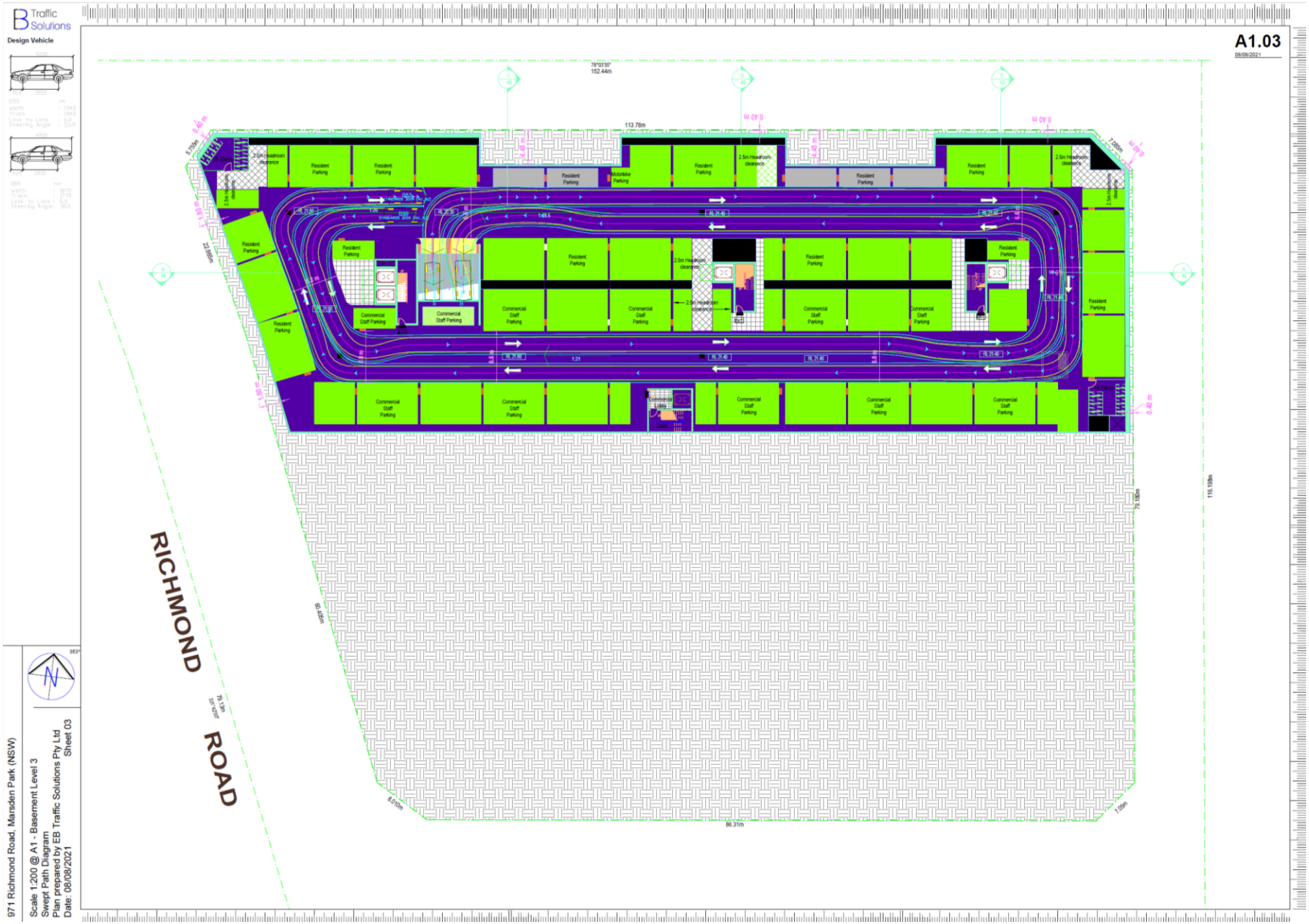
Ned Kelly parking rails alternate in height

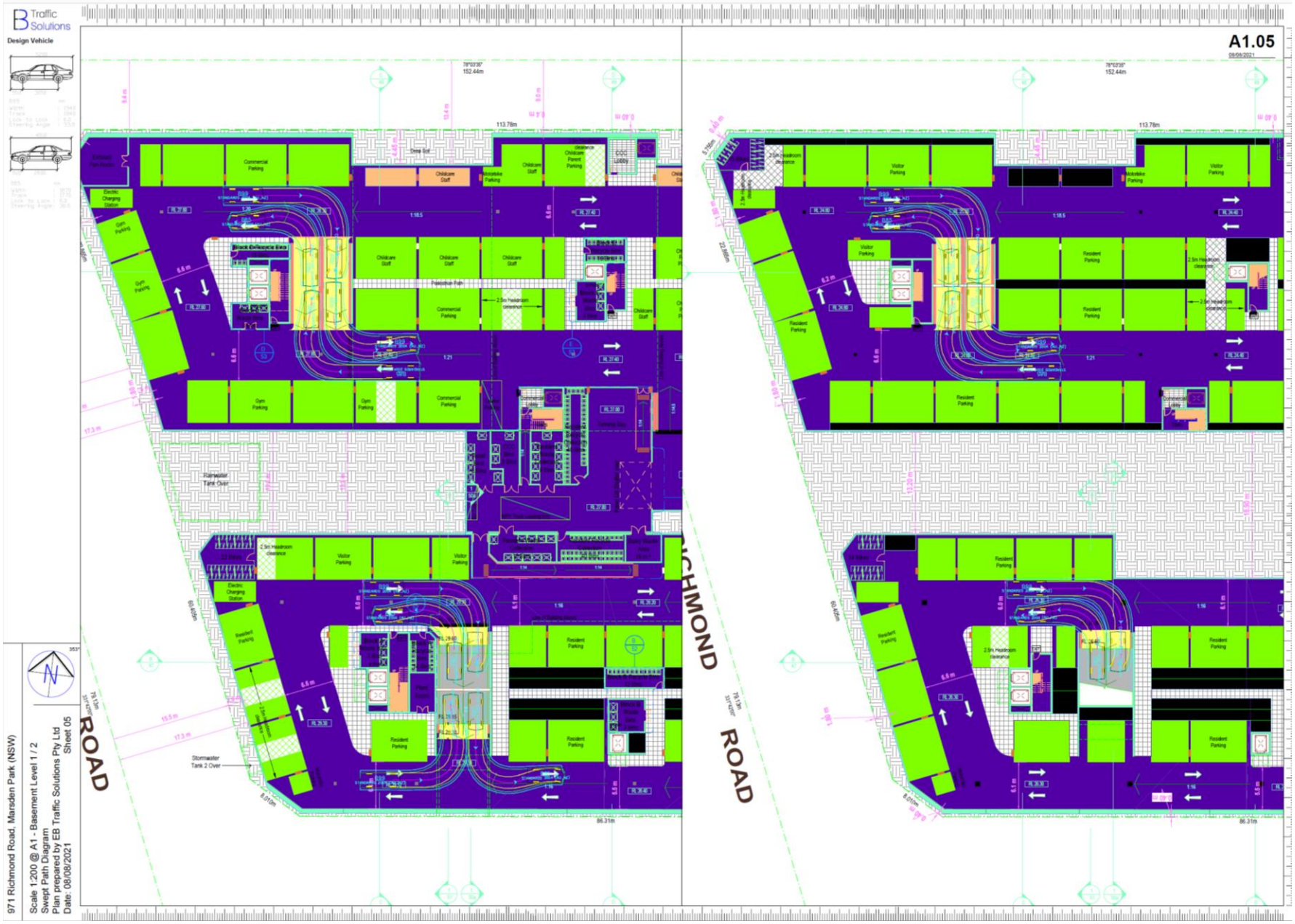
ATTACHMENT E

SWEPT PATH ANALYSIS (B85/B99 CARS)


Traffic Solutions
Design Vehicle
A1.01
08/08/2021
RICHMOND ROAD
Stormwater Tank 1 Over
Stormwater Tank 2 Over
Rainwater Tank Over
Commercial Parking
Childcare Staff
Childcare Parent Parking
Visitor Parking
Resident Parking
Gym Parking
Electric Charging Station
Motorbike Parking
Pedestrian Path
2.5m Headroom clearance
Deep Soil
113.78m
152.44m
86.31m
971 Richmond Road, Marsden Park (NSW)
Scale 1:200 @ A1 - Basement Level 1
Swept Path Diagram
Plan prepared by EB Traffic Solutions Pty Ltd
Date: 08/08/2021
Sheet 01

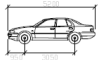

Traffic Solutions
Design Vehicle
A1.02
08/08/2021
RICHMOND ROAD
971 Richmond Road, Marsden Park (NSW)
Scale 1:200 @ A1 - Basement Level 2
Swept Path Diagram
Plan prepared by EB Traffic Solutions Pty Ltd
Date: 08/08/2021
Sheet 02

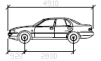

Traffic Solutions
Design Vehicle
A1.03
08/08/2021
RICHMOND ROAD
Resident Parking
Commercial Staff Parking
Motorbike Parking
2.5m Headroom clearance
113.78m
152.44m
86.31m
971 Richmond Road, Marsden Park (NSW)
Scale 1:200 @ A1 - Basement Level 3
Swept Path Diagram
Plan prepared by EB Traffic Solutions Pty Ltd
Date: 08/08/2021
Sheet 03


Traffic Solutions
Design Vehicle
A1.05
08/08/2021
113.78m
152.44m
RICHMOND ROAD
Commercial Parking
Childcare Staff
Childcare Parent Parking
Gym Parking
Visitor Parking
Resident Parking
Rainwater Tank Over
Stormwater Tank 2 Over
86.31m
971 Richmond Road, Marsden Park (NSW)
Scale 1:200 @ A1 - Basement Level 1 / 2
Swept Path Diagram
Plan prepared by EB Traffic Solutions Pty Ltd
Date: 08/08/2021
Sheet 05

Traffic Solutions

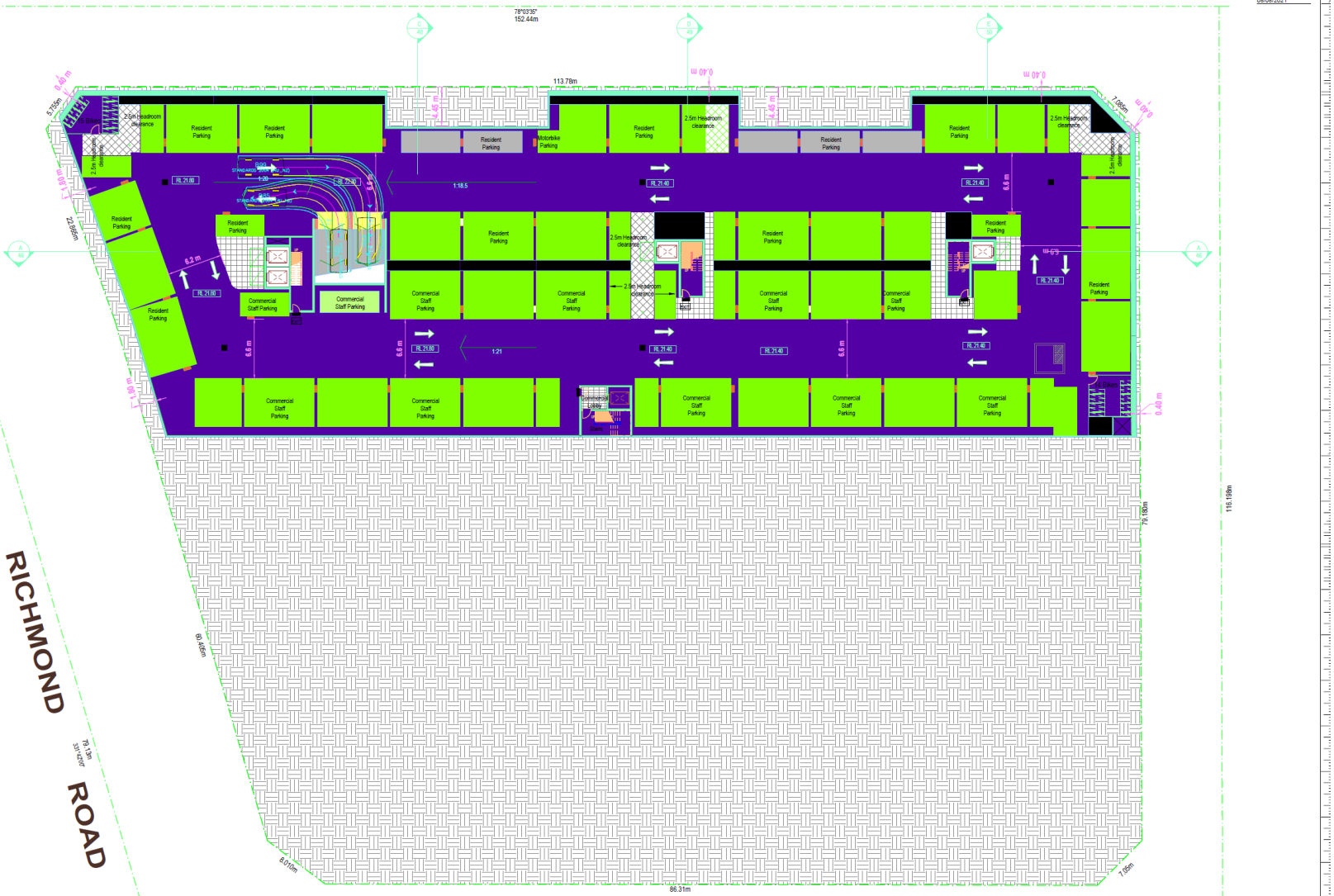
Design Vehicle





A1.06

09/08/2021



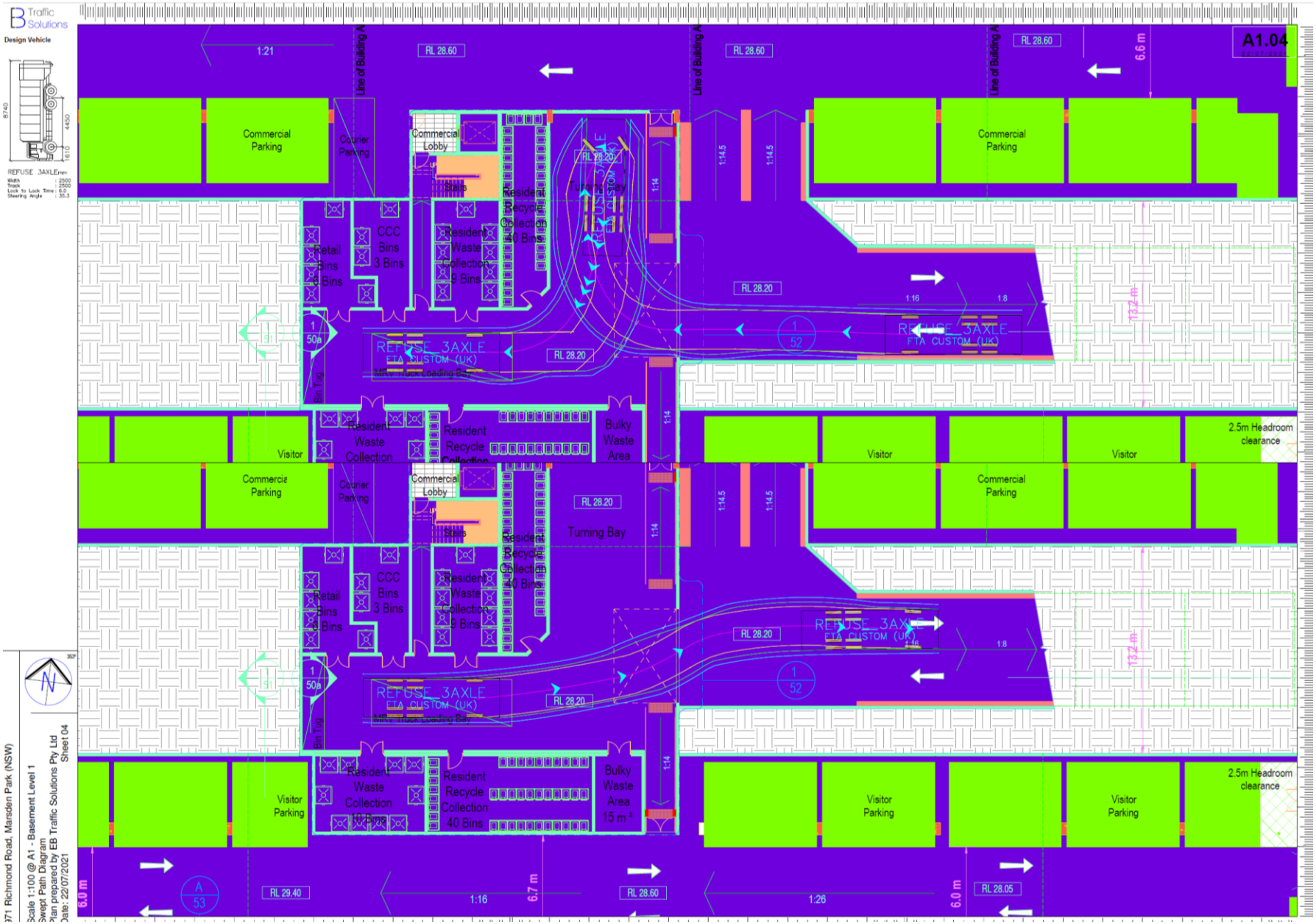
971 Richmond Road, Marsden Park (NSW)

Scale 1:200 @ A1 - Basement Level 3
Swept Path Diagram
Plan prepared by EB Traffic Solutions Pty Ltd
Date: 06/08/2021

Sheet 06

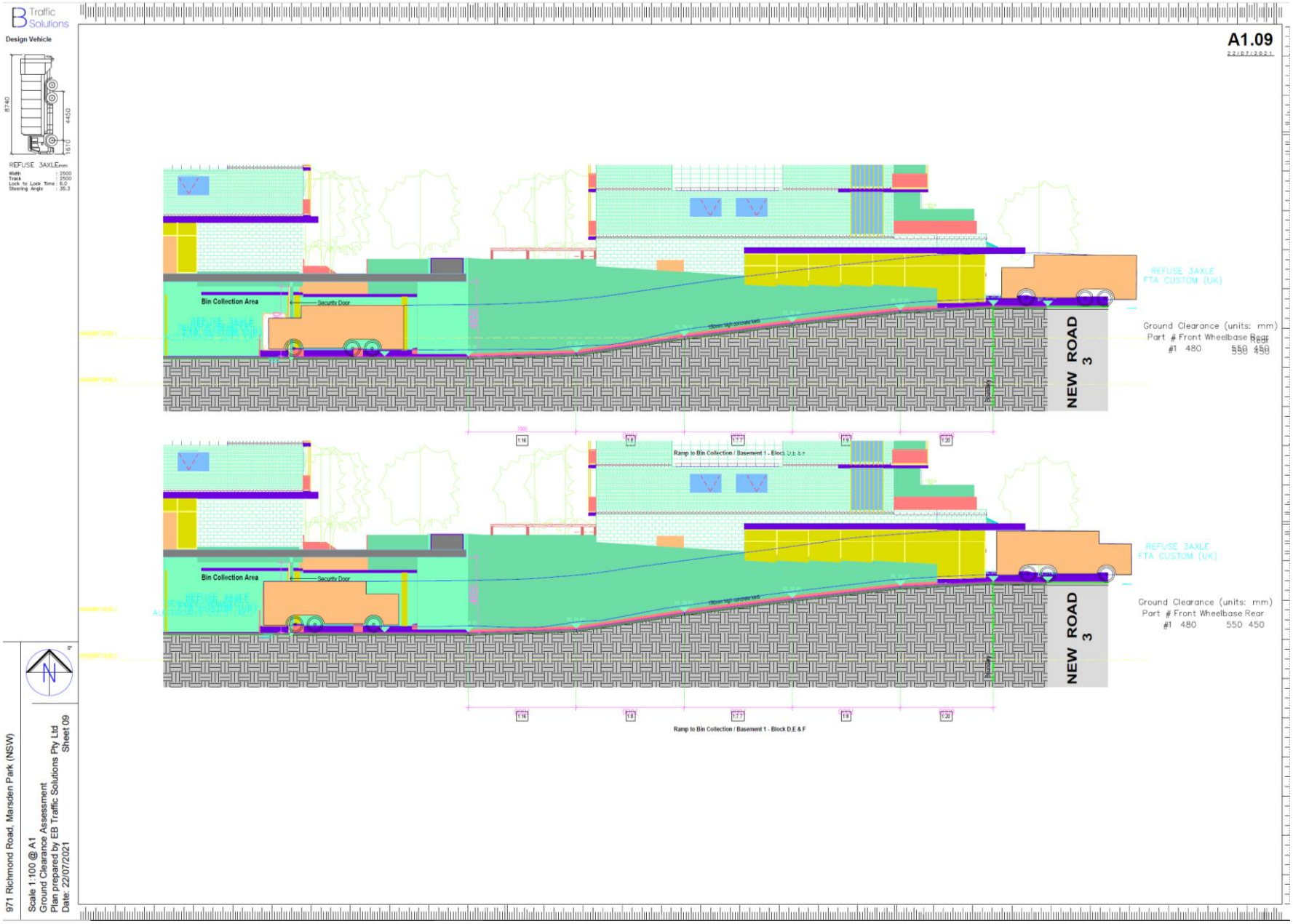
ATTACHMENT F

SWEPT PATH ANALYSIS (8.8 M REFUSE TRUCK)


Traffic Solutions
Design Vehicle
REFUSE 3AXLEmm
A1.04
Commercial Parking
Courier Parking
Commercial Lobby
Stairs
Retail Bins 3 Bins
CCC Bins 3 Bins
Resident Waste Collection 9 Bins
Resident Recycle Collection 40 Bins
Turning Bay
RL 28.60
RL 28.20
RL 29.40
RL 28.05
1:21
1:16
1:8
1:26
1:14
1:14.5
6.6 m
10.2 m
13.2 m
6.0 m
6.7 m
REFUSE 3AXLE
ETA CUSTOM (UK)
MRV Truck Loading Bay
Bin Tug
Visitor
Visitor Parking
Bulky Waste Area
15 m²
2.5m Headroom clearance
Line of Building A
971 Richmond Road, Marsden Park (NSW)
Scale 1:100 @ A1 - Basement Level 1
Swept Path Diagram
Plan prepared by EB Traffic Solutions Pty Ltd
Date: 22/07/2021
Sheet 04

ATTACHMENT G

GROUND CLEARANCE ANALYSIS (8.8 M REFUSE TRUCK)


Traffic Solutions
Design Vehicle
8140
4450
1610
REFUSE 3AXLE mm
Width : 2500
Track : 2500
Lock to Lock Time : 6.0
Steering Angle : 35.3
A1.09
22/07/2021
Bin Collection Area
Security Door
150mm high concrete kerb
NEW ROAD 3
Ramp to Bin Collection / Basement 1 - Block D,E & F
REFUSE 3AXLE FTA CUSTOM (UK)
Ground Clearance (units: mm)
Part # Front Wheelbase Rear
#1 480 550 450
1:16
1:8
1:77
1:9
1:20
971 Richmond Road, Marsden Park (NSW)
Scale 1:100 @ A1
Ground Clearance Assessment
Plan prepared by EB Traffic Solutions Pty Ltd
Date: 22/07/2021
Sheet 09

ATTACHMENT H

INTERSECTION PEFORMANCE

BASE CASE (EXISTING VOLUMES + APPROVED DEVELOPMENT)

PM PEAK

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	7	5.0	7	5.0	0.005	7.7	LOS A	0.0	0.2	0.10	0.62	0.10	61.1
2	T1	1817	5.0	1913	5.0	*0.855	44.1	LOS D	44.2	323.0	0.95	0.91	1.02	41.0
3	R2	560	5.0	589	5.0	*0.833	72.1	LOS E	21.1	154.2	1.00	0.91	1.15	29.7
Approach		2384	5.0	2509	5.0	0.855	50.6	LOS D	44.2	323.0	0.96	0.91	1.05	37.6
East: South Street East														
4	L2	343	5.0	361	5.0	0.514	14.5	LOS B	10.0	73.1	0.50	0.74	0.50	54.2
5	T1	14	5.0	15	5.0	0.091	72.7	LOS E	0.5	3.7	0.99	0.65	0.99	29.6
6	R2	495	5.0	521	5.0	*0.850	75.6	LOS E	19.1	139.2	1.00	0.93	1.20	28.6
Approach		852	5.0	897	5.0	0.850	51.0	LOS D	19.1	139.2	0.80	0.85	0.91	35.4
North: Richmond Road North														
7	L2	504	5.0	531	5.0	0.402	12.1	LOS B	10.9	79.9	0.39	0.72	0.39	56.9
8	T1	1433	5.0	1508	5.0	0.636	34.7	LOS C	27.0	196.9	0.86	0.76	0.86	45.7
9	R2	16	5.0	17	5.0	0.046	55.8	LOS E	0.9	6.7	0.84	0.70	0.84	34.2
Approach		1953	5.0	2056	5.0	0.636	29.0	LOS C	27.0	196.9	0.73	0.75	0.73	48.0
West: South Street West														
10	L2	27	5.0	28	5.0	0.049	25.8	LOS C	1.0	7.2	0.58	0.69	0.58	46.4
11	T1	15	5.0	16	5.0	*0.098	72.8	LOS E	0.5	4.0	0.99	0.65	0.99	29.6
12	R2	16	5.0	17	5.0	0.027	58.3	LOS E	0.5	3.5	0.86	0.67	0.86	33.3
Approach		58	5.0	61	5.0	0.098	46.9	LOS D	1.0	7.2	0.76	0.67	0.76	36.9
All Vehicles		5247	5.0	5523	5.0	0.855	42.6	LOS D	44.2	323.0	0.85	0.84	0.91	40.5

ATTACHMENT J

INTERSECTION PEFORMANCE

BASE CASE + PROPOSED DEVELOPMENT

PM PEAK

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	7	5.0	7	5.0	0.005	7.7	LOS A	0.0	0.2	0.10	0.62	0.10	61.1
2	T1	1817	5.0	1913	5.0	*0.888	51.1	LOS D	48.0	350.1	0.97	0.97	1.10	38.0
3	R2	646	5.0	680	5.0	*0.868	73.9	LOS E	25.2	183.9	1.00	0.93	1.19	29.3
Approach		2470	5.0	2600	5.0	0.888	56.9	LOS E	48.0	350.1	0.98	0.96	1.12	35.3
East: South Street East														
4	L2	407	5.0	428	5.0	0.591	15.7	LOS B	13.3	97.4	0.55	0.76	0.55	53.2
5	T1	14	5.0	15	5.0	0.091	72.7	LOS E	0.5	3.7	0.99	0.65	0.99	29.6
6	R2	495	5.0	521	5.0	*0.887	80.9	LOS F	19.9	145.3	1.00	0.96	1.27	27.5
Approach		916	5.0	964	5.0	0.887	51.8	LOS D	19.9	145.3	0.80	0.87	0.95	35.1
North: Richmond Road North														
7	L2	504	5.0	531	5.0	0.416	13.5	LOS B	12.4	90.8	0.43	0.73	0.43	55.8
8	T1	1433	5.0	1508	5.0	0.659	36.4	LOS D	27.7	202.0	0.88	0.78	0.88	44.7
9	R2	16	5.0	17	5.0	0.042	53.1	LOS D	0.9	6.5	0.81	0.70	0.81	35.1
Approach		1953	5.0	2056	5.0	0.659	30.6	LOS C	27.7	202.0	0.76	0.77	0.76	47.0
West: South Street West														
10	L2	27	5.0	28	5.0	0.047	26.3	LOS C	1.0	7.2	0.59	0.69	0.59	46.1
11	T1	15	5.0	16	5.0	*0.098	72.8	LOS E	0.5	4.0	0.99	0.65	0.99	29.6
12	R2	16	5.0	17	5.0	0.029	59.2	LOS E	0.5	3.5	0.87	0.67	0.87	33.0
Approach		58	5.0	61	5.0	0.098	47.4	LOS D	1.0	7.2	0.77	0.67	0.77	36.7
All Vehicles		5397	5.0	5681	5.0	0.888	46.4	LOS D	48.0	350.1	0.87	0.87	0.96	38.8

ATTACHMENT K

INTERSECTION PEFORMANCE

FUTURE FLOWS (2031) + APPROVED DEVELOPMENT

PM PEAK

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	9	5.0	9	5.0	0.006	7.7	LOS A	0.0	0.2	0.10	0.62	0.10	61.1
2	T1	2197	5.0	2313	5.0	*1.035	116.8	LOS F	87.3	636.9	1.00	1.34	1.57	22.5
3	R2	683	5.0	719	5.0	*1.016	125.0	LOS F	36.1	263.4	1.00	1.10	1.62	20.7
Approach		2889	5.0	3041	5.0	1.035	118.4	LOS F	87.3	636.9	1.00	1.28	1.58	22.1
East: South Street East														
4	L2	418	5.0	440	5.0	0.681	20.8	LOS C	17.7	129.6	0.70	0.81	0.70	49.6
5	T1	17	5.0	18	5.0	0.111	73.0	LOS E	0.6	4.5	0.99	0.66	0.99	29.5
6	R2	603	5.0	635	5.0	*1.035	136.4	LOS F	33.0	241.1	1.00	1.16	1.72	19.2
Approach		1038	5.0	1093	5.0	1.035	88.8	LOS F	33.0	241.1	0.88	1.01	1.29	25.7
North: Richmond Road North														
7	L2	614	5.0	646	5.0	0.525	15.4	LOS B	18.9	138.0	0.53	0.76	0.53	54.2
8	T1	1732	5.0	1823	5.0	0.772	37.5	LOS D	35.5	259.1	0.93	0.83	0.93	44.2
9	R2	20	5.0	21	5.0	0.058	55.9	LOS E	1.2	8.4	0.84	0.71	0.84	34.2
Approach		2366	5.0	2491	5.0	0.772	31.9	LOS C	35.5	259.1	0.82	0.81	0.82	46.3
West: South Street West														
10	L2	33	5.0	35	5.0	0.063	36.8	LOS D	1.5	11.0	0.72	0.71	0.72	40.8
11	T1	18	5.0	19	5.0	*0.117	73.0	LOS E	0.7	4.8	0.99	0.66	0.99	29.5
12	R2	20	5.0	21	5.0	0.034	58.4	LOS E	0.6	4.4	0.86	0.68	0.86	33.2
Approach		71	5.0	75	5.0	0.117	52.1	LOS D	1.5	11.0	0.83	0.69	0.83	35.1
All Vehicles		6364	5.0	6699	5.0	1.035	80.7	LOS F	87.3	636.9	0.91	1.06	1.24	28.4

ATTACHMENT L

INTERSECTION PEFORMANCE

FUTURE FLOWS (2031) + APPROVED DEVELOPMENT + PROPOSED DEVELOPMENT

PM PEAK

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	9	5.0	9	5.0	0.006	7.7	LOS A	0.0	0.2	0.10	0.62	0.10	61.1
2	T1	2197	5.0	2313	5.0	*1.055	130.9	LOS F	91.9	670.9	1.00	1.41	1.65	20.6
3	R2	731	5.0	769	5.0	*1.049	145.3	LOS F	42.1	307.2	1.00	1.15	1.74	18.4
Approach		2937	5.0	3092	5.0	1.055	134.1	LOS F	91.9	670.9	1.00	1.34	1.67	20.1
East: South Street East														
4	L2	450	5.0	474	5.0	0.724	22.1	LOS C	20.4	149.0	0.74	0.83	0.74	48.7
5	T1	17	5.0	18	5.0	0.111	73.0	LOS E	0.6	4.5	0.99	0.66	0.99	29.5
6	R2	603	5.0	635	5.0	*1.035	136.4	LOS F	33.0	241.1	1.00	1.16	1.72	19.2
Approach		1070	5.0	1126	5.0	1.035	87.3	LOS F	33.0	241.1	0.89	1.01	1.30	26.0
North: Richmond Road North														
7	L2	614	5.0	646	5.0	0.531	15.9	LOS B	19.5	142.4	0.54	0.77	0.54	53.8
8	T1	1732	5.0	1823	5.0	0.789	38.5	LOS D	36.2	264.2	0.94	0.84	0.94	43.7
9	R2	20	5.0	21	5.0	0.056	55.0	LOS E	1.1	8.3	0.83	0.71	0.83	34.5
Approach		2366	5.0	2491	5.0	0.789	32.7	LOS C	36.2	264.2	0.83	0.82	0.83	45.8
West: South Street West														
10	L2	33	5.0	35	5.0	0.062	36.1	LOS D	1.5	10.9	0.71	0.71	0.71	41.1
11	T1	18	5.0	19	5.0	*0.117	73.0	LOS E	0.7	4.8	0.99	0.66	0.99	29.5
12	R2	20	5.0	21	5.0	0.034	58.4	LOS E	0.6	4.4	0.86	0.68	0.86	33.2
Approach		71	5.0	75	5.0	0.117	51.8	LOS D	1.5	10.9	0.82	0.69	0.82	35.2
All Vehicles		6444	5.0	6783	5.0	1.055	88.2	LOS F	91.9	670.9	0.92	1.09	1.29	26.7