

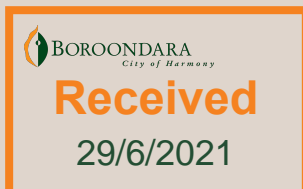
Report Prepared for:  
Homes Victoria

## Traffic Impact Assessment

1-7 & 12 Bills Street and 151-153  
Robinson Road, Hawthorn –  
Proposed Residential Development

Homes Victoria Project No.  
302817

February 2021



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## 1.1 Introduction

Ratio has been engaged by Homes Victoria to prepare a Traffic Impact Assessment for the proposed renewal of the Homes Victoria land located at 1-7 & 12 Bills Street and 151-153 Robinson Road, Hawthorn.

This report has been prepared to address the parking and traffic matters of the proposed development based on surveys, observations in the vicinity of the site, and previous studies of the subject site and other similar developments in Melbourne. This report is based on the Hayball Revision 5 plans dated 4 December 2020, referred to as the 100% SD Issue.

Based on the scope of Ratio's engagement, the information contained within this assessment has been prepared to respond the following objectives:

- Car Parking Consideration;
- Traffic Impact Considerations; and
- Design Considerations.

Ratio Consultants previously prepared an Integrated Transport Assessment for the site during 2019 to inform a planning scheme amendment for a proposed development plan overlay.

## 1.2 Background

As part Victoria's Big Housing Build Program, the Director of Housing is seeking new approaches to renew existing homes that are no longer fit for purpose and to grow social housing.

Rental affordability continues to decline in Victoria with one in ten renters paying more than 30% of household income towards rent. This has led to increasing demand for social housing in Victoria, particularly those on statutory incomes.

In response, the Victorian Government is seeking to facilitate the redevelopment of the Bills Street, Hawthorn site.

This Traffic Impact Assessment has been prepared to assess the proposed development including car parking and transport implications.

## 2 Existing Conditions:

### 2.1 Subject Site

The subject site, owned by Homes Victoria, is currently vacant. The subject site was previously occupied by ten buildings containing 52 dwellings. Two buildings were demolished in 2011, leaving eight (8) buildings; four buildings north of Bills Street and four buildings south of Bills Street, accommodating 36 public dwellings.

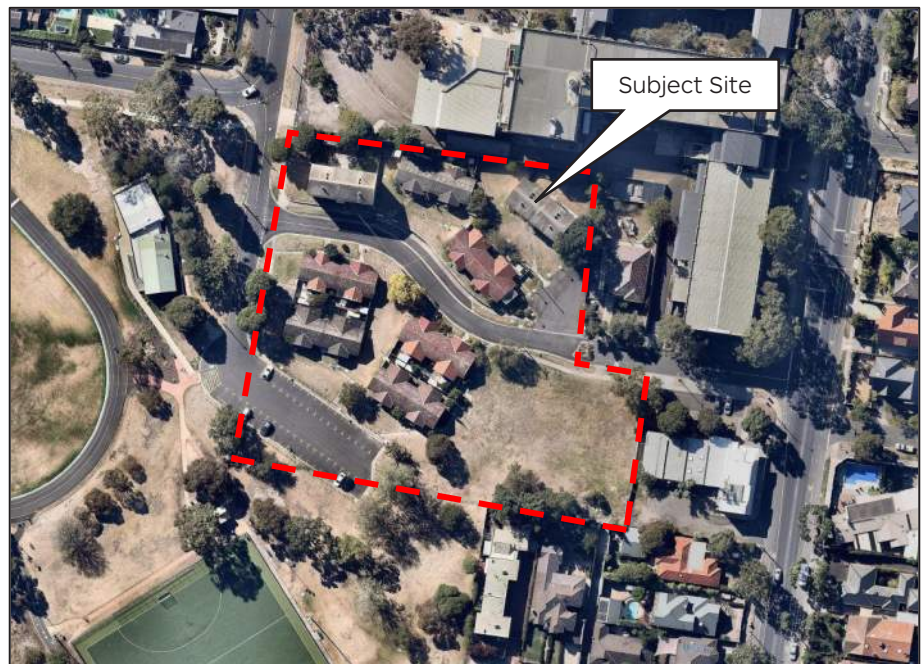
The subject site encompasses the western end of Bills Street and a portion of the Patterson Reserve car park located at the southern terminus of Robinson Road.

The site is generally regular in shape, is bisected by Bills Street generally through the centre of the site and has an overall site area of 10,081 square metres. The site is subject to a noticeable fall, with the northern boundary of the site being approximately 9m higher than the southern boundary.

The site has frontages of approximately 90 metres to Robinson Road and approximately 100 metres of the total length of Bills Street is located within the site.

Figure 2.1 provides an aerial photographic view of the site and its immediate surrounds.

**Figure 2.1: Subject Site (Pre demolition of existing buildings on-site)**



Source: [www.nearmap.com.au](http://www.nearmap.com.au)

The Patterson Reserve car park has provision for 38 car spaces, including one DDA space, and provides car parking for existing residents of the subject site as well as the nearby Hawthorn Velodrome and Hawthorn Hockey Ground.

Of the 38 spaces, a total of 11 are signed as Permit Parking for the previous residents of the site with the remaining 27 spaces for public use.

### 2.2 Subject Site Context

Land use in the wider vicinity of the subject site is predominantly residential in nature.

In the immediate vicinity of the site, the site is bound to the southeast by the rear of residential dwellings that front onto Burgess Street. Patterson Reserve forms the site boundary to the west and southwest of the site.

To the direct north of the site is The University of Melbourne's Hawthorn Campus. Along the eastern boundary of the site is a Local Activity Centre that fronts onto Bills Street and Auburn Road.

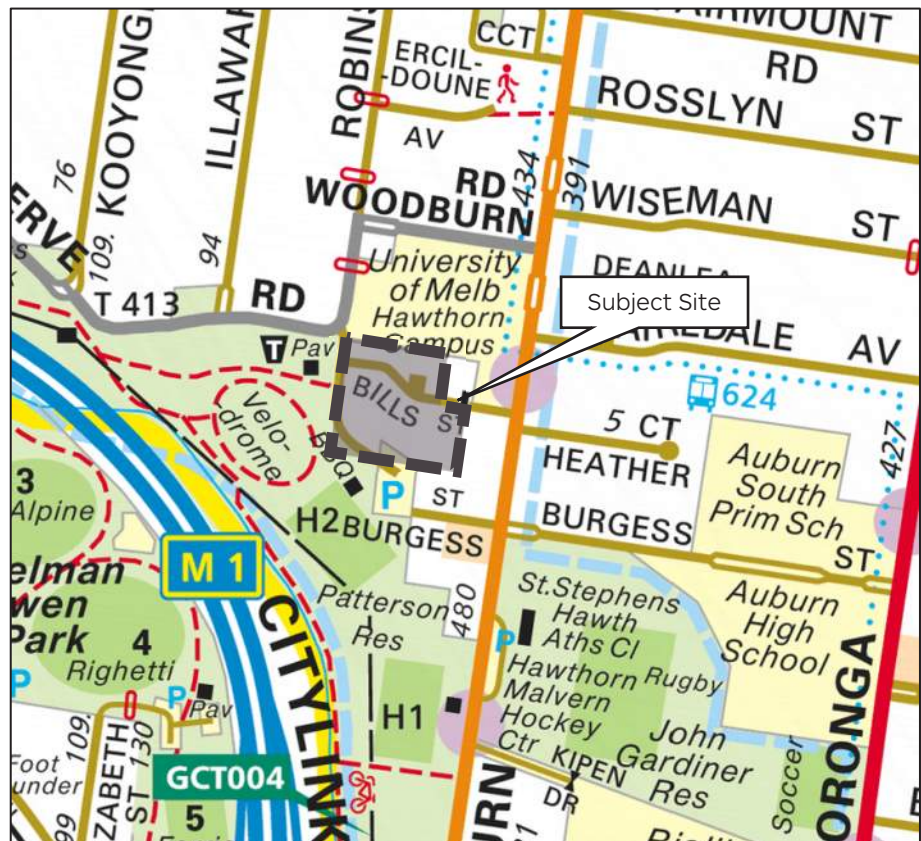
The Hawthorn Velodrome and Hawthorn Hockey Centre are located to the south-west of the site within the Patterson Reserve. Auburn High School is located to the south east of the site, pupils from the school have access to the aforementioned sporting facilities during the week.

Further to the south of the site is a large industrial precinct spread across a number of roads located between Tooronga Road and Auburn Road.

Other land uses of note within proximity of the site include the Kooyong Railway Station located approximately 1.0km west of the site and Stockland Tooronga Shopping Centre which is located south of Toorak Road approximately 1.1km from the site.

The area surrounding the site is illustrated in Figure 2.2.

**Figure 2.2: Subject Site Locality**



Source: [www.melway.com.au](http://www.melway.com.au)

## 2.3 Road Network

### Robinson Road

Robinson Road, adjacent the subject site, is a local road under Council management. Aligned in a north to south direction, Robinson Road extends from Riversdale Road in the north, terminating at its southern extent at the Patterson Reserve car park adjacent the subject site.



Robinson Road, south of Reserve Road, has an approximate pavement width of 5.8 metres accommodating a lane of traffic in each direction. 'No Stopping' restrictions apply to both sides Robinson Road in site's vicinity.

North of Reserve Road, Robinson Road comprises a 12m pavement accommodating a single through lane in each direction and unrestricted kerb side parallel parking.

The default built-up urban speed limit of 50km/h speed applies to Robinson Road near the subject site. A series of flat top road humps are located along Robinson Road as part of a local area traffic management strategy.

Figure 2.3 to Figure 2.5 illustrate the typical configuration of Robinson Road.

**Figure 2.3: Robinson Road Facing North Adjacent the Subject Site**



**Figure 2.4: Robinson Road Facing South Adjacent the Subject Site**



**Figure 2.5: Robinson Road Facing North, North of the Subject Site**



### **Bills Street**

Bills Street is a Local Road, generally aligned in an east to west direction. Bills Street extends between Robinson Road in the west and Auburn Road in the east. A road closure is in place approximately 60m west of Auburn Road coinciding with the eastern property boundary.

The western section of Bills Street provides access to the subject site and has an approximate carriageway width of 6.0 metres and operates with two-way traffic. It is understood that this section of Bills Street was removed from Council's Road Register in 2015 but has still functioned as a road since that time.

Indented kerbside parking is provided on the north side of Bills Street, and kerbside parking along the south side. All parking is restricted to 'Permit Zone' parking.

At the eastern end, Bills Street is constructed with a approx. 7.5m pavement width and provides access to the Melbourne University site to the north, and on-site parking servicing the local activity centre to the south.

The default built-up urban speed limit of 50km/h applies to Bills Street in the vicinity of the subject site.

The general cross-section of Bills Street, pre-demolition of the buildings, within the site is illustrated in Figure 2.5 and Figure 2.6.

The cross section of Bills Street external to the site is shown in Figure 2.8 and the road closure in Figure 2.9.

**Figure 2.6: Bills Street Facing East Within the Site (Pre Demolition)**



**Figure 2.7: Bills Street Facing West Within the Site (Pre Demolition)**





**Figure 2.8: Bills Street Facing West from Auburn Road to the Site (pre demolition)**



**Figure 2.9: Bills Street Facing West to the Road Closure (pre demolition)**



### **Auburn Road**

Auburn Road, at its intersection with Bills Street, is a Council Road aligned generally in a north to south direction, connecting Barkers Road in the north with Toorak Road (Burwood Highway) in the south.

At its intersection with Bills Street, Auburn Road has an approximate carriageway width of 13.6 metres, accommodating one lane of traffic and a bicycle lane in each direction.

Parallel kerbside parking is permissible along the east side of Auburn Road, with angled/kerbside parking available on the west side, south of the Bills Street intersection, at the local activity centre.

North of Wiseman Street and south of Burgess Street, parallel kerb side parking is provided on both sides of Auburn Road.

A signalised pedestrian crossing (Pedestrian Operated Signals (POS)) is located approximately 25 metres north of the Bills Street.

A posted speed limit of 60km/h applies to Auburn Road in the vicinity of the subject site, which reduces to 40 km/h during peak school pick-up/drop-off times on school days.

The general cross-section of Auburn Road near to Bills Street is shown in Figure 2.10 and Figure 2.11.

**Figure 2.10: Auburn Road Facing North**



**Figure 2.11: Auburn Road Facing South**



## 2.4 Public Transport

The site is serviced by public transport with bus, tram and train routes nearby. Bus, tram and train services operate 7 days a week and provide a high quality and accessible means of transport to wider Melbourne.



Figure 2.12 shows the public transport services that operate within the proximity of the site with Figure 2.13 illustrating stop locations.

The public transport services operating within proximity of the subject site, are summarised below.

### Bus Services

The subject site is serviced by the bus routes identified in Table 2.1.

**Table 2.1: Public Transport Services - Bus**

Route	Route Description	Nearest Stop	Frequency	Walking Distance
624	Kew - Oakleigh	Airedale Avenue / Auburn Road	~30 mins	150 metres

Bus services operate 7 days a week with first services typically commencing at approximately 6:30am and final services finishing at approximately 9:15pm.

In the vicinity of the subject site, southbound bus services are accessed via a stop on Auburn Road approximately 80m north of Bills Street.

Northbound services are accessed via a stop located on Airedale Avenue approximately 60m north of Bills Street. Both stops comprise a passenger shelter and totem sign including timetable information.

Both stops are readily accessible via the Pedestrian Operated Signals (POS) located north of Bills Street.

### Tram Services

The subject site is serviced by the bus routes identified in Table 2.2.

**Table 2.2: Public Transport Services - Tram**

Route	Route Description	Nearest Stop	Frequency	Walking Distance
16	Melbourne University – Kew via St Kilda	Gardiner Road / Glenferrie Road	~10 mins	850 metres (approx. 10 minute walk)

Tram services operate 7 days a week with first services typically commencing at approximately 5:30am and final services finishing at approximately 12:00am.

Access to Route 16 is provided via two tram stops, one providing connection to northbound services and one to southbound services. Both stops comprise a passenger shelter and totem sign including timetable information. The two tram stops can be accessed via the Gardiners Creek shared path and the surrounding pedestrian path network.

### Train Services

The subject site is serviced by the bus routes identified in Table 2.3.

**Table 2.3: Public Transport Services - Train**

Route	Station	Distance from Site	Frequency
Glen Waverley Line	Kooyong Railway Station	1.0 kilometre (approx. 12 minute walk)	15 minutes

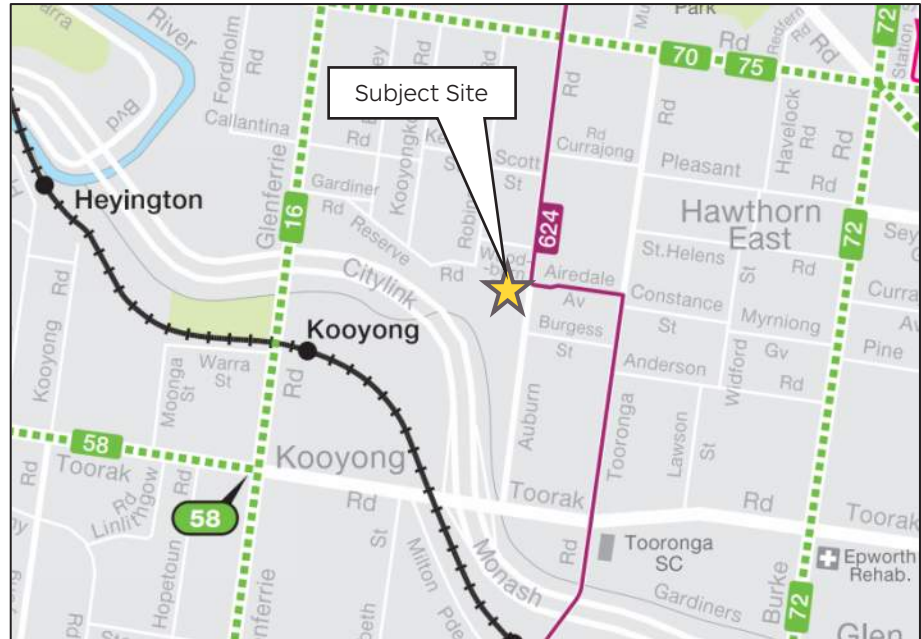
Train services operate 7 days a week with first services typically commencing at approximately 5:30am and final services finishing at

approximately 12:00am. On Friday and weekend evenings, trains operate continuously.

Access to the metropolitan railway network is provided via Kooyong Railway Station which can be accessed via the Gardiners Creek shared path and the surrounding pedestrian path network.

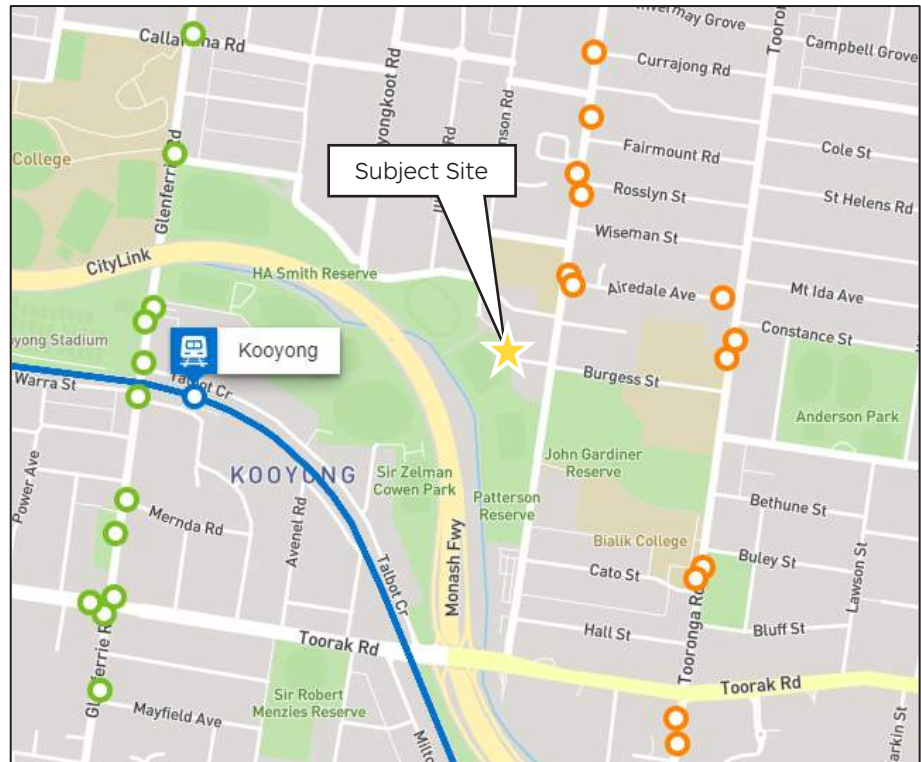
Kooyong Railway Station currently provides DDA compliant access, sheltered waiting areas, bicycle racks and a modest supply of car parking.

**Figure 2.12: Public Transport Connections**



Source: [www.ptv.vic.gov.au](http://www.ptv.vic.gov.au)

**Figure 2.13: Public Transport Stops**



Source: [www.ptv.vic.gov.au](http://www.ptv.vic.gov.au)

## 2.5 Active Transport

### Walkability

The site is located within an established area of Melbourne and as such is connected to a high quality pedestrian network.

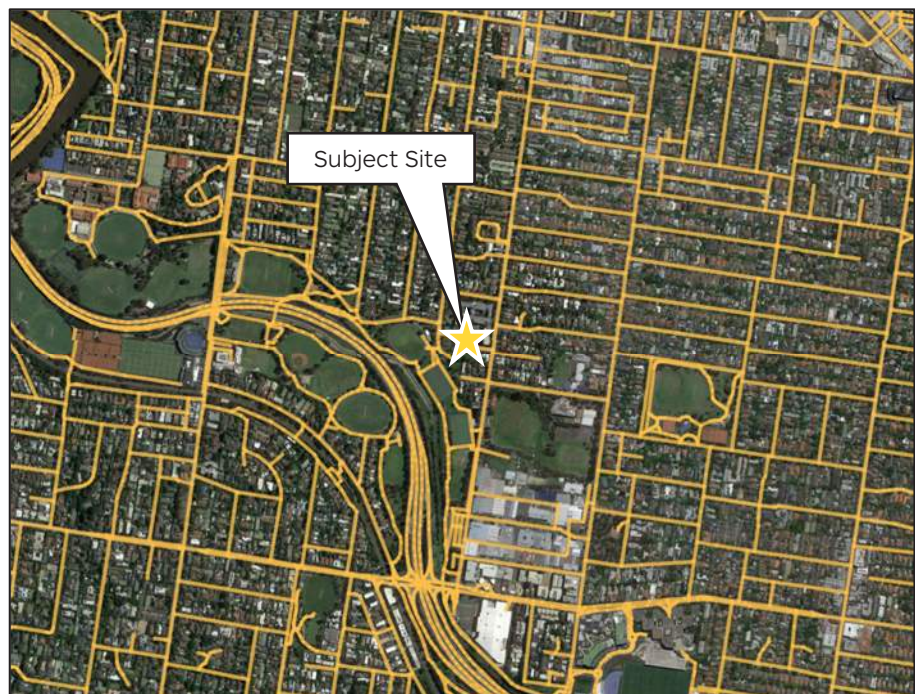
The pedestrian network generally comprises sealed foot paths on both sides of nearby roads as well as shared paths and walking trails through recreation areas.

The available path network in the vicinity of the site is illustrated in Figure 2.14.

Additionally, a number of controlled pedestrian crossing points are provided throughout the area to assist pedestrian permeability.

These typically take the form of pedestrian operated signals, crossing facilities at signalised intersections, and flagged school crossings.

**Figure 2.14: Surrounding Pedestrian Path Network**



The site is located within walking distance of, and is well connected to, multiple services that cater for day-to-day resident needs.

The site achieves a 'Walk Score' of 70 points (out of a possible 100) and is described as 'Very Walkable' on WalkScore.com indicating daily errands can be done without the use of a motor vehicle.

A site's walk score is calculated based on the walking distance to local amenities, such as supermarkets, food and drink premises, restaurants, parks, public transport, etc.

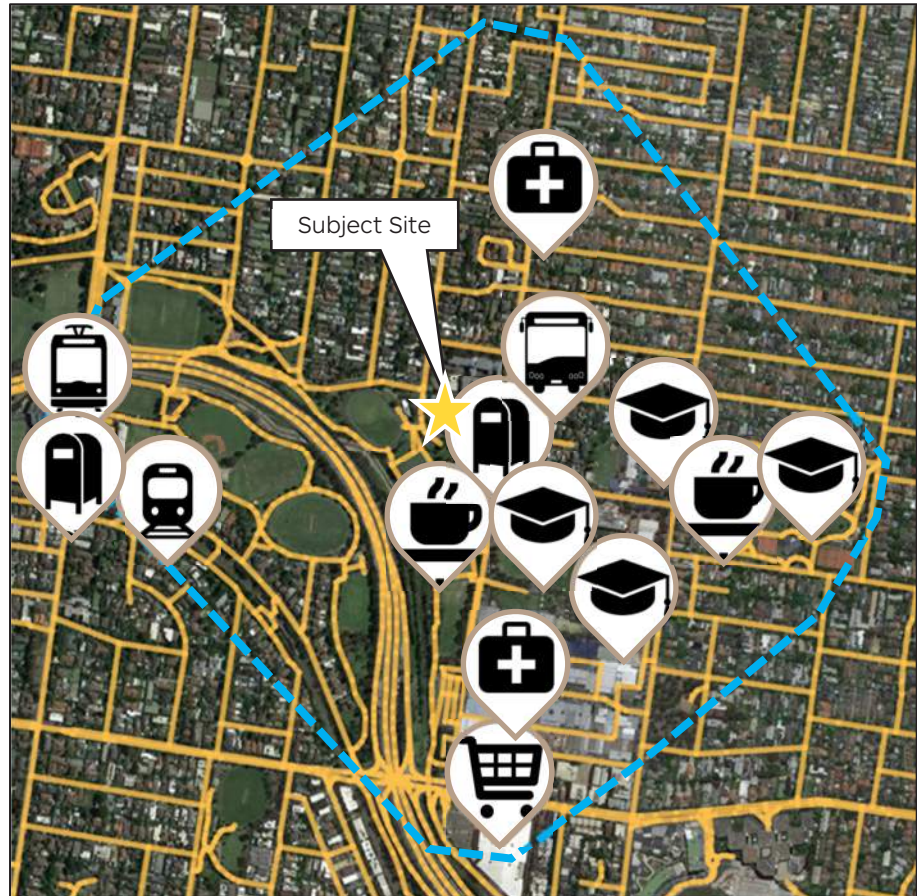
Walkscore.com utilises data sources such as Google and road network data to calculate a 'Walk Score'.

Destinations within a 10-minute walk of the site include supermarkets, schools, retail outlets, post office, dining and social businesses, medical centre, recreation reserves and multiple transport opportunities.



The facilities within this 10-minute walk are illustrated in Figure 2.15, which is effectively an 840m walking catchment based on the average walking speed of 1.4m/s.

**Figure 2.15: Facilities Within 10 Minute Walk Distance**



### **Cycle Connectivity**

The subject site has very good access to the surrounding bicycle network, with the following bicycle routes located in close proximity to the site:

- On-road bicycle lanes along Auburn Road, Tooronga Road and Glenferrie Road;
- Informal bicycle routes along Robinson Road, Burgess Street, Woodburn Road, Kooyongkoot Road and Callantina Road; and,
- The Gardiners Creek off-road shared path.

Bicycle connections and paths in the wider area of the subject site are shown in Figure 2.16.

**Figure 2.16: Bicycle Connections**

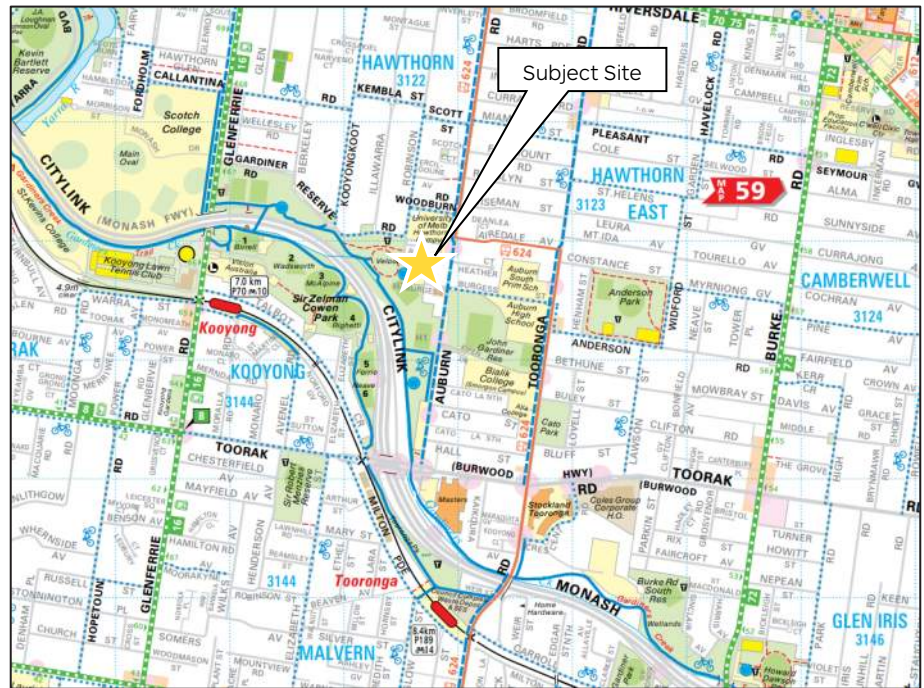


Figure 2.17 and Figure 2.18 illustrate the typical configuration of bicycle infrastructure in the area.

**Figure 2.17: Gardiners Creek Path in close proximity to the Site**



**Figure 2.18: Gardiners Creek Path in close proximity to the Site**



## **2.6 Existing Traffic Volumes**

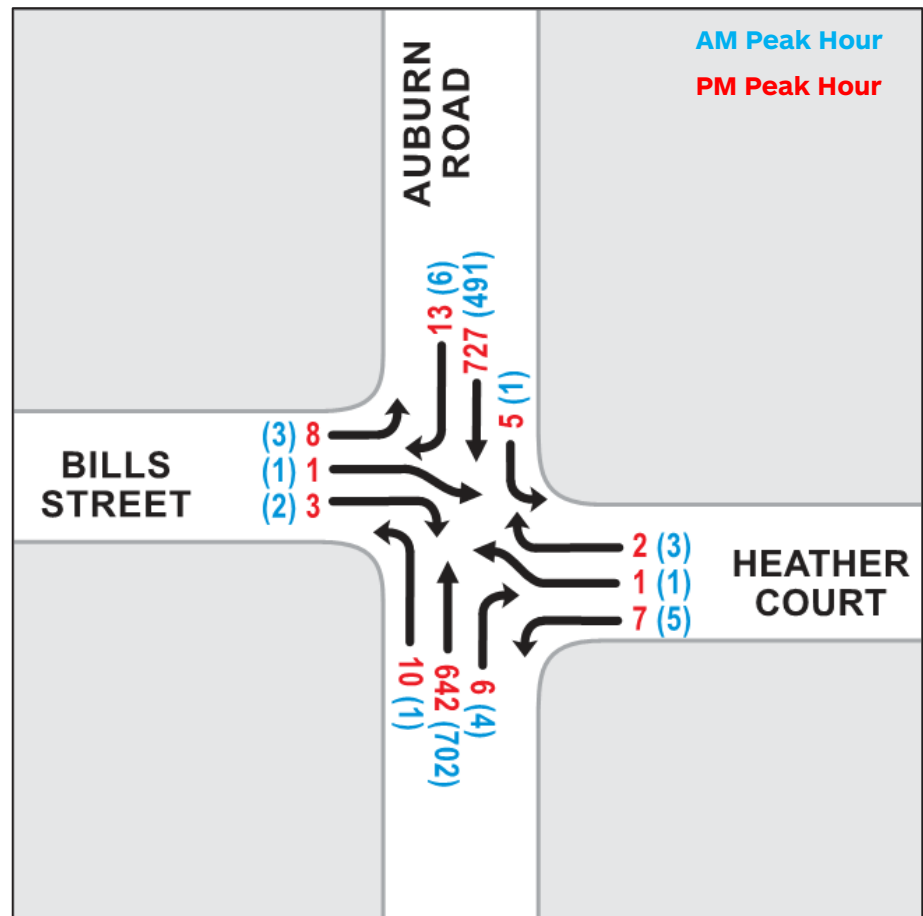
Traffic volume surveys were commissioned by Ratio Consultants in the vicinity of the subject site at the intersection of Bills Street / Auburn Road / Heather Court on Wednesday 17 October 2018, as part of a previous engagement.

The survey was undertaken between 6:00am – 10:00am and 2:30pm – 6:30pm to capture typical weekday peak periods.

The peak hour volumes for the observed weekday peak periods are shown in Figure 2.19.



Figure 2.19: Peak Hour Volumes – Bills Street / Auburn Road / Heather Court



### Impact of Toorak Road Level Crossing Removal

As part of the Victorian State Government Level Crossing Removal Program, the Toorak Road Level Crossing was removed during early 2020. The project, which aimed to reduce wait times at the Monash Freeway Interchange, may have had a broader impact on traffic volumes in the surrounding road network, including Auburn Road.

At the time of preparing this report, social distancing rules relating to the Covid-19 situation meant that undertaking up to date traffic surveys and data collection is not possible.

Notwithstanding, it is expected that traffic volumes along Auburn Road have will not alter significantly as an outcome of the level crossing removal at Toorak Road and the surveys undertaken in October 2018 are still fit for the purposes of this assessment.

## 2.7 Existing Intersection Operation

Based on the surveyed traffic volumes displayed in Figure 2.19, an assessment of the existing intersection operation adjacent the subject site has been undertaken using the intersection analysis software SIDRA.

### SIDRA Parameters

The key parameters used to determine the operational capacity of an intersection are queue length, average delay and degree of saturation (or volume to capacity ratio).

Degree of Saturation is a ratio of arrival (or demand) flow to capacity. Degrees of saturation above 1.0 represent overcapacity conditions and degrees of saturation below 1.0 represent under capacity conditions.

The operational rating associated with the degree of saturation is summarised in Table 2.4.

**Table 2.4: Ratings of Degree of Saturation**

Degree of Saturation (DOS)	Rating
Up to 0.6	Excellent
0.61 – 0.70	Very Good
0.71 – 0.80	Good
0.81 – 0.90	Fair
0.91 – 1.00	Poor
Greater than 1.00	Very Poor

Although operating conditions with a degree of saturation around 1.00 are undesirable, it is acknowledged that this level of congestion is typical of many metropolitan intersections during the AM and PM peak hours.

The 95th percentile queue length is the value below which 95 percent of all observed cycle queue lengths fall, or conversely, the length 5 percent of all observed queues exceed.

Average Delay is the average time, in seconds, that all vehicles making a particular movement can expect to wait at an intersection.

The results of the SIDRA Intersection analysis of the existing conditions are presented in Table 2.5 with detailed SIDRA outputs contained within Table 2.5.

**Table 2.5: Intersection of Bills Street / Auburn Road / Heather Court (Existing Conditions)**

Approach	AM Peak			PM Peak		
	DoS	Average Delay (sec)	95%ile Queue (m)	DoS	Average Delay (sec)	95%ile Queue (m)
Auburn Road (S)	0.36	1	2	0.38	1	1
Heather Court	0.04	21	1	0.03	19	1
Auburn Road (N)	0.41	1	3	0.27	1	1
Bills Street	0.05	21	1	0.03	21	1

The SIDRA model has been calibrated based on site observations to reflect the existing road network operations.

Based on the above assessment, the intersection of Bills Street / Auburn Road / Heather Court is currently operating under 'Excellent' conditions.



It is noted that on-site observations by Ratio staff suggests that queues on Auburn Road can extend north from the intersection with Toorak Road. Whilst extensive queuing was observed on Auburn Road, it was not observed to extend to the Bills Street intersection.

While the Toorak Road level crossing is unlikely to have increased traffic volumes on Auburn Road, it is likely that the operation of the signalised intersection of Auburn Road and Toorak Road has improved, in particular for right turns out of Auburn Road.

## 3.1 Development Schedule

The proposed residential development will involve the construction of 206 dwellings on-site.

These dwellings will be a mixture of social and affordable dwellings and spread across the six new buildings.

For the purposes of this assessment, it is understood that Building A, E and G are proposed to accommodate social housing dwellings, while Buildings B, C and F are proposed to accommodate affordable housing dwellings.

It is understood that the development will comprise the dwelling mix shown at Table 3.1.

**Table 3.1: Dwelling Schedule**

Level	1 Bedroom	2 Bedroom	3 Bedroom	Total
<b>Social Dwellings (Building A, E &amp; G)</b>				
Dwellings	57	31	15	103
<b>Affordable Dwellings (Buildings B, C &amp; F)</b>				
Dwellings	31	52	20	103
<b>Total</b>	<b>88</b>	<b>83</b>	<b>35</b>	<b>206</b>

## 3.2 Pedestrian and Cyclist Facilities

Primary pedestrian access is provided to/from Bills Street via individual building lobbies. Secondary pedestrian access will be provided via basement levels and car parking areas.

A high quality public realm is proposed to guide pedestrians into and through the site. This is to take the form of pedestrian paths along the realigned Bills Street, and the creation of a wide pedestrian spine that connects from Bills Street to Patterson Reserve between Buildings A and B to the south of Bills Street.

This alignment is based on an existing easement that runs through the site.

## 3.3 Car Parking & Access Arrangements

### Access

Access to the subject site is proposed via the realigned Bills Street. The realignment comprises the current curved alignment through the site being removed and replaced with a linear extension of Bills Street east of the road closure.

As part of the realignment it is proposed to relocate the existing road closure to provide access to the site from Auburn Road and remove the current access arrangement via Robinson Road.

East of the relocated road closure, approximately 50 metres west of Robinson Road, Bills Street will operate as a typical roadway.

Towards the west of the road closure, Bills Street will operate as a shared space primarily for the purposes of pedestrian and cyclist access, with

The closed section of road will connect Bills Street to the extension of Robinsons Road south of Reserve Road.

## Car Parking

A total of 165 car parking spaces are proposed to be provided, spread over a total of three separate car parks:

- 22 parking spaces within car park P1 are proposed for residents of Building A;
- 57 parking spaces within car park P2 are proposed for residents of Buildings B & C; and,
- 86 parking spaces within car park P3 and P4 is proposed for residents of Buildings E, F & G.

Three car park access points are proposed to Bills Street, one to each of the basements.

## On-Street Parking & Proposed Road Works

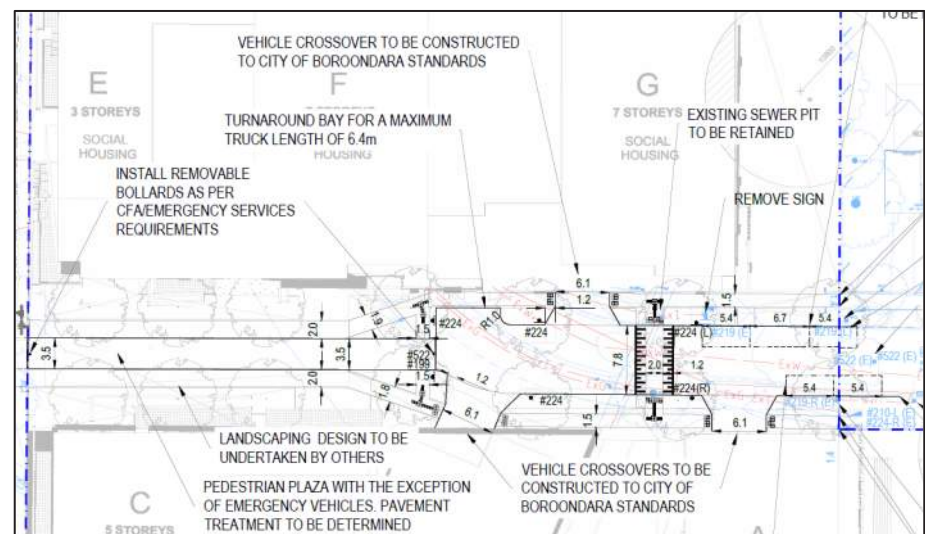
Bills Street through the site is envisaged to reflect the cross section east of the existing road closure which provides sufficient width to accommodate kerb side parallel parking and through traffic movements.

The renewal also includes the truncation of Robinson Road south of Reserve Road where it meets the extension of Bills Street. The existing Robinson Road car park will potentially be reconstructed, however this is outside the scope of this project.

It is proposed to provide a 16.0 metre wide cross section within Bills Street, consistent with the existing road reserve width between Auburn Road and the property boundary.

The proposed cross-section including provision of road and footpath infrastructure within the reconfigured section of Bills Street is illustrated below in Figure 3.2, with a full version attached to Appendix A.

**Figure 3.1: Realigned Bills Street section**



### 3.4 Bicycle Parking

A total of 101 bicycle parking spaces are proposed to be provided across the development within a mixture of publicly available hoops or rails for visitors (12 spaces), and 89 resident spaces using 2-tier bicycle racks and hoops within secure bicycle compounds.

Specifically, bicycle parking is to be provided within each of the basement car parks for the use of residents. At ground floor level bicycle parking is to be provided in close proximity to each of the buildings for visitor use.

### 3.5 Waste Collection & Service Vehicles

Waste is proposed to be individually collected from each basement car park by a private waste contractor using a 6.4 metre long mini-rear loader vehicles.

The waste vehicle is proposed to access the basements from the road network and then manoeuvre on-site to the designated waste collection point within the basement.

Bins will be emptied, and transferred back to bin stores, upon completion. The waste vehicle will exit to the adjacent road network in a forward direction.

Waste collection vehicles are shown in the swept path analysis to undertake a three-point turn within the basements at the waste collection point. This is considered to be an acceptable outcome from a traffic safety perspective, on the basis of the following:

- The reverse manoeuvres involved are relatively short in length.
- The drivers of the waste collection vehicles are trained professionals who are regularly required to undertake such manoeuvres.
- The manoeuvres are undertaken in a relatively open area on a flat surface which is conducive to safe manoeuvring.
- The vehicles are fitted with flashing lights and audible reversing beepers, making them noticeable to any nearby pedestrians in the area.
- The vehicles are fitted with reversing cameras which provides excellent visibility by drivers of any potential conflict throughout the reverse manoeuvre.

The proposed Bills Street closure is to be designed to restrict the through movement of general vehicles but still allow for the movement of service and emergency vehicles between Robinson Road and Bills Street (if required).

The primary purpose of the road closure is to prevent movements through the site between Auburn Road and Robinson Road, however, it is still possible for vehicles (like service utility vehicles etc.) to access both sides of the control treatment when required.

## 4.1 Statutory Assessment

### Clause 52.20 – Parking Assessment

Clause 52.20-2 exempts this development proposal from various requirements of the scheme, including the need to obtain planning permission for certain things, or requirements to carry out development in a particular manner.

This exemption extends to the requirements of Clause 52.06 which ordinarily contains the car parking provisions applicable to permit applications. Instead, consideration of car parking is now captured within the Car Parking development standard at Clause 52.20-6.7. Clause 52.20-6.7 suggests that a minimum of 0.6 car spaces should be provided to each dwelling, either covered or uncovered.

Applying this minimum rate of provision to the 206 dwellings proposed yields a minimum requirement of **123 spaces**. The proposal includes 165 basement parking spaces which far exceeds the minimum requirement.

In support of the proposed provision, we have undertaken a review of the anticipated car ownership levels of the social and affordable housing components.

### Social Housing – ABS Data

Car ownership data has been sourced from the 2016 ABS census for existing social housing buildings across Melbourne.

A summary of average car ownership of social housing apartments for these suburbs is provided in Table 5.2.

**Table 4.1 Average Car Ownership of Social Housing Apartments**

Suburb	Apartments	Vehicles Owned	Average Car Ownership Per Dwelling
North	463	297	<b>0.64</b>
Brunswick	89	16	<b>0.18</b>
Footscray	110	38	<b>0.35</b>
Kensington	234	106	<b>0.45</b>
Williamstown	124	71	<b>0.57</b>
Flemington	608	443	<b>0.72</b>
<b>Total/Average</b>	<b>1628</b>	<b>971</b>	<b>0.59</b>

A review of the car ownership statistics highlights that a substantial proportion of dwellings for social housing estates do not own a vehicle. In this regard, not all dwellings will require car parking spaces and a reduced car parking provision could be adopted in this area to encourage the use of more sustainable modes of transportation.

It is noted that the dwelling composition of the case study sites summarised above include approximately 30% three-bedroom dwellings whilst the proposed application considers 5% three bedroom dwellings.

Larger dwelling types typically have higher car ownership levels than one and two bedroom dwellings and therefore, the provision of 0.6 spaces per

dwelling for the redeveloped Homes Victoria site is expected to be conservative.

The proposed car parking rate of 0.6 spaces per social dwelling is consistent with the rate prescribed by the car parking study of social housing car parking demands undertaken by GTA in 2017 (reference V121030) and numerous Parking Overlays recently gazetted at various renewal sites across Melbourne.

The proposed car parking provision rate of 0.6 spaces per social housing dwelling is therefore considered appropriate.

### **Affordable Housing – ABS Data**

Based on the affordable income thresholds defined in the Planning and Environment Act, an assessment of the ABS car ownership data was conducted according to income across the entire Boroondara municipality. The municipal-wide data set is considered to suitably represent the likely car ownership levels of future residents for the subject site, noting the dataset includes areas of both good and poor access to public transport and other amenities with the subject site sitting somewhere in the middle in terms of accessibility.

Based on this review, the data indicates that the overall provision rate of 1 space per dwelling is appropriate in catering for the demands of the intended occupants according to their income levels.

**Table 4.2: Average Car Ownership of Affordable Housing - Boroondara**

Affordable Apartment Type	Quantity	Rate / dwelling based on ABS data by income range	Anticipated Demand
1BR	31	0.78	24
2BR	52	1.06	55
3BR	20	1.19	24
<b>Totals</b>	<b>103</b>	<b>Average = 1.000</b>	<b>103</b>

Based on the above, the proposed car parking provision rate of 1.0 space per affordable housing dwelling is considered appropriate in meeting anticipated demands.

### **Visitor Parking – Empirical Assessment**

There is no requirement under Clause 52.20 for visitor parking to be provided on-site as part of the development.

Visitor parking demands generated by the proposed development will be accommodated on the streets surrounding the development. This includes 5 on-street spaces on the section of the reconfigured Bills Street that sits within the Homes Victoria property boundary.

A number of surveys have been undertaken by various consulting firms to identify visitor car parking rates for high density dwellings. This data indicates that peak visitor parking demands of 0.1 spaces per apartment were recorded during the evenings and weekends, whilst demands of 0.06 spaces per apartment was recorded during business hours. These

rates have been generally adopted across the industry, accepted by VCAT and adopted within various Parking Overlays.

Applying the above rates to the 206 dwellings proposed yields a weekday evening and weekend demand of 21 visitor vehicles, and a weekday demand of 12 spaces. This represents an off-site on-street demand of between 7 and 16 spaces taking the 5 'on-site' spaces into account.

The surrounding streets anticipated to cater for visitor demands are illustrated in the diagram below, noting that all of the streets described are on sections of road fronted by non-residential uses.

**Figure 4.1: Visitor parking survey area**



It is noted that the north side of Reserve Road is no-standing Monday-Friday between 8am and 6pm and is unrestricted on the southern side. Robinson Road is unrestricted on the eastern side, north of the University of Melbourne vehicular access, and on the western side is restricted to 2P between 8am-8pm Monday to Friday and 8am-6pm Saturday, making it suitable for visitor parking. There is unrestricted parking along the south side of Woodburn Road which consists of marked bays. The north side of Bills Street contains unrestricted kerbside parking.

Based on daytime spot count surveys undertaken using aerial photographs taken prior to the current Covid-19 pandemic, there is observed to be ample capacity in the surrounding streets to readily accommodate the on-street visitor demands generated by the development such that there will be no adverse impacts to surrounding residents that rely on this parking.

**Table 4.3: On-street parking availability – aerial spot counts**

Date	Capacity		Parked Vehicles	Availability
Sat Feb 17 2018	73		3	70
Wed Apr 4 2018	73		17	56
Fri Jan 11 2019	73		14	59
Tue Dec 17 2019	73		21	52



## 5 Access Strategy:

### 5.1 Access Arrangements

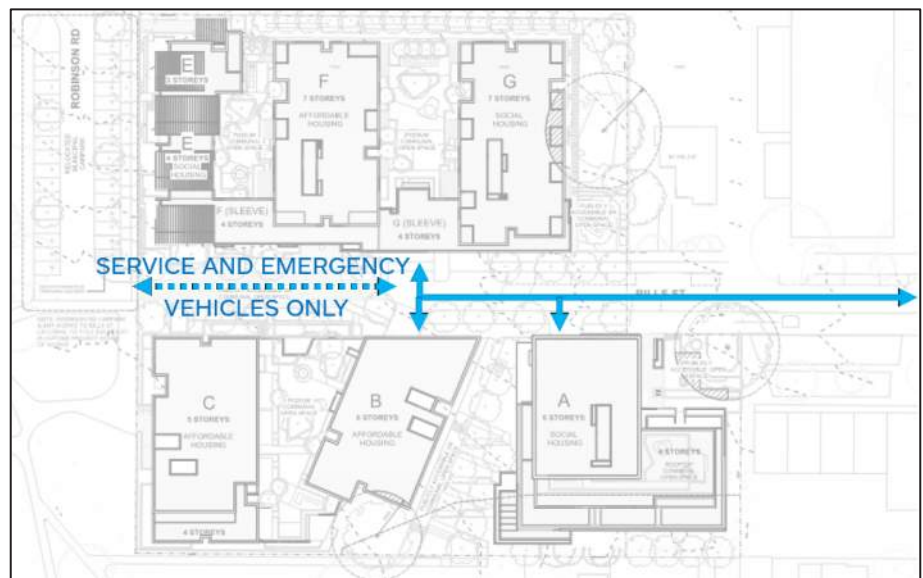
Access to the dwellings will be provided via Auburn Road with the current access from Robinson Road closed.

Based on this arrangement, primary access to the site is to occur via the intersection of Bills Street and Auburn Road. The individual basement car parks gain direct access to Bills Street. Access to basement car parking includes 1 access north of Bills Street and 2 accesses to the south of Bills Street.

The proposed road closure is flexible to allow for the movement of service and emergency vehicles but still prohibit the movement of private vehicles. A turnaround facility is provided at the termination of Bills Street.

The site access strategy is indicatively illustrated in Figure 5.1.

**Figure 5.1: Site Access Strategy**



## 6.1 Clause 52.20-6.7 Design Standard Assessment

An assessment of the proposal against the relevant design standards of Clause 52.20-6.7 of the Boroondara Planning Scheme is provided below, noting that the car parking provisions of Clause 52.06 are exempt for this application.

### Accessway Design

**Table 6.1 Accessway Design Assessment**

Requirement	Comments
Accessways Must be at least 3m wide.	<b>Satisfied</b> – The accessway has been designed with a minimum width in excess of 3.0 metres.
Have an internal radius of at least 4m at changes of direction or intersection or be at least 4.2m wide.	<b>Satisfied</b> – Changes of direction are at least 4.2 metres wide.
Allow vehicles parked in the last space of a dead-end accessway in public car parks to exit in a forward direction with one manoeuvre.	<b>N/A</b> - The proposed car park is not a public car park.
Provide at least 2.1m headroom beneath overhead obstructions, calculated for a vehicle with a wheelbase of 2.8m.	<b>Satisfied</b> – A minimum 2.1 metre clearance has been provided within the car parks and accessways
If the accessway serves four or more car spaces or connects to a road in a Road Zone, the accessway must be designed so that cars can exit the site in a forward direction.	<b>Satisfied</b> – As demonstrated in the swept path assessment (refer to Appendix B), the subject site has been designed to allow all vehicles to exit the site in a forward direction.
Provide a passing area at the entrance at least 6.1m wide and 7m long if the accessway serves ten or more car parking spaces and is either more than 50m long or connects to a road in a Road Zone.	<b>Satisfied</b> – The basements serve more than 10 car parking spaces and include accessways that are more than 50m long.  Passing areas are provided at each of the basement entrances measuring at least 6.1m wide and 7.0m long
Have a corner splay or area at least 50% clear of visual obstructions extending at least 2m along the frontage road from the edge of an exit lane and 2.5m along the exit lane from the frontage, to provide a clear view of pedestrians on the footpath of the frontage road. The area clear of visual obstructions may include an adjacent entry or exit lane where more than one lane is provided, or adjacent landscaped areas, provided the landscaping in those areas is less than 900mm in height.	<b>Satisfied</b> – Pedestrian sight triangles measuring 2.0 metres along the road frontage and extending 2.5 metres are provided on the exit side of each of the basement access points.
If an accessway to four or more car parking spaces is from land in a Road Zone, the access to the car spaces must be at least 6m from the road carriageway.	<b>N/A</b> – Access to the site is not from a Road Zone.

If entry to the car space is from a road, the width of the accessway may include the road.

**N/A** – All car parking spaces are to be accessed via the internal accessway.

## Car Parking Spaces

**Table 6.2: Car Parking Spaces Design Assessment**

Requirement	Comments
Car parking spaces and accessways must have the minimum dimensions as outlined in Table 2 of Design Standard 2.	<b>Satisfied</b> – The at grade car parking spaces have been provided with dimensions that meet the minimum requirements in Table 2.
A wall, fence, column, tree, tree guard or any other structure that abuts a car space must not encroach into the area marked 'clearance required' on Diagram 1, other than:  - A column, tree or tree guard, which may project into a space if it is within the area marked 'tree or column permitted' on Diagram 1.  - A structure, which may project into the space if it is at least 2.1m above the space.	<b>Satisfied</b> – Each car space is provided in accordance with the clearance requirements of Diagram 1.
Car spaces in garages or carports must be at least 6m long and 3.5m wide for a single space and 5.5m wide for a double space measured inside the garage or carport.	<b>N/A</b>
Where parking spaces are provided in tandem (one space behind the other) an additional 500mm in length must be provided between each space.	<b>N/A</b>

## Gradients

**Table 6.3: Gradients Assessment**

Requirement	Comments
Accessway grades must not be steeper than 1:10 (10%) within 5m of the frontage to ensure safety for pedestrians and vehicles. The design must have regard to the wheelbase of the vehicle being designed for; pedestrian and vehicular traffic volumes; the nature of the car park; and the slope and configuration of the vehicle crossover at the site frontage. This does not apply to accessways serving three dwellings or less.	<b>Satisfied</b> - The accessway grade is not steeper than 1:10 for the first 5 metres at each of the basement access points.
Ramps (except within 5 metres of the frontage) must have the maximum grades as outlined in Table 3 and be	<b>Satisfied</b> - The proposed ramp grades are in accordance with, with grades no

designed for vehicles travelling in a forward direction.	steeper than 1:4.5, less than the 1:4 maximum allowed.
<p>Where the difference in grade between two sections of ramp or floor is greater than 1:8 (12.5%) for a summit grade change, or greater than 1:6.7 (15%) for a sag grade change, the ramp must include a transition section of at least 2 metres to prevent vehicles scraping or bottoming.</p> <p>Plans must include an assessment of grade changes of greater than 1:5.6 (18%) or less than 3 metres apart for clearances, to the satisfaction of the responsible authority.</p>	<b>Satisfied</b> - Appropriate transitions have been provided to prevent scraping or bottoming.

## 6.2 Swept Path Assessment

A swept path assessment of the accesses to Bill Street has been prepared, using the 'Autodesk Vehicle Tracking' software. The B99 (99.8th percentile car) was used in the assessment of the access, as shown in Appendix B.

The swept path assessment indicates that vehicles can enter and egress the various site accesses simultaneously in a satisfactory manner.

All vehicles will be able to enter / exit the site in a forwards direction.

A swept path assessment has also been undertaken of the more constrained car parking spaces within the car parks using the 'Autodesk Vehicle Tracking' software.

The B85 and B85 (99<sup>th</sup> and 85<sup>th</sup> percentile car) were used in the assessment where appropriate.

The car park swept path assessment found that all car parking spaces are accessible.

The swept path assessment provided within Appendix B demonstrates the ability for a waste truck to access the various car parks in a forwards direction, turn around on site to collect the waste and depart in a forwards direction.

## 6.3 Summary

The preceding assessment confirms that the access arrangements and car park layout has been designed appropriately and is in accordance with the requirements of the Boroondara Planning Scheme and/or AS/NZS 2890.1:2004.

## 7.1 Traffic Generation

### Affordable Dwelling Traffic Generation

It is generally accepted that residential lots in inner suburban areas generate vehicular traffic at a rate between three to six vehicle movements per day (with 10% of movements occurring in the peak hours).

In areas of higher density or with access to good public transport lower traffic generation rates can be recorded.

As outlined in Section 2, the site is positioned to take advantage of the public transport network.

The Department of Transport operates the *Victorian Integrated Survey of Travel and Activity* (VISTA) which collects the transport patterns of residents across Melbourne. VISTA data collects, amongst other characteristics, trip generation data.

This VISTA data for residential apartment dwellings in Boroondara shows an average traffic generation rate of 4.06 vehicle movements per dwelling per day.

Based on the preceding, a design traffic generation rate of four vehicle movements per day per affordable dwelling is considered appropriate.

Application of this rate to the proposed 103 affordable dwellings, equates to a daily traffic generation of 418 vehicle movements, inclusive of 41 vehicle movements during the commuter peak periods.

During the commuter peak hours traffic generation has been assessed as 80% outbound and 20% inbound in the AM peak hour and 40% outbound and 60% inbound during the PM peak hour.

### Social Housing Traffic Generation

Traffic generation rates for the social housing dwellings has been sourced from 2016 traffic volume data taken from the Flemington Estate.

The 2016 Flemington Estate surveys identified a peak hour traffic generation rate of 0.37 movements per dwelling in the AM peak and 0.67 movements per dwelling in the PM peak hour.

Application of these rates to the proposed 103 social housing dwellings, equates to a traffic generation of 38 vehicle movements during the AM peak hour and 69 during the PM peak hour.

Assuming 10% of movements occur in the peak hours, the social housing dwellings are expected to generate up to 690 daily vehicle movements.

### Total Traffic Generation

Based on the preceding, the proposal is anticipated to generate a daily traffic generation of 1,108 vehicle movements, inclusive of 79 vehicle movements during the AM peak hour and 110 vehicle movements during the PM peak hour.

The anticipated peak hour volumes are summarised in Table 7.1.

**Table 7.1: Anticipated Total Peak Hour Traffic Volumes**

	Social Dwellings		Affordable Dwellings		Total
	In	Out	In	Out	
AM	8	30	8	33	79
PM	41	28	25	16	110

## 7.2 Traffic Distribution

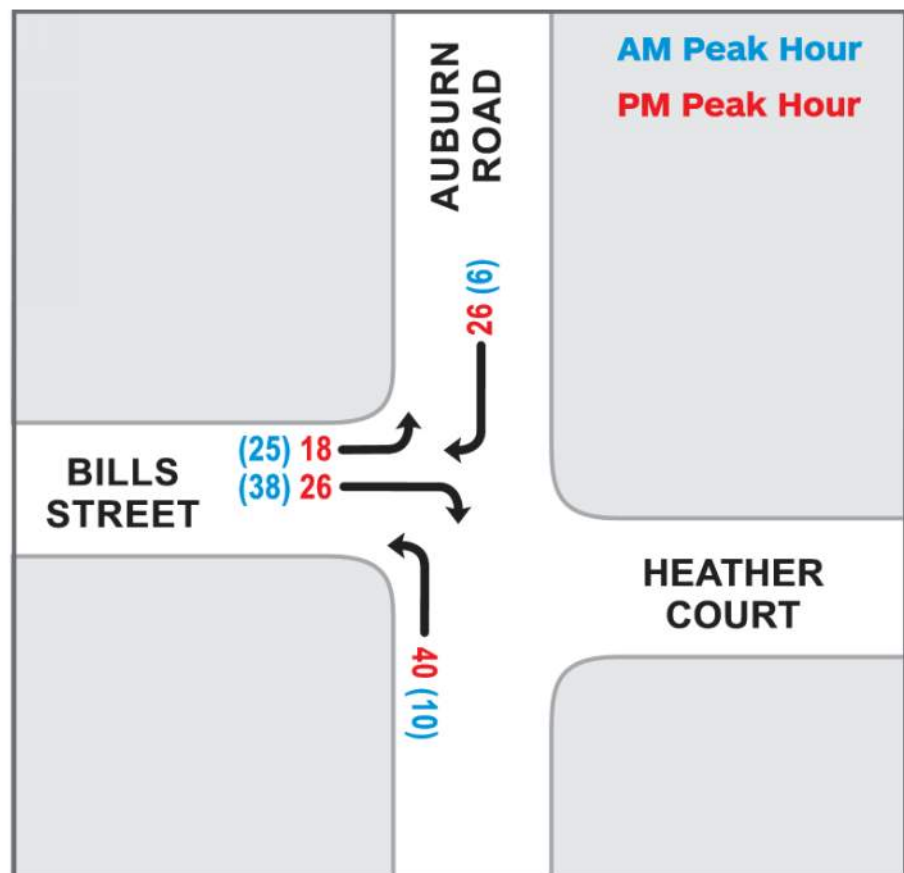
The anticipated traffic generation of the proposed development has been distributed through the network using VISTA journey data having regard to road network connections, employment opportunities, nearby social infrastructure and the existing traffic patterns in the area.

The resulting distributions applied to movements generated by dwellings on the subject site is as follows:

- 40% towards the North; and,
- 60% towards the South.

Based on the above, the anticipated traffic volumes generated by the site and the associated distribution of traffic to the local network are illustrated in Figure 7.1.

**Figure 7.1: Projected Development Generated Traffic Volumes**

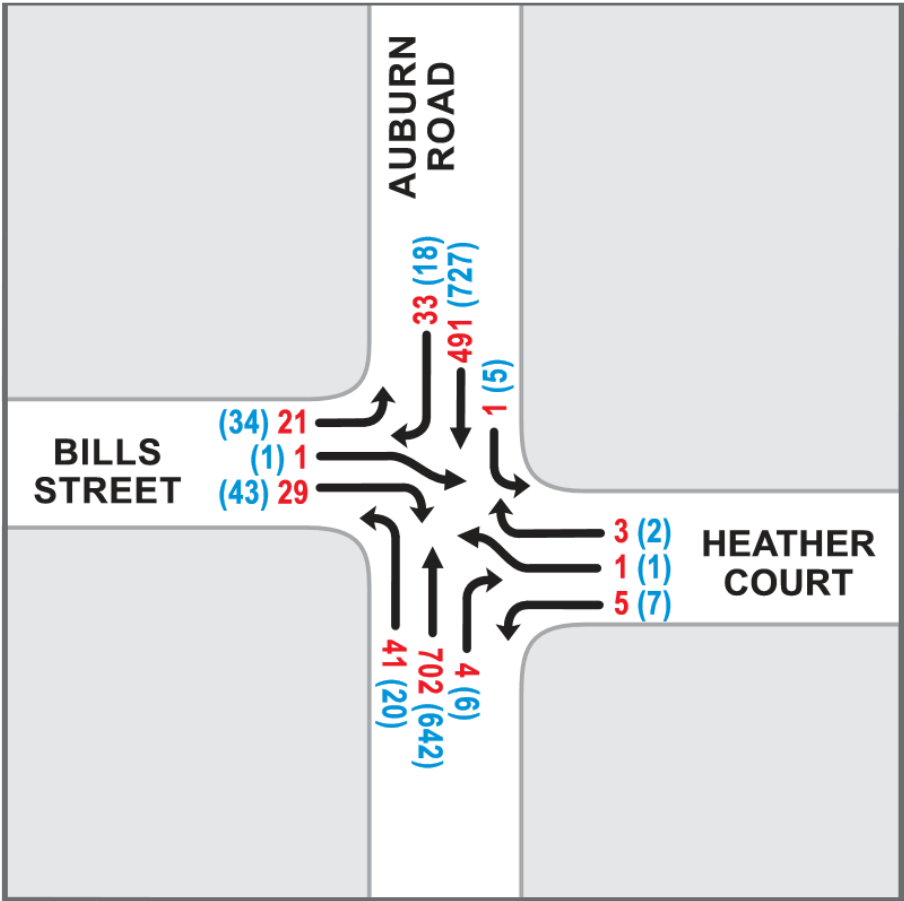


### 7.3 Intersection Analysis

A SIDRA analysis of the projected traffic volumes generated by the development and superimposed on existing traffic counts has been undertaken for the intersection of Bills Street / Auburn Road / Heather Court to ascertain the traffic impacts associated with the proposal to the nearby road network.

The projected future traffic movements are shown at Figure 7.2.

**Figure 7.2: Projected Post Development Traffic Volumes**



The Bills Street / Auburn Road / Heather Court intersection peak hour SIDRA results are displayed in Table 7.1 with SIDRA outputs included in Appendix CC.

**Table 7.2: Intersection of Bills Street / Auburn Road / Heather Court (Future)**

Approach	AM Peak			PM Peak		
	DoS	Average Delay (sec)	95%ile Queue (m)	DoS	Average Delay (sec)	95%ile Queue (m)
Auburn Road (S)	0.37	1	2	0.41	1	1
Heather Court	0.04	20	1	0.03	19	1
Auburn Road (N)	0.42	1	4	0.31	2	6
Bills Street	0.52	38	14	0.25	25	6

The post development SIDRA results for the Bills Street / Auburn Road / Heather Court intersection reveal that the intersection is expected to continue to operate in the 'Excellent' category.

On this basis, it is considered that the traffic generated by the proposed development can be readily catered for by surrounding road network without adverse impacts.



## 8 Bicycle Parking Assessment:

### 8.1 Bicycle Facilities

While the provisions of Clause 52.34 Bicycle Facilities do not apply to this application, bicycle parking has anyway been provided in excess of the requirements of that clause, which are set out in Table 8.1.

**Table 8.1: Clause 52.34 assessment**

Use	Type	No.	C52.34 Parking Rate	C52.34 provision
Residential	Resident	206 dwellings	1 space per five dwellings	41 spaces
	Visitor		1 space per ten dwellings	21 space
TOTAL				62 spaces

If assessed under Clause 52.34, application of these rates to the proposed development would have produced a requirement for 41 resident bicycle spaces and 21 visitor bicycle spaces.

The proposed provision of 101 bicycle parking spaces exceeds the rates of Clause 52.34 and is therefore considered satisfactory.

### 8.2 Homes Victoria Bicycle Facilities

In light of the car ownership of social housing dwellings, and to provide adequate transport opportunities, Homes Victoria have previously required for similar developments that one bicycle space should be provided to each social housing dwelling that does not have an allocated car parking space.

Based on this, the resulting bicycle parking provision rates are summarised in Table 8.2.

**Table 8.2: Proposed Bicycle Parking Requirements**

Dwelling / User Type	No.	Bicycle parking rate	Bicycle parking provision
Affordable Housing	103	1 space per five dwellings	21 spaces
Social Housing (Parking)	62	1 space per five dwellings	12 spaces
Social Housing (No Parking)	41	1 space per dwelling	41 spaces
Visitor	206	1 space per ten dwellings	21 space
<b>TOTAL</b>			<b>95 spaces</b>

Application of these rates to the proposed development would produce a quota for 21 affordable housing resident bicycle spaces, 12 social housing bicycle spaces, 41 social housing (no car parking) spaces and 21 visitor bicycle spaces.

The proposed provision of 101 bicycle parking spaces exceeds these bicycle parking rates and is therefore considered satisfactory.

### **8.3 Bicycle Parking Layout**

Bicycle parking spaces have been designed in accordance with the dimensional requirements of AS2890.3:2015.

More specifically, the following standards have been met:

- AS 2890.3:2015 requires that 20% of bicycle parking be provided within ground level (horizontal) rails. The proposed bicycle provision provides in excess of 20% of the bicycle parking within ground level (horizontal) rails, which complies with the requirement outlined in the Australian Standard.
- Double tier bicycle rails are spaced at 400mm intervals. Furthermore, the double tier bicycle rails are provided with an envelope of 2.0 metres and a 2.0 metre access aisle.
- All resident bicycle spaces are located undercover in secure location across the site, which satisfies the requirements for resident spaces.

Accordingly, it is considered that the bicycle parking has been designed appropriately and in accordance with the relevant sections of AS2890.3:2015.

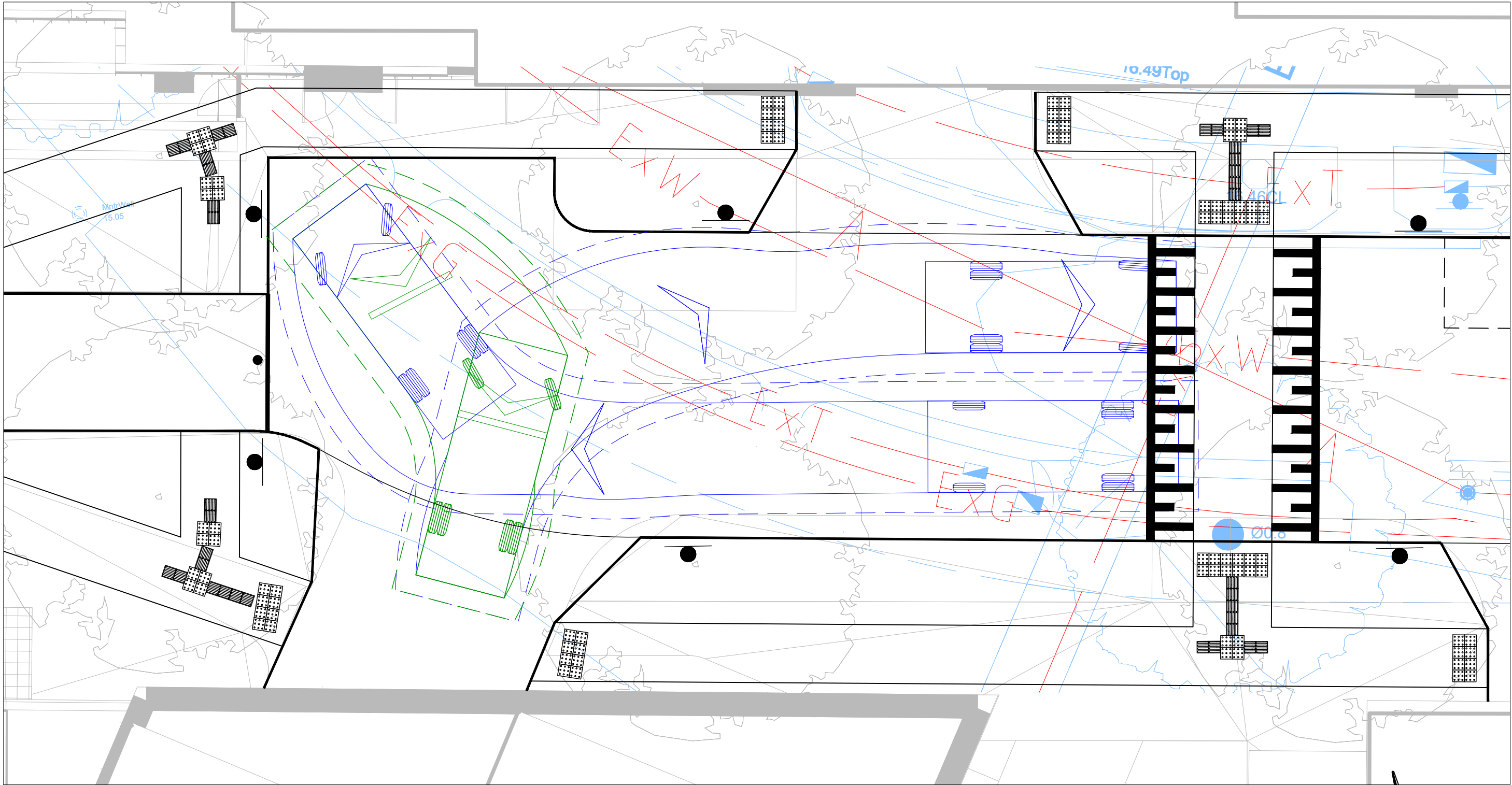
## 9 Conclusions:

A total 206 dwellings are proposed at the Bills Street renewal site, comprising 103 social housing dwellings and 103 affordable housing dwellings. Based on the transport assessment undertaken of the Schematic Design scheme prepared by Hayball architects, the following conclusions have been reached:

- The proposed provision of 165 basement parking spaces exceeds the minimum rate of 0.6 spaces per dwelling set out in Clause 52.20 of the Planning Scheme, with 0.8 spaces per dwelling provided. Notwithstanding, the proposed level of parking provided is considered to be appropriate for the development, in consideration of the particular needs of the dwelling types proposed:
  - The proposed provision of 0.6 spaces per social housing dwelling meets the demand levels indicated by Census data for social housing developments.
  - The proposed provision of 1.0 spaces per affordable housing dwelling meets the ABS data for dwellings in Boroondara that are within the affordable income ranges of the proposed residents and is therefore considered appropriate in meeting likely demands.
- The proposed provision of 101 bicycle parking spaces is considered adequate in meeting the needs of the proposal, exceeding rates set out in both Clause 52.34 of the Planning Scheme (noting it technically does not apply) and Homes Victoria specifications.
- The proposed access arrangements from the reconfigured Bills Street meet the relevant design standards of Clause 52.20 of the Planning Scheme.
- The proposed car parking arrangements meet the relevant design standards of Clause 52.20 of the Planning Scheme.
- The waste collection arrangements allow the waste truck to access the various car parks in a forwards direction, turn around on site to collect the waste and depart in a forwards direction and is considered to be an acceptable arrangement.
- The bicycle parking provided has been designed appropriately and in accordance with the relevant sections of AS2890.3:2015.
- The traffic generated by the proposed development can be readily catered for by surrounding road network without adverse impacts, as demonstrated by the SIDRA intersection analysis undertaken.

## Appendix A Bills Street Functional Layout

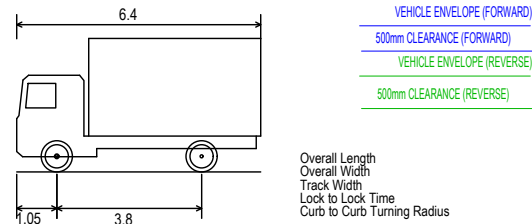




#### LEGEND

	EXISTING		GAS
	TITLE BOUNDARY		FUTURE DEVELOPMENT
	ELECTRICITY		PROPOSED LINE MARKING
	TELECOM		PROPOSED INVERT OF KERB
	WATER		PROPOSED FOOTPATH
	DRAIN		PROPOSED SIGN
	SEWER		EXISTING SIGN

#### SRV - Small Rigid Vehicle (AS/NZS2890.2:2002)



Overall Length 6.400m  
Overall Width 2.330m  
Track Width 2.330m  
Lock to Lock Time 4.00 sec  
Curb to Curb Turning Radius 7.100m

MELWAY REF 59 E3

**WARNING**  
BEWARE OF UNDERGROUND SERVICES  
THE LOCATIONS OF UNDERGROUND SERVICES ARE  
APPROXIMATE ONLY AND THEIR EXACT POSITION  
SHOULD BE PROVEN ON SITE. NO GUARANTEE IS  
GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

**PRELIMINARY PLAN**  
FOR DISCUSSION PURPOSES ONLY  
SUBJECT TO CHANGE WITHOUT NOTIFICATION  
DATE OF ISSUE: 27/11/2020

#### GENERAL NOTES

1. ARCHITECTURAL BASE (TP01.03(3)) PREPARED BY HAYBALL, DATED 06/11/2020
2. FEATURE AND LEVEL SURVEY BASE (21535-0-RF-M-G) PREPARED BY REEDS, DATED 30/10/2020
3. BILLS STREET (LOCAL ROAD) - DEFAULT SPEED LIMIT 50 KM/HR
4. ROBINSONS ROAD (LOCAL ROAD) - DEFAULT SPEED LIMIT 50KM/HR
5. ALL MEASUREMENTS ARE IN METRES AND MEASURED FROM THE INVERT OF KERB UNLESS OTHERWISE NOTED

DESIGNED E.Y. 11/11/20

CHECKED B.K. 11/11/20

AUTHORISED B.Y. 11/11/20

SCALE 1:100 @ --- 0 1 2

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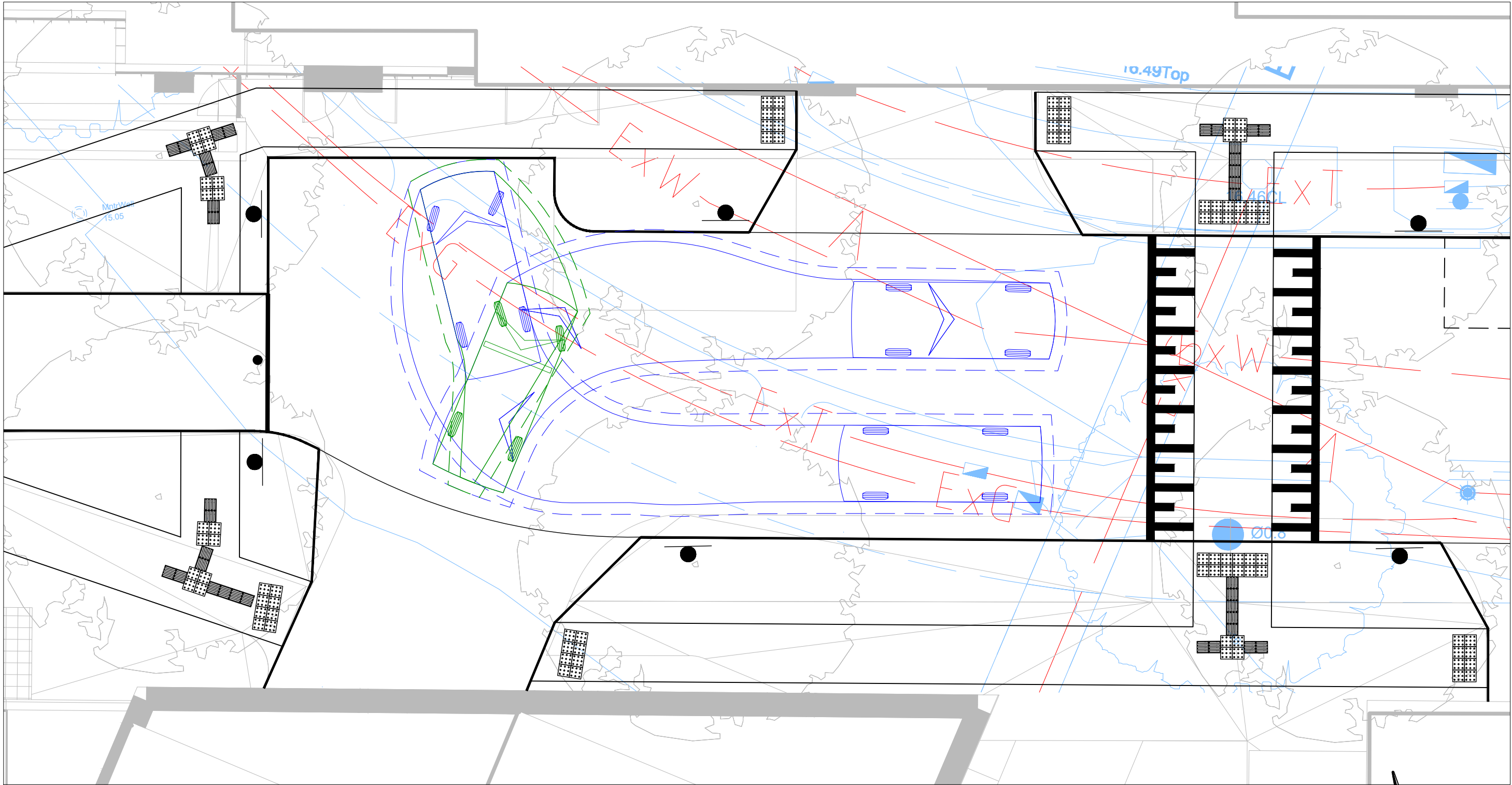
Proposed Residential Development  
Boroondara City Council  
Bills Street/Robinsons Road Alignment  
Swept Path Assessment

DATE 11/11/2020	SHEET NO. 2 of 3	DRAWING NO. 17122T-FLP-001	ISSUE C
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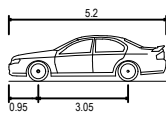
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LEGEND

- |   |                |   |                         |
|---|----------------|---|-------------------------|
| — | EXISTING       | — | GAS                     |
| — | TITLE BOUNDARY | — | FUTURE DEVELOPMENT      |
| — | ELECTRICITY    | — | PROPOSED LINE MARKING   |
| — | TELECOM        | — | PROPOSED INVERT OF KERB |
| — | WATER          | — | PROPOSED FOOTPATH       |
| — | DRAIN          | ● | PROPOSED SIGN           |
| — | SEWER          | ● | EXISTING SIGN           |

B99 Vehicle (AS/NZS2890.1:2004)



Overall Length  
Overall Width  
Overall Body Height  
Min Body Ground Clearance  
Track Width  
Lock to Lock Time  
Curb to Curb Turning Radius

VEHICLE ENVELOPE (FORWARD)  
300mm CLEARANCE (FORWARD)  
VEHICLE ENVELOPE (REVERSE)  
300mm CLEARANCE (REVERSE)

**WARNING**  
BEWARE OF UNDERGROUND SERVICES  
THE LOCATIONS OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

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DATE OF ISSUE: 27/11/2020

MELWAY REF 59 E3

GENERAL NOTES

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DESIGNED E.Y. 11/11/20

CHECKED B.K. 11/11/20

AUTHORISED B.Y. 11/11/20

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Proposed Residential Development  
Boroondara City Council  
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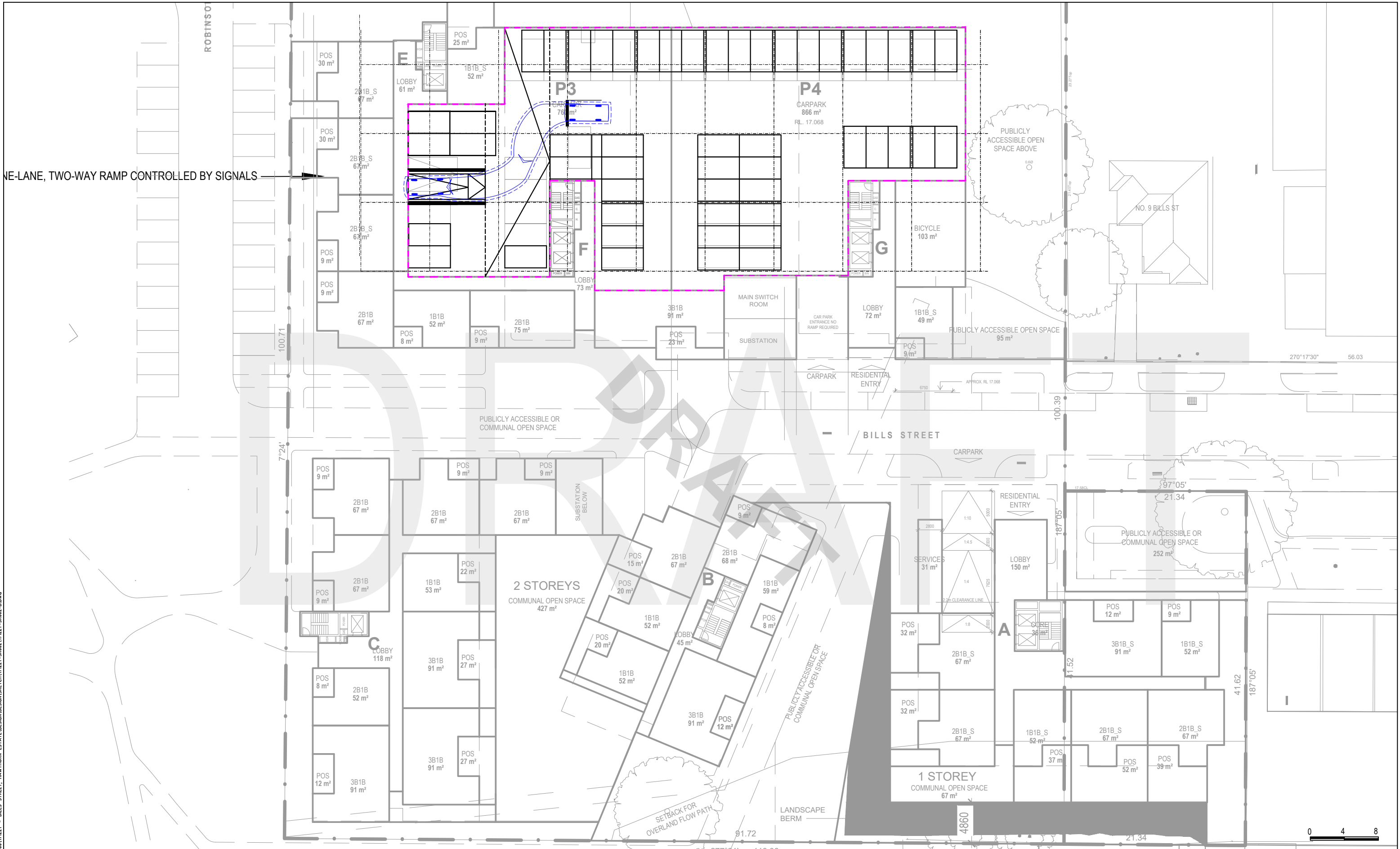
DATE 11/11/2020	SHEET NO. 3 of 3	DRAWING NO. 17122T-FLP-001	ISSUE C
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## Appendix B Swept path analysis



ONE-LANE, TWO-WAY RAMP CONTROLLED BY SIGNALS



**ratio:**

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FACSIMILE (03)9429 3011

**B99 Vehicle (AS/NZS2890.1:2004)**

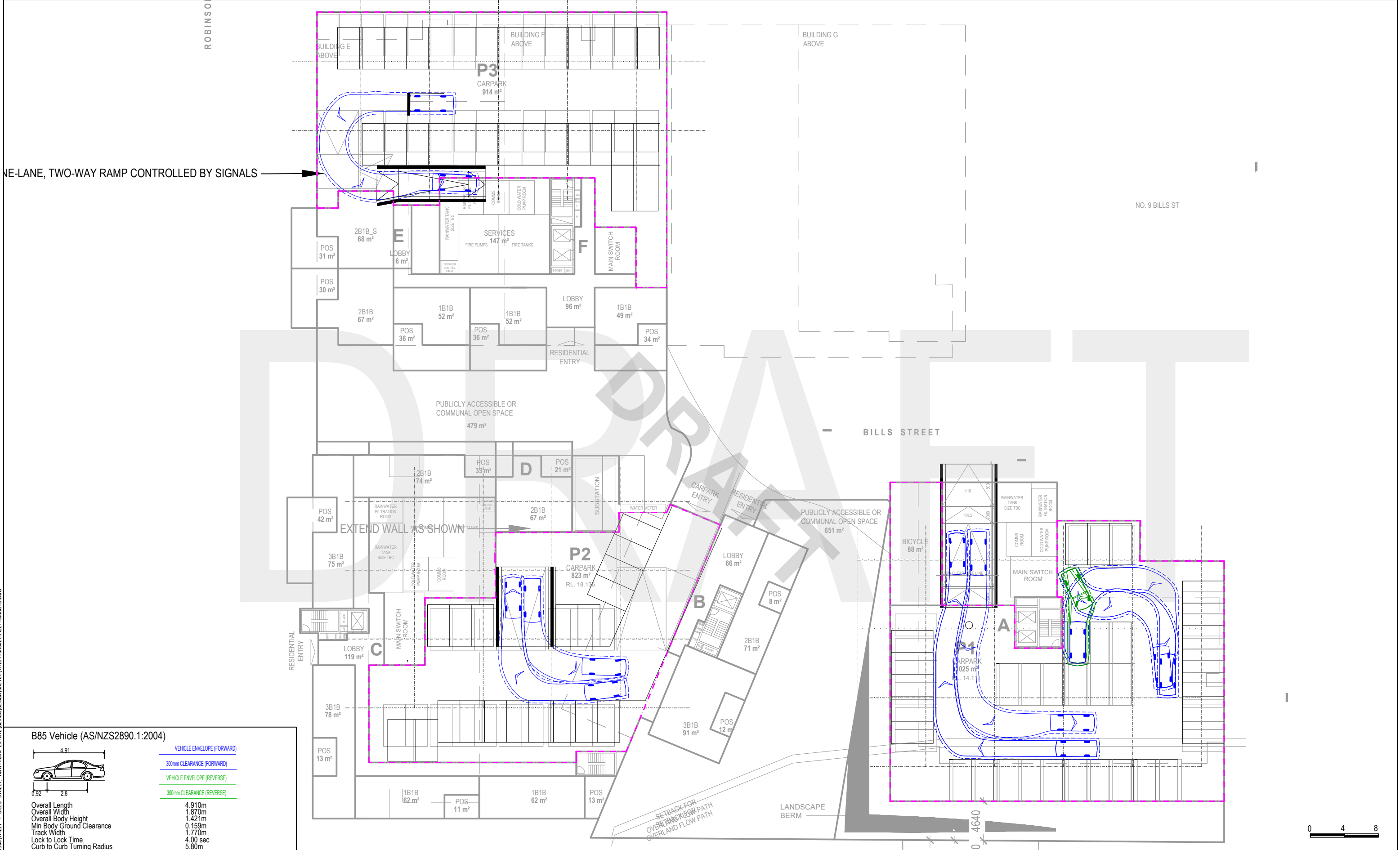
VEHICLE ENVELOPE (FORWARD)  
300mm CLEARANCE (FORWARD)  
VEHICLE ENVELOPE (REVERSE)  
300mm CLEARANCE (REVERSE)

Overall Length 5.200m  
Overall Width 1.940m  
Overall Body Height 2.200m  
Min Body Ground Clearance 0.312m  
Track Width 1.840m  
Lock to Lock Time 4.00 sec  
Curb to Curb Turning Radius 6.30m

**Proposed Residential Development**  
**Bills Street, Hawthorn**  
**Swept Path Assessment - Lower Ground 2**

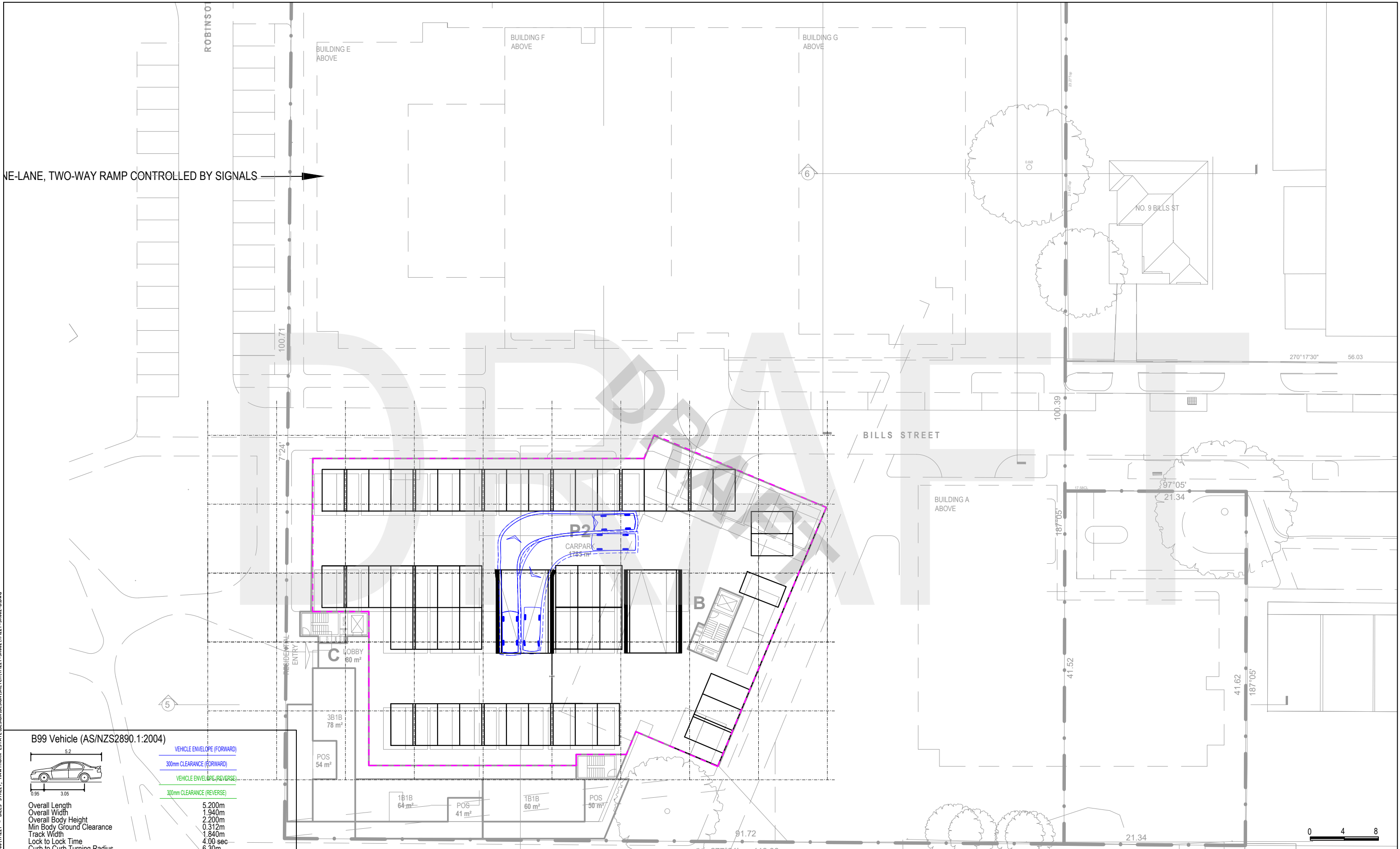
NOTE:  
1) Base Plan Supplied By Hayball on 09/07/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE 17122T-SK002-B	SHEET No. 4 of 6	PREPARED BY E.Y.	SCALE 1:400@A3	DATE 10/07/2020
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<div>ratio:</div> <div>RATIO CONSULTANTS PTY LTD ABN 005 422 104 8 GWYNNE STREET CREMORNE, VICTORIA 3121 TELEPHONE (03)9429 3111 FACSIMILE (03)9429 3011</div>		<div>B85 Vehicle (AS/NZS2890.1:2004)</div> <div><div><div><div></div><div>4.91</div></div><div><div></div><div>0.92</div></div><div><div></div><div>2.8</div></div></div><div><div>Overall Length</div><div>1.870m</div></div><div><div>Overall Width</div><div>1.421m</div></div><div><div>Overall Body Height</div><div>0.159m</div></div><div><div>Min Body Ground Clearance</div><div>1.770m</div></div><div><div>Track Width</div><div>4.00 sec</div></div><div><div>Lock to Lock Time</div><div>5.80m</div></div></div> <div><div>VEHICLE ENVELOPE (FORWARD)</div><div>300mm CLEARANCE (FORWARD)</div><div>VEHICLE ENVELOPE (REVERSE)</div><div>300mm CLEARANCE (REVERSE)</div></div>	<div>B99 Vehicle (AS/NZS2890.1:2004)</div> <div><div><div><div></div><div>5.2</div></div><div><div></div><div>0.95</div></div><div><div></div><div>3.05</div></div></div><div><div>Overall Length</div><div>1.940m</div></div><div><div>Overall Width</div><div>2.200m</div></div><div><div>Overall Body Height</div><div>0.312m</div></div><div><div>Min Body Ground Clearance</div><div>1.840m</div></div><div><div>Track Width</div><div>4.00 sec</div></div><div><div>Lock to Lock Time</div><div>6.30m</div></div></div> <div><div>VEHICLE ENVELOPE (FORWARD)</div><div>300mm CLEARANCE (FORWARD)</div><div>VEHICLE ENVELOPE (REVERSE)</div><div>300mm CLEARANCE (REVERSE)</div></div>	<div>Proposed Residential Development Bills Street, Hawthorn Swept Path Assessment - Lower Ground 1</div> <div>NOTE: 1) Base Plan Supplied By Hayball on 09/07/20 2) Maximum Design Speed 10km/h</div>	<div>RATIO REFERENCE 17122T-SK002-B</div>	<div>SHEET No. 5 of 6</div>	<div>PREPARED BY E.Y.</div>	<div>SCALE 1:400@A3</div>	<div>DATE 10/07/2020</div>
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ONE-LANE, TWO-WAY RAMP CONTROLLED BY SIGNALS



**B99 Vehicle (AS/NZS2890.1:2004)**

VEHICLE ENVELOPE (FORWARD)  
300mm CLEARANCE (FORWARD)  
VEHICLE ENVELOPE (REVERSE)  
300mm CLEARANCE (REVERSE)

**ratio:**

RATIO CONSULTANTS PTY LTD  
ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

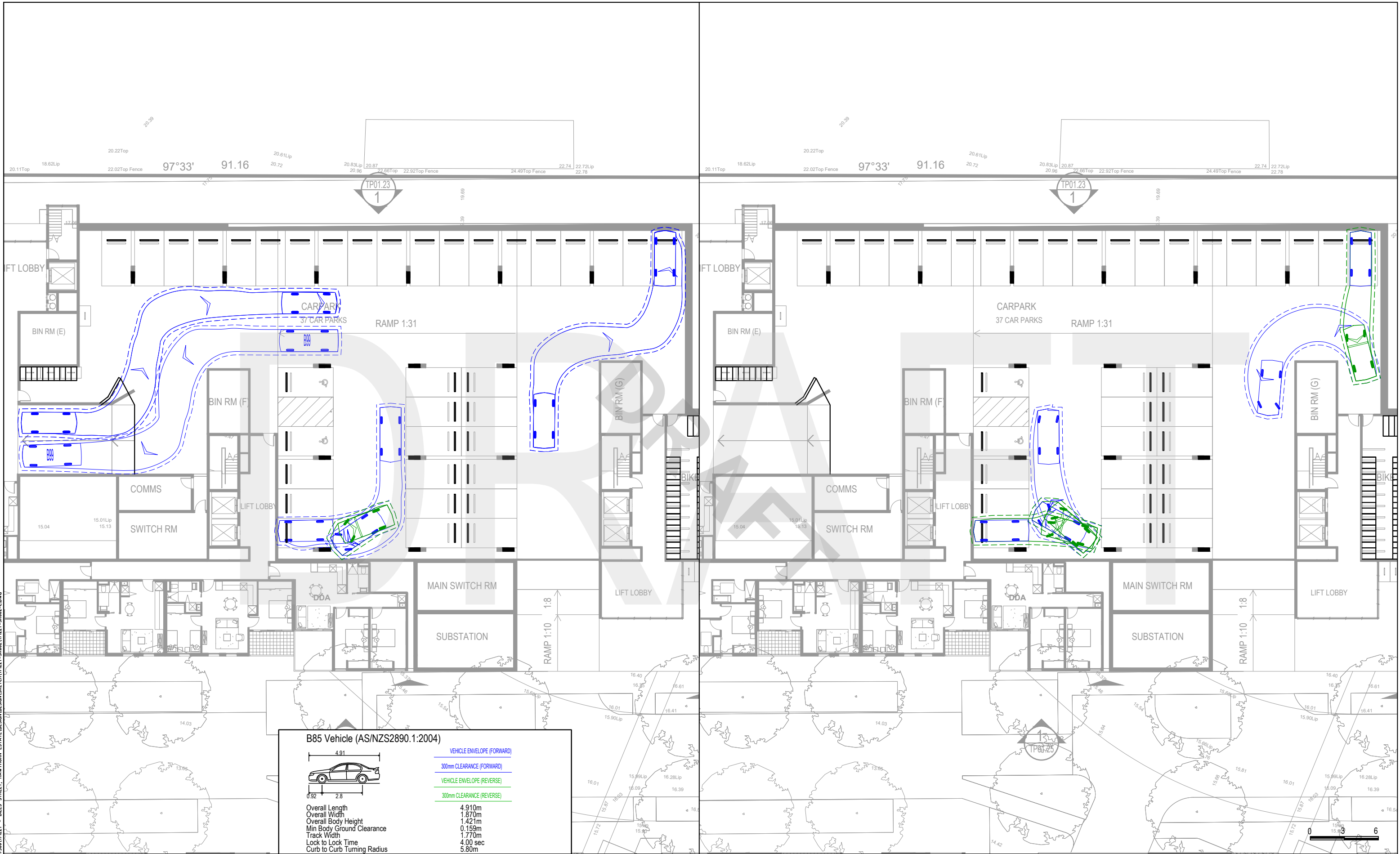
**B85 Vehicle (AS/NZS2890.1:2004)**

VEHICLE ENVELOPE (FORWARD)  
300mm CLEARANCE (FORWARD)  
VEHICLE ENVELOPE (REVERSE)  
300mm CLEARANCE (REVERSE)

**Proposed Residential Development**  
**Bills Street, Hawthorn**  
**Swept Path Assessment - Lower Ground 2**

NOTE:  
1) Base Plan Supplied By Hayball on 09/07/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE 17122T-SK002-B	SHEET No. 6 of 6	PREPARED BY E.Y.	SCALE 1:400@A3	DATE 10/07/2020
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**B85 Vehicle (AS/NZS2890.1:2004)**

	VEHICLE ENVELOPE (FORWARD)	VEHICLE ENVELOPE (REVERSE)
Overall Length	4.91m	4.91m
Overall Width	1.870m	1.870m
Overall Body Height	1.421m	1.421m
Min Body Ground Clearance	0.159m	0.159m
Track Width	1.770m	1.770m
Lock to Lock Time	4.00 sec	4.00 sec
Curb to Curb Turning Radius	5.80m	5.80m

**B99 Vehicle (AS/NZS2890.1:2004)**

	VEHICLE ENVELOPE (FORWARD)	VEHICLE ENVELOPE (REVERSE)
Overall Length	5.200m	5.200m
Overall Width	1.940m	1.940m
Overall Body Height	2.200m	2.200m
Min Body Ground Clearance	0.312m	0.312m
Track Width	1.840m	1.840m
Lock to Lock Time	4.00 sec	4.00 sec
Curb to Curb Turning Radius	6.30m	6.30m

Proposed Residential Development  
Bills Street, Hawthorn  
Swept Path Assessment - Ground

NOTE:  
1) Base Plan Supplied By Hayball on 09/07/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE  
17122T-SK002-C

SHEET No.  
4 of 8

PREPARED BY  
E.Y.

SCALE  
1:300@A3

DATE  
21/10/2020





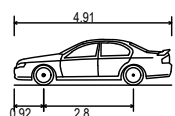
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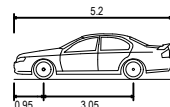
RATIO CONSULTANTS PTY LTD  
ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

B85 Vehicle (AS/NZS2890.1:2004)



VEHICLE ENVELOPE (FORWARD)  
300mm CLEARANCE (FORWARD)  
VEHICLE ENVELOPE (REVERSE)  
300mm CLEARANCE (REVERSE)

B99 Vehicle (AS/NZS2890.1:2004)



VEHICLE ENVELOPE (FORWARD)  
300mm CLEARANCE (FORWARD)  
VEHICLE ENVELOPE (REVERSE)  
300mm CLEARANCE (REVERSE)

## Proposed Residential Development Bills Street, Hawthorn Swept Path Assessment - Lower Ground 1

NOTE:  
1) Base Plan Supplied By Hayball on 09/07/20  
2) Maximum Design Speed 10km/h

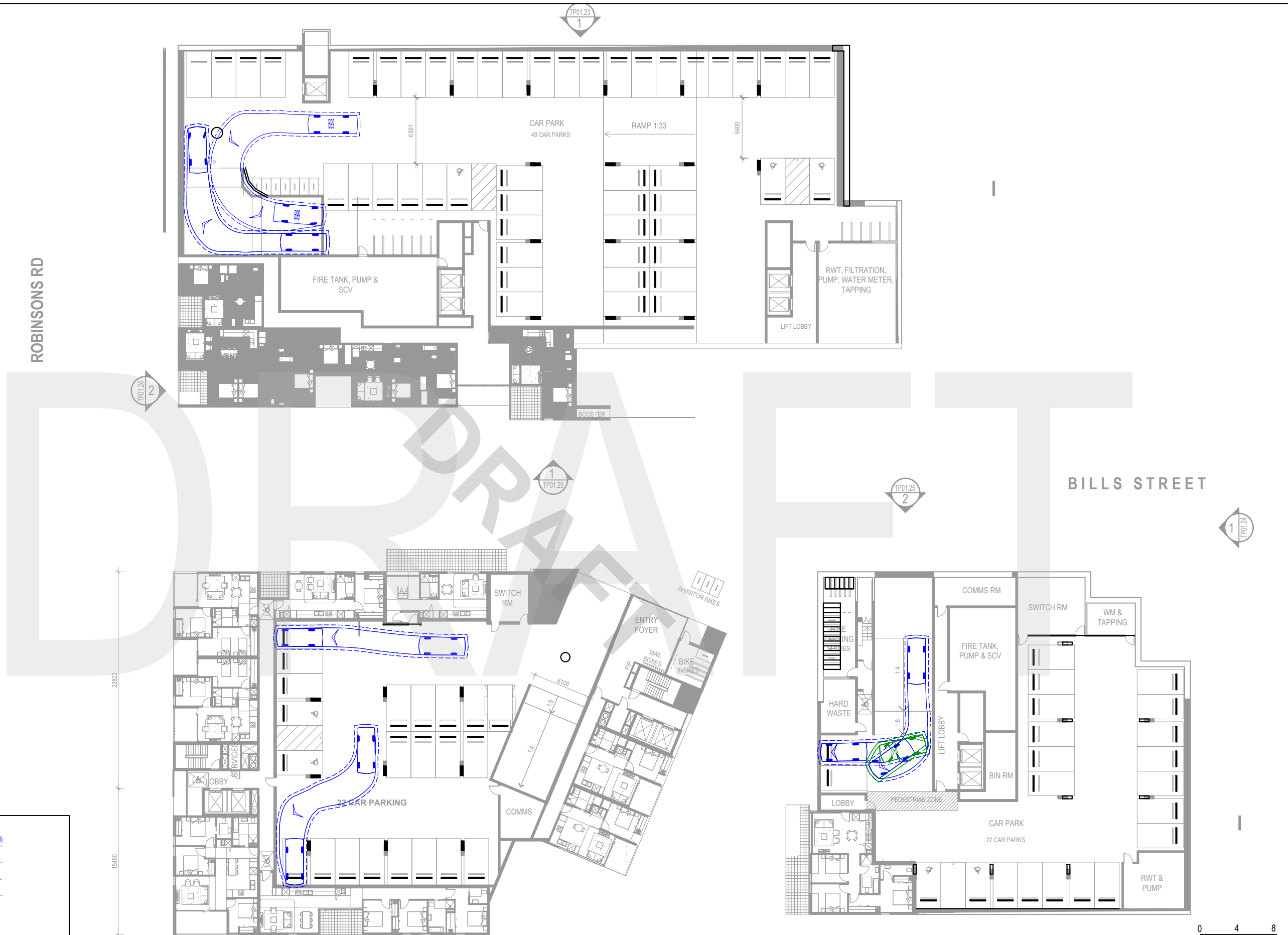
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17122T-SK002-C

SHEET No.  
5 of 8

PREPARED BY  
E.Y.

SCALE  
1:400@A3

DATE  
21/10/2020



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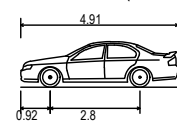
ROBINSONS RD



**ratio:**

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ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

B85 Vehicle (AS/NZS2890.1:2004)



Overall Length  
Overall Width  
Overall Body Height  
Min Body Ground Clearance  
Track Width  
Lock to Lock Time  
Curb to Curb Turning Radius

VEHICLE ENVELOPE (FORWARD)  
300mm CLEARANCE (FORWARD)  
VEHICLE ENVELOPE (REVERSE)  
300mm CLEARANCE (REVERSE)

4.910m  
1.870m  
1.421m  
0.159m  
1.770m  
4.00 sec  
5.80m

## Proposed Residential Development Bills Street, Hawthorn Swept Path Assessment - Lower Ground 1

NOTE:  
1) Base Plan Supplied By Hayball on 09/07/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE  
17122T-SK002-C

SHEET No.  
6 of 8

PREPARED BY  
E.Y.

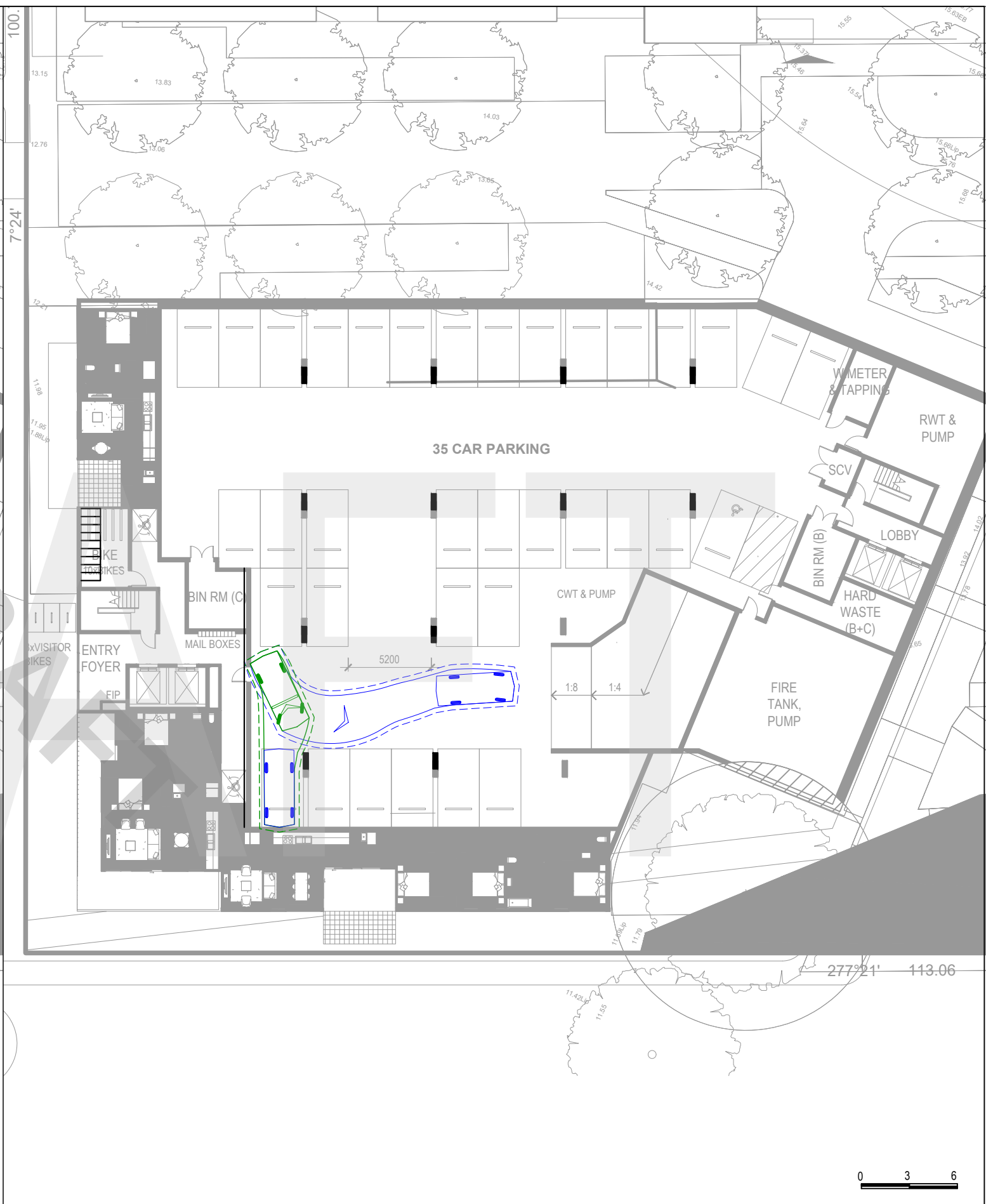
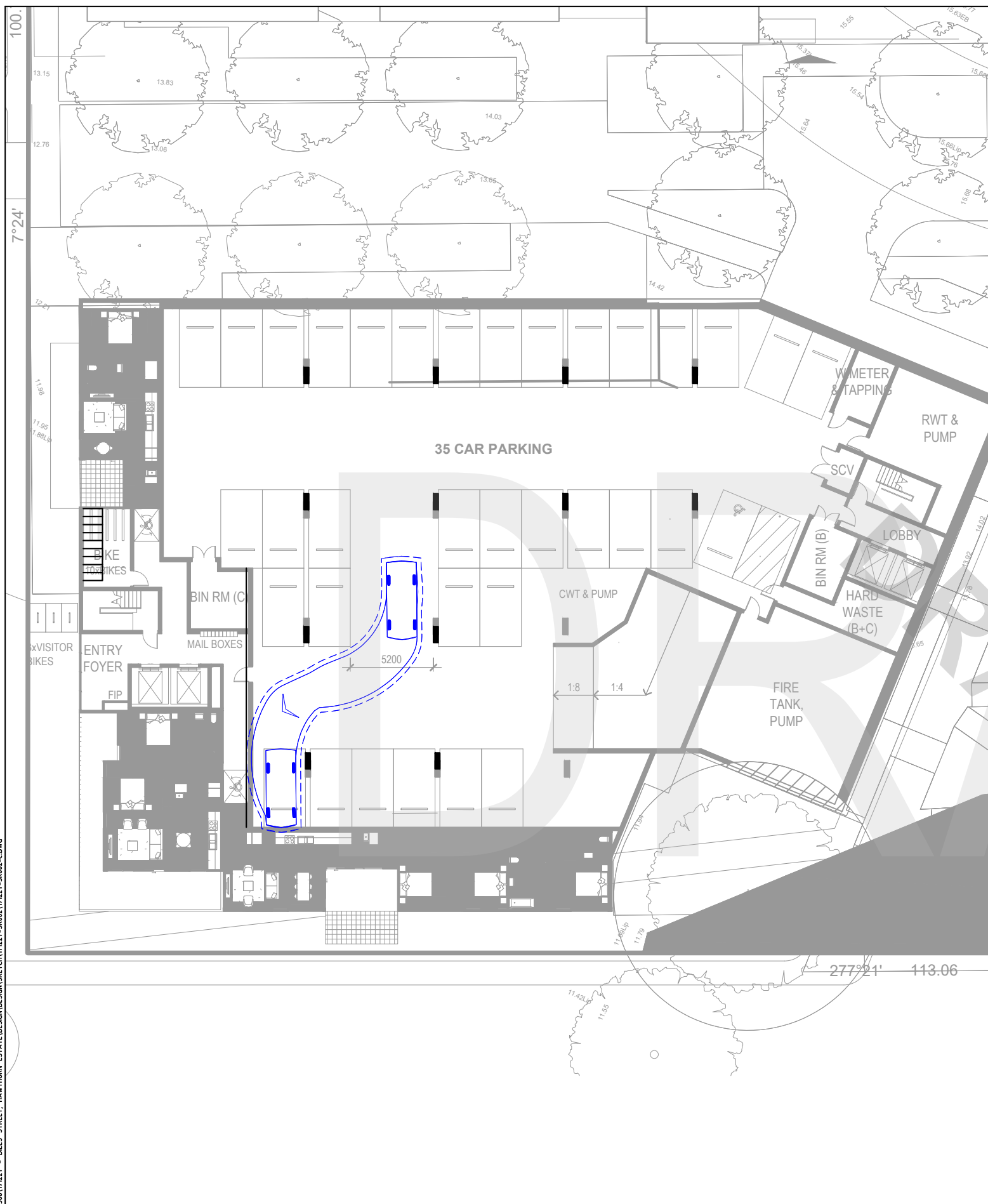
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DATE  
21/10/2020



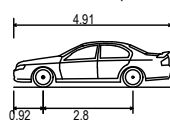






## ratio:

**RATIO CONSULTANTS PTY LTD**  
**ABN 005 422 104**  
**8 GWYNNE STREET**  
**CREMORNE, VICTORIA 3121**  
**TELEPHONE (03)9429 3111**  
**FACSIMILE (03)9429 3011**



B85 Vehicle (AS/NZS2890.1:2004)

VEHICLE ENVELOPE (FORWARD)

300mm CLEARANCE (FORWARD)

VEHICLE ENVELOPE (REVERSE)

300mm CLEARANCE (REVERSE)

Overall Length  
Overall Width  
Overall Body Height  
Min Body Ground Clearance  
Track Width  
Lock to Lock Time  
Curb to Curb Turning Radius

4.910m  
1.870m  
1.421m  
0.159m  
1.770m  
4.00 sec  
5.80m

Proposed Residential Development  
Bills Street, Hawthorn  
Swept Path Assessment - Lower Ground 2

**NOTE:**  
1) Base Plan Supplied By Hayball on 09/07/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE  
17122T-SK002-C

SHEET No.  
8 of 8

PREPARED BY  
E.Y.

SCALE  
1:300 @A3

DATE  
21/10/2020





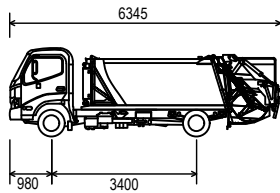
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**ratio:**

RATIO CONSULTANTS PTY LTD  
ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

Mini-Rear Loader Waste Collection Vehicle



VEHICLE ENVELOPE (FORWARD)

300mm CLEARANCE (FORWARD)

VEHICLE ENVELOPE (REVERSE)

300mm CLEARANCE (REVERSE)

Overall Length  
Body Width  
Overall Body Height  
Min Body Ground Clearance  
Track Width  
Lock to Lock Time  
Curb to Curb Turning Radius

6.345m  
1.700m  
2.080m  
0.205m  
1.670m  
4.00 sec  
6.450m

## Proposed Residential Development Bills Street, Hawthorn Swept Path Assessment - Lower Ground 1

NOTE:  
1) Base Plan Supplied By Hayball on 09/07/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE  
17122T-SK002-D

SHEET No.  
10 of 12

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E.Y.

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DATE  
21/10/2020





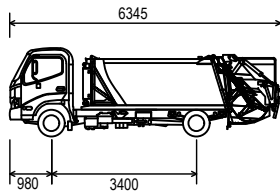
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**ratio:**

RATIO CONSULTANTS PTY LTD  
ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

Mini-Rear Loader Waste Collection Vehicle



VEHICLE ENVELOPE (FORWARD)

300mm CLEARANCE (FORWARD)

VEHICLE ENVELOPE (REVERSE)

300mm CLEARANCE (REVERSE)

Overall Length  
Body Width  
Overall Body Height  
Min Body Ground Clearance  
Track Width  
Lock to Lock Time  
Curb to Curb Turning Radius

6.345m  
1.700m  
2.080m  
0.205m  
1.670m  
4.00 sec  
6.450m

## Proposed Residential Development Bills Street, Hawthorn Swept Path Assessment - Lower Ground 1

### NOTE:

- 1) Base Plan Supplied By Hayball on 09/07/20
- 2) Maximum Design Speed 10km/h

RATIO REFERENCE  
17122T-SK002-D

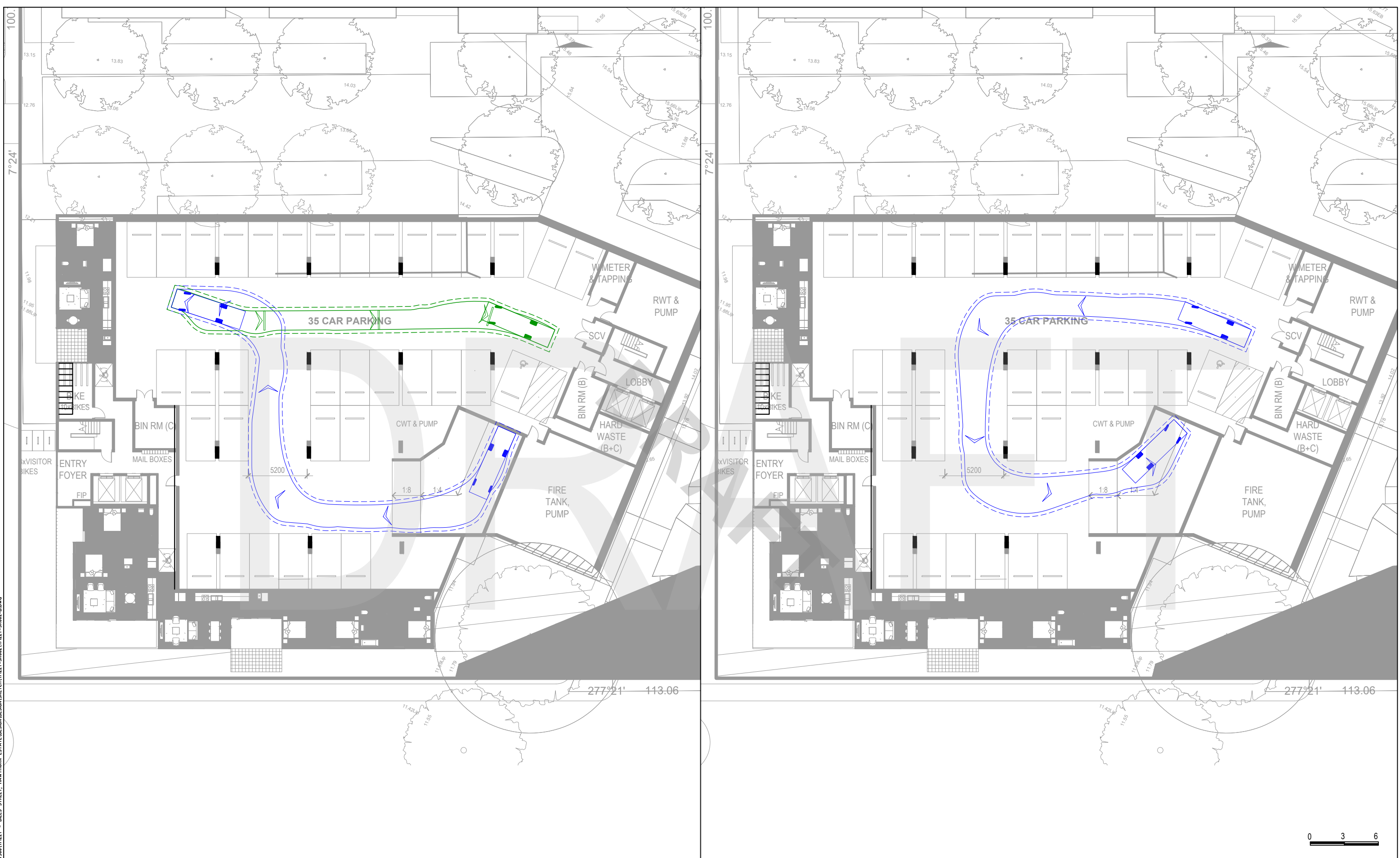
SHEET No.  
11 of 12

PREPARED BY  
E.Y.

SCALE  
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DATE  
21/10/2020





ratio:

RATIO CONSULTANTS PTY LTD  
ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

Mini-Rear Loader Waste Collection Vehicle

VEHICLE ENVELOPE (FORWARD)

300mm CLEARANCE (FORWARD)

VEHICLE ENVELOPE (REVERSE)

300mm CLEARANCE (REVERSE)

Proposed Residential Development  
Bills Street, Hawthorn  
Swept Path Assessment - Lower Ground 2

NOTE:  
1) Base Plan Supplied By Hayball on 09/07/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE  
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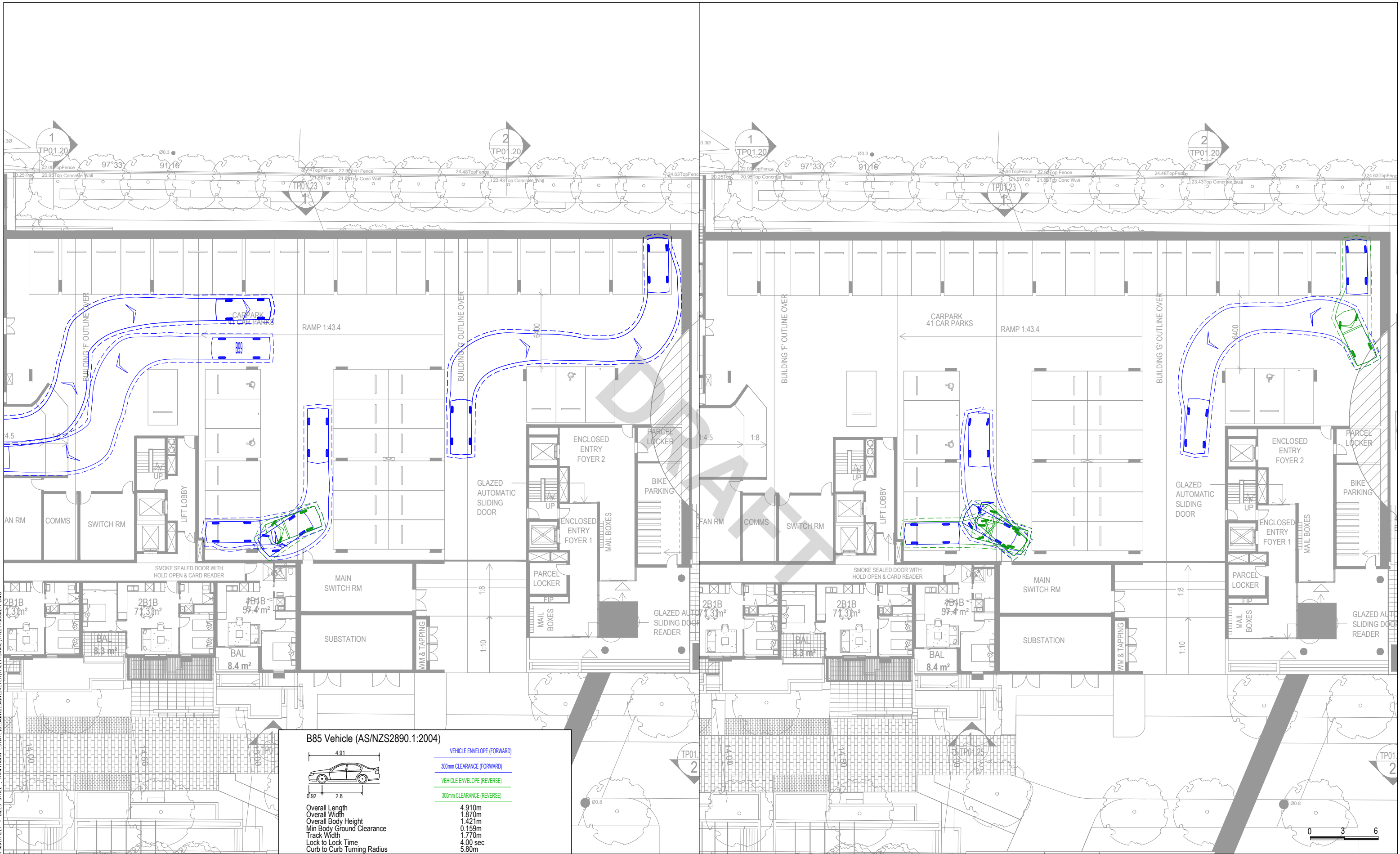
SHEET No.  
12 of 12

PREPARED BY  
E.Y.

SCALE  
1:300@A3

DATE  
21/10/2020





RATIO CONSULTANTS PTY LTD  
ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

B85 Vehicle (AS/NZS2890.1:2004)	
	VEHICLE ENVELOPE (FORWARD)
	300mm CLEARANCE (FORWARD)
	VEHICLE ENVELOPE (REVERSE)
	300mm CLEARANCE (REVERSE)
Overall Length	4.910m
Overall Width	1.870m
Overall Body Height	1.421m
Min Body Ground Clearance	0.159m
Track Width	1.770m
Lock to Lock Time	4.00 sec
Curb to Curb Turning Radius	5.80m
B99 Vehicle (AS/NZS2890.1:2004)	
	VEHICLE ENVELOPE (FORWARD)
	300mm CLEARANCE (FORWARD)
	VEHICLE ENVELOPE (REVERSE)
	300mm CLEARANCE (REVERSE)
Overall Length	5.200m
Overall Width	1.940m
Overall Body Height	2.200m
Min Body Ground Clearance	0.312m
Track Width	1.840m
Lock to Lock Time	4.00 sec
Curb to Curb Turning Radius	6.30m

### Proposed Residential Development

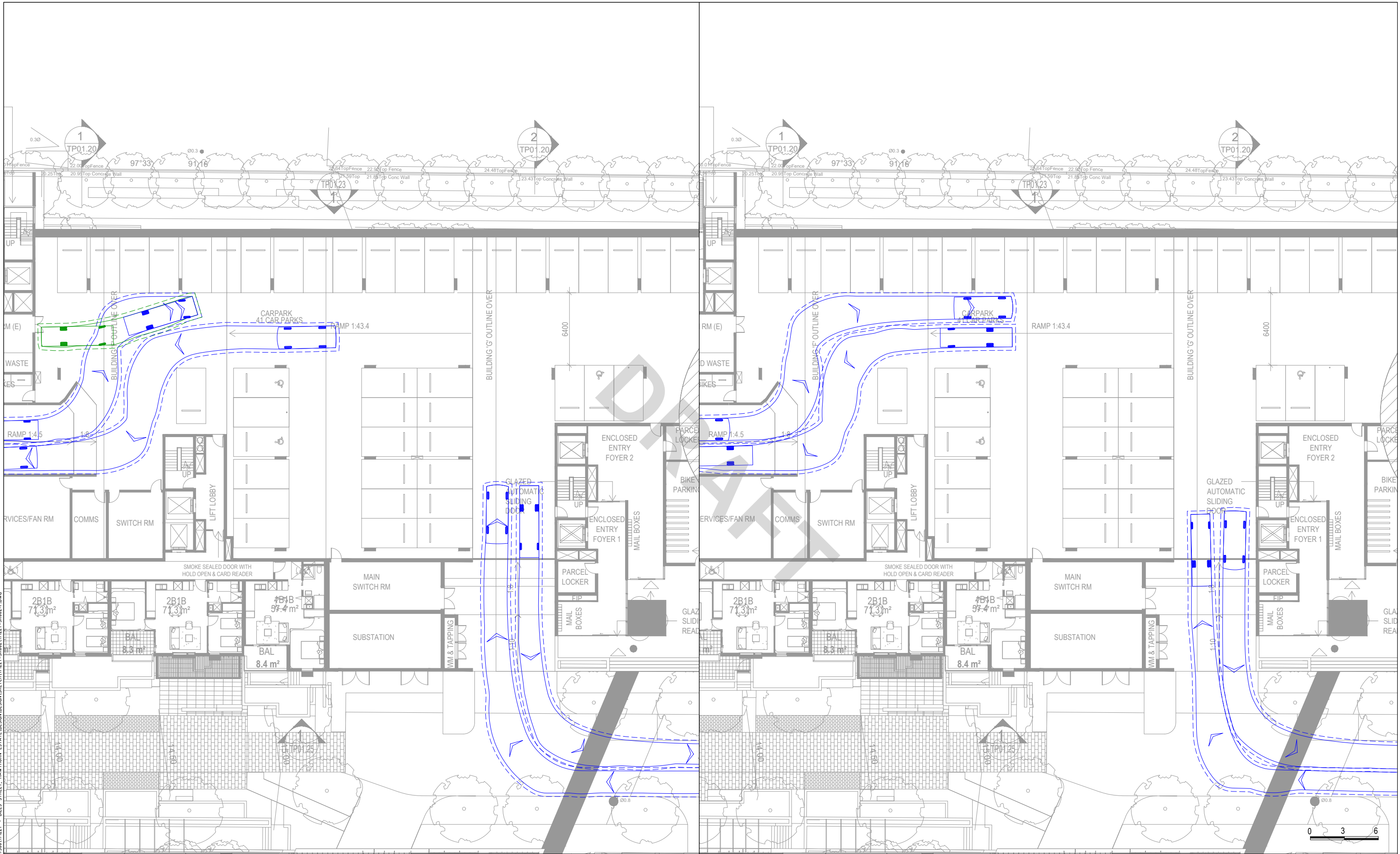
### Bills Street, Hawthorn

### Swept Path Assessment - Ground

NOTE:  
1) Base Plan Supplied By Hayball on 08/12/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE 17122T-SK002-F	SHEET No. 1 of 9	PREPARED BY E.Y.	SCALE 1:300@A3	DATE 01/02/2021
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# ratio:

RATIO CONSULTANTS PTY LTD  
ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

Mini-Rear Loader Waste Collection Vehicle

Overall Length 6.345m  
Body Width 1.700m  
Overall Body Height 2.080m  
Min Body Ground Clearance 0.205m  
Track Width 1.670m  
Lock to Lock Time 4.00 sec  
Curb to Curb Turning Radius 6.450m

## Proposed Residential Development

### Bills Street, Hawthorn

### Swept Path Assessment - Ground

NOTE:  
1) Base Plan Supplied By Hayball on 08/12/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE  
17122T-SK002-F

SHEET No.  
2 of 9

PREPARED BY  
E.Y.

SCALE  
1:300@A3

DATE  
01/02/2021

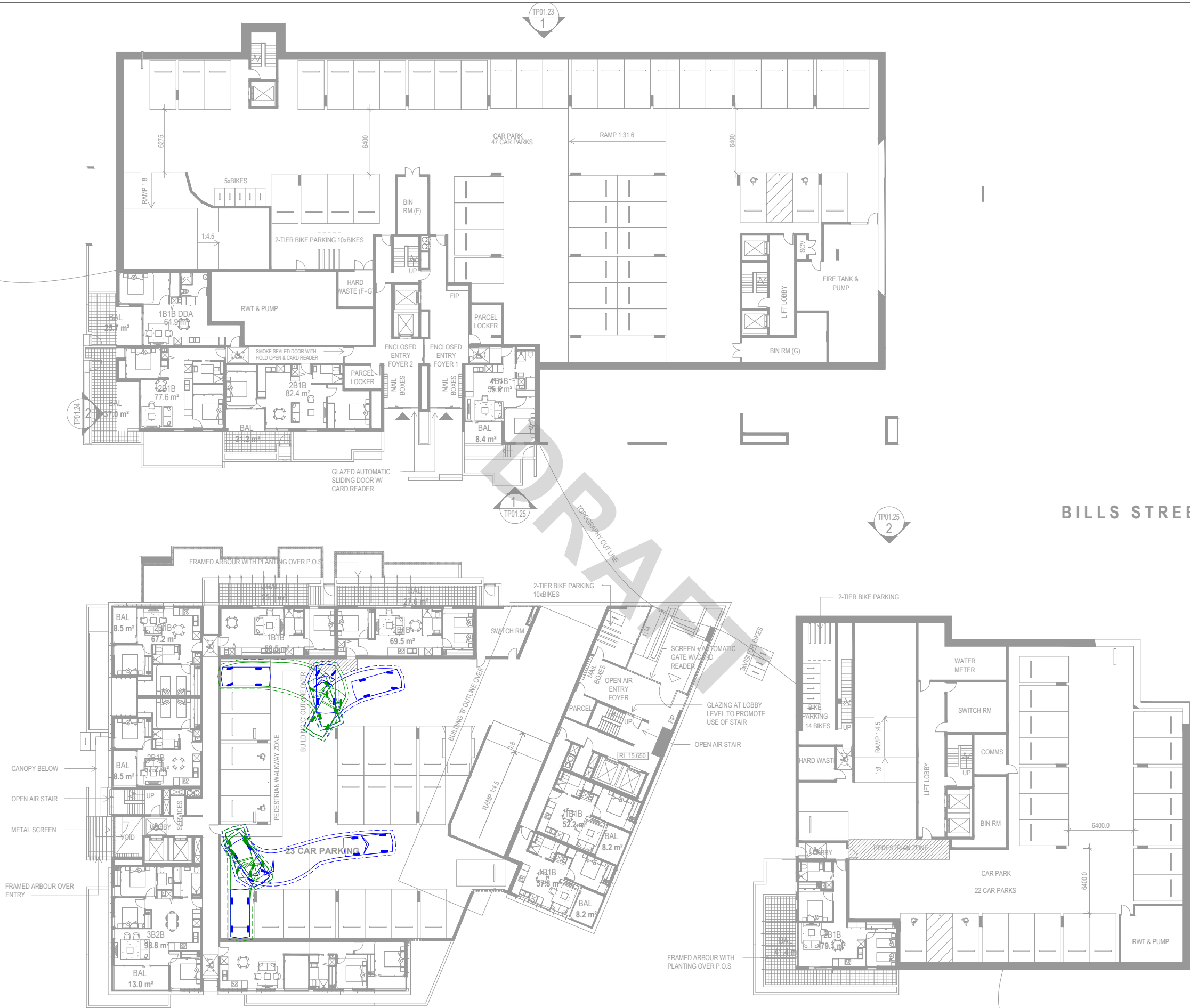




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ROBINSONS RD

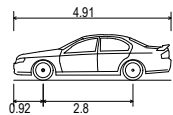
BILLS STREET



ratio:

RATIO CONSULTANTS PTY LTD  
ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

B85 Vehicle (AS/NZS2890.1:2004)



Overall Length  
Overall Width  
Overall Body Height  
Min Body Ground Clearance  
Track Width  
Lock to Lock Time  
Curb to Curb Turning Radius

VEHICLE ENVELOPE (FORWARD)  
300mm CLEARANCE (FORWARD)  
VEHICLE ENVELOPE (REVERSE)  
300mm CLEARANCE (REVERSE)

## Proposed Residential Development Bills Street, Hawthorn Swept Path Assessment - Lower Ground 1

NOTE:  
1) Base Plan Supplied By Hayball on 08/12/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE  
17122T-SK002-F

SHEET No.  
4 of 9

PREPARED BY  
E.Y.

SCALE  
1:400@A3

DATE  
01/02/2021

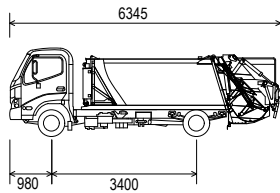


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RATIO CONSULTANTS PTY LTD  
ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

Mini-Rear Loader Waste Collection Vehicle



VEHICLE ENVELOPE (FORWARD)  
300mm CLEARANCE (FORWARD)  
VEHICLE ENVELOPE (REVERSE)  
300mm CLEARANCE (REVERSE)

Overall Length 6.345m  
Body Width 1.700m  
Overall Body Height 2.080m  
Min Body Ground Clearance 0.205m  
Track Width 1.670m  
Lock to Lock Time 4.00 sec  
Curb to Curb Turning Radius 6.450m

## Proposed Residential Development Bills Street, Hawthorn Swept Path Assessment - Lower Ground 1

NOTE:  
1) Base Plan Supplied By Hayball on 08/12/20  
2) Maximum Design Speed 10km/h

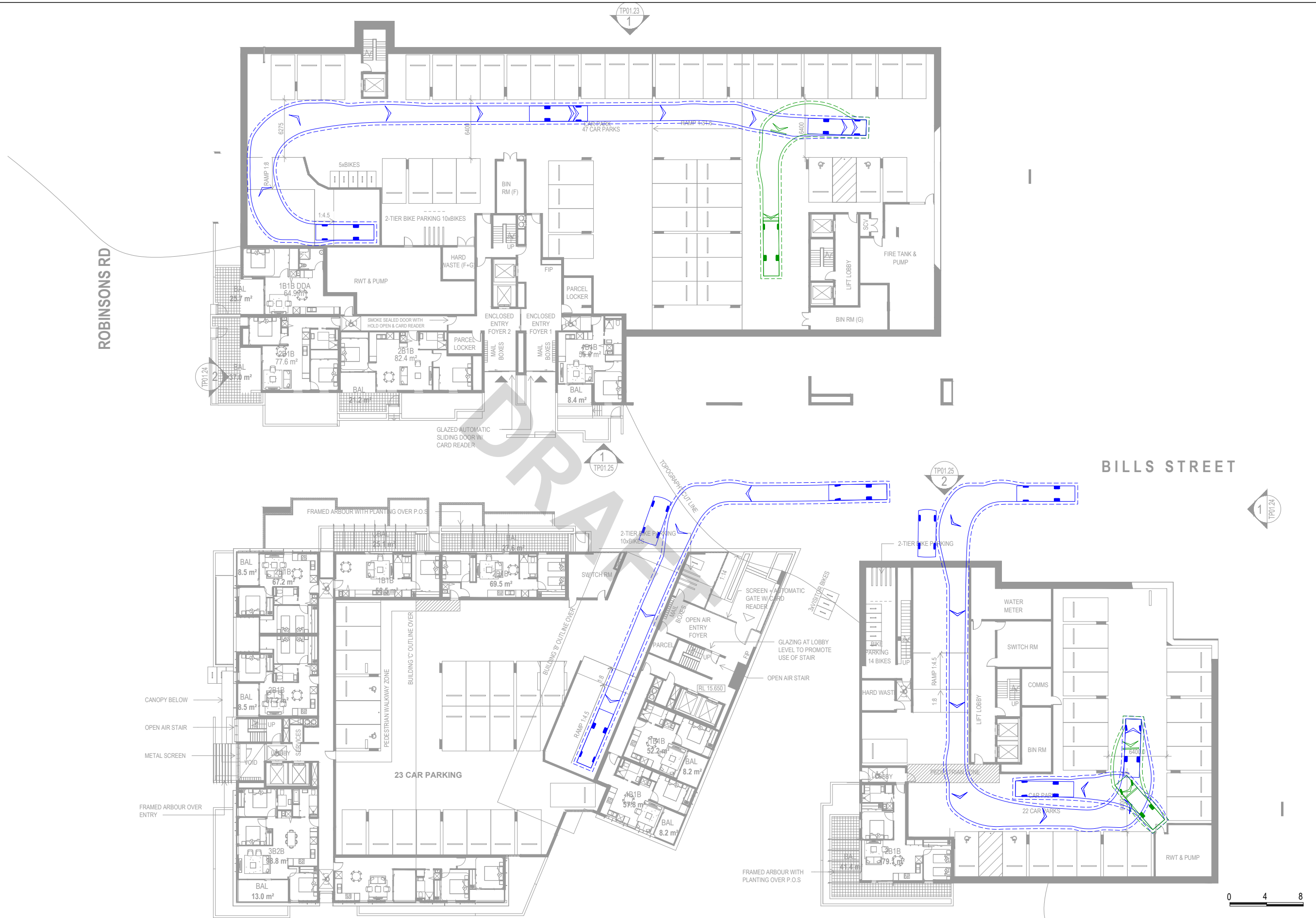
RATIO REFERENCE  
17122T-SK002-F

SHEET No.  
5 of 9

PREPARED BY  
E.Y.

SCALE  
1:400@A3

DATE  
01/02/2021



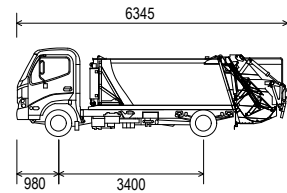


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RATIO CONSULTANTS PTY LTD  
ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

Mini-Rear Loader Waste Collection Vehicle



VEHICLE ENVELOPE (FORWARD)  
300mm CLEARANCE (FORWARD)  
VEHICLE ENVELOPE (REVERSE)  
300mm CLEARANCE (REVERSE)

Overall Length 6.345m  
Body Width 1.700m  
Overall Body Height 2.080m  
Min Body Ground Clearance 0.205m  
Track Width 1.670m  
Lock to Lock Time 4.00 sec  
Curb to Curb Turning Radius 6.450m

## Proposed Residential Development Bills Street, Hawthorn Swept Path Assessment - Lower Ground 1

NOTE:  
1) Base Plan Supplied By Hayball on 08/12/20  
2) Maximum Design Speed 10km/h

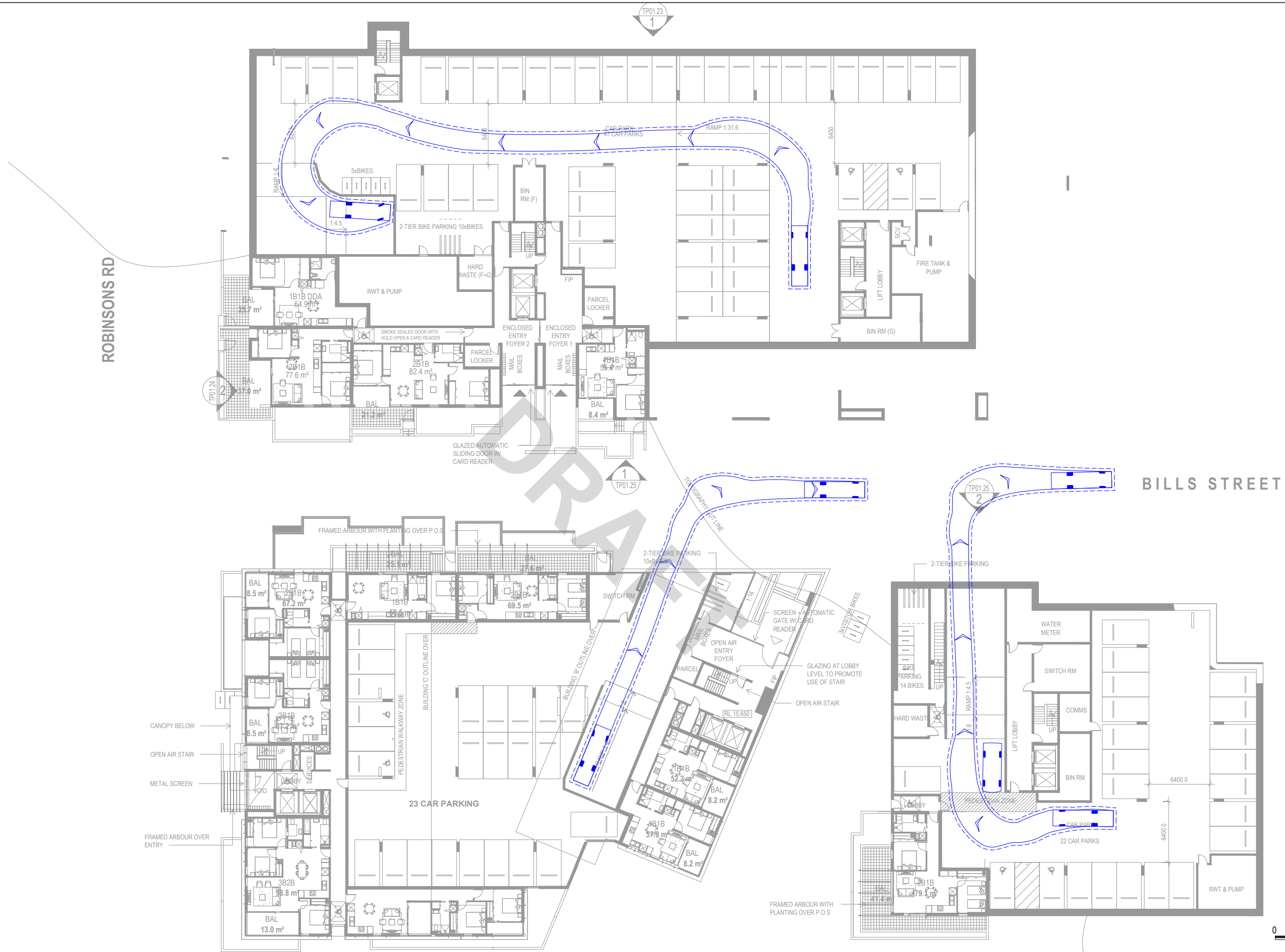
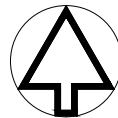
RATIO REFERENCE  
17122T-SK002-F

SHEET No.  
6 of 9

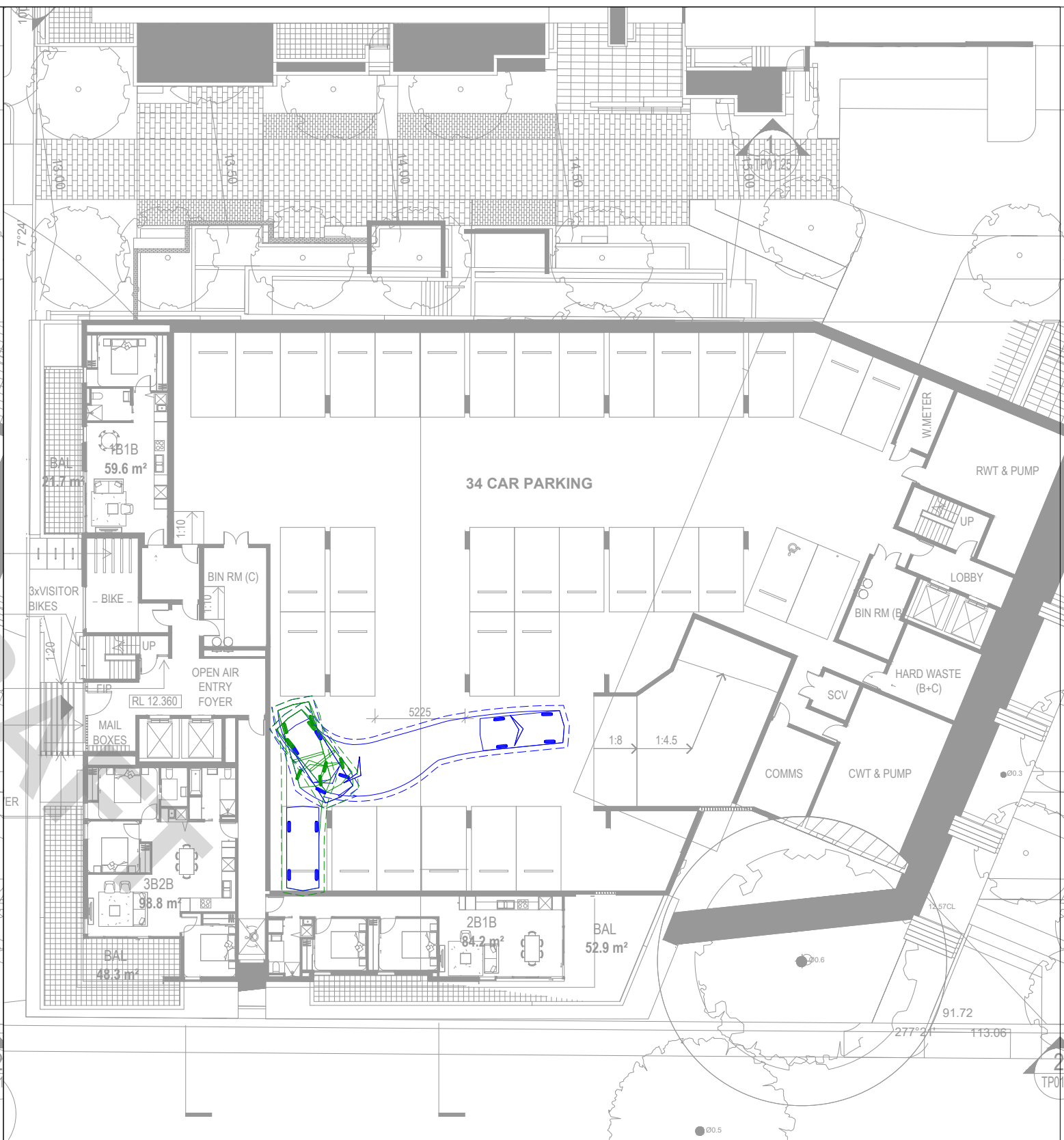
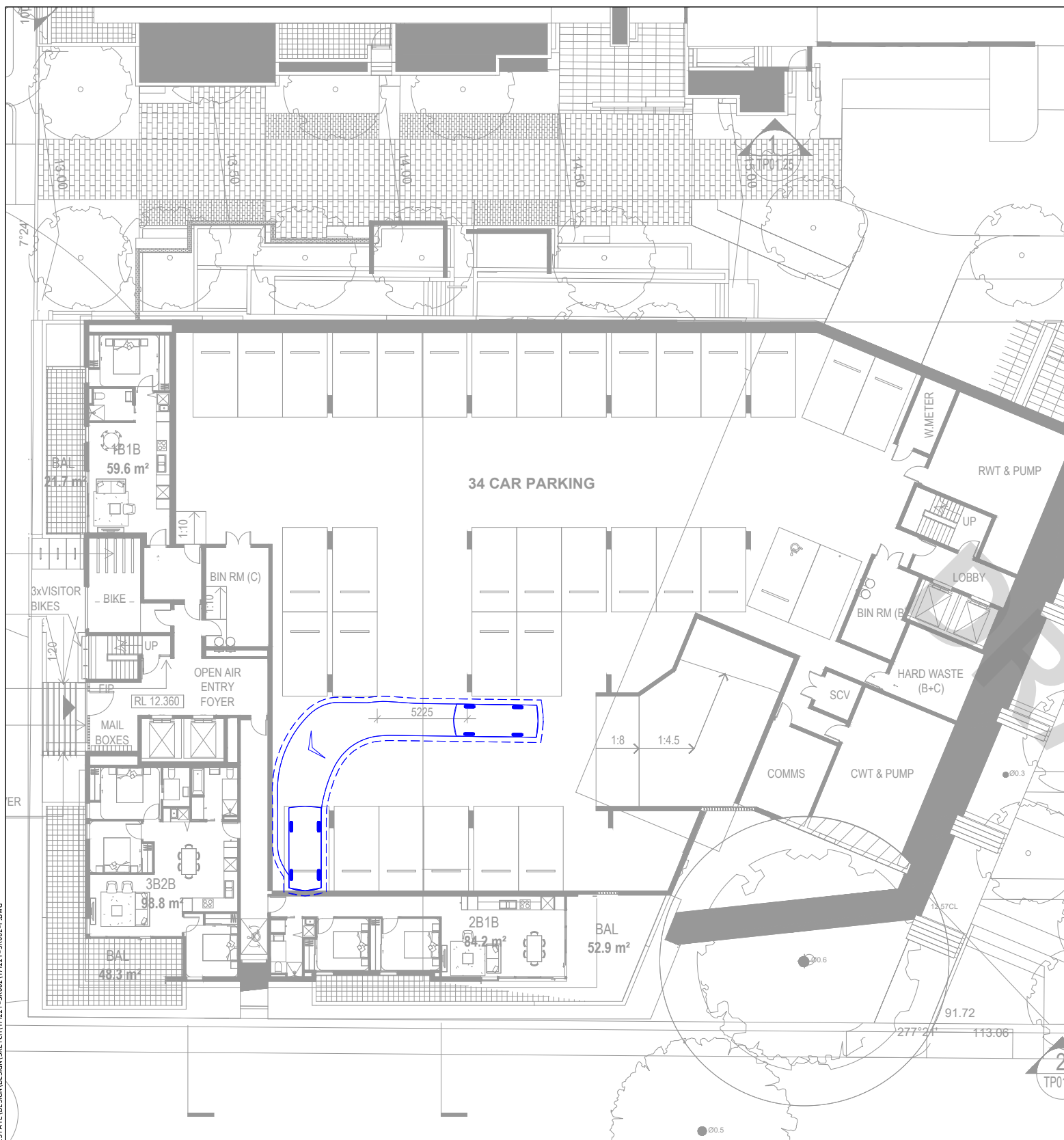
PREPARED BY  
E.Y.

SCALE  
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DATE  
01/02/2021





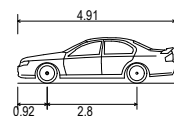


A number line from 0 to 10. The segment from 0 to 3 is shaded black. The segment from 3 to 6 is outlined with a bracket above it.

## ratio:

**RATIO CONSULTANTS PTY LTD**  
**ABN 005 422 104**  
 8 GWYNNE STREET  
 CREMORNE, VICTORIA 3121  
 TELEPHONE (03)9429 3111  
 FACSIMILE (03)9429 3011

B85 Vehicle (AS/NZS2890.1:2004)



Overall Length  
Overall Width  
Overall Body Height  
Min Body Ground Clearance  
Track Width  
Lock to Lock Time  
Curb to Curb Turning Radius

VEHICLE ENVELOPE (FORWARD)  
300mm CLEARANCE (FORWARD)  
VEHICLE ENVELOPE (REVERSE)  
300mm CLEARANCE (REVERSE)

4.910m  
1.870m  
1.421m  
0.159m  
1.770m  
4.00 sec  
5.80m

Proposed Residential Development  
Bills Street, Hawthorn  
Swept Path Assessment - Lower Ground 2

**NOTE:**  
1) Base Plan Supplied By Hayball on 08/12/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE  
17122T-SK002-F

SHEET No.  
8 of 9

PREPARED BY  
E.Y.

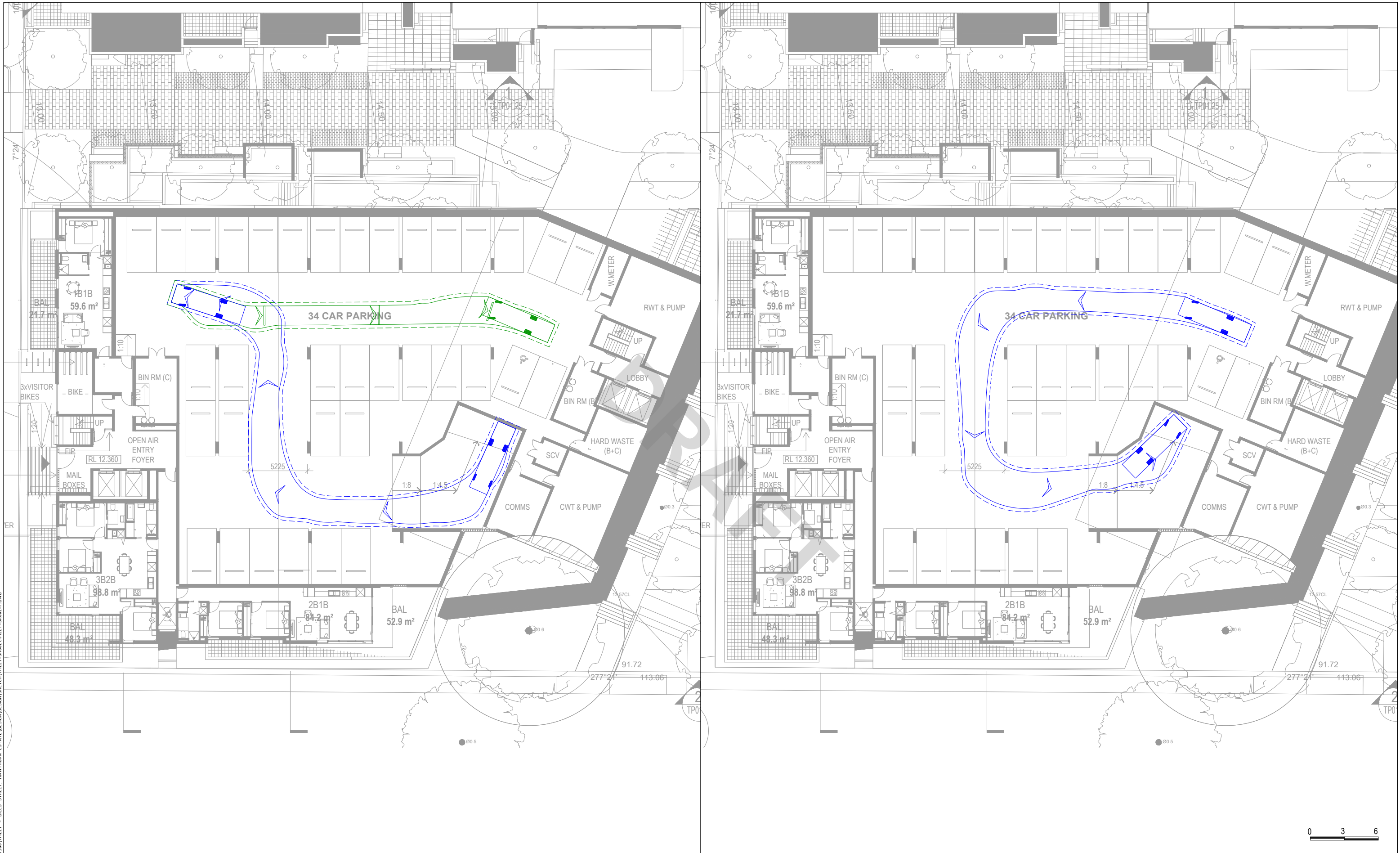
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DATE  
1/02/2021



01/02/2021 4:09:11 PM Y:\17001-17500\17122T - BILLS STREET, HAWTHORN ESTATE\DESIGN\SKETCH\17122T-SK002\17122T-SK002-F.DWG





ratio:

RATIO CONSULTANTS PTY LTD  
ABN 005 422 104  
8 GWYNNE STREET  
CREMORNE, VICTORIA 3121  
TELEPHONE (03)9429 3111  
FACSIMILE (03)9429 3011

Mini-Rear Loader Waste Collection Vehicle

6345

980

3400

VEHICLE ENVELOPE (FORWARD)

300mm CLEARANCE (FORWARD)

VEHICLE ENVELOPE (REVERSE)

300mm CLEARANCE (REVERSE)

Overall Length  
Body Width  
Overall Body Height  
Min Body Ground Clearance  
Track Width  
Lock to Lock Time  
Curb to Curb Turning Radius

6.345m  
1.700m  
2.080m  
0.205m  
1.670m  
4.00 sec  
6.450m

Proposed Residential Development  
Bills Street, Hawthorn  
Swept Path Assessment - Lower Ground 2

NOTE:  
1) Base Plan Supplied By Hayball on 08/12/20  
2) Maximum Design Speed 10km/h

RATIO REFERENCE  
17122T-SK002-F

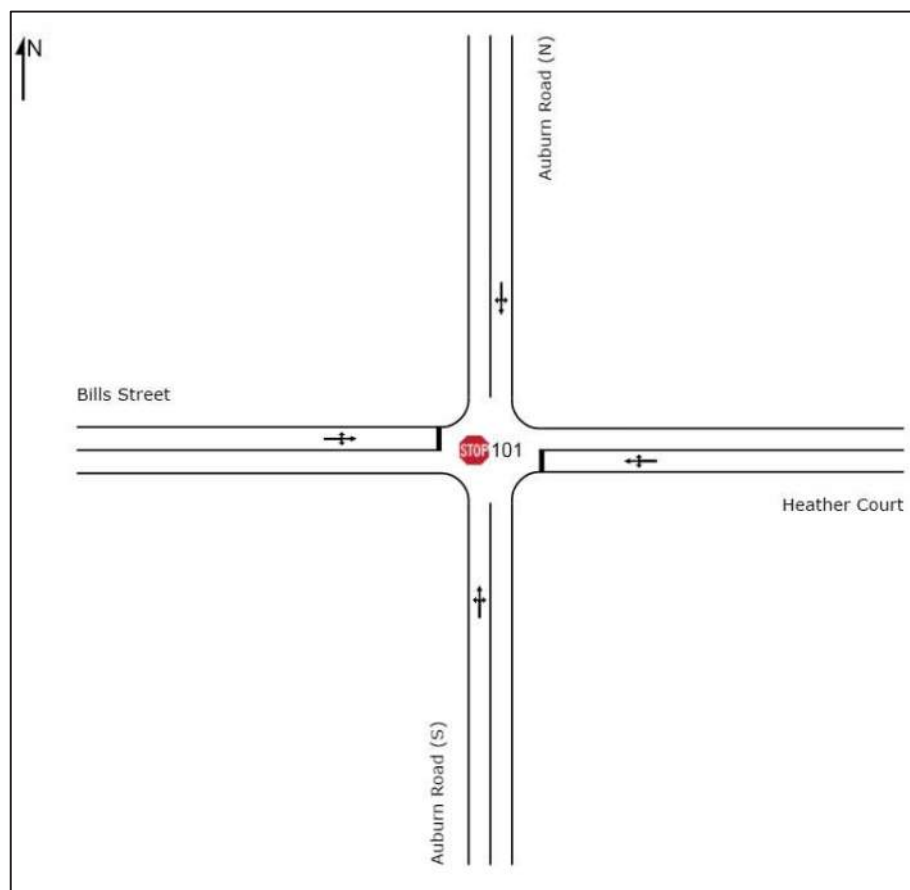
SHEET No.  
9 of 9

PREPARED BY  
E.Y.

SCALE  
1:300@A3

DATE  
01/02/2021

# Appendix C SIDRA Summary





## MOVEMENT SUMMARY

 **Site: 101 [Bills Street / Auburn Road / Heather Court Intersection - Existing AM Peak]**

Bills Street / Auburn Road / Heather Court Intersection

Site Category: (None)

Stop (Two-Way)

### Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Auburn Road (S)												
1	L2	11	0.0	0.361	9.1	LOS A	0.2	1.5	0.03	0.01	0.04	58.0
2	T1	676	0.0	0.361	0.1	LOS A	0.2	1.5	0.03	0.01	0.04	59.6
3	R2	6	0.0	0.361	11.8	LOS B	0.2	1.5	0.03	0.01	0.04	57.4
Approach		693	0.0	0.361	0.4	NA	0.2	1.5	0.03	0.01	0.04	59.6
East: Heather Court												
4	L2	7	0.0	0.040	13.0	LOS B	0.1	0.8	0.77	0.96	0.77	45.3
5	T1	1	0.0	0.040	31.7	LOS D	0.1	0.8	0.77	0.96	0.77	45.1
6	R2	2	0.0	0.040	37.3	LOS E	0.1	0.8	0.77	0.96	0.77	44.9
Approach		11	0.0	0.040	19.7	LOS C	0.1	0.8	0.77	0.96	0.77	45.2
North: Auburn Road (N)												
7	L2	5	0.0	0.412	10.4	LOS B	0.4	2.7	0.05	0.01	0.07	57.9
8	T1	765	0.0	0.412	0.2	LOS A	0.4	2.7	0.05	0.01	0.07	59.5
9	R2	14	0.0	0.412	11.1	LOS B	0.4	2.7	0.05	0.01	0.07	57.3
Approach		784	0.0	0.412	0.5	NA	0.4	2.7	0.05	0.01	0.07	59.5
West: Bills Street												
10	L2	8	0.0	0.049	11.9	LOS B	0.1	1.0	0.75	0.95	0.75	45.1
11	T1	1	0.0	0.049	31.8	LOS D	0.1	1.0	0.75	0.95	0.75	44.9
12	R2	3	0.0	0.049	37.5	LOS E	0.1	1.0	0.75	0.95	0.75	44.7
Approach		13	0.0	0.049	20.0	LOS C	0.1	1.0	0.75	0.95	0.75	45.0
All Vehicles		1500	0.0	0.412	0.7	NA	0.4	2.7	0.05	0.03	0.07	59.2

## MOVEMENT SUMMARY

 **Site: 101 [Bills Street / Auburn Road / Heather Court Intersection - Existing PM Peak]**

Bills Street / Auburn Road / Heather Court Intersection

Site Category: (None)

Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Auburn Road (S)												
1	L2	1	0.0	0.384	8.6	LOS A	0.1	0.6	0.01	0.00	0.01	58.3
2	T1	739	0.0	0.384	0.0	LOS A	0.1	0.6	0.01	0.00	0.01	59.9
3	R2	4	0.0	0.384	8.9	LOS A	0.1	0.6	0.01	0.00	0.01	57.6
Approach		744	0.0	0.384	0.1	NA	0.1	0.6	0.01	0.00	0.01	59.9
East: Heather Court												
4	L2	5	0.0	0.031	10.5	LOS B	0.1	0.7	0.69	0.91	0.69	46.3
5	T1	1	0.0	0.031	23.7	LOS C	0.1	0.7	0.69	0.91	0.69	46.1
6	R2	3	0.0	0.031	27.5	LOS D	0.1	0.7	0.69	0.91	0.69	45.9
Approach		9	0.0	0.031	17.6	LOS C	0.1	0.7	0.69	0.91	0.69	46.2
North: Auburn Road (N)												
7	L2	1	0.0	0.274	10.4	LOS B	0.1	0.9	0.03	0.01	0.03	58.1
8	T1	517	0.0	0.274	0.1	LOS A	0.1	0.9	0.03	0.01	0.03	59.7
9	R2	6	0.0	0.274	10.6	LOS B	0.1	0.9	0.03	0.01	0.03	57.5
Approach		524	0.0	0.274	0.3	NA	0.1	0.9	0.03	0.01	0.03	59.7
West: Bills Street												
10	L2	3	0.0	0.024	12.6	LOS B	0.1	0.5	0.76	0.95	0.76	45.4
11	T1	1	0.0	0.024	23.6	LOS C	0.1	0.5	0.76	0.95	0.76	45.2
12	R2	2	0.0	0.024	27.4	LOS D	0.1	0.5	0.76	0.95	0.76	45.1
Approach		6	0.0	0.024	19.3	LOS C	0.1	0.5	0.76	0.95	0.76	45.3
All Vehicles		1284	0.0	0.384	0.4	NA	0.1	0.9	0.03	0.02	0.03	59.6

## MOVEMENT SUMMARY

 Site: 101 [Bills Street / Auburn Road / Heather Court Intersection - Future AM Peak]

Bills Street / Auburn Road / Heather Court Intersection

Site Category: (None)

Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Auburn Road (S)												
1	L2	22	0.0	0.367	7.8	LOS A	0.2	1.6	0.04	0.02	0.05	57.9
2	T1	676	0.0	0.367	0.1	LOS A	0.2	1.6	0.04	0.02	0.05	59.5
3	R2	6	0.0	0.367	11.9	LOS B	0.2	1.6	0.04	0.02	0.05	57.3
Approach		704	0.0	0.367	0.5	NA	0.2	1.6	0.04	0.02	0.05	59.4
East: Heather Court												
4	L2	7	0.0	0.041	13.0	LOS B	0.1	0.9	0.77	0.96	0.77	45.0
5	T1	1	0.0	0.041	32.8	LOS D	0.1	0.9	0.77	0.96	0.77	44.8
6	R2	2	0.0	0.041	39.4	LOS E	0.1	0.9	0.77	0.96	0.77	44.6
Approach		11	0.0	0.041	20.2	LOS C	0.1	0.9	0.77	0.96	0.77	44.9
North: Auburn Road (N)												
7	L2	5	0.0	0.422	10.9	LOS B	0.6	4.3	0.08	0.02	0.11	57.7
8	T1	765	0.0	0.422	0.4	LOS A	0.6	4.3	0.08	0.02	0.11	59.3
9	R2	22	0.0	0.422	11.3	LOS B	0.6	4.3	0.08	0.02	0.11	57.1
Approach		793	0.0	0.422	0.8	NA	0.6	4.3	0.08	0.02	0.11	59.2
West: Bills Street												
10	L2	39	0.0	0.520	21.2	LOS C	2.0	13.8	0.89	1.11	1.28	37.0
11	T1	1	0.0	0.520	44.6	LOS E	2.0	13.8	0.89	1.11	1.28	36.8
12	R2	48	0.0	0.520	51.2	LOS F	2.0	13.8	0.89	1.11	1.28	36.7
Approach		88	0.0	0.520	37.9	LOS E	2.0	13.8	0.89	1.11	1.28	36.8
All Vehicles		1596	0.0	0.520	2.8	NA	2.0	13.8	0.11	0.09	0.15	57.2

## MOVEMENT SUMMARY

 Site: 101 [Bills Street / Auburn Road / Heather Court Intersection - Future PM Peak]

Bills Street / Auburn Road / Heather Court Intersection

Site Category: (None)

Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Auburn Road (S)												
1	L2	43	0.0	0.406	5.9	LOS A	0.1	0.8	0.01	0.04	0.02	58.0
2	T1	739	0.0	0.406	0.0	LOS A	0.1	0.8	0.01	0.04	0.02	59.6
3	R2	4	0.0	0.406	9.0	LOS A	0.1	0.8	0.01	0.04	0.02	57.4
Approach		786	0.0	0.406	0.4	NA	0.1	0.8	0.01	0.04	0.02	59.5
East: Heather Court												
4	L2	5	0.0	0.033	10.5	LOS B	0.1	0.7	0.70	0.91	0.70	45.9
5	T1	1	0.0	0.033	26.5	LOS D	0.1	0.7	0.70	0.91	0.70	45.6
6	R2	3	0.0	0.033	29.1	LOS D	0.1	0.7	0.70	0.91	0.70	45.5
Approach		9	0.0	0.033	18.5	LOS C	0.1	0.7	0.70	0.91	0.70	45.7
North: Auburn Road (N)												
7	L2	1	0.0	0.312	11.4	LOS B	0.8	5.4	0.16	0.04	0.19	57.0
8	T1	517	0.0	0.312	0.8	LOS A	0.8	5.4	0.16	0.04	0.19	58.5
9	R2	34	0.0	0.312	11.4	LOS B	0.8	5.4	0.16	0.04	0.19	56.4
Approach		552	0.0	0.312	1.5	NA	0.8	5.4	0.16	0.04	0.19	58.4
West: Bills Street												
10	L2	22	0.0	0.246	14.3	LOS B	0.8	5.6	0.83	1.02	0.92	42.5
11	T1	1	0.0	0.246	28.2	LOS D	0.8	5.6	0.83	1.02	0.92	42.3
12	R2	29	0.0	0.246	32.9	LOS D	0.8	5.6	0.83	1.02	0.92	42.2
Approach		53	0.0	0.246	25.0	LOS C	0.8	5.6	0.83	1.02	0.92	42.3
All Vehicles		1400	0.0	0.406	1.9	NA	0.8	5.6	0.11	0.08	0.12	58.1