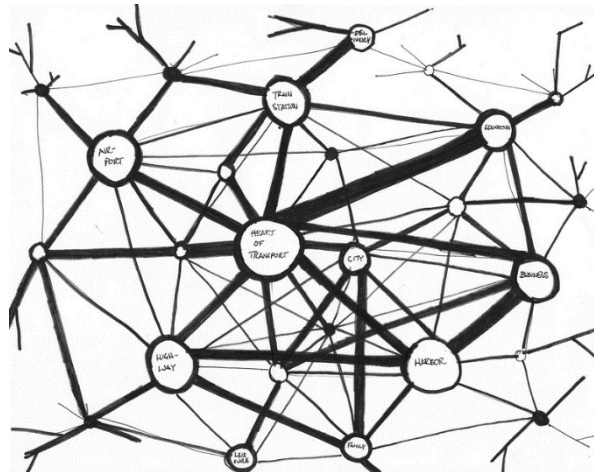


TRAFFIC, PARKING AND TRANSPORT IMPACT STATEMENT

PROPOSED RESIDENTIAL DEVELOPMENT (1 – 5 BATHURST STREET LIVERPOOL)



Date:
May 2017

Office:
Suite 15/9 Hoyle Ave., Castle Hill
NSW 2154

All Correspondence:
75 Gindurra Ave., Castle Hill NSW
2154

Ph: (02) 8850 2788

Mob:
0418 262 125 (David Thompson)
0450 747 401 (Yafeng Zhu)

Email:
david@thompsonstanbury.com.au
yafeng@thompsonstanbury.com.au

Website:
www.thompsonstanbury.com.au

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APPENDICES

1. Swept Path Plans

1. **INTRODUCTION**

TSA has been commissioned by Synergy Development Group to prepare a Traffic Impact Assessment accompanying a Development Application (DA) lodged with Liverpool City Council. The subject DA proposes a residential flat building development comprising 94 apartments on land located at 1 - 5 Bathurst Street, Liverpool (hereafter referred to as the 'subject site').

The purpose of this report is to assess and document the likely traffic and parking implications of the proposed development and to recommend appropriate remedial measures where required. Specifically, this report:

- Assesses the adequacy, or otherwise, of the proposed off-street parking provision having regard to the rates specified by Liverpool City Council and the Roads and Maritime Services;
- Assesses the suitability of the proposed vehicular access arrangements based on standards specified by the Roads and Maritime Services and the Australian Standards;
- Assesses the proposed parking layout with respect to internal circulation and vehicle manoeuvrability;
- Reviews the existing traffic conditions within the vicinity of the site, including traffic volumes, traffic efficiency and general traffic safety; and
- Determines the expected traffic generation from the proposed development based on Roads and Maritime Services' generation rates, and assesses the impact of the net increase in traffic on the surrounding road network.

Throughout this report, reference is made to the following documents:

- The Roads and Maritime Services' *Guide to Traffic Generating Developments*;
- Australian Standard *Parking Facilities Part 1: Off-Street Parking* (AS 2890.1-2004); and
- Part 4 of Liverpool City Council's *Development Control Plan 2008* (DCP 2008) relating to *Development in Liverpool City Centre*.

This report should be read in conjunction with architectural plans prepared by Algorry Zappia & Associates (Project Ref: P4714), submitted under a separate cover.

2. SITE DETAILS

2.1 Site Location

The subject site is located at the south-western corner of Lachlan Street and Bathurst Street, Liverpool. This location is shown in the context of the surrounding road network in **Figure 1** overleaf and in the local context in **Figure 2**.

2.2 Site Description

The subject site comprises Lots D – F DP 33121 and provides a street address of 1 - 5 Bathurst Street, Liverpool. Collectively, the allotments form a rectangular shaped parcel of land providing frontages of approximately 60m and 45m to Bathurst Street and Lachlan Street, respectively. The site has area in of 2,744m².

2.3 Existing Uses

The subject site currently accommodates the following residential land uses:

- A two-storey duplex with a four space carport situated within 1 Bathurst Street, Liverpool;
- A single-storey detached residential dwelling with associated outbuildings situated within 3 Bathurst Street, Liverpool; and
- A two-storey medium density residential development comprising 6 x 2-bedroom units with an at-grade outdoor car park, situated within 5 Bathurst Street, Liverpool.

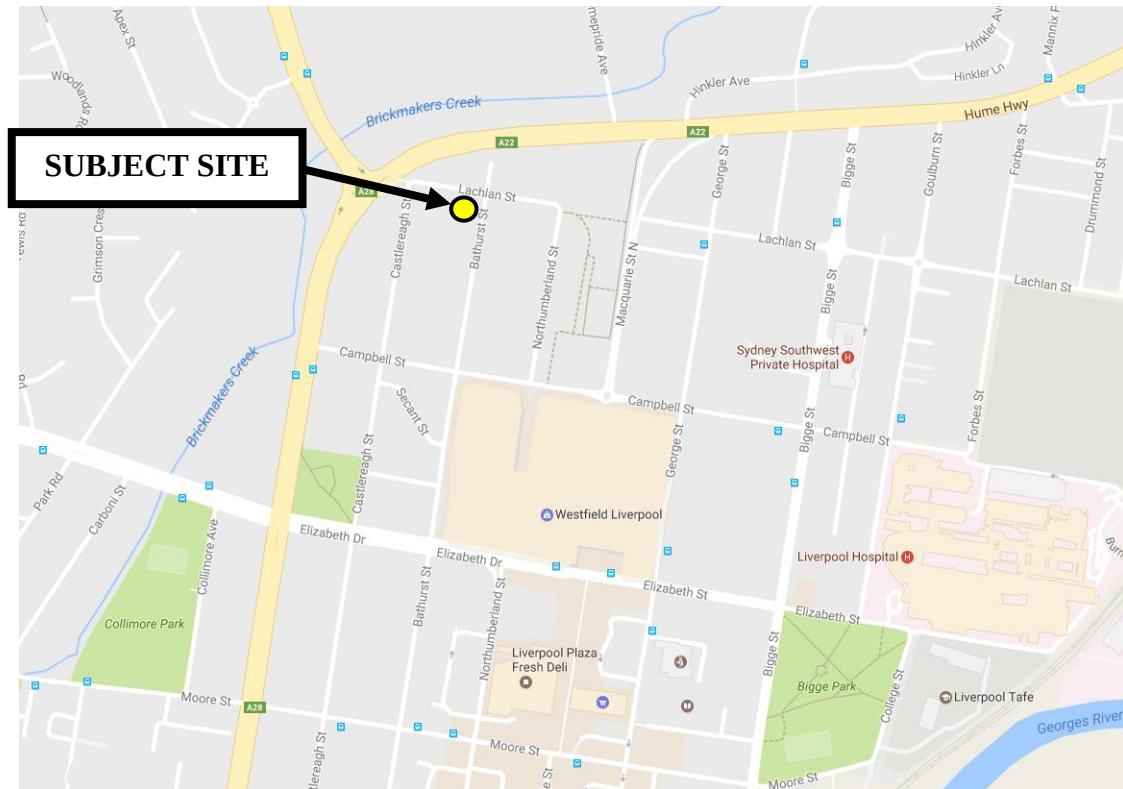
The existing developments occupying 3 and 5 Bathurst Street, Liverpool are serviced by access driveways connecting to Bathurst Street, whilst the two-storey duplex is serviced by access driveway connecting to Lachlan Street at the northern property boundary.

2.4 Surrounding Uses

The site is generally surrounded by a combination of low to medium density residential developments in the form of single detached dwellings and residential flat buildings in its immediate vicinity.

A mix of retail, commercial and residential land uses occupies the land further to the south-east.

FIGURE 1
SITE LOCATION – ROAD NETWORK CONTEXT



Source: Google Maps

FIGURE 2
SITE LOCATION – LOCAL CONTEXT



Source: Six Maps

3. PROPOSED DEVELOPMENT

3.1 Built Form

The subject application seeks Council approval for demolition of the existing developments and the erection of a nine-storey residential apartment building containing 94 dwellings, providing the following dwelling mix:

- 11 one bedroom apartments;
- 71 two bedroom apartments; and
- 12 three bedroom apartments.

The above development is proposed to be serviced by two levels of basement car parking containing 117 passenger vehicle parking spaces.

The basement parking and servicing areas are proposed to be serviced by a single combined ingress / egress access driveway providing connectivity to Bathurst Street in the south-eastern corner of the site.

Pedestrian access into the building is provided from both Bathurst Street and Lachlan Street. These entrance points are located away from the vehicular access driveways to facilitate safe pedestrian access to/from the development.

4. ACCESS & INTERNAL CONSIDERATIONS

4.1 Vehicular Access

Vehicular access to the subject development is proposed via a 6.0m wide combined ingress / egress driveway connecting with Bathurst Street in the south-eastern corner of the site.

In order to undertake an assessment of the proposed driveway design, reference is made to AS2890.1-2004. This Standard provides driveway design specifications based on the number of parking spaces accommodated on-site, the land-use proposed and the functional order of the frontage road. Based on the development parking provision of 117 spaces, the residential nature of the land-use and the local (non-arterial) nature of Bathurst Street, AS2890.1-2004 specifies, at minimum, a Category 2 type driveway requiring a minimum combined ingress / egress width of 6.0m. The proposed 6.0m wide driveway arrangement therefore complies with the Australian Standard requirements and is accordingly considered to be satisfactory.

The consistent vertical and horizontal alignment of Bathurst Street in the immediate vicinity of the subject site results in good sight distance conditions between public roadway and the site access driveway.

The access driveway design provides a suitable area free of any obstructions to sight distance adjoining the northern side of the driveway, thereby resulting in sight distance between pedestrians along the western Bathurst Street road reserve and motorists exiting the site according with the relevant AS2890.1-2004 requirements. The vehicle / vehicle and vehicle / pedestrian sight distance is proposed to be assisted by the provision of a maximum grade of 1:20 for the first 6m of roadway extending into the property from Bathurst Street. In consideration of this and the above discussion, the proposed site access arrangements are considered satisfactory.

4.2 Off-Street Parking

4.2.1 Passenger Vehicle Parking

Liverpool City Council provides the following relevant locally sensitive parking requirements within Part 4 of DCP 2008, relating to *Development within the Liverpool City Centre*:

Residential Development

1 space per one bedroom dwelling

1 space per two bedroom dwelling

1.5 spaces per three bedroom dwelling

1 space per 10 dwellings for visitors

1 space per 40 units for service vehicle (including removalist vans

(and car washing bays, up to a maximum of 4 spaces per building.

Based on the proposed development yield of 11 one bedroom dwellings, 71 two bedroom dwellings and 12 three bedroom dwellings, the following calculations are provided:

$$(1 \times 11) + (1 \times 71) + (1.5 \times 12) + (94/10) + (94/40) = 112 \text{ spaces.}$$

Council's DCP therefore requires the provision of 112 parking spaces, comprising 100 resident and 10 visitor including two service bays.

The proposed development provides a total of 117 off-street parking spaces over two basement parking levels, comprising 107 resident spaces, 10 visitor spaces and two service (car wash) bays. Compliance with Council's parking requirements is therefore achieved.

4.2.2 Motorcycle Parking

Liverpool City Council provides the following requirements for motorcycles within DCP 2008 relevant to the subject proposal:

Provision is to be made for motorcycle parking at the rate of 1 motorcycle space per 20 car spaces

Based on a car parking provision of 117 spaces, six motorcycle spaces are required to be provided.

The development provides six motorcycle spaces within the basement parking area. Compliance with DCP 2008 is therefore achieved with respect to the provision of motorcycle parking spaces.

4.2.3 Bicycle Parking

Liverpool City Council provides the following requirements for bicycle parking within DCP 2008 relevant to the subject proposal:

1 bicycle space per 200m² of gross floor area

Based on a gross floor area provision of approximately 8,223m² for the total development, a total of 42 bicycle parking spaces are required to be provided.

Bicycle parking racks capable of accommodating up to 42 bicycles are proposed to be provided within the north-western corner of the basement parking levels. Compliance with DCP 2008 is therefore achieved with respect to the provision of bicycle parking.

4.3 Internal Circulation

The proposed access driveway servicing off Bathurst Street is proposed to provide connectivity to the basement parking levels via connecting ramps. The basement parking levels are proposed to provide parking spaces in a standard 90 degree angled arrangement being servicing by circulating aisles.

The basement parking and circulation areas have been designed in accordance with AS2890.1-2004 providing the following minimum dimensions:

- Standard parking space width = 2.4m;

- Additional space width where parking spaces adjoins an obstruction = 0.3m;
- Motorcycle bay width = 1.2m;
- Standard 90 degree parking space length = 5.4m;
- Motorcycle bay length = 2.5,
- Parking aisle width adjoining 90 degree spaces = 6.2m;
- Two-way straight roadway / ramp width = 6.0m;
- Headroom = 2.2m;
- Headroom above disabled parking spaces and adjoining shared areas = 2.5m;
- Maximum ramp grade = 1 in 4;
- Maximum ramp grade for the first 6m inside the site = 1 in 20; and
- Maximum change in grade = 1 in 8.

In order to demonstrate the internal passenger vehicle manoeuvrability within the parking areas, this Practice has prepared a number of swept path plans which are included as **Appendix 1**. The turning paths provided on the plans have been generated using Autoturn software and derived from B85 vehicle specifications provided within the *Australian Standard for Parking Facilities Part 1: Off-Street Car Parking* (AS2890.1-2004).

Section B4.4 of AS2890.1-2004 states the following with regard to the use of templates to assess vehicle manoeuvring:

‘Constant radius swept turning paths, based on the design vehicle’s minimum turning circle are not suitable for determining the aisle width needed for manoeuvring into and out of parking spaces. Drivers can manoeuvre vehicles within smaller spaces than swept turning paths would suggest.’

It would therefore appear that whilst the turning paths provided within AS 2890.1 - 2004 can be utilised to provide a ‘general indication’ of the suitability or otherwise of internal parking and manoeuvring areas, vehicles can generally manoeuvre more efficiently than the paths indicate. Notwithstanding this, the swept path plans illustrate that passenger vehicles can manoeuvre throughout and enter and exit the most difficult passenger vehicle parking spaces within the parking areas. The proposed site layout as it relates to passenger vehicle manoeuvrability is considered satisfactory.

5. EXISTING TRAFFIC CONDITIONS

5.1 Surrounding Road Network

The following subsections of the report provide a description of these roads and the surrounding road network.

5.1.1 Bathurst Street

Bathurst Street performs a collector function to the Liverpool Town Centre, between Campbell Street in the north and Macquarie Street in the south. In this regard, Bathurst Street intersects with Macquarie Street, Memorial Avenue, Moore Street, Elizabeth Drive, Westfield Shopping Centre / Secant Street and Campbell Street under traffic signal control.

In the vicinity of the subject site between Lachlan Street and Campbell Street, Bathurst Street performs a local access function to abutting residential properties. In this regard, within this section of the road, Bathurst Street provides one through lane of traffic in each direction, with pavement widening provided on approach to Campbell Street to accommodate a combined through and left turn lane.

5.1.2 Castlereagh Street

Castlereagh Street performs a local access function under the care and control of Liverpool City Council. In this regard, it provides a parallel north-south route to Bathurst Street however facilitating a reduced function, with intersections primarily being governed by signage control. In the vicinity of the subject site, Castlereagh Street intersects with Campbell Street under “Give-Way” signage control with Campbell Street forming the priority route.

5.1.3 Lachlan Street

Lachlan Street performs a lower order residential access function within the surrounding road hierarchy. In this regard, it has an east/west alignment connecting Northumberland Street in the east with Castlereagh Street in the west. Lachlan Street provides an 8.0m wide pavement, accommodating one through lane of traffic in conjunction with parallel parking along both kerb alignments.

5.1.4 Campbell Street

Campbell Street provides a collector function to the Town Centre, providing an east-west connection from the Highway and Forbes Street in the east. In this regard, Campbell Street intersects with Hume Highway, Bathurst Street, Northumberland Street, George Street, Bigge Street and Goulburn Street under traffic signal control.

In the vicinity of the subject site, Campbell Street provides an undivided carriageway providing two travel lanes in each direction. To the north-west of the site, Campbell Street forms a somewhat non-standard five way intersection with Castlereagh and Secant Streets governed by a combination of Stop and Give Way signage control.

5.2 Existing Traffic Volumes

In order to obtain an indication of the existing operation of the local road network adjacent to the site, morning and evening peak hour traffic surveys were undertaken by staff of this Practice. Surveys were undertaken at the following intersections between 7.00am – 9.00am and 4.00pm – 6.00pm (with peak hours identified to be between 8:00am – 9:00am and 5:00pm – 6:00pm) on the 15th of May 2017:

- Campbell Street and Castlereagh Street; and
- Campbell Street and Bathurst Street.

Figure 3 below provides a graphical representation of the surveyed peak hour traffic volumes, whilst full details are available upon request. There are minor losses / gains at nearby intersections associated with intersecting streets and private development accesses.

FIGURE 3
EXISTING WEEKDAY PEAK HOUR TRAFFIC VOLUMES
(8:00AM – 9:00AM AND 5:00AM – 6:00AM)

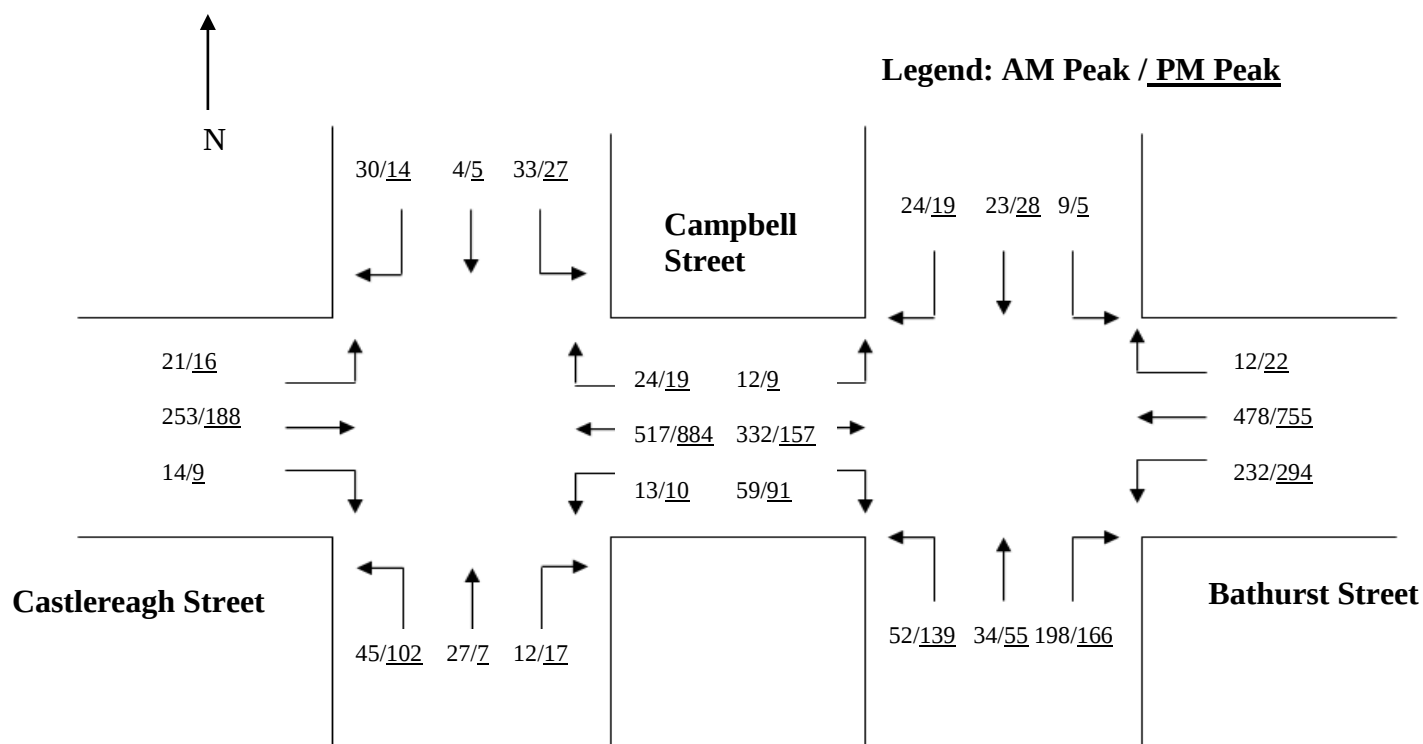


Figure 2 indicates the following:

- Bathurst Street accommodates two directional traffic demands in the order of 400 - 500 vehicles per hour during peak periods, whereby northbound movements dominate during both peak periods;

- Castlereagh Street accommodates minor traffic demands (less than 200 vehicles per hour) during peak periods, commensurate with its local access function; and
- Campbell Street accommodates two directional traffic demands in the order of 1,100 – 1,300 vehicles per hour during peak periods, whereby westbound movements dominate during both peak periods.

5.3 Existing Road Network Operation

In order to estimate the existing peak efficiency of the adjoining road network, a SIDRA analysis has been undertaken of the surveyed junctions surrounding the subject site. SIDRA is an advanced analytical tool for evaluation of alternative intersection designs in terms of capacity, level of service, a wide range of performance measures including delay, queue length, and number of stops. Key indicators of SIDRA include level of service which is a summary indicator ranging from A to F with A representing optimum intersection performance, and degree of saturation which represents a ratio of the demand of an approach to its capacity.

SIDRA uses detailed analytical traffic models coupled with an iterative approximation method to provide estimates of the abovementioned key indicators of capacity and performance statistics. Other key indicators provided by SIDRA are average vehicle delay, the number of stops per hour and the degree of saturation. Degree of saturation is the ratio of the arrival rate of vehicles to the capacity of the approach. Degree of saturation is a useful and professionally accepted measure of intersection performance. SIDRA provides analysis of the operating conditions that can be compared to the performance criteria set out in **Table 1** (adapted from the Roads & Maritime Services' *Guide to Traffic Generating Developments*).

TABLE 1			
LEVELS OF SERVICE CRITERIA FOR INTERSECTION			
Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	Less than 14	Good Operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & Spare capacity
C	29 to 42	Satisfactory	Satisfactory but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Extra capacity required	Extreme delay, traffic signals or other major treatment required

The existing conditions have been modelled utilising the peak hour traffic volumes presented within **Figure 3**. **Table 2** provides a summary of the SIDRA output data.

TABLE 2 SIDRA NETWORK MODELLING ANALYSIS EXISTING CONDITIONS		
Intersection	AM Peak	PM Peak
Campbell Street & Castlereagh Street		
Average Vehicle Delay	10.5	14.3
Degree of Saturation	0.16	0.13
Level of Service	A	A
Campbell Street & Bathurst Street		
Average Vehicle Delay	11.4	12.8
Degree of Saturation	0.56	0.71
Level of Service	A	A

Table 2 indicates that both of the surveyed intersections operates with a level of service (LoS) of ‘A’ during both peak periods, representing good operating conditions with spare capacity.

5.4 Public Transport

The subject locality is well serviced by public transport services.

Liverpool Railway Station is located within walking distance (approximately 1.5km) from the site, which provides access to train services operating along the Main South Line. This Line provides regular services between the Southern Highlands and the City, servicing the South Line (City Circle via Granville), Cumberland Line (Blacktown via Parramatta), Bankstown Line (City Circle via Bankstown and Inner West Line (City Circle via Regents Park).

Liverpool Railway Station also provides a regional bus interchange frequented by Westbus, Metrolink, Busabout, Interline, Veolia Transport, Night Ride, Metrobus and importantly, the Liverpool to Parramatta T-Way services. These services operate along Elizabeth Drive and Campbell Street, which provides the closest bus stops to the subject site.

6. PROJECTED TRAFFIC CONDITIONS

6.1 Traffic Generation

6.1.1 Existing Site Use

In order to estimate the traffic generation of the existing developments on site, reference is made to the Roads & Maritime Services' *Guide to Traffic Generating Developments*. This publication provides the following peak hour traffic generation rates pertinent to the various residential land uses occupying the subject site:

Dwelling Houses

0.85 trips per dwelling

Medium Density Residential Flat Building

Smaller units and flats (up to two bedrooms):

Weekday peak hour vehicle trips = 0.4 trips per dwelling.

Based on the above rates, the total peak hour traffic generation associated with the existing land use comprising two detached dwellings and a two-storey residential flat building development (containing 6 x 2-bedroom units) is calculated to be approximately four (4) trips to and from the site.

6.1.2 Proposed Site Use

The peak hour traffic generation rate for the proposed nine-storey residential apartment building containing 94 dwellings, as detailed within the Roads & Maritime Services' *Guide to Traffic Generating Developments TDT 2013/04*, is as follows:

High Density Residential Flat Dwellings (greater than six storeys)

0.19 trips per dwelling

Based on the above rates, the peak hour traffic generation of the development was calculated to be approximately 18 trips to and from the site.

6.1.4 Net Alteration to Traffic Generation

The proposed development is projected to generate in the order of 18 peak hour vehicle trips. This represents an increase of approximately 14 peak hour trips over and above that currently being generated by the existing residential dwellings.

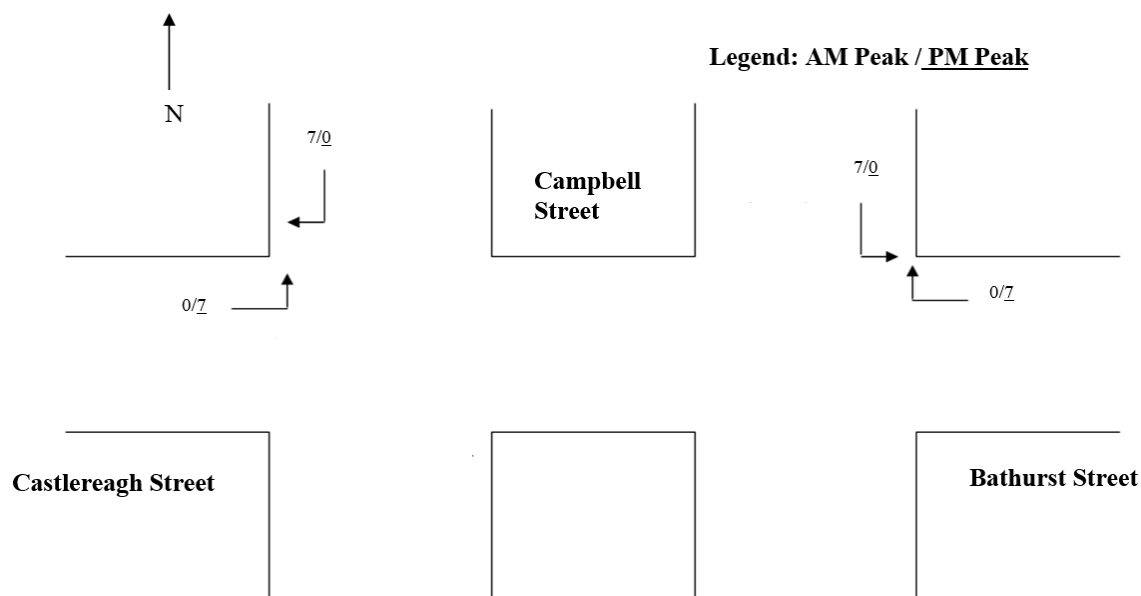
6.2 Trip Assignment

In order to gauge the impact of the traffic projected to be generated by the proposed development on the local road network, it is necessary to determine the impact on surrounding intersection efficiency. The objective of this section is to distribute the traffic generated by the proposed development along the major approach routes before it dissipates throughout the general road network.

For the purposes of simplicity, it has been assumed that all residential vehicle trips are outbound during the morning peak and inbound during the evening peak.

Figure 4 below provides a graphical representation of the additional traffic movements projected to be generated by the subject, whereby traffic has generally been assigned in accordance with existing traffic distribution profile illustrated in **Figure 3**.

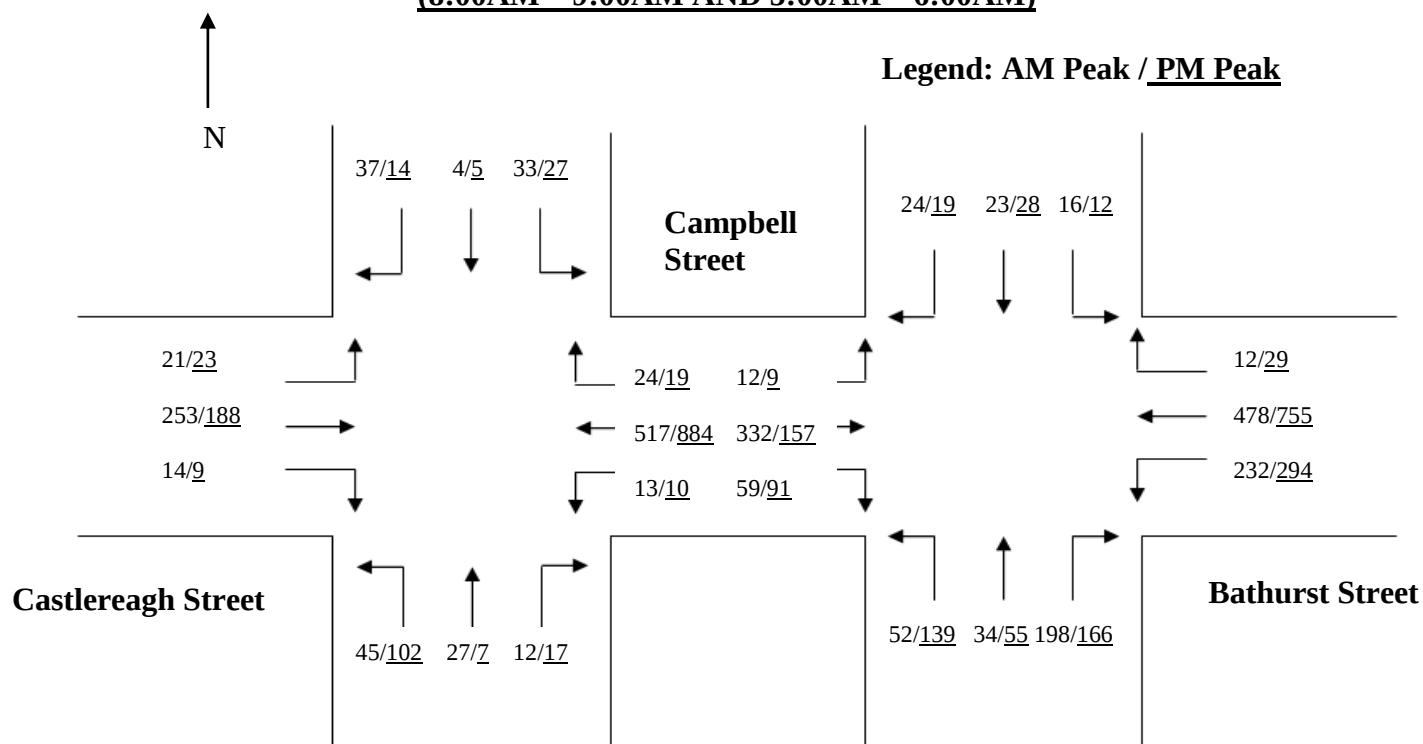
FIGURE 4
SUBJECT DEVELOPMENT TRIP ASSIGNMENT



6.3 Projected Traffic Volumes

Based on the discussion provided previously on likely traffic generation and trip assignment, the projected peak hour traffic volumes have been formulated by adding the trip assignment presented within **Figure 4** to the existing surveyed peak volumes presented within **Figure 3**. **Figure 5** overleaf provides an estimation of the future traffic volumes associated with and adjoining the subject site.

FIGURE 5
PROJECTED WEEKDAY PEAK HOUR TRAFFIC VOLUMES
(INCORPORATING SUBJECT DEVELOPMENT TRAFFIC GENERATION)
(8:00AM – 9:00AM AND 5:00AM – 6:00AM)



6.4 Projected Intersection Performance

In order to estimate the future operational efficiency of the surrounding road network, a secondary SIDRA analysis has been undertaken utilising the projected traffic volumes illustrated by **Figure 5**. **Table 3** provides a summary of the most pertinent results.

TABLE 3 SIDRA NETWORK MODELLING ANALYSIS PROJECTED CONDITIONS		
Intersection	AM Peak	PM Peak
Campbell Street & Castlereagh Street		
Average Vehicle Delay	12.6	14.4
Degree of Saturation	0.18	0.13
Level of Service	A	A
Campbell Street & Bathurst Street		
Average Vehicle Delay	11.4	12.9
Degree of Saturation	0.57	0.71
Level of Service	A	A

Table 3 indicates that the average vehicle delay and / or the degree of at the surrounding intersections are expected to increase marginally as a result of the additional traffic projected to be generated by the subject development. Notwithstanding this, the intersection levels of service are projected to remain as that which currently exists.

6.5 General Discussion on Traffic Impact

The proposed development has been assessed to generate in the order of 14 peak hour vehicle trips over and above that currently generated by the existing site use. This represents approximately one additional vehicle trip every four minutes during peak periods.

SIDRA modelling indicates that the additional level of traffic projected to be generated by the subject development is not projected to have any unreasonable impacts on the operational performance of the surrounding public road intersections.

In addition to the above, it is noted that whilst the overall intersection operations are good (LoS 'A'), the notable through volumes along Campbell Street result in slightly higher delays for right turning movements at the signage controlled Castlereagh Street. It is however noted that the average vehicular delay and accordingly, the overall level of safety at this signage controlled intersection is significantly assisted in the subject town centre vicinity by the operation of nearby signalised intersections. Traffic signal control heavily punctuates directional traffic volumes, providing regular and extended gaps within main road traffic flow. These gaps facilitate the undertaking of turning movements with a reasonable level of safety and with a resultant degree of safety, which is not captured by isolated intersection assessment packages such as SIDRA.

The impact of the subject development is therefore most likely to be a factor of the level of safety afforded by the site access arrangements. In this regard, the consistent vertical and horizontal alignment of Bathurst Street in the vicinity of the site access in conjunction with the limited conflicts at the driveway associated with its proximity to the existing public street termination is such that vehicle movements are envisaged to be capable of manoeuvring to and from the site in a safe and efficiency manner. In consideration of this and the above discussion, it is not considered that the subject proposal will result in any unreasonable impacts on the safety and efficiency of the surrounding public road network or indeed the amenity of the surrounding land-uses.

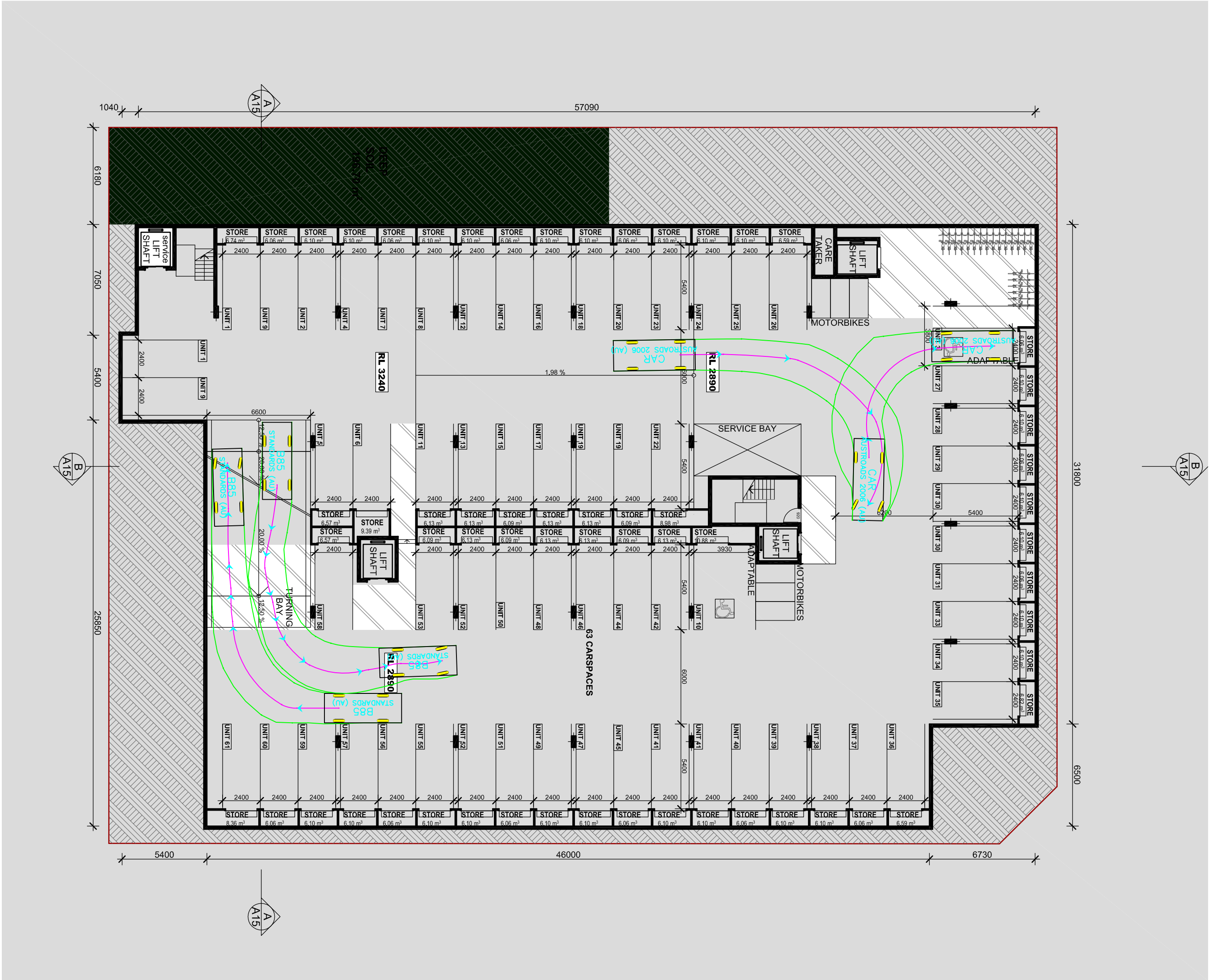
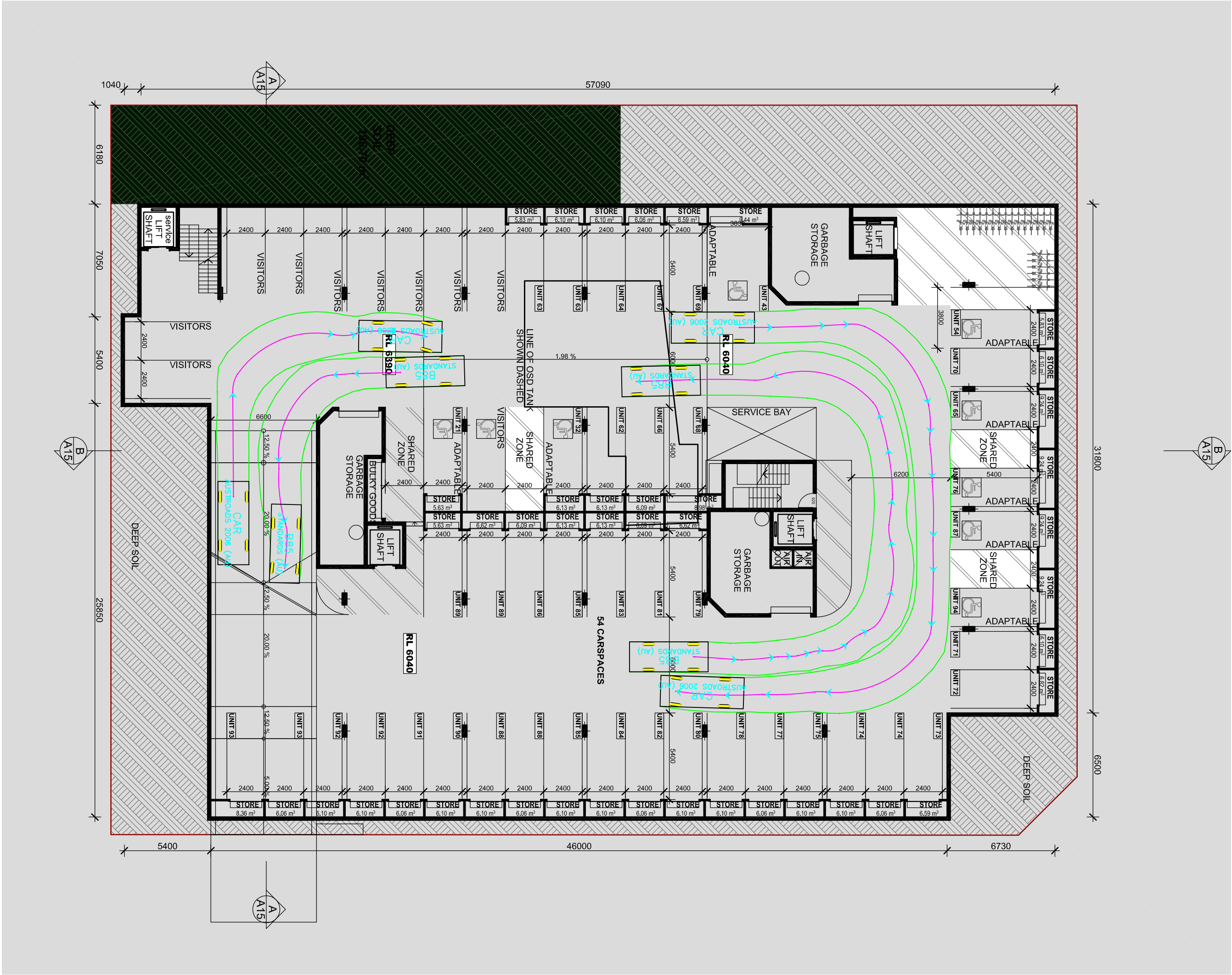
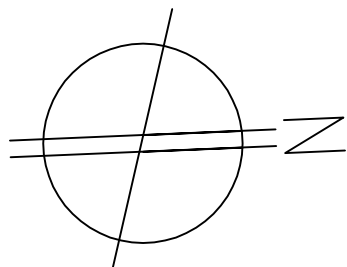
7. **CONCLUSION**

This Practice has undertaken an assessment of the potential traffic and parking implications associated with the proposed residential development for land at 1 – 5 Bathurst Street, Liverpool. Based on this assessment, the following conclusions are now made:

- The proposed off-street passenger vehicle, motorcycle and bicycle parking provision complies with Council's relevant DCP 2008 requirements;
- The proposed access arrangements, internal circulation and manoeuvring arrangements are capable of providing for safe and efficient vehicular movements during peak times;
- The surrounding road network operates with a reasonable level of service during peak periods;
- The subject development has been projected to generate in the order of 14 peak hour vehicle trips to and from the subject site over and above existing site traffic generation; and
- It is considered that the adjoining road network is capable of accommodating the additional traffic projected to be generated by the subject development.

Based on the contents of this report, and the conclusions contained herein, we consider that there are no traffic related issues that should prevent approval of the subject application and we therefore recommend that action to Council.

APPENDIX 1



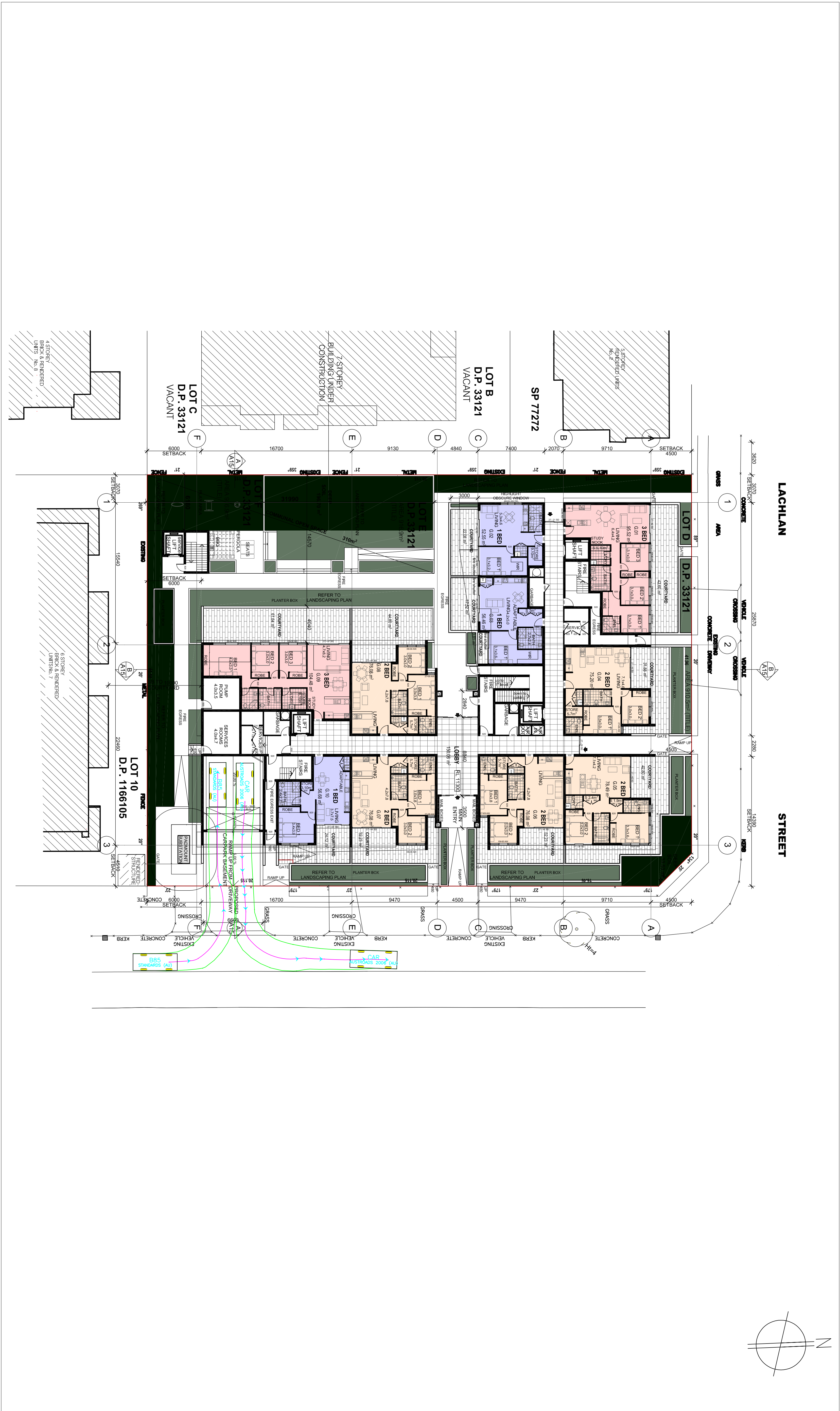
- NOTES:-
1. THIS PLAN IS BASED ON ARCHITECTURAL PLANS PREPARED BY ALGORRY ZAPPIA ASSOCIATES PTY. LTD.
 2. THE TURNING PATHS USED ON THIS PLAN ARE GENERATED USING AUTODURN SOFTWARE AND DERIVED FROM SPECIFICATIONS PROVIDED WITHIN AS2890.1-2004 FOR B85 AND B99 PASSENGER VEHICLES.

THOMPSON STANBURY ASSOCIATES

PROPOSED RESIDENTIAL DEVELOPMENT
1 – 5 BATHURST STREET, LIVERPOOL
PASSENGER VEHICLE INTERNAL CIRCULATION
SWEEP PATHS – BASEMENT LEVELS

SCALE:	1:450	ISSUE
FILE:	16-152	SUPERSEDES SHEET/ISSUE
DATE:	23/05/2017	SHEET





NOTES:-
1. THIS PLAN IS BASED ON ARCHITECTURAL PLANS PREPARED BY
ALCORY ZAPPA ASSOCIATES PTY. LTD.
2. THE TURNING PATHS USED ON THIS PLAN ARE GENERATED USING
AUTOURN SOFTWARE AND DERIVED FROM SPECIFICATIONS PROVIDED
WITHIN AS2890.1-2004 FOR BB5 AND B99 PASSENGER VEHICLES.



ABN: 79 943 737 368

THOMPSON STANBURY ASSOCIATES

PROPOSED RESIDENTIAL DEVELOPMENT

1 - 5 BATHURST STREET, LIVERPOOL

PASSENGER VEHICLE ACCESS DRIVEWAY MOVEMENTS

SWEEP PATHS - GROUND FLOOR LEVEL

SCALE: 1:450 (APPROX.)

FILE: 16-152

DATE: 23/05/2017

ISSUE

A

SUPERSTORES
SHEET/ISSUE

SHEET

2