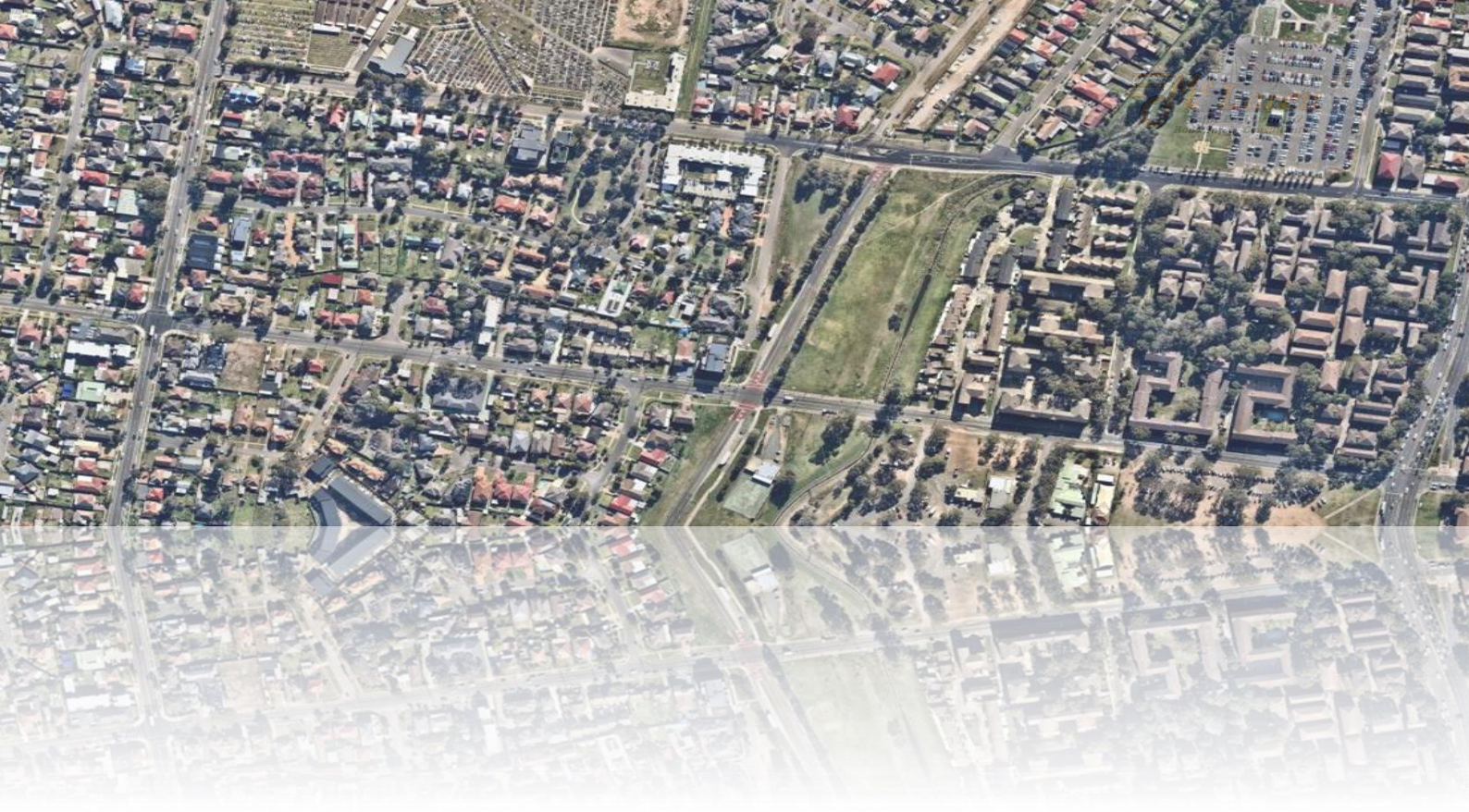

TRAFFIC AND PARKING IMPACT ASSESSMENT OF THE RESIDENTIAL DEVELOPMENT AT 1-7 ANDERSON AVENUE & 12 EL ALAMEIN AVENUE, LIVERPOOL

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Transport Planning, Traffic Impact Assessments, Road Safety Audits, Expert Witness

190442.02FA - 5th December 2019

Development Type: **Residential Development**

Site Address: **1-7 Anderson Avenue & 12 El Alamein Avenue, Liverpool**

Prepared for: **Kennedy Associates Architects**

Document reference: **190442.02FA**

Status	Issue	Prepared By	Checked By	Date
Draft	A	DF	DF	5th December 2019
Final	A	DF	DF	5th December 2019

TABLE OF CONTENTS

1 INTRODUCTION

M^CLaren Traffic Engineering was commissioned by *Kennedy Associates Architects* to provide a Traffic and Parking Impact Assessment of the Residential Development at 1-7 Anderson Avenue & 12 El Alamein Avenue, Liverpool as depicted in **Annexure A**.

1.1 Description and Scale of Development

The proposed development has the following characteristics relevant to traffic and parking:

- A total of 63 units across three (3) buildings consisting of:
  - 15 x one-bedroom apartments;
  - 43 x two-bedroom apartments;
  - 5 x three-bedroom apartments;
- 34 of the proposed units are Affordable Renting Houses (ARH);
- Two (2) basement parking levels with vehicular access via a proposed two-way driveway from Anderson Avenue, accommodating a total of 78 car spaces including:
  - 70 residential car spaces including five (5) disabled spaces;
  - 8 visitor car spaces including two (1) spaces capable for use by disabled persons.

1.2 State Environmental Planning Policy (Infrastructure) 2007

The proposed development does not qualify as a traffic generating development with relevant size and/or capacity under Clause 104 of the SEPP (Infrastructure) 2007. Accordingly, formal referral to the Roads and Maritime Services (RMS) is unnecessary and the application can be assessed by *Liverpool City Council* officers accordingly.

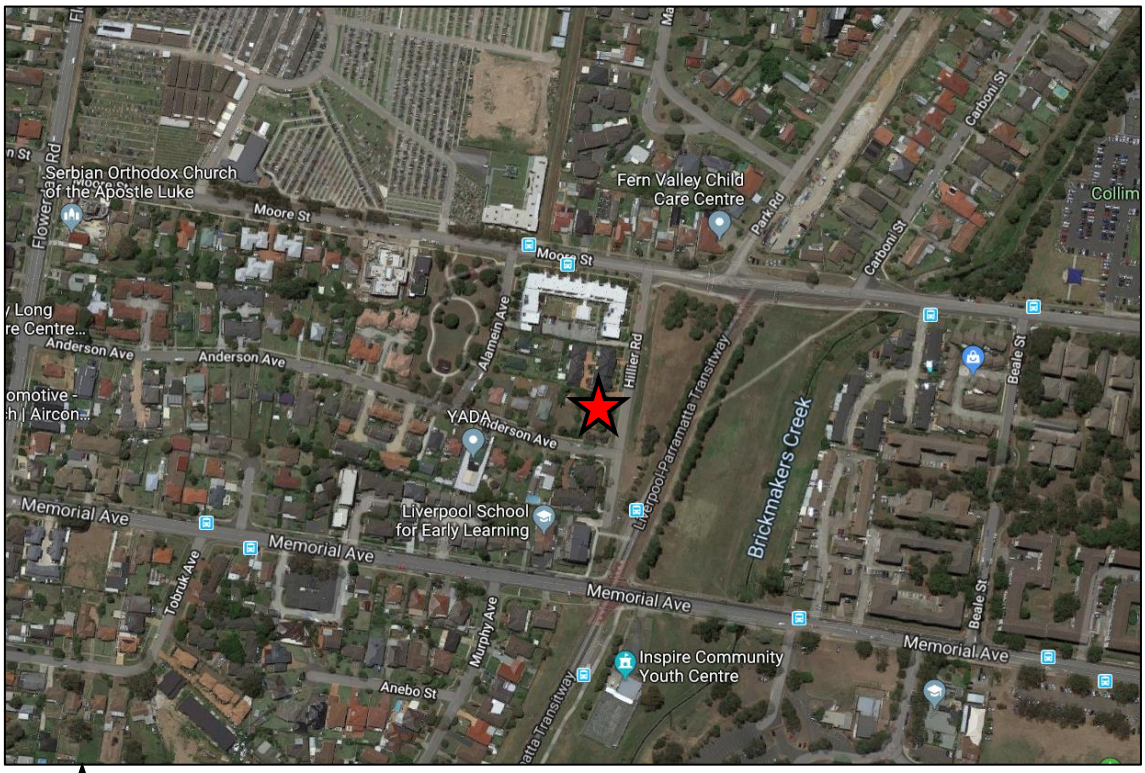
1.3 Site Description

The subject is currently zoned *R4 – High Density Residential* under the Liverpool City Council LEP 2008 and is currently occupied by a single residential dwelling. The site has frontages to Anderson Avenue to the south and Hillier Road to the east.

The site is generally surrounded by low to medium density residential developments with Whitlam Leisure Centre to the south and the Liverpool City Centre to the east of the subject site. The site is within close proximity to bus stops located north and south of the site.

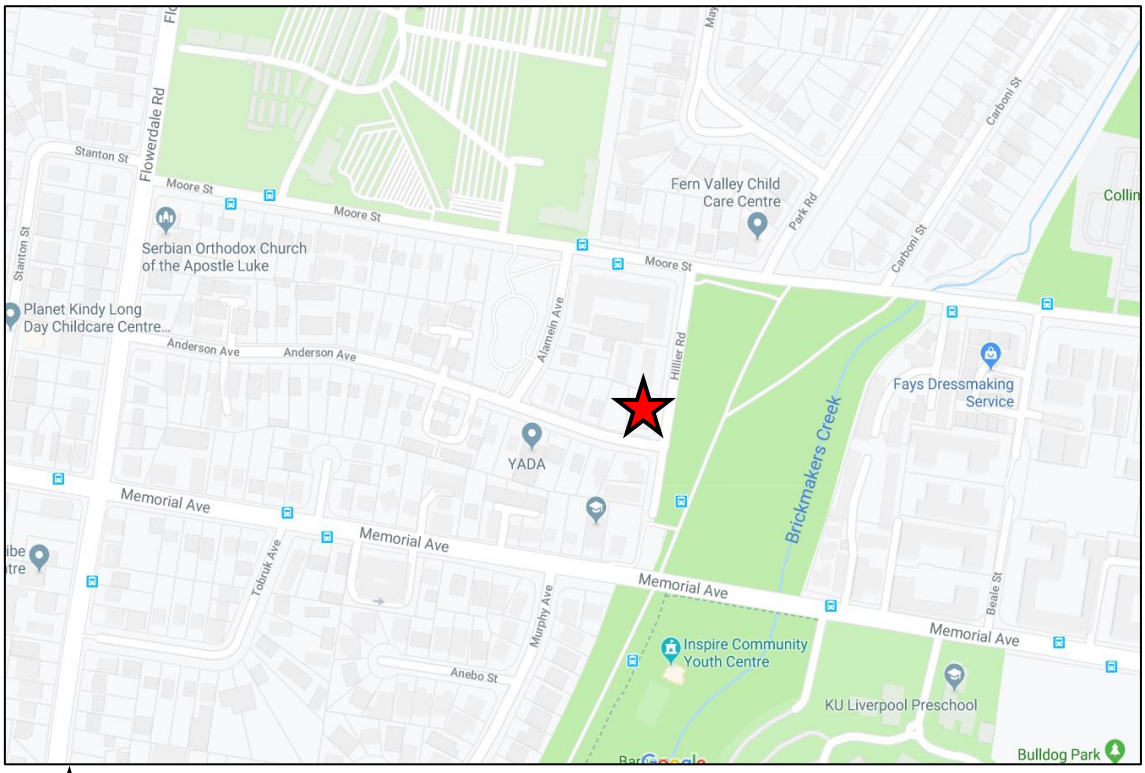
1.4 Site Context

The sites location is shown on an aerial photo and a street map in **Figure 1** and **Figure 2** respectively.



Site Location

FIGURE 1: SITE CONTEXT – AERIAL PHOTO



Site Location

FIGURE 2: SITE CONTEXT – STREET MAP

2 EXISTING TRAFFIC AND PARKING CONDITIONS

2.1 Road Hierarchy

The road network servicing the site has characteristics as described in the following sub-sections.

2.1.1 Anderson Avenue

- Unclassified LOCAL Road;
- Approximately 7.5m wide carriageway facilitating one traffic-flow lane with opportunities for two way passing at driveways and kerbside parking.
- Signposted 50km/h speed limit;
- Unrestricted kerbside parking permitted along both sides of the road.

2.1.2 Hillier Road

- Unclassified LOCAL Road;
- Approximately 7m wide carriageway facilitating one-traffic lane in each direction and kerbside parking.;
- Informal kerbside parking available on the western side of the street;
- No speed limit signposted, 50km/h speed limit applies;
- Unrestricted kerbside parking permitted along both sides of the road.

2.1.3 Moore Street

- Unclassified COLLECTOR Road;
- Approximately 11m wide carriageway facilitating two traffic-flow lanes (one in each direction) and kerbside parking;
- Signposted 50km/h speed limit;
- Unrestricted kerbside parking permitted along both sides of the road.

2.1.4 Alamein Avenue

- Unclassified LOCAL Road;
- Approximately 7m wide carriageway facilitating one traffic-flow lane with opportunities for two-way passing at driveway and kerbside parking
- No speed limit signposted, 50km/h speed limit applies;
- Unrestricted kerbside parking permitted along both sides of the road.

2.2 Existing Traffic Management

- Priority controlled intersection of Anderson Avenue / Alamein Avenue;
- Priority controlled intersection of Anderson Avenue / Hillier Road;
- Priority controlled intersection of Hillier Road / Moore Street;
- Priority controlled intersection of Moore Street / Alamein Avenue.

2.3 Existing Traffic Volumes

Intersection traffic surveys were conducted at the intersections of Flowerdale Road / Anderson Avenue and Moore Street / Hiller Road from 7:00 AM to 9:00 AM and 4:00 PM to 7:00 PM on Monday the 5th of August 2019 representing a typical operating weekday. The full survey results are shown in **Annexure B** for reference.

2.3.1 Existing Road Performance

The performance of the surrounding intersections under the existing traffic conditions has been assessed using SIDRA INTERSECTION 8.0, **Table 1** summarises the resultant intersection performance data, with full SIDRA results reproduced in **Annexure C**.

TABLE 1: EXISTING INTERSECTION PERFORMANCES (SIDRA INTERSECTION 8.0)

Intersection	Peak Hour	Degree of Saturation(1)	Average Delay(2) (sec/veh)	Level of Service(3)	Control Type	Worst Movement	95th Percentile Queue
EXISTING PERFORMANCE							
Flowerdale Road / Anderson Avenue	AM	0.38	0.3 (Worst: 17)	**NA** (Worst: B)	Give Way	RT from Anderson Avenue	0.1 veh (1m) Flowerdale Road
	PM	0.45	0.4 (Worst: 26.3)	**NA** (Worst: B)		RT from Anderson Avenue	0.3 veh (2.3m) Flowerdale Road
Hillier Road / Moore Street	AM	0.15	0.1 (Worst: 6.8)	**NA** (Worst: A)	Give Way	RT from Hillier Road	0 veh (0.1m) Hillier Road
	PM	0.15	0.3 (Worst: 6.9)	**NA** (Worst: A)		RT from Hillier Road	0 veh (0.3m) Hillier Road

NOTES:

(1) Degree of Saturation is the ratio of demand to capacity for the most disadvantaged movement.

(2) Average delay is the delay experienced on average by all vehicles. The value in brackets represents the delay to the most disadvantaged movement.

(3) Level of Service is a qualitative measure of performance describing operational conditions. There are six levels of service, designated from A to F, with A representing the best operational condition and level of service F the worst. The LoS of the intersection is shown in bold, and the LoS of the most disadvantaged movement is shown in brackets.

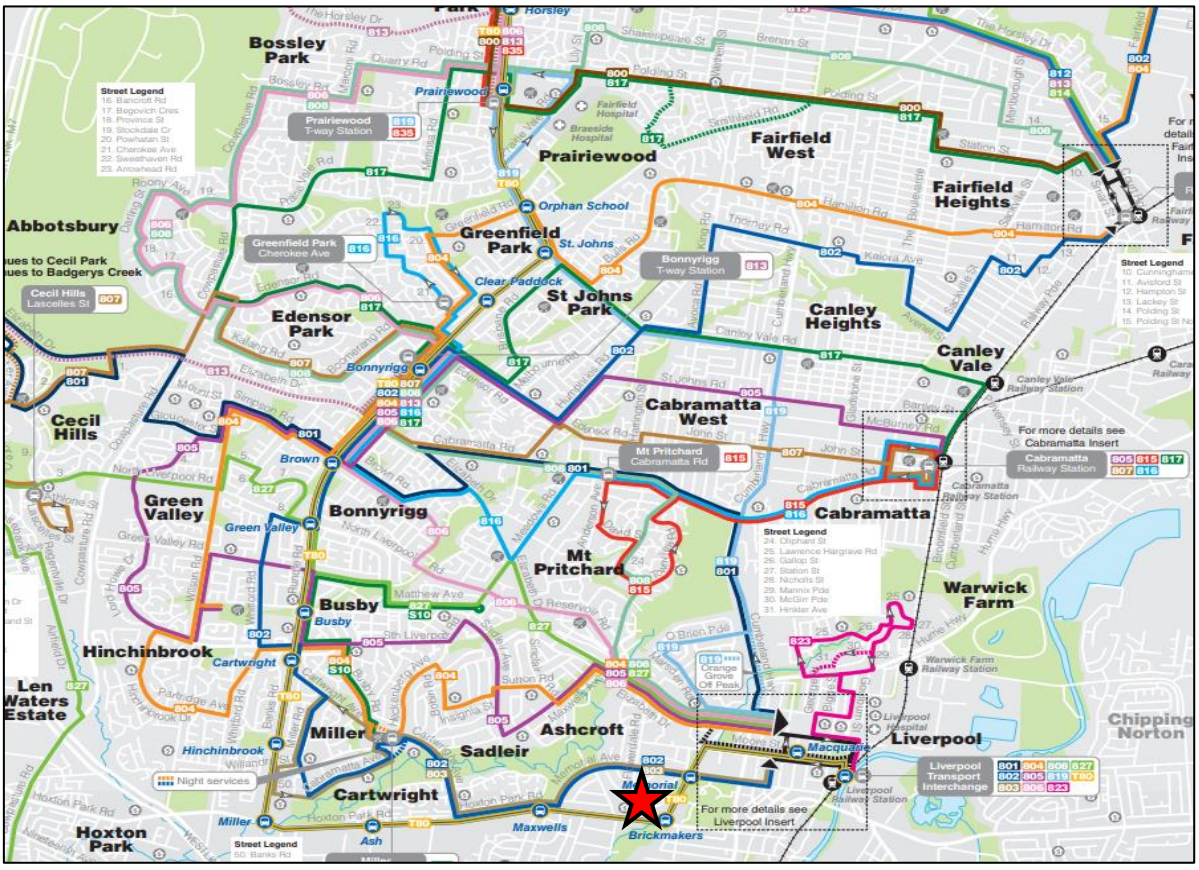
(4) No overall Level of Service is provided for Give Way and Stop controlled intersections as the low delays associated with the dominant movements skew the average delay of the intersection. The Level of Service of the worst approach is an indicator of the operation of the intersection, with a worse Level of Service corresponding to long delays and reduced safety outcomes for that approach.

As shown above, the two relevant intersections are currently performing at a high level of efficiency, with a level of service “A” or “B” conditions in both the AM & PM peak hour periods. The level of service “A” and “B” performance is characterised by low approach delays and spare capacity.

2.4 Public Transport

The subject site has access to existing bus stop (ID: 2170496, ID: 2170485, ID: 2170486, ID: 2170522, ID: 2170520) located approximately two (2) minutes (110m) walking distance (ID: 2170496, ID:2170485), one (1) minute (70m) walking distance (ID:2170486) and two (2) minutes (180m) walking distance (ID: 2170522, ID: 2170520) on Memorial Avenue, Hillier Road and Moore Street respectively. The bus stop services existing bus route 802 (Liverpool to Parramatta via Green Valley), 803 (Liverpool to Miller), T80 (Liverpool to Parramatta via T-way), 853 (Carnes Hill to Liverpool via Hoxton Park Road) and 854 (Carnes Hill to Liverpool via Greenway Drive & Hoxton Park Road) provided by Transit Systems (802, 803, T80) and Interline Bus Services (853, 854).

The sites location subject to the surrounding public transport network is shown in **Figure 3** below.



Site Location

FIGURE 3: PUBLIC TRANSPORT NETWORK MAP

2.5 Future Road and Infrastructure Upgrades

From Liverpool Council's Development Application tracker and RMS Projects website, it appears that there are no future planned road or public transport changes that will affect traffic conditions within the immediate vicinity of the subject site.

3 PARKING ASSESSMENT

Reference is made to the *State Environmental Planning Policy (Affordable Rental Housing) 2009* referred to as SEPP (ARH) hereafter, which designates the following car, bicycle and motorcycle parking rates applicable to the affordable renting housing portion of the proposed development:

> *(14) Standards that cannot be used to refuse consent*
>
> *(2) General*
>
> *(a) parking*
>
> *(i) in the case of a development application made by a social housing provider for development on land in an accessible area – at least 0.4 parking spaces are provided for each dwelling containing 1 bedroom, at least 0.5 parking spaces are provided for each dwelling containing 2 bedrooms and at least 1 parking space is provided for each dwelling containing 3 or more bedrooms, or…*

It must be noted that the development application is made on behalf of a social housing provider.

The proposed development provides a combination of both Affordable Renting Housing and traditional units. Reference is made to *Liverpool Development Control Plan 2008 Part 1 – General Controls for all development – Section 20: Car Parking and Access – Table 13 Car Parking, Servicing and Loading Provision* which designates the following car parking rates applicable to the proposed development:

> ***20.2 Car Parking Provision and Service Facilities by Land Use***
>
> *1. Tables 11, 12 and 13 outline the number of car parking spaces… in proposals where calculations of the car parking requirements result in fractions of spaces being required, the fraction will be rounded up to the nearest whole space…*
>
> ***Multi dwelling housing and residential flat buildings***
>
> *Residential & Business zones:*
>
> *1 space per small dwelling (<65sqm) or 1 bedroom*
>
> *1.5 spaces per medium dwelling (65-110sqm) or 2 bedrooms*
>
> *2 spaces per large dwelling (>110sqm) or 3 or more bedroom*
>
> *1 visitor car space for every 4 dwellings or part thereof*

The car parking requirements of the proposal with application of both SEPP (ARH) 2009 rates and Council's DCP rates are outline in **Table 2**.

TABLE 2: PARKING SUMMARY

Land Use	Authority	Scale	Type	Rate	Parking Required
Residential Flat Buildings	SEPP (ARH)	14	1-bedroom	0.4 per dwelling	5.6 (6)
		17	2-bedroom	0.5 per dwelling	8.5 (9)
		3	3-bedroom	1 per dwelling	3
	Liverpool DCP 2008	1	1-bedroom	1 per dwelling	1
		26	2-bedroom	1.5 per dwelling	39
		2	3-bedroom	2 per dwelling	4
		29	Visitor	1 per 4 dwellings	7.25 (8)
Total	**-**	**63**	**-**	**-**	**68.35 (70)**

As shown above with strict application of both SEPP (ARH) 2009 and Council's DCP, the proposed development requires a total of **70** car parking spaces. The proposed plans detail the provision of **78** spaces, exceeding the requirements of the relevant authorities.

3.1 Disabled Parking

Council's DCP does not specify the requirement for disabled parking for residential developments. A total of five (**5**) adaptable dwellings are included within the proposed development. Reference is made to *AS4299:1995 Adaptable Housing* which provides the following extract relating to the provision of disabled car parking:

> *3.7.1 General Private car parking spaces shall be large enough to enable a person with a wheelchair to get in and out of both the car and the parking space. A car parking space width of 3.8m minimum is necessary to enable a driver to alight, open the passenger side door, and assist a person with a disability into a wheelchair, or for a side-loading ramp. A 3.8 m, minimum width is also required for a driver with a disability to unload a wheelchair and to alight.*

As such, five (**5**) adaptable and disabled car parking spaces are required and are adequately provided within the proposed plans, meeting the relevant standard requirements.

Further, two (2) visitor spaces are separated by a turning bay/shared area. Although the provision of a disabled space for visitors not a mandatory requirement, these two spaces could be used by disabled persons, which is a satisfactory outcome.

3.2 Bicycle & Motorcycle Parking Requirements

The *SEPP (ARH) 2009* does not provide bicycle nor motorbike parking requirements for In-fill affordable housing, therefore reference is made to the *Liverpool Development Control Plan 2008* (LDCP).

The LDCP does not provide a rate for motorcycle parking for the proposed development and as such none are provided for the general residential portion of the development. Reference is made *to Liverpool Development Control Plan 2008 Part 1 – General Controls for all development – Section 20: Car Parking and Access – Table 12 Bicycle Parking Provision* which designates the following requirement for bicycle parking:

> *Residential*
>
> *Residential Flat Building, Multi-dwelling Housing:*
>
> *1 per 2 units, or 1 for every 4 bedrooms (whichever is greater)*
>
> *Visitor:*
>
> *1 per 10 units*

The bicycle and motorcycle parking requirement for the proposed development is summarised in **Table 3**. Although the SEPP (ARH) 2009 does not provide motorbike or bicycle parking requirements, the LDCP rates have been applied to the affordable rental housing units for a conservative assessment.

TABLE 3: BICYCLE AND MOTORCYCLE PARKING SUMMARY

Land Use	Type	Scale	Type	Rate	Parking Required
Residential	Affordable Rental Housing	34	Motorcycle	-	-
			Bicycle	1 per 2 units, or 1 for every 4 bedrooms	17
			Bicycle (Visitor)	1 per 10 units	3.4
	Residential Flat Building	29	Motorcycle	-	-
			Bicycle	1 per 2 units, or 1 for every 4 bedrooms	14.75
			Bicycle (Visitor)	1 per 10 units	2.9
Total	**-**	**63**	**Motorcycle**	**-**	**0**
			Bicycle		(31.75) **32**
			Bicycle (Visitor)		(6.3) **7**

As shown above, the LDCP requires **32** residential parking spaces and seven (**7**) visitor parking spaces, assuming the affordable rental housing units are provided with bicycle

parking at the same rate as the LDCP. The proposed plans detail **42** bicycle parking spaces, satisfying the requirements of the relevant authorities.

3.3 Servicing & Loading

Reference is made to *Liverpool Development Control Plan 2008 Part 1 – General Controls for all development* which designates the following requirement for servicing and loading applicable to the proposed site:

> *Residential Flat Building, Multi-dwelling housing:*
>
> *Service access for removalists and garbage servicing.*
>
> *Access to waste and recycling storage:*
>
> *5. Waste and recycling collection vehicles should be able to service the development efficiently and effectively with no need to reverse…*
>
> *6. Council and waste collection contractor vehicles will not enter private property including driveways to collect waste or recycling.*

Waste collection will take place off-street as per the existing operations of the sites. The building manager will utilise the motorised bin tug to move bins from the basement to the street for collection.

3.4 Car Park Design & Compliance

The car parking layout as depicted in **Annexure A,** have been assessed to achieve the relevant clauses and objectives of AS2890.1:2004 and AS2890.6:2009. Any variances from standards are addressed in the following subsections including required changes, if any.

The proposed car park design achieves:

- 5.5m width two-way driveway (kerb to kerb) facilitating access to Hillier Road;
- Minimum 5.8m width parking aisles;
- Compliant ramp grades not exceeding 25% for private developments and no grade change greater than 12.5%;
- Minimum 5.4m length, 2.4m width spaces;
- Minimum headroom of 2.2m for general circulation and 2.5m headroom clearance provided over disabled and adaptable parking areas;

3.4.1 Required Changes

- Convex Mirrors

It is recommended that convex mirrors be placed at the base of the driveway ramp and at the corners of the ramp between basements 1 and 2. The locations are provided in **Annexure D**.

- Visitor Parking Signage

Visitor parking signage should be included at the bottom of the basement ramp to direct visitor vehicles to these spaces.

Whilst the plans have been assessed to comply with the relevant standards, it is usual and expected that a design certificate be required at the Construction Certificate stage to account for any changes following the development application.

4 TRAFFIC ASSESSMENT

The impact of the expected traffic generation levels associated with the subject proposal is discussed in the following sub-sections.

4.1 Traffic Generation

Traffic generation rates for the relevant land uses are provided in the *Roads and Maritime Services (RMS) Updated Traffic Surveys (TDT 2013/04a)* and are as follows:

TDT 2013/04a

High density residential flat dwellings

AM peak (1 hour) vehicle trips per unit *0.19*

PM peak (1 hour) vehicle trips per unit *0.15*

The resulting traffic generation is summarised in **Table 4**.

TABLE 4: ESTIMATED TRAFFIC GENERATION

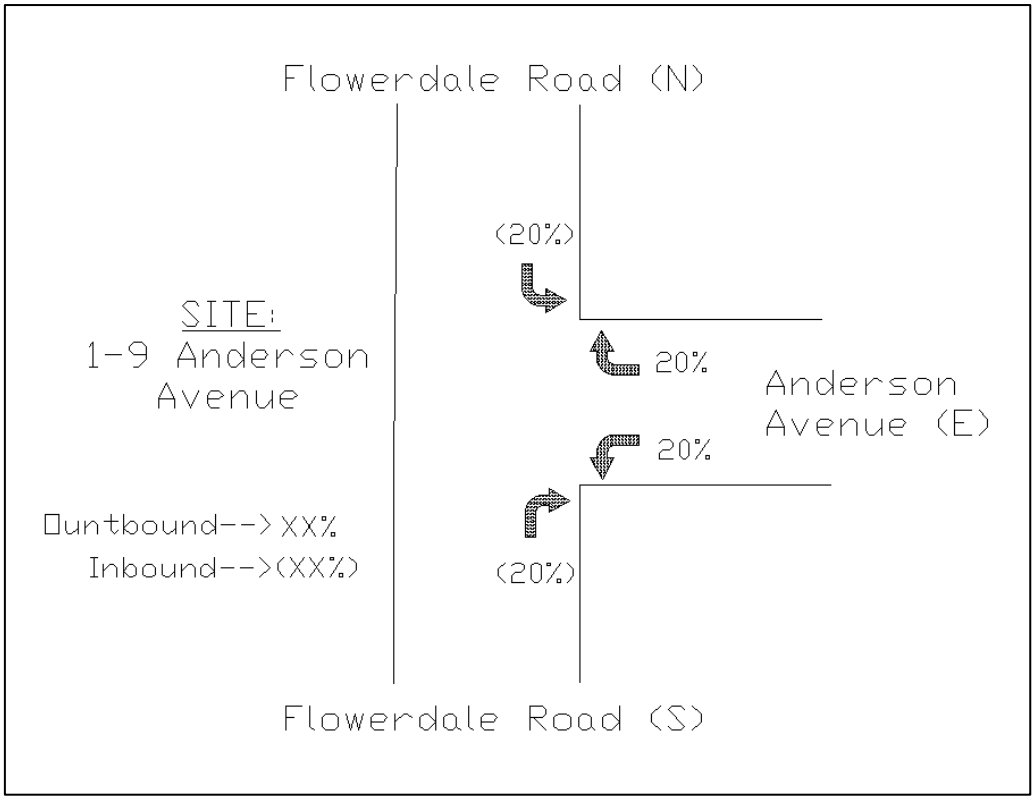
Use	Time	Scale	Peak Hour Traffic Generation Rate	Peak Hour Split
High density Residential	AM	63 units	0.19 trips per unit	11.97 (12)
	PM		0.15 trips per unit	9.45 (10)
Total	**AM**	**-**	**-**	**2 IN; 10 OUT**
	PM			**8 IN; 2 OUT**

Note: (1) Assumes 20% inbound & 80% outbound during AM peak: Vice versa for PM.

As shown, the maximum traffic generation associated with the proposed development is in the order of **12** (2 IN; 10 OUT for AM Peak) vehicle trips. The *Metropolitan Sub-Regional Centres* rate from the *RMS' Updated Traffic Surveys (TDT 2013/04a)* rate has been used to calculate traffic generation as the subject site is not within immediate proximity to the suburb train station. Note that this traffic generation is considered to be conservative as it does not incorporate the traffic generation of the existing site use.

4.2 Trip Assignment

The road network and the locations of residential areas surrounding the site have been assessed and the following traffic assignment has been assumed for all traffic to and from the site:



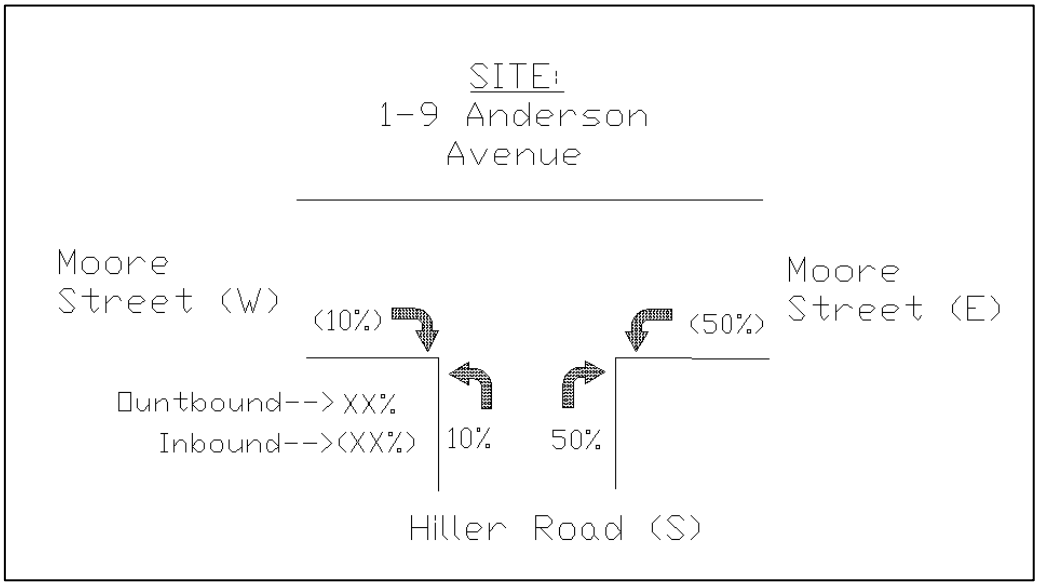


FIGURE 4: TRIP DISTRUBUTION

4.3 Traffic Impact

The traffic generation outlined in **Section 4.1** & **4.2** above has been added to the existing traffic volumes recorded. SIDRA INTERSECTION 8.0 was used to assess the intersections performance. The purpose of this assessment is to compare the existing intersection operations to the future scenario under the increased traffic load. The results of this assessment are shown in **Table 5**.

TABLE 5: INTERSECTION PERFORMANCE (SIDRA INTERSECTION 8.0)

Intersection	Peak Hour	Degree of Saturation[1]	Average Delay[2] (sec/vehicle)	Level of Service[3]	Control Type	Worst Movement
EXISTING PERFORMANCE						
Flowerdale Road / Anderson Avenue	AM	0.38	0.3 (Worst: 17)	**NA** (Worst: B)	Give Way	RT from Anderson Avenue
	PM	0.45	0.4 (Worst: 26.3)	**NA** (Worst: B)		RT from Anderson Avenue
Hillier Road / Moore Street	AM	0.15	0.1 (Worst: 6.8)	**NA** (Worst: A)	Give Way	RT from Hillier Road
	PM	0.15	0.3 (Worst: 6.9)	**NA** (Worst: A)		RT from Hillier Road
FUTURE PERFORMANCE						
Flowerdale Road / Anderson Avenue	AM	0.38	0.4 (Worst: 17.2)	**NA** (Worst: B)	Give Way	RT from Anderson Avenue
	PM	0.46	0.5 (Worst: 26.5)	**NA** (Worst: B)		RT from Anderson Avenue
Hillier Road / Moore Street	AM	0.15	0.3 (Worst: 6.9)	**NA** (Worst: A)	Give Way	RT from Hillier Road
	PM	0.15	0.5 (Worst: 6.9)	**NA** (Worst: A)		RT from Hillier Road

Notes: Refer to Table 1 Notes

As shown, the intersection of Flowerdale Road / Anderson Avenue and Moore Street / Hiller Road all retain the same overall Level of Service under future conditions with minimal delays and additional capacity, indicating that there will be negligible impact on the existing road network as a result of the proposed development.

5 CONCLUSION

In view of the foregoing, the subject Residential Development proposal at 1-7 Anderson Avenue & 12 El Alamein Avenue, Liverpool (as depicted in **Annexure A**) is fully supportable in terms of its traffic and parking impacts. The following outcomes of this traffic impact assessment are relevant to note:

- The proposal includes a total of 78 car parking spaces, comprised of 70 for residential use and 8 for visitor satisfying the relevant controls applicable to the development, including SEPP(ARH) 2009 and Liverpool Council's DCP requirements.

- Council's DCP requires the provision of 39 bicycle parking spaces. 42 bicycle parking spaces have been provided onsite resulting in compliance with Council's requirements.

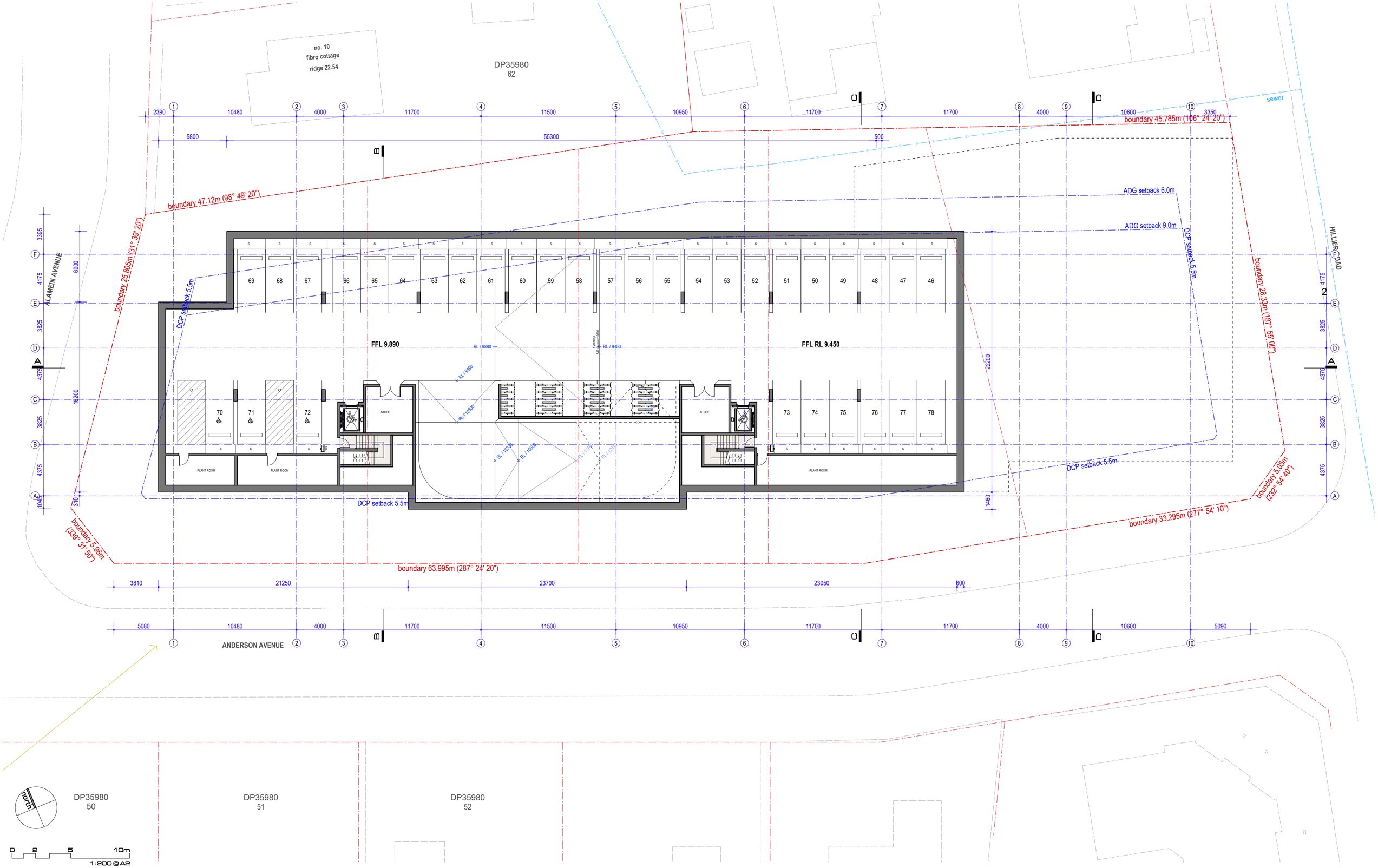
- The parking areas of the site have been assessed against the relevant sections of AS2890.1, AS2890.6 and AS4299 and have been found to satisfy the objectives of each standard.

- Convex mirrors should be provided at the base of the driveway ramp and at the corners of the ramp between basements 1 and 2. The locations are provided in **Annexure D**.

- The traffic generation of the proposed development has been estimated to be some **12** trips in the AM peak hour. The impacts of the traffic generation have been modelled using SIDRA INTERSECTION 8.0, indicating that there will be no detrimental impact to the performance of the intersections or on residential amenity surrounding the site as a result of the generated traffic.

ANNEXURE A: PROPOSED PLANS

(2 SHEETS)



proposed level -02

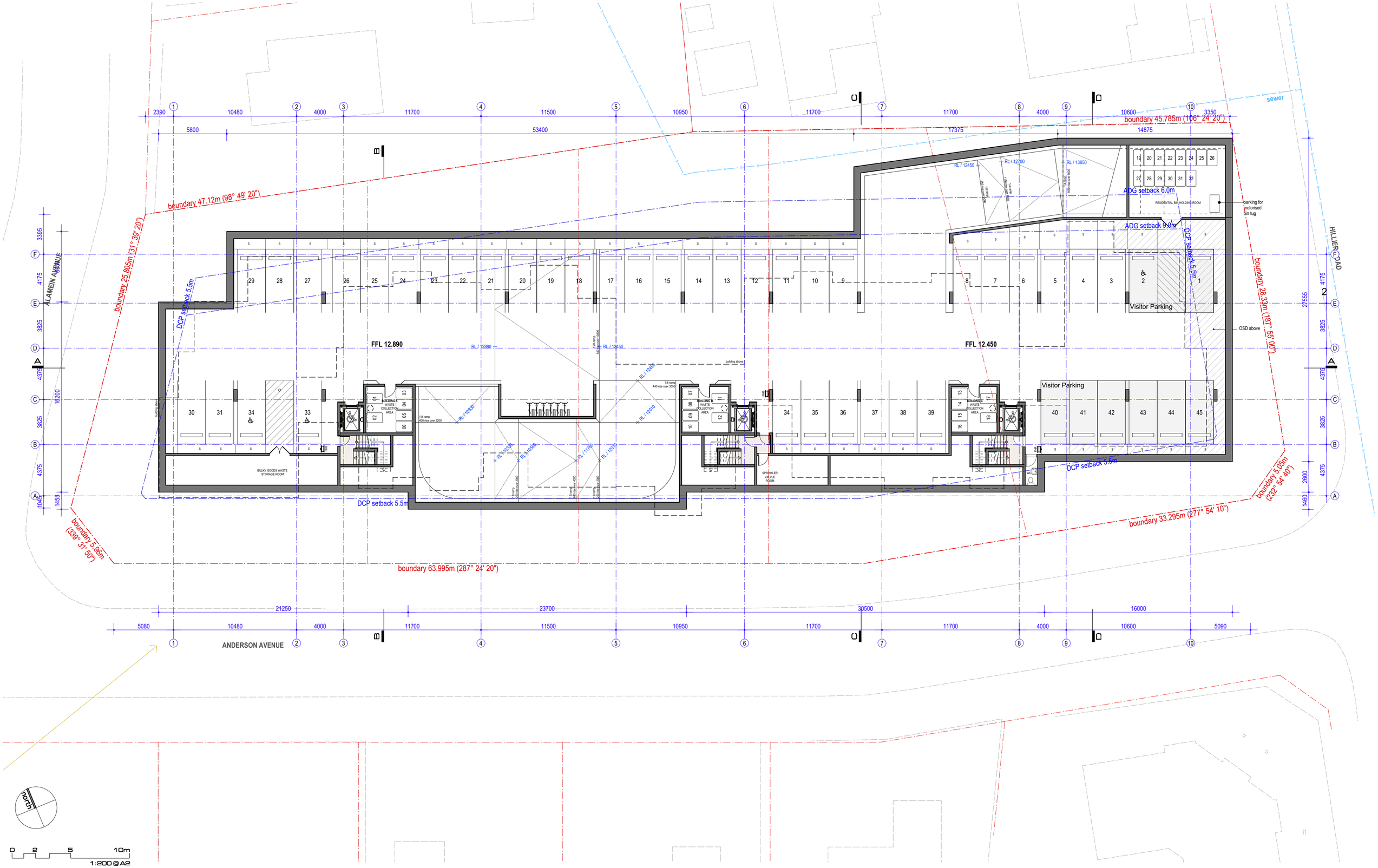
new residential development at

1-7 Anderson Avenue and 12 El Alamein Avenue LIVERPOOL

A 11/11/19 issue for DA submission

1846 – DA 07 A

kennedy associates architects level 3 / 1 booth street annandale 2038 p + 61 2 9557 6466 f + 61 2 9557 6477 nominated architect - anthony nolan - registration no. 6773



north

0 2 5 10m

1:200 @ A2

proposed level -01

new residential development at

1-7 Anderson Avenue and 12 El Alamein Avenue LIVERPOOL

A 11/11/19 issue for DA submission

1846 – DA 08 A

kennedy associates architects level 3 / 1 booth street annandale 2038 p + 61 2 9557 6466 f + 61 2 9557 6477 nominated architect - anthony nolan - registration no. 6773

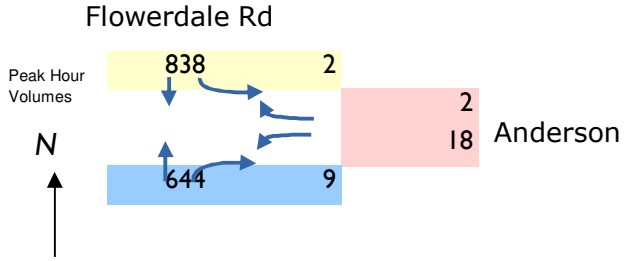
ANNEXURE B: TRAFFIC SURVEY DATA

(6 SHEETS)

Curtis Traffic Surveys

Turning movement count

Job:	190803mcl (19_0422)
Day, date	5/08/19
Location:	Flowerdale Rd & Anderson Av
Weather:	Fine
Client:	McLaren Traffic Engineering



Time Period			From Flowerdale Rd south through	right	From Anderson Av left	right	From Flowerdale Rd north left	through	Total vehicles	Peak
16:00	to	16:15	156	2	3	0	1	208	370	
16:15	to	16:30	164	2	2	1	0	198	367	
16:30	to	16:45	178	3	4	0	0	210	395	peak
16:45	to	17:00	146	2	9	1	1	222	0	
17:00	to	17:15	150	3	5	2	2	220	1	
17:15	to	17:30	132	1	6	2	1	201	2	
17:30	to	17:45	126	0	2	0	3	232	3	
17:45	to	18:00	126	0	4	3	3	176	4	
18:00	to	18:15	135	2	4	1	2	165	5	
18:15	to	18:30	144	4	3	2	3	146	6	
18:30	to	18:45	120	3	2	1	1	156	7	
18:45	to	19:00	118	2	3	0	1	149	8	
Total			1695	24	47	13	18	2283		

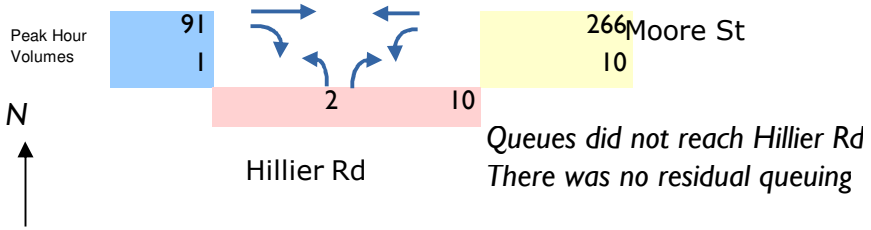
Hourly summary

16:00	to	17:00	644	9	18	2	2	838	1132 peak hour
16:15	to	17:15	638	10	20	4	3	850	763
16:30	to	17:30	606	9	24	5	4	853	398
16:45	to	17:45	554	6	22	5	7	875	6
17:00	to	18:00	534	4	17	7	9	829	10
17:15	to	18:15	519	3	16	6	9	774	14
17:30	to	18:30	531	6	13	6	11	719	18
17:45	to	18:45	525	9	13	7	9	643	22
18:00	to	19:00	517	11	12	4	7	616	26

Curtis Traffic Surveys

Turning movement count

Job:	190803mcl (19_0422)
Day, date	5/08/19
Location:	Moore St & Hillier Rd
Weather:	Fine
Client:	McLaren Traffic Engineering



Queues did not reach Hillier Rd
There was no residual queuing

Time Period			From Moore St west through	From Moore St west right	From Hillier Rd left	From Hillier Rd right	From Moore St east left	From Moore St east through	Total vehicles	Peak	Worst case queue eastbound
16:00	to	16:15	27	2	1	1	2	62	95		1
16:15	to	16:30	26	0	0	2	1	51	80		2
16:30	to	16:45	22	0	0	1	2	60	85		1
16:45	to	17:00	19	1	0	2	1	51	74		2
17:00	to	17:15	18	0	0	1	3	56	78		1
17:15	to	17:30	24	0	1	6	2	88	121	peak	1
17:30	to	17:45	23	1	1	1	2	71	99		2
17:45	to	18:00	26	0	0	2	3	51	82		3
18:00	to	18:15	22	1	1	2	6	39	71		1
18:15	to	18:30	21	0	1	0	3	45	70		1
18:30	to	18:45	18	1	0	2	2	38	61		1
18:45	to	19:00	15	0	2	0	1	32	50		2
Total			261	6	7	20	28	644			

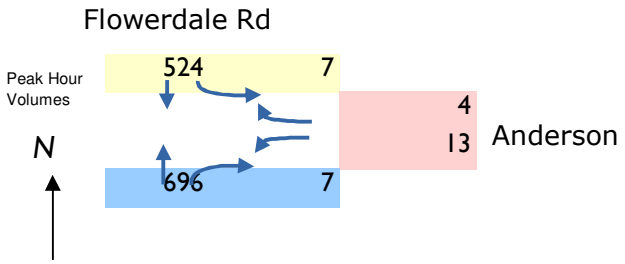
Hourly summary

16:00	to	17:00	94	3	1	6	6	224	334
16:15	to	17:15	85	1	0	6	7	218	317
16:30	to	17:30	83	1	1	10	8	255	358
16:45	to	17:45	84	2	2	10	8	266	372
17:00	to	18:00	91	1	2	10	10	266	380 peak hour
17:15	to	18:15	95	2	3	11	13	249	373
17:30	to	18:30	92	2	3	5	14	206	322
17:45	to	18:45	87	2	2	6	14	173	284
18:00	to	19:00	76	2	4	4	12	154	252

Curtis Traffic Surveys

Turning movement count

Job:	190803mcl (19_0422)
Day, date	5/08/19
Location:	Flowerdale Rd & Anderson Av
Weather:	Fine
Client:	McLaren Traffic Engineering



Time Period			From Flowerdale Rd south through	right	From Anderson Av left	right	From Flowerdale Rd north left	through	Total vehicles	Peak
07:00	to	07:15	101	1	2	1	0	60	165	
07:15	to	07:30	125	2	1	0	0	85	213	
07:30	to	07:45	148	3	1	0	1	131	284	
07:45	to	08:00	203	2	5	0	1	115	0	
08:00	to	08:15	185	1	2	1	2	120	311	
08:15	to	08:30	175	2	3	2	1	130	313	
08:30	to	08:45	161	3	5	1	3	149	322	peak
08:45	to	09:00	175	1	3	0	1	125	305	
Total			1273	15	22	5	9	915		

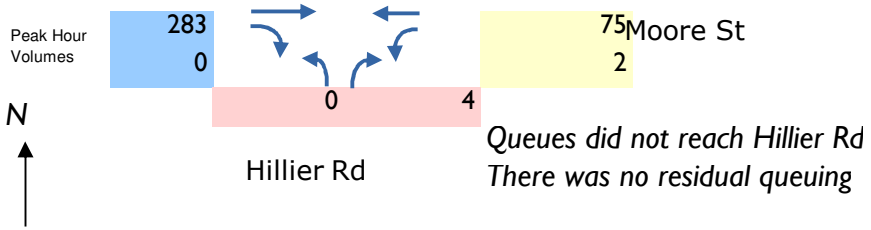
Hourly summary

07:00	to	08:00	577	8	9	1	2	391	662	
07:15	to	08:15	661	8	9	1	4	451	808	
07:30	to	08:30	711	8	11	3	5	496	908	
07:45	to	08:45	724	8	15	4	7	514	946	
08:00	to	09:00	696	7	13	4	7	524	1251	peak hour

Curtis Traffic Surveys

Turning movement count

Job:	190803mcl (19_0422)
Day, date	5/08/19
Location:	Moore St & Hillier Rd
Weather:	Fine
Client:	McLaren Traffic Engineering



Queues did not reach Hillier Rd
There was no residual queuing

Time Period			From Moore St west through	From Moore St west right	From Hillier Rd left	From Hillier Rd right	From Moore St east left	From Moore St east through	Total vehicles	Peak	Worst case queue eastbound
07:00	to	07:15	19	0	0	0	0	12	31		1
07:15	to	07:30	23	0	1	0	1	11	36		3
07:30	to	07:45	41	0	0	0	0	15	56		4
07:45	to	08:00	51	0	1	1	1	19	0		3
08:00	to	08:15	66	0	0	1	0	21	88		5
08:15	to	08:30	97	0	0	2	0	29	128	peak	3
08:30	to	08:45	85	0	0	1	1	18	105		3
08:45	to	09:00	35	0	0	0	1	7	43		2
Total			417	0	2	5	4	132			
Hourly summary											
07:00	to	08:00	134	0	2	1	2	57	123		
07:15	to	08:15	181	0	2	2	2	66	180		
07:30	to	08:30	255	0	1	4	1	84	272		
07:45	to	08:45	299	0	1	5	2	87	321		
08:00	to	09:00	283	0	0	4	2	75	364	peak hour	

ANNEXURE C: SIDRA RESULTS

(8 SHEETS)

MOVEMENT SUMMARY

Site: 101 [(Existing AM) Anderson Avenue / Flowerdale Road]

New Site
Site Category: (None)
Giveway / Yield (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: Flowerdale Road												
2	T1	733	0.0	0.383	0.1	LOS A	0.1	1.0	0.02	0.01	0.03	59.8
3	R2	7	0.0	0.383	9.3	LOS A	0.1	1.0	0.02	0.01	0.03	57.6
Approach		740	0.0	0.383	0.2	NA	0.1	1.0	0.02	0.01	0.03	59.8
East: Anderson Avenue												
4	L2	14	0.0	0.030	7.7	LOS A	0.1	0.7	0.56	0.72	0.56	50.4
6	R2	4	0.0	0.030	17.0	LOS B	0.1	0.7	0.56	0.72	0.56	49.9
Approach		18	0.0	0.030	9.9	LOS A	0.1	0.7	0.56	0.72	0.56	50.3
North: Flowerdale Road												
7	L2	7	0.0	0.287	5.6	LOS A	0.0	0.0	0.00	0.01	0.00	58.2
8	T1	552	0.0	0.287	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.9
Approach		559	0.0	0.287	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles		1317	0.0	0.383	0.3	NA	0.1	1.0	0.02	0.02	0.02	59.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [(Exising AM) Hillier Road / Moore Street]

New Site
Site Category: (None)
Giveway / Yield (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: Hillier Road												
1	L2	1	0.0	0.005	5.7	LOS A	0.0	0.1	0.25	0.58	0.25	52.8
3	R2	4	0.0	0.005	6.8	LOS A	0.0	0.1	0.25	0.58	0.25	47.1
Approach		5	0.0	0.005	6.6	LOS A	0.0	0.1	0.25	0.58	0.25	48.7
East: Moore Street												
4	L2	2	0.0	0.042	3.5	LOS A	0.0	0.0	0.00	0.01	0.00	56.9
5	T1	79	0.0	0.042	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.8
Approach		81	0.0	0.042	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.7
West: Moore Street												
11	T1	298	0.0	0.153	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	60.0
12	R2	1	0.0	0.153	5.7	LOS A	0.0	0.1	0.00	0.00	0.00	57.7
Approach		299	0.0	0.153	0.0	NA	0.0	0.1	0.00	0.00	0.00	59.9
All Vehicles		385	0.0	0.153	0.1	NA	0.0	0.1	0.00	0.01	0.00	59.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [(Existing PM) Anderson Avenue / Flowerdale Road]

New Site
Site Category: (None)
Giveway / Yield (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: Flowerdale Road												
2	T1	678	0.0	0.364	0.3	LOS A	0.3	2.3	0.05	0.01	0.06	59.5
3	R2	9	0.0	0.364	14.1	LOS A	0.3	2.3	0.05	0.01	0.06	57.3
Approach		687	0.0	0.364	0.5	NA	0.3	2.3	0.05	0.01	0.06	59.5
East: Anderson Avenue												
4	L2	19	0.0	0.047	10.6	LOS A	0.2	1.1	0.71	0.87	0.71	48.9
6	R2	2	0.0	0.047	26.3	LOS B	0.2	1.1	0.71	0.87	0.71	48.4
Approach		21	0.0	0.047	12.2	LOS A	0.2	1.1	0.71	0.87	0.71	48.8
North: Flowerdale Road												
7	L2	2	0.0	0.453	5.6	LOS A	0.0	0.0	0.00	0.00	0.00	58.2
8	T1	882	0.0	0.453	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		884	0.0	0.453	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
All Vehicles		1593	0.0	0.453	0.4	NA	0.3	2.3	0.03	0.02	0.04	59.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [(Future AM) Anderson Avenue / Flowerdale Road]

New Site
Site Category: (None)
Giveway / Yield (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: Flowerdale Road												
2	T1	733	0.0	0.384	0.1	LOS A	0.2	1.2	0.02	0.01	0.03	59.8
3	R2	8	0.0	0.384	9.3	LOS A	0.2	1.2	0.02	0.01	0.03	57.6
Approach		741	0.0	0.384	0.2	NA	0.2	1.2	0.02	0.01	0.03	59.8
East: Anderson Avenue												
4	L2	17	0.0	0.054	7.7	LOS A	0.2	1.2	0.61	0.76	0.61	49.5
6	R2	9	0.0	0.054	17.2	LOS B	0.2	1.2	0.61	0.76	0.61	49.1
Approach		26	0.0	0.054	11.2	LOS A	0.2	1.2	0.61	0.76	0.61	49.4
North: Flowerdale Road												
7	L2	8	0.0	0.287	5.6	LOS A	0.0	0.0	0.00	0.01	0.00	58.2
8	T1	552	0.0	0.287	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.9
Approach		560	0.0	0.287	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles		1327	0.0	0.384	0.4	NA	0.2	1.2	0.03	0.02	0.03	59.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [(Future PM) Anderson Avenue / Flowerdale Road]

New Site
Site Category: (None)
Giveway / Yield (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: Flowerdale Road												
2	T1	678	0.0	0.369	0.4	LOS A	0.4	3.1	0.06	0.01	0.09	59.3
3	R2	13	0.0	0.369	14.2	LOS A	0.4	3.1	0.06	0.01	0.09	57.1
Approach		691	0.0	0.369	0.7	NA	0.4	3.1	0.06	0.01	0.09	59.3
East: Anderson Avenue												
4	L2	20	0.0	0.056	10.7	LOS A	0.2	1.2	0.72	0.88	0.72	48.4
6	R2	3	0.0	0.056	26.5	LOS B	0.2	1.2	0.72	0.88	0.72	48.0
Approach		23	0.0	0.056	12.8	LOS A	0.2	1.2	0.72	0.88	0.72	48.4
North: Flowerdale Road												
7	L2	5	0.0	0.455	5.6	LOS A	0.0	0.0	0.00	0.00	0.00	58.2
8	T1	882	0.0	0.455	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		887	0.0	0.455	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
All Vehicles		1601	0.0	0.455	0.5	NA	0.4	3.1	0.04	0.02	0.05	59.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [(Exising PM) Hillier Road / Moore Street]

New Site
Site Category: (None)
Giveway / Yield (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: Hillier Road												
1	L2	2	0.0	0.013	6.4	LOS A	0.0	0.3	0.36	0.61	0.36	52.6
3	R2	11	0.0	0.013	6.9	LOS A	0.0	0.3	0.36	0.61	0.36	46.8
Approach		13	0.0	0.013	6.8	LOS A	0.0	0.3	0.36	0.61	0.36	48.3
East: Moore Street												
4	L2	11	0.0	0.149	3.5	LOS A	0.0	0.0	0.00	0.02	0.00	56.8
5	T1	280	0.0	0.149	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	59.7
Approach		291	0.0	0.149	0.1	NA	0.0	0.0	0.00	0.02	0.00	59.6
West: Moore Street												
11	T1	96	0.0	0.050	0.0	LOS A	0.0	0.1	0.01	0.01	0.01	59.8
12	R2	1	0.0	0.050	6.4	LOS A	0.0	0.1	0.01	0.01	0.01	57.6
Approach		97	0.0	0.050	0.1	NA	0.0	0.1	0.01	0.01	0.01	59.8
All Vehicles		400	0.0	0.149	0.3	NA	0.0	0.3	0.01	0.04	0.01	59.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [(Future AM) Hillier Road / Moore Street]

New Site
Site Category: (None)
Giveway / Yield (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: Hillier Road												
1	L2	2	0.0	0.015	5.8	LOS A	0.0	0.3	0.28	0.60	0.28	52.7
3	R2	13	0.0	0.015	6.9	LOS A	0.0	0.3	0.28	0.60	0.28	46.9
Approach		15	0.0	0.015	6.7	LOS A	0.0	0.3	0.28	0.60	0.28	48.2
East: Moore Street												
4	L2	4	0.0	0.043	3.5	LOS A	0.0	0.0	0.00	0.03	0.00	56.8
5	T1	79	0.0	0.043	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	59.7
Approach		83	0.0	0.043	0.2	NA	0.0	0.0	0.00	0.03	0.00	59.5
West: Moore Street												
11	T1	298	0.0	0.154	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	59.9
12	R2	2	0.0	0.154	5.7	LOS A	0.0	0.1	0.00	0.00	0.00	57.7
Approach		300	0.0	0.154	0.0	NA	0.0	0.1	0.00	0.00	0.00	59.9
All Vehicles		398	0.0	0.154	0.3	NA	0.0	0.3	0.01	0.03	0.01	59.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [(Future PM) Hillier Road / Moore Street]

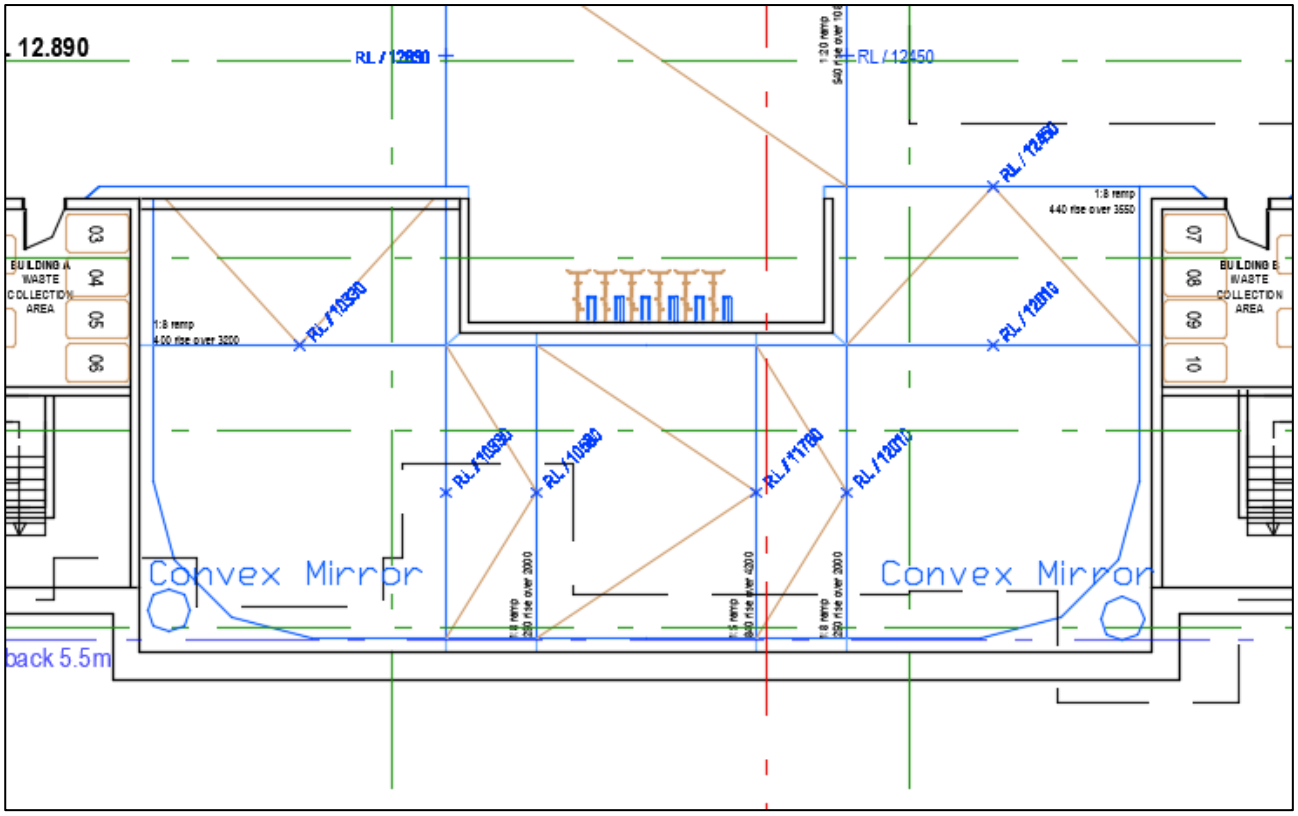
New Site
Site Category: (None)
Giveway / Yield (Two-Way)

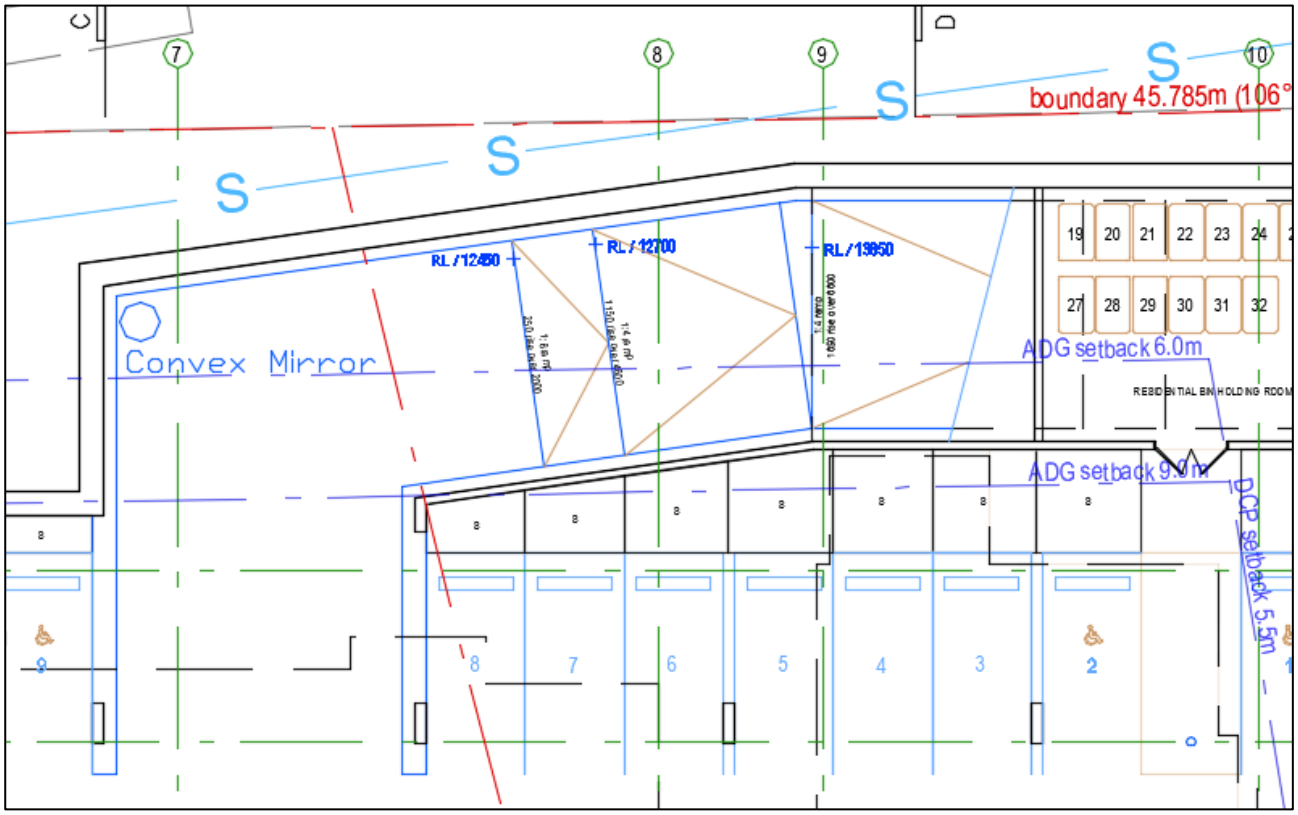
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Hillier Road												
1	L2	3	0.0	0.016	6.4	LOS A	0.1	0.4	0.36	0.61	0.36	52.6
3	R2	13	0.0	0.016	6.9	LOS A	0.1	0.4	0.36	0.61	0.36	46.8
Approach		16	0.0	0.016	6.8	LOS A	0.1	0.4	0.36	0.61	0.36	48.5
East: Moore Street												
4	L2	19	0.0	0.154	3.5	LOS A	0.0	0.0	0.00	0.04	0.00	56.7
5	T1	280	0.0	0.154	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.6
Approach		299	0.0	0.154	0.2	NA	0.0	0.0	0.00	0.04	0.00	59.4
West: Moore Street												
11	T1	96	0.0	0.051	0.0	LOS A	0.0	0.1	0.02	0.01	0.02	59.6
12	R2	2	0.0	0.051	6.5	LOS A	0.0	0.1	0.02	0.01	0.02	57.5
Approach		98	0.0	0.051	0.2	NA	0.0	0.1	0.02	0.01	0.02	59.5
All Vehicles		413	0.0	0.154	0.5	NA	0.1	0.4	0.02	0.05	0.02	58.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

ANNEXURE D: CONVEX MIRROR RECOMMENDATION

(1 SHEET)





CONVEX MIRROR LOCATIONS