LOCHARD ENERGY

JANUARY 2023

WINTON ENERGY RESERVE 1 FACILITY

TRAFFIC IMPACT ASSESSMENT REPORT

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Winton Energy Reserve 1 Facility
Traffic Impact Assessment Report

Lochard Energy

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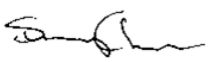
Reviewed by:	Sunny Chen	25/08/2021	
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TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

WSP has been engaged by Lochard Energy to prepare a Traffic Impact Assessment for the proposed energy hub to be located at 386 Lee Road, Winton.

1.1 SCOPE AND PURPOSE OF THIS REPORT

This report has been prepared to discuss the traffic implications of the proposed development, including an assessment of the estimated site generated traffic movements, both during construction and under general operation conditions. In conjunction with this, the report has also been prepared to discuss the suitability of the identified site access arrangements and the ability of this arrangement to adequately cater for the traffic demands of the site during peak construction stages.

In the course of undertaking this assessment, a desktop inspection of the existing conditions proximate to the site has been conducted.

1.2 REFERENCES/ASSUMPTIONS

In the preparation of this assessment, the following documents have been referenced:

- Austroads Guide to Road Design
- Department of Transport (DoT) Supplements to Austroads
- Benalla Planning Scheme

2 BACKGROUND AND EXISTING CONDITIONS

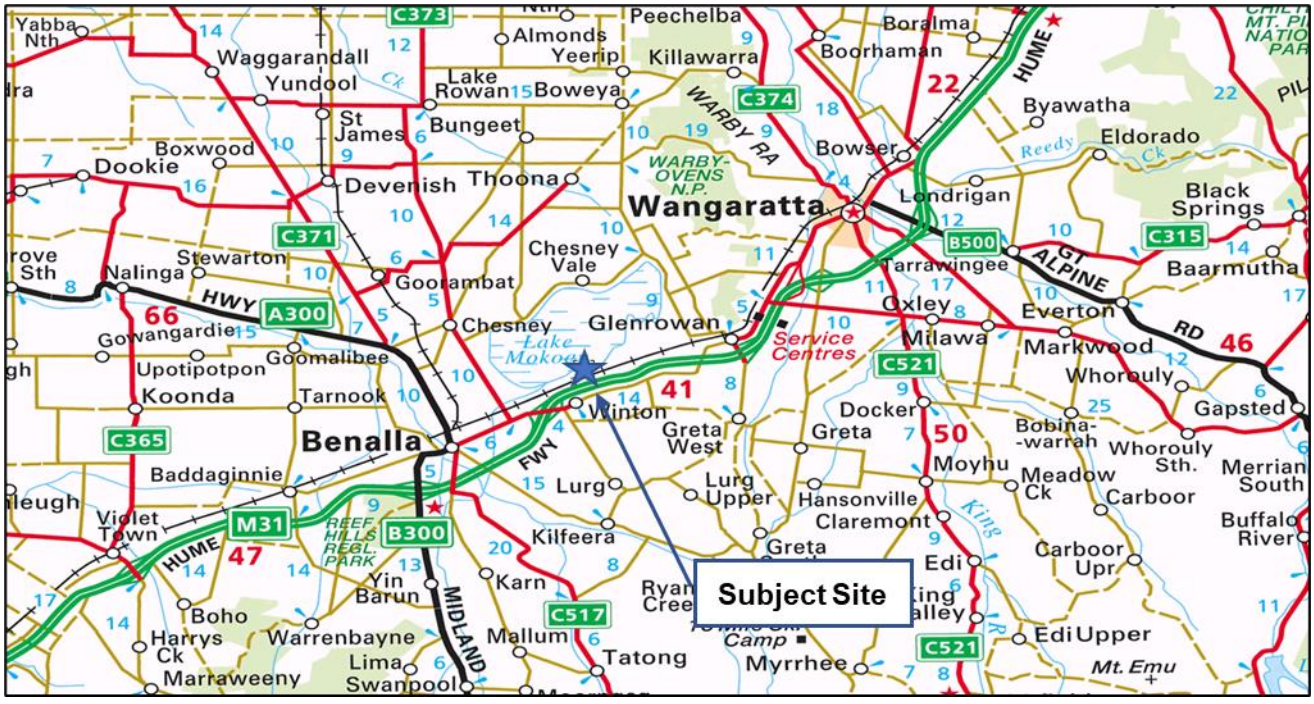
2.1 SUBJECT SITE

The subject site is located on the northern side of the Hume Freeway, almost directly north of the township of Winton, and accommodates a total area of approximately 41ha. The site is situated approximately 3.5 km to the east of the Sydney Road/Hume Freeway interchange and 2.0 km to the west of the Bowers Road/Hume Freeway intersection. In addition to these intersections, a rest area (Mokoan Rest Area - northbound) also exists approximately 350m east of the subject site and includes the provision of freeway entry and exit lanes.

Vehicle access to the subject site is currently facilitated via the Bowers Road intersection which provides a connection through to Lee Road (unsealed) and the subject site. The Bowers Road intersection includes a connection across the central median, allowing for vehicle movements in all directions and also includes the provision of deceleration lanes for all turning movements. It is understood that recently the southern leg of Bowers Road at this intersection has been closed to traffic movements.

The subject site is zoned for farm use (FZ) within the Benalla Planning Scheme and is largely bound by Hume Freeway (Road Zone 1) to the south and Lake Mokoan/Winton Wetlands to the north. A number of other solar farms/renewable energy hubs also already exist, or are currently being planned for, within the area surrounding the subject site.

The location of the subject site with respect to the wider surrounding area is shown in Figure 2.1



Source: *www.street-directory.com.au*

Figure 2.1 Subject Site Locality Plan

2.2 ROAD NETWORK

2.2.1 LEE ROAD

Lee Road, proximate to the site, is a local access road comprising an unsealed carriageway of approximately 6.3m width which provides a connection to the subject site from Bowers Road. It primarily runs in an east-west alignment, parallel to the rail reserve and train tracks located to its north, however near the subject site the alignment does change to run in a southwest – northeast alignment.

The typical configuration of Lee Road is shown in Figure 2.2

Source: www.nearmap.com.au

Figure 2.2 Existing Conditions - Lee Road

2.2.2 BOWERS ROAD

Bowers Road is a local access road comprising a 7.0m wide sealed two-way carriageway and extends in a north-south direction from the Hume Freeway to Lee Road. South of the Hume Freeway, Bowers Road has previously also extended south to Winton Road, however recent road upgrades have resulted in the closure of this leg.

The typical configuration of Bowers Road is shown in Figure 2.3 with the southern leg closure shown in Figure 2.4.

Source: www.nearmap.com.au

Figure 2.3 Bowers Road – Existing Conditions

Source: Google Street View – December 2020

Figure 2.4 Bowers Road – Existing Conditions – Southern Leg Closure

2.2.3 HUME FREEWAY

The Hume Freeway is a declared arterial road and makes up part of one of Australia major inter-city highways, providing connection between Melbourne and Sydney. Within proximity of the subject site, it comprises a dual carriageway, accommodating 2 lanes of travel plus a sealed shoulder in each direction and operates with a posted speed limit of 110 km/h. A central median of approximately 23m width divides the north and south bound carriageways.

Based on DoT data, it is understood that within the investigation area, the Hume Freeway accommodates in the order of 16,000 average daily vehicle movements, typically evenly distributed in the north-eastbound and south-westbound directions.

The typical configuration of the Hume Freeway is shown in Figure 2.5.

Source: www.nearmap.com.au

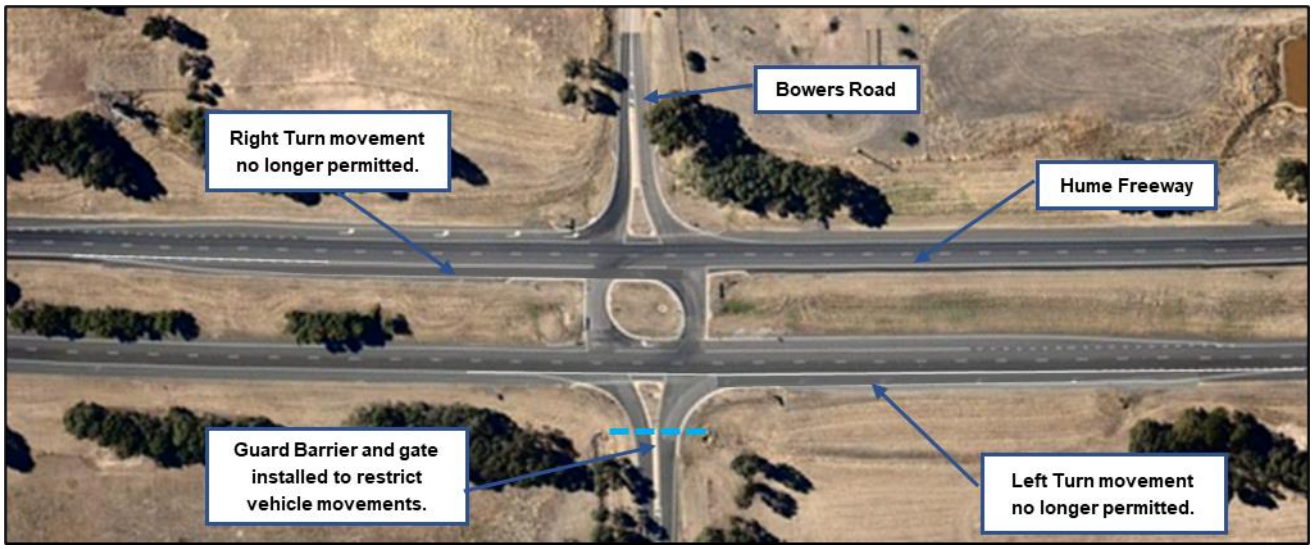
Figure 2.5 Existing Conditions – Hume Freeway

2.2.4 BOWERS ROAD / HUME FREEWAY INTERSECTION

The intersection of Bowers Road and the Hume Freeway has historically operated as a fully directional four-legged intersection, however as previously noted, the southern leg of this intersection has recently been closed off, with access now restricted to authorised vehicles only. The intersection now essentially operates as a T-intersection.

To allow for movements in all directions, vehicle movements are facilitated across the 23.0m wide central median. This width is sufficient to allow for storage of a vehicle up to the size of a 19m semi-trailer. A 185m long left turn deceleration lane is also provided on the northbound side of the carriageway to provide access to the northern leg of Bowers Road, with a 185m right turn lane provided on the southbound side for the same purpose. Previously auxiliary turn lanes had also been provided for access to the southern leg of Bowers Road, however these have been removed with the recent leg closure.

The existing conditions at the Bowers Road and Hume Freeway intersection are shown in Figure 2.6



Source: *www.nearmap.com.au*

Figure 2.6 Existing Conditions – Bowers Road / Hume Freeway Intersection

2.2.5 MOKOAN REST AREA INTERCHANGE

Approximately 350m east of the subject sight lies the northbound Mokoan Rest area. The rest area is accessed by an approximately 350m long left turn deceleration lane, with access back onto the Hume Freeway facilitated via a 300m long acceleration lane. Figure 2.7, shows the existing interchange conditions at the northbound Mokoan rest area.

Source: *www.nearmap.com.au*

Figure 2.7 Existing Conditions – Mokoan Rest Area

2.3 EXISTING TRAFFIC VOLUMES

2.3.1 BOWERS ROAD / HUME HIGHWAY

Existing traffic volume data for the intersection of Bowers Road and the Hume Freeway has been sourced from the investigation that was undertaken by Benalla City Council in the lead up to the closure of the southern leg of the intersection. The sourced traffic volume data was collected between Saturday 29th July and Friday 4th August, 2017.

Excluding the movements to and from the now closed off southern leg, the traffic volume data indicates that the Bowers Road and Hume Freeway intersection could typically accommodate between 15,000 and 20,000 daily vehicle movements, with peak movements occurring on the Friday of the survey period. A copy of the sourced traffic volumes are presented in Appendix A.

For the purposes of the following assessment, consideration has been given to the Friday peak traffic volumes, with an allowance made for a growth factor rate of 3% per annum to allow for growth in traffic volumes since the surveys were undertaken. These anticipated volumes are subsequently presented in Table 2.1 and Figure 2.8 below.

Table 2.1 Bowers Road Intersection - Estimated Existing Traffic Volumes

TIME	ROAD								TOTAL
	Hume Freeway (Eastbound)			**Bowers Road (Southbound)**		**Hume Freeway (Westbound)**			
	Left	Thru	U-turn	Left	Right	U-turn	Right	Thru	
Daily	24	11688	10	4	15	4	5	10081	21831
AM	3	701	0	2	3	0	0	728	1437
PM	2	904	2	0	0	2	2	810	1722

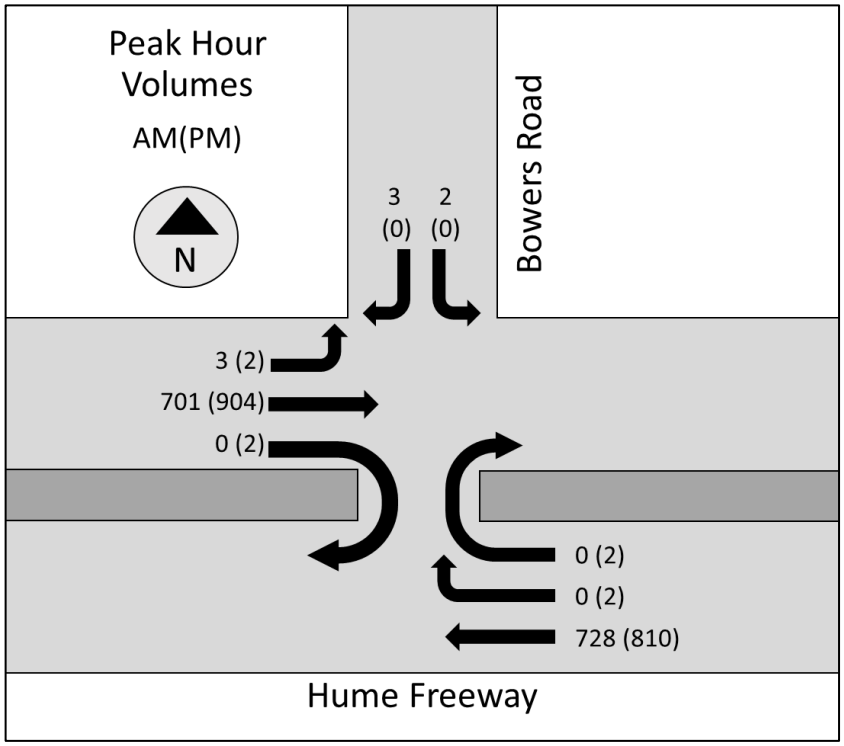


Figure 2.8 Bowers Road Intersection - Estimated Existing Traffic Volumes

2.4 EXISTING CRASH DATA

Crash statistics data for the last 5 years (2016 to present) has been sourced from the DoT. With specific relevance to the subject site, it is noted that across this time, three (3) crashes have occurred at the Bowers Road/Hume Freeway intersection. These crashed comprise:

- 1 fatality crash
- 1 serious injury crash
- 1 other injury crash

The location and details of these crashes are shown in Figure 2.9

Accident Code	Date and Time	Severity	DCA Code	DCA Description	Light Condition	No. People Involved	No. Vehicles Involved	Road Geometry	Vehicle 1 Direction	Vehicle 2 Direction
T20170019136	2017-10-07 23:12:00	Serious injury	110	CROSS TRAFFIC(INTERSECTIONS ONLY)	Day	7	2	Cross intersection	NW	SW
T20170010457	2017-05-28 06:05:00	Fatality	110	CROSS TRAFFIC(INTERSECTIONS ONLY)	Day	4	2	Cross intersection	N	W
T20160016654	2016-07-30 10:35:00	Other injury	116	LEFT NEAR (INTERSECTIONS ONLY)	Dark No street lights	5	2	Cross intersection	NW	SW

Source: https://discover.data.vic.gov.au/dataset/crash-stats-data-extract

Figure 2.9 Crash Locations and Data

Review of these outputs indicate that both the fatal and serious injury crashes occurred during daytime conditions and were the result of a vehicle crossing the intersection and being impacted by a vehicle travelling along the Hume Freeway. It is noted that these crashes all occurred prior to the closure of the southern leg of the Bowers Road/Hume Freeway intersection and it is understood that these crashes were a contributor in the decision to make these changes to the intersection.

3 PROPOSAL

3.1 GENERAL

Lochard Energy (Iona Operations) Pty Ltd, an energy infrastructure company based in Australia, is seeking to develop the land for an energy hub at 386 Lee Road, Winton (the subject site). The proposed energy hub is known as Winton Energy Reserve 1 facility (the project).

The project will utilise hybrid technology with Li-Ion batteries and fast-start high-efficiency duel-fuel gas reciprocating engines and will comprise:

- A 200-megawatt (MW) Gas-Powered Generator (GPG) facility and adjoining ~200 metre (m) gas pipeline including metering station.
- A Battery Energy Storage System (BESS) facility. The BESS facility will supply and absorb 200MW real power with 400-megawatt-hour (MWh) energy storage capacity.
- A single electrical substation for both battery and GPG which then feeds into the local network.

A ~3 kilometre (km) 220-kilovolt (kV) underground transmission line from the Glenrowan Terminal Station (GTS) to the subject site. The transmission line will cross the Hume Freeway and follow the existing AusNet easement northwest from the GTS. It will then head east within the road reserve of Lee Road before entering the subject site.

The project is located approximately 9 km north east of Benalla and 175 km north east of Melbourne within the Rural City of Benalla (Local Government Area). A concept layout plan for the project is provided at Figure 3.1.

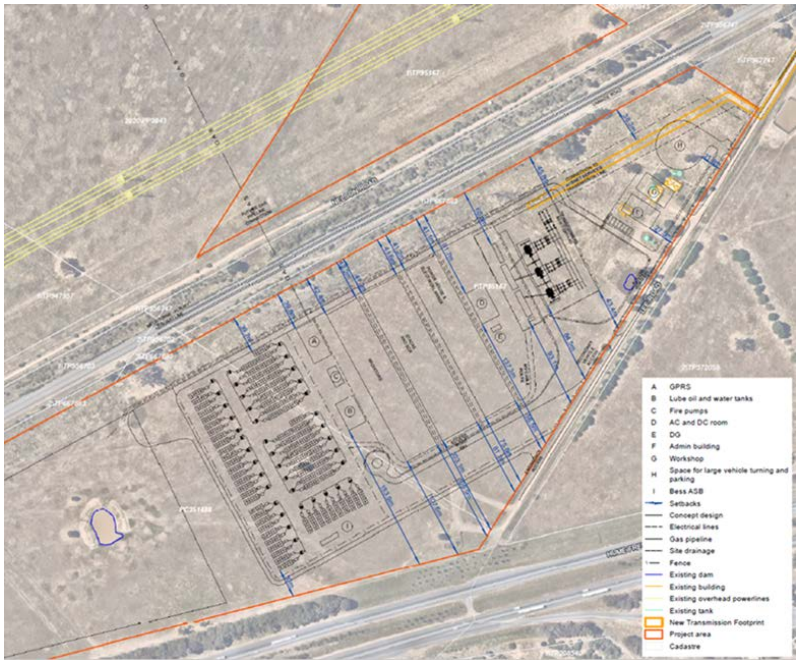


Figure 3.1 – Concept layout plan

3.2 SITE ACCESS

Access to the subject site is proposed via utilisation of the existing Bowers Road/Hume Freeway intersection with connection to the site then facilitated via Lee Road and its connection to Bowers Road.

Further discussion on this access treatment will be provided in the following report.

4 TRAFFIC GENERATION

4.1 SITE OPERATIONS

Traffic movements as generated by the development and use of the subject site can be classified into the following two (2) distinct categories:

- Construction Period Traffic Movements; and
- Typical Operations Traffic Movements.

Given that these generation periods will both occur at separate timeframes, both have been individually assessed as follows to indicate their anticipated impact on the road network.

4.1.1 CONSTRUCTION PERIOD

Construction of the energy hub is expected to take 12- 18 months from the point of site establishment. This is likely to including periods of 4 – 5 months during which time the number peak construction vehicle movements are anticipated to occur. Construction traffic generation estimates are therefore presented based on this peak period.

4.1.1.1 LIGHT VEHICLE MOVEMENTS

During the construction phase, daily light vehicle movements generated by the site will primarily come from the regular workforce, with a smaller number of movements made of from isolated deliveries and specialist trades.

Given the sites size, it is estimated that at its peak, construction of the energy hub may require a workforce of up to 100 staff, with staff typically arriving during the morning peak, and leaving in the evening peak. On the assumption that each individual staff member drives to and from the site, this could therefore equate to in the order of 100 individual light vehicle trips or 200 light vehicle movements per day during the peak stages of construction.

With respect to how these movements will occur during the AM and PM peak periods, based on typical site operations, it is anticipated that during the AM peak, 90% of movements will be inbound whilst during the PM peak, 90% of movements will be outbound. This equates to an inbound/outbound split of 90/10 vehicle movements in the AM peak and an inbound/outbound split of 10/90 vehicle movements in the PM peak.

4.1.1.2 HEAVY VEHICLE MOVEMENTS

Based on other developments of a similar nature, it is understood that construction of the site will be undertaken by a variety of heavy vehicles, typically ranging up to a 19.0m articulated semi-trailer as the largest vehicle to access the site on a regular basis (noting that this does not preclude the use of larger vehicles if required). It is anticipated that these vehicles will typically generate in the order of 10 – 15 vehicle trips per day, equating to a peak of approximately 30 heavy vehicle movements.

The occurrence of these movements is anticipated to be evenly distributed across a typical working day (8:00am – 6:00pm), generally resulting in between 1-2 heavy vehicle trips per hour. It is assumed that each trip will include both an arrival and departure movement, thereby resulting in up to 4 heavy vehicle movements per hour.

4.1.1.3 SUMMARY OF CONSTRUCTION VEHICLE MOVEMENTS

Based on the preceding analysis, the following summary of construction vehicles per day (vpd) is provided:

- Light Vehicle Movements – 200 vpd
- Heavy Vehicle Movements – 30 vpd
- **Total Vehicle movements – 230 vpd**

4.1.2 TYPICAL OPERATIONS

Post construction, it is anticipated that site staffing requirements will largely be generated through the sites needs for a mixture of routine and emergency maintenance. As such, it has been advised that the site will typically operate with between 5 – 10 full time staff onsite per day.

On the basis that all staff drive to and from the site, it is therefore considered that under general operations the site may typically generate up to 20 vehicle movements per day. This volume of movements is considered low in a traffic engineering context and would be expected to be readily accommodated within the wider surrounding road network.

4.1.3 PEAK TRAFFIC IMPACT PERIOD

Given the preceding assessment, it has been identified that traffic volumes during peak construction periods are anticipated to greatly exceed (at a rate of 10:1) those volumes that are anticipated to be generated during typical operations. It is therefore with respect to the vehicle movements during those peak construction periods that the subsequent traffic analysis has been undertaken.

4.2 PEAK PERIOD TRAFFIC DISTRIBUTIONS

Traffic distributions for the subject site will likely vary between light and heavy vehicle movements. Light vehicle movements as generated by site staff, specialist tradesmen, and smaller deliveries are anticipated to come from the surrounding local townships (place of residence), whilst heavy vehicle movements are primarily expected to originate and subsequently return to Melbourne via the Hume Freeway. With respect to the light vehicle movements, for the purposes of estimating distributions consideration has been given to the population of key surrounding catchments as follows:

- Benalla (10km-15km south-west of the subject site) – Approximately 14,000 people.
- Greater Shepparton (60km-65km west of the subject site) – Approximately 66,000 people.
- Wangaratta (20km-25km north-east of the subject site) – Approximately 30,000 people.

It is assumed that all vehicle movements to and from the site will be facilitated via the Hume Freeway, and therefore on this basis, and with respect to the preceding populations of surrounding regional centres it is considered the distribution of light vehicle traffic will be as follows:

- 73% to/from the south-west.
- 27% to/from north-east.

With regards to these distributions, it is noted that proximity of Wangaratta to the site compared to that of Shepparton, may result in a higher generation of vehicle movements than the above distributions indicate, however in order to allow for a conservative assessment with regards to the critical right turn out movement from Bowers Road, the above noted distributions have been adopted. Subsequently, these distribution rates have been applied to the estimated site traffic generations resulting in the following outputs for daily movements as presented below:

Table 4.1 Estimated Total Daily Traffic Volumes and Distributions

	TO/FROM SOUTH-WEST	TO/FROM NORTH-EAST
Light Vehicles	146	54
Heavy Vehicles	30	0
Total Daily Vehicle Movements	**176**	**54**

With respect to these daily distributions, and traffic volume estimations presented prior, the anticipated peak hourly volumes and distributions would be as presented in Table 4.2 and Figure 4.1 following

Table 4.2 Estimated Peak Hourly Site Generated Traffic Volumes and Distributions

	ARRIVAL FROM SOUTH-WEST	DEPARTURE TO SOUTH-WEST	ARRIVAL FROM NORTH-EAST	DEPARTURE TO NORTH-EAST
AM Peak	68	11	24	3
PM Peak	11	68	3	24
Daily Total	**79**	**79**	**27**	**27**

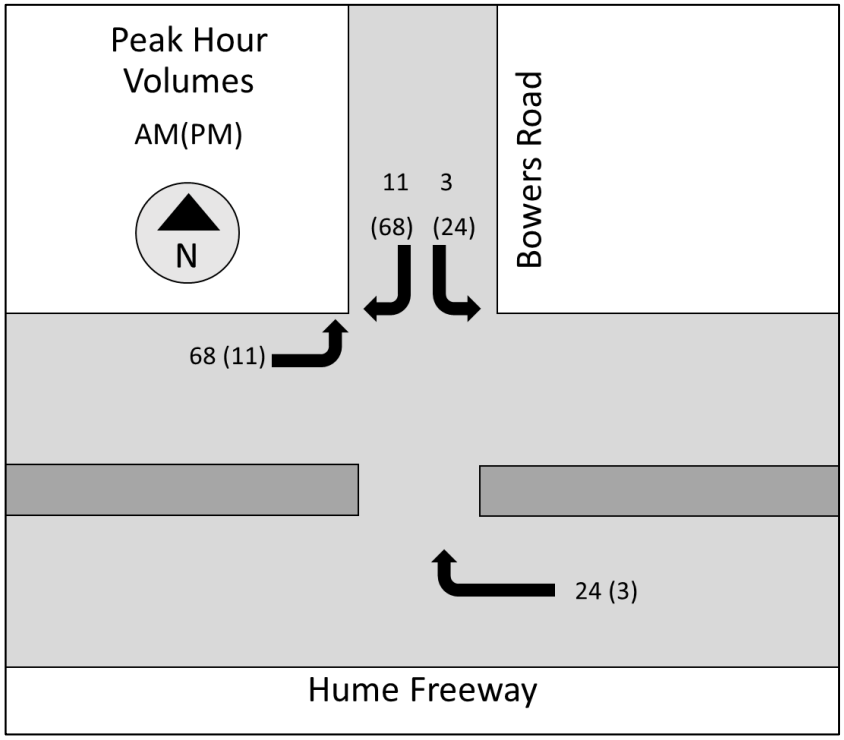


Figure 4.1 Estimated Peak Hourly Site Generated Traffic Volumes and Distributions

These peak hour distributions are based on the conservative assumption that all light vehicle movements to and from the site occur during either the AM and PM peak periods.

5 SITE ACCESS CONSIDERATIONS

5.1 PROPOSED SITE ACCESS ARRANGEMENTS

As noted in Section 3.2, access to the subject site is proposed to be facilitated via utilisation of the existing Bowers Road/Hume Freeway intersection and the adjoining Lee Road connection extending through to the subject site.

In terms of assessing the site access requirements for the proposal, it is considered that as Lee Road operates more in the function of a local road, with minimal if any other traffic than what is generated by the site, the key point of access assessment will be the Bowers Road and Hume Freeway intersection.

5.2 ACCESS DESIGN CONSIDERATIONS

In assessing the appropriateness of the Bowers Road intersection to operate as the primary point of access to the subject site, consideration has been given to the following sight distance and turn treatment design requirements in order to ascertain if the existing conditions adhere to relevant standards, and whether any additional works will be required to facilitate site access.

5.2.1 SIGHT DISTANCE REQUIREMENTS

Ensuring that the appropriate sight distance provisions are made for intersections and access points is critical in ensuring that vehicles approaching an intersection have sufficient time to observe and react to a potential hazard. Several variation of sight distance requirements exist with those considered applicable to the subject site noted and defined as follows:

- Stopping Sight Distance (SSD) - *Austroads Guide to Road Design Part 3 Section 5.3* defines SSD as "*the distance to enable a normally alert driver, travelling at the design speed on wet pavement, to perceive, react and brake to a stop before reaching a hazard on the road ahead*".
- Approach Sight Distance (ASD) - *Austroads Guide to Road Design Part 4A Section 3.2.1* defines ASD as "*the minimum level of sight distance which must be available on the minor road approaches to all intersections to ensure that drivers are aware of the presence of an intersection*".
- Safe Intersection Sight Distance (SISD) - *Austroads Guide to Road Design Part 4A Section 3.2.2* defines SISD as "*the minimum sight distance which should be provided on the major road at any intersection.*".

An assessment for each of these sight distance requirements is subsequently provided as follows:

5.2.1.1 STOPPING SIGHT DISTANCE (SSD)

Table 5.5 to the *Austroads Guide to Road Design Part 3* sets out desirable Stopping Sight Distances (SSD) for cars on sealed roads. These distances are separated into the minimum values permitted under specific situations, the desirable values for typical road conditions, and the values for major highway and freeway conditions. In conjunction with this, SSD for trucks is set out within Table 5.6 of the same Austroads Guide.

On the basis of the Hume Freeway operating with a posted speed limit of 110km/h, there is therefore an SSD requirement for cars of 260m based on the values for major freeways, and a conservative reaction time of 2.5 seconds. For trucks, it is noted that Table 5.6 specifies an SSD of 241m based on a 2.5 second reaction time, and therefore this distance is covered within the above noted SSD.

5.2.1.2 APPROACH SIGHT DISTANCE (ASD)

For the intersection of Bowers Road and the Hume Freeway, the ASD is applicable to the Bowers Road approach to the Hume Freeway. Assuming that Bowers Road operates under the default speed limit of 100km/h that is applicable to un-signposted rural roads outside of built up areas, Table 3.1 to the *Austroads Guide to Road Design Part 4A* specifies that an ASD of 179m would be applicable based on a reaction time of 2.5 seconds.

5.2.1.3 SAFE INTERSECTION SIGHT DISTANCE (SISD)

Further to the SSD and ASD presented above, Table 3.2 to the *Austroads Guide to Road Design Part 4A* sets out the desirable Safe Intersection Sight Distance (SISD) requirements for vehicles on sealed roads.

Given the Hume Freeway operates with a posted speed limit of 110km/h, the SISD requirement within proximity of the subject Bowers Road intersection would be 300m based on a conservative reaction time of 2.5 seconds.

5.2.1.4 SUITABILITY OF PROVIDED SIGHT DISTANCES

Based on a desktop review of the subject site, and as presented in Figure 5.1, it is considered that the straight alignments of Bowers Road and the Hume Freeway on approach to the intersection are adequate such that the required unimpeded sight lines are generally already provided within the existing road network arrangement.

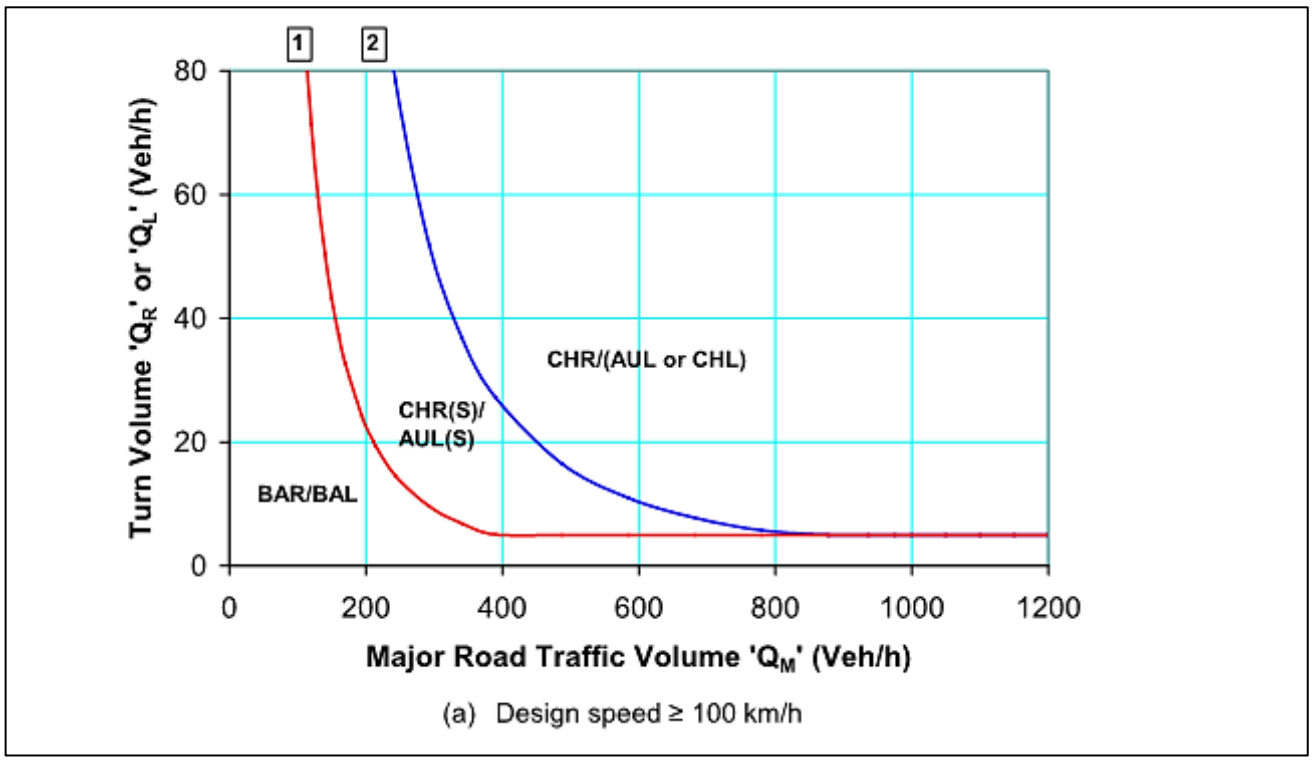
Figure 5.1 Bowers Road and Hume Freeway Intersection Existing Sight Distance Provisions

5.2.2 TURN TREATMENT REQUIREMENTS

In addition to the sight line considerations noted prior, a review of the existing channelised turn treatments has also been undertaken to ensure that they will be sufficient to accommodate the demands of the proposed development. In assessing these existing conditions, consideration has been given to the necessary turn treatments that are required to be provided, and also the required lengths of these turn treatments.

5.2.2.1 TURN TREATMENT WARRANTS

Warrants for specific turn treatments at intersections are derived based on a combination of the peak hourly volume of traffic along the major road and turning vehicle movements onto the minor road. Figure 5.2 below has been extracted from the *Austroads Guide to Road Design Part 4* and details the warrants for various turn treatments along major roads with an operating speed of 100km/h or greater.



Source: *Austroads Guide to Road Design Part 4*

Figure 5.2 Turn Treatment Warrants

With respect to the above, given that construction of the proposed development is anticipated to see the generation of more than 20 peak hour turning movements from both directions, along with hourly through movements along the Hume Freeway exceeding 600 vehicles in both directions, it is required that any turn provisions are accommodated in the form of a channelised treatment. This aligns with the existing conditions as they stand and therefore it is considered that no additional works would be required.

5.2.2.2 TURN LANE LENGTH REQUIREMENTS

Turn lane length requirements are outlined within Table 5.2 to *Austroads Guide to Road Design Part 4A* and specify that turn lanes on roads with an operating speed of 110km/h are required to have a length of between 135m – 185m in order to provide sufficient distance to vehicles to stop prior to turning from the major road. As noted within Section 2.2.4, both the left and right turn lanes on approach to Bowers Road have total lengths of 185m or more and therefore comply with the necessary turn lane length requirements.

On this basis, it is considered that the currently provided turn lane lengths adhere to the required standards and will be appropriate for site use.

5.3 VEHICLE ACCESS CONSIDERATIONS AND CONSTRAINTS

Under typical operations vehicles accessing the subject site will largely be contained to smaller passenger vehicles, or medium sized loading/delivery vehicles, all of which will be sufficiently accommodated within the provided road network and intersection configurations. During construction however it is anticipated that there will be a requirement for larger vehicles to access the site and subsequently consideration has been given to ability of the existing intersection configuration to accommodate these movements, the potential impacts these movements might have, and any modifications that would be required to be undertaken to accommodate these movements.

In terms of these vehicle movements, it is considered that whilst on a typical basis vehicles most vehicles will likely be the size of a 19.0m articulated semi-trailer or less, there may be occasions where larger vehicles might require access to the site. Subsequently, in conjunction with the 19.0m semi-trailer, consideration has also been given to the site access requirements and impacts for a 19.0m semi-trailer with an oversized load (4.0m) and a 26.0m B-double.

To review the accessibility and potential impacts of each of these vehicle movements, swept path diagrams have been prepared using Autoturn V10.2. In preparing these diagrams, the assumption has been made that as noted in Section 4.1.1.2 heavy construction vehicle movements will typically originate from, and travel back to Melbourne via the Hume Freeway. Subsequently all movement to the site will be left in, with departure movements typically to be right-out, with vehicle staging facilitated via the central median cut-through. It is noted that 26.0m B-Doubles will not be able to store within the central median and will instead be required to turn left from Bowers Road onto the Hume Freeway. Additional details on this arrangement are presented in Section 5.4.

The diagrams are presented in Figure 5.3 to Figure 5.7 below, and are also included in Appendix B.

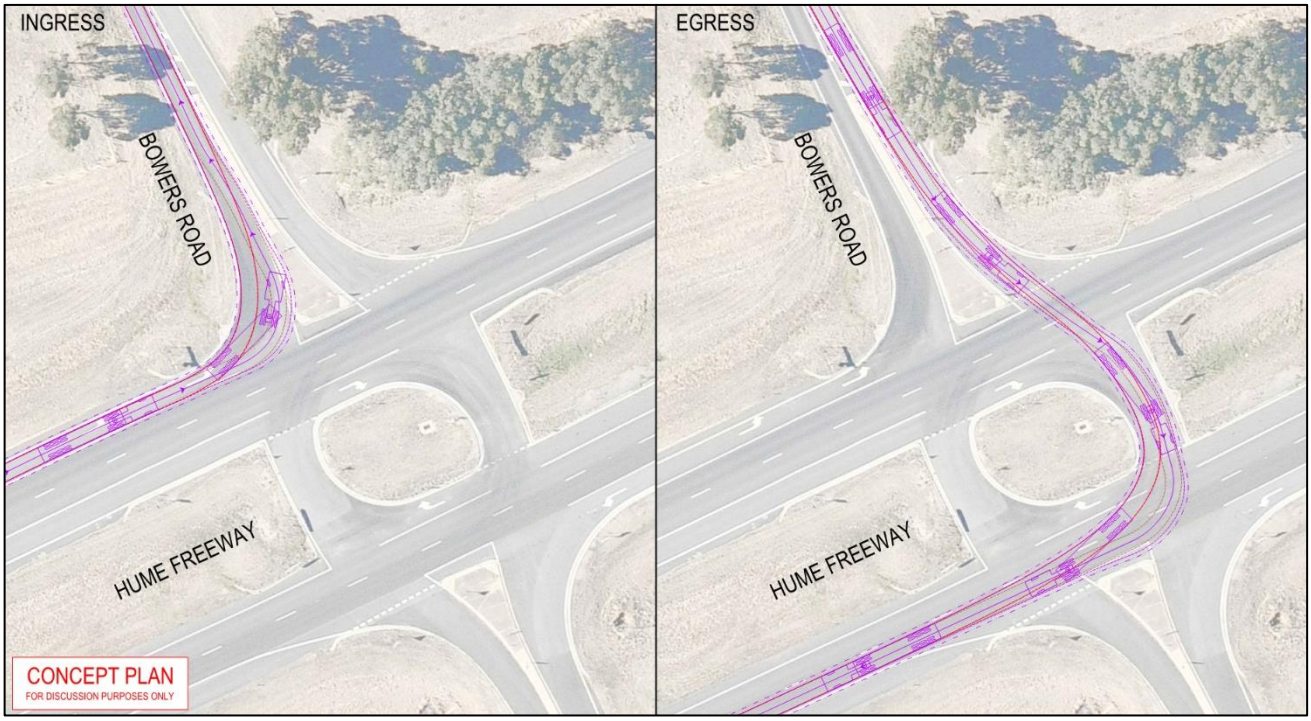


Figure 5.3 19.0m Articulated Semi-Trailer Bowers Road Ingress/Egress

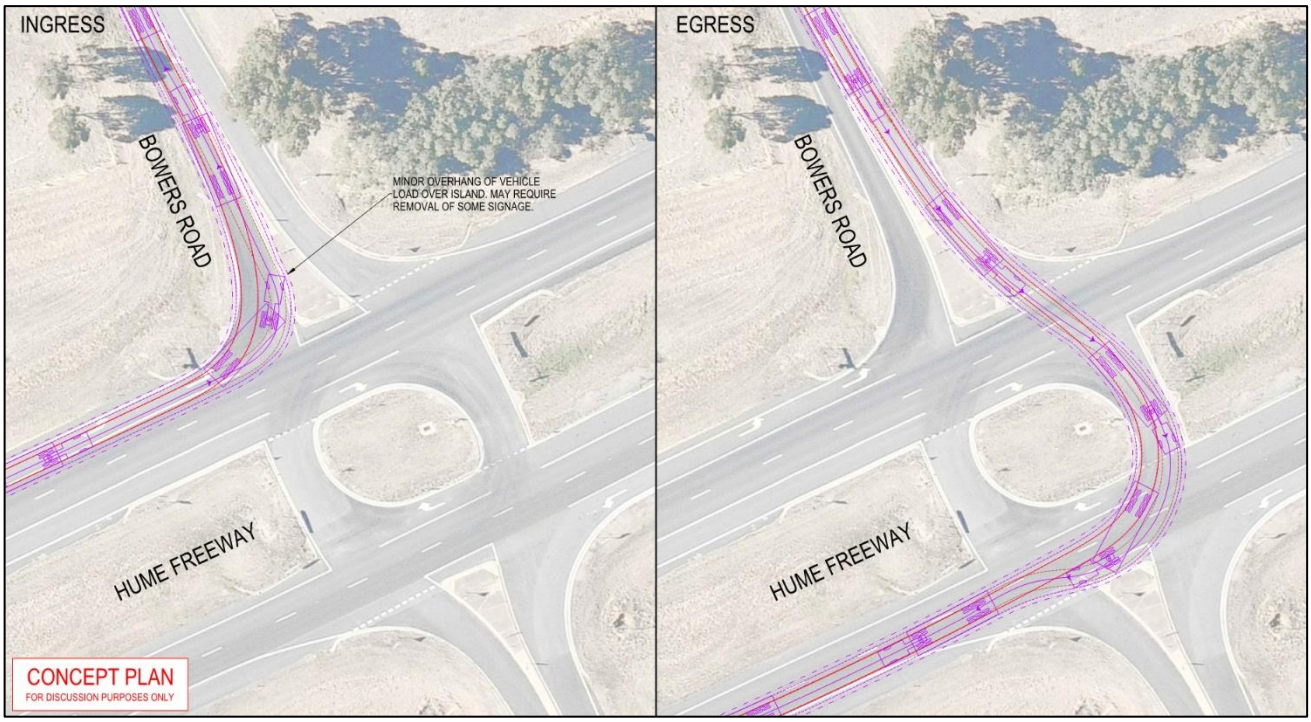


Figure 5.4 4.0m Wide 19.0m Articulated Semi-Trailer Bowers Road Ingress/Egress

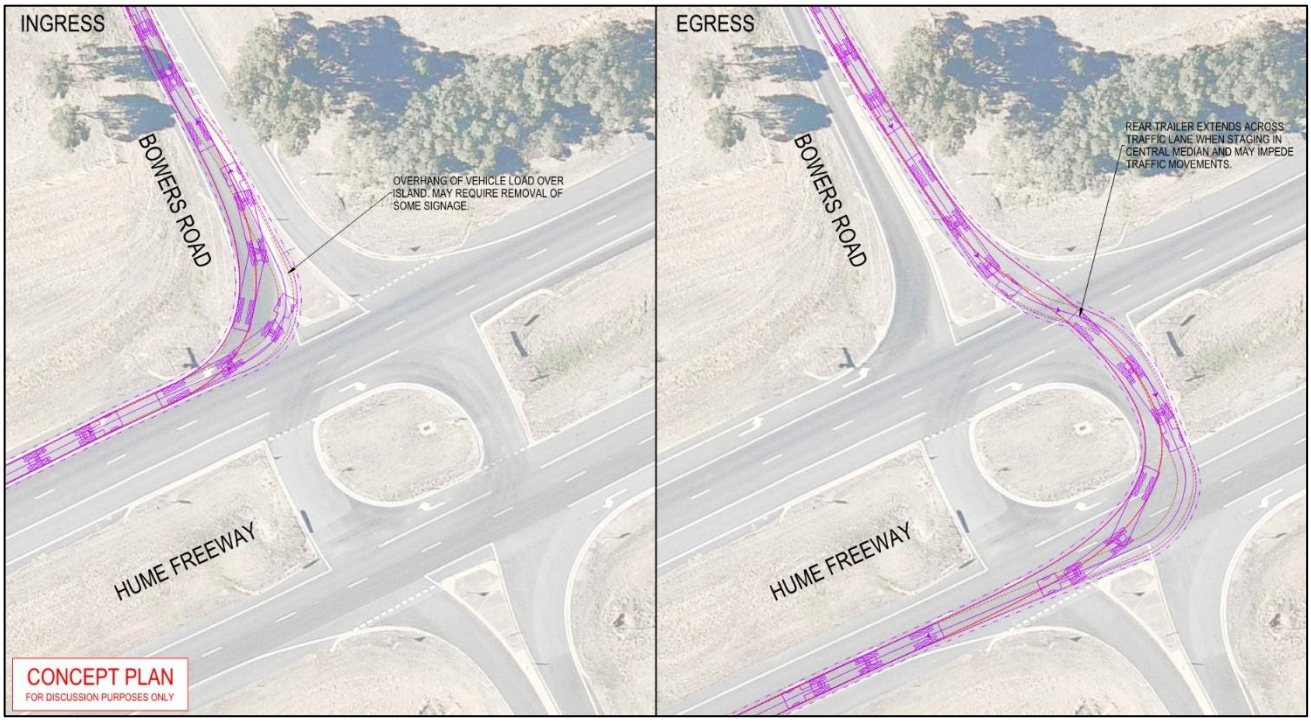


Figure 5.5 26.0m B-Double Bowers Road Ingress/Egress

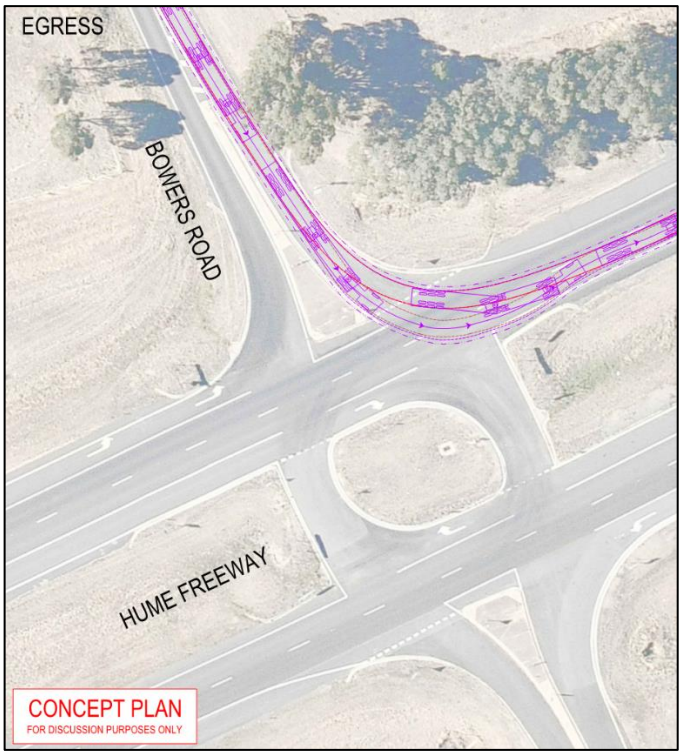


Figure 5.6 26.0m B-Double Bowers Road Left Turn Egress

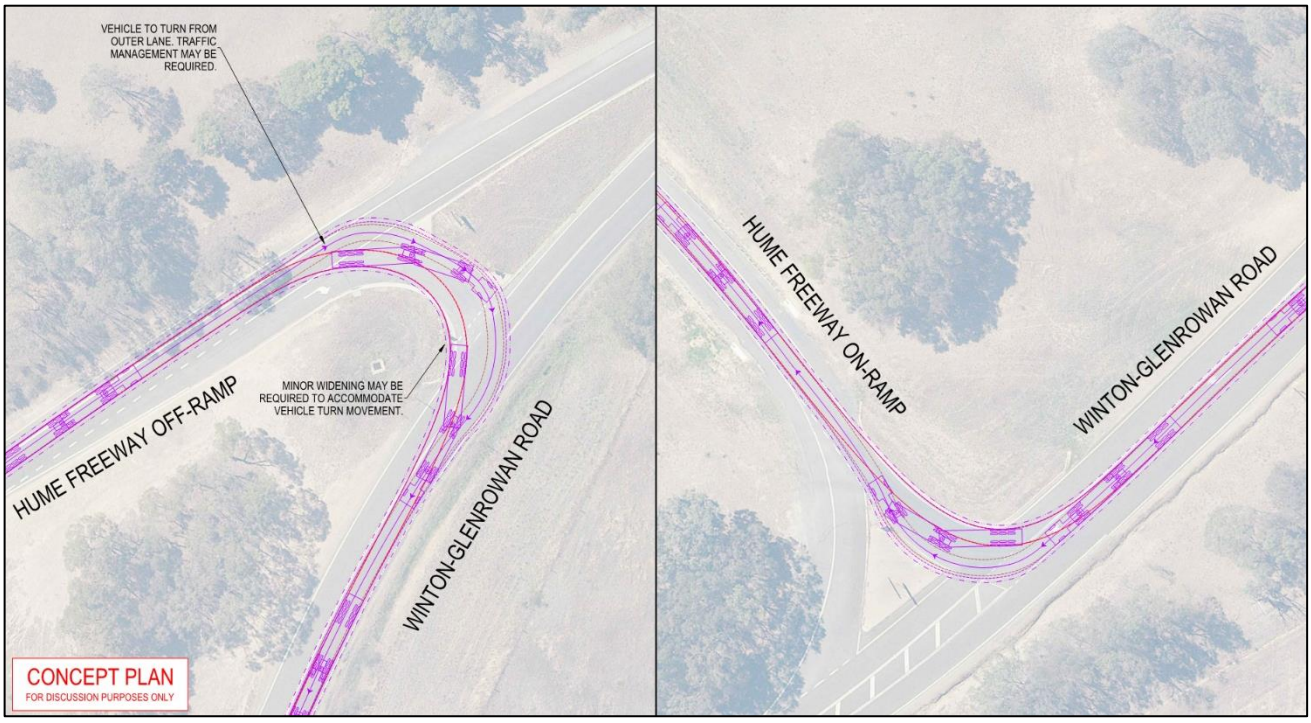


Figure 5.7 26.0m B-Double Winton-Glenrowan Road Turn Movements

The swept path diagrams show that the vehicle turn movements for a 19.0m semi-trailer can be adequately accommodated within the existing conditions at the Bowers Road intersection. Along with this, the diagrams also confirm that a semi-trailer carrying a wide load can also be accommodated by these existing arrangements, noting that some allowance may need to be made for removal of signage in the Bowers Road island due to the overhang of the load. Furthermore, should a load the size of that assessed be required to access the site then traffic management will also be required given the size of the load would exceed standard width allowances.

In terms of the B-double movements, the diagrams confirm that whilst both ingress and egress movements will be achievable within the current turn treatment areas, it is noted that when departing from Bowers Road and turning right, a B-Double staged in the central median would have the end of its rear trailer extending across the eastbound carriageway, thereby impeding traffic. It is therefore noted that should a vehicle of this size be required to exit from the site, then to avoid the potential conflict, it will need to turn left out of Bowers Road (Figure 5.6) and utilise the existing Winton-Glenrowan Road interchange approximately 8km to the east in order to turn around and head back towards Melbourne. As presented in Figure 5.7, the existing conditions at this interchange should generally be sufficiently to accommodate the necessary B-double turn movements, subject to some minor widening of turn treatments and the provision of traffic management.

With regards to the preceding, it is therefore considered that whilst typical heavy vehicle movements up to a 19.0m semi-trailer can be adequately catered for by the existing intersection arrangements and that whilst larger vehicles can also be accommodated by these arrangements, further vehicle specific considerations may be warranted once it is identified that these movements need to occur.

Notwithstanding the above, it is suggested that in order to reduce the potential for conflict that may be generated by right turning heavy vehicles across the Hume Freeway at the Bowers Road intersection, that consideration should be given to enforcing all large vehicles to turn left out of Bowers Road and utilise the Winton-Glenrowan Road interchange to turn around. Further detail on this is given in the following section.

5.4 VEHICLE ACCESS MANAGEMENT PLAN

As noted in Section 5.3 and depicted in Figure 5.5 preceding, in the event that a 26.0m B-Double were to turn right from Bowers Road onto the Hume Freeway, it is likely that when propping in the central median, its rear trailer would extend across the eastbound carriageway, potentially impeding traffic movements and acting as a hazard.

Subsequently, it is proposed that as part of the operation of the sight, a vehicle access management plan will be required to be utilised in order to outline the direction of travel that specific vehicles must use when accessing the site.

This plan would stipulate that when departing the site, any vehicle larger than a 19.0m semi-trailer would be required to turn left from Bowers Road onto the Hume Freeway and utilise the existing Winton-Glenrowan Road interchange approximately 8km to the east in order to turn around and head back towards Melbourne. By requiring all vehicles of this size to undertake this movement on departure from the site, it is anticipated that the potential vehicle encroachment/impediment along the eastbound Hume Freeway carriageway should be mitigated.

6 TRAFFIC IMPACTS

With respect to the preceding traffic generation analysis, it is noted that the construction period presents as the critical period for traffic generation by the subject site. Subsequently, the assessment of traffic impacts as posed by the site has been undertaken with respect to this period.

6.1 OVERALL ROAD NETWORK

DoT traffic volume data for the Hume Freeway within proximity of the site indicates that on average it currently accommodates in the order of 16,000 two-way daily vehicle movements, with these movements generally evenly split in both directions (8,000 per direction). This is further supported by the sourced traffic volume data for the intersection of Bowers Road and the Hume Freeway which indicates average volumes of between 15,000 and 20,000 vehicles per day. This is representative of a 25% variability in daily traffic volumes.

The estimated generation of 230 daily vehicle movement during peak site construction therefore only equates to a 1% - 2% change in daily vehicle movements against existing conditions. Subsequently, the anticipated increase in traffic movements, as generated through the construction of the proposed energy hub, are considered to be minimal with respect to existing traffic volumes along the Hume Freeway and well within the daily variations that would typically be experienced. Site construction traffic volumes are therefore expected to be adequately accommodated within the existing road network and are anticipated to have negligible impact on existing network conditions.

6.2 BOWERS ROAD / HUME FREEWAY INTERSECTION VOLUMES

Based on the existing traffic volumes that have been noted in Section 2.3 and the estimated site generated traffic volumes and distributions as per Section 4.2, Figure 6.1 below has been prepared to show the anticipated traffic volumes that may be experienced at the Bowers Road/Hume Freeway intersection during the peak construction period.

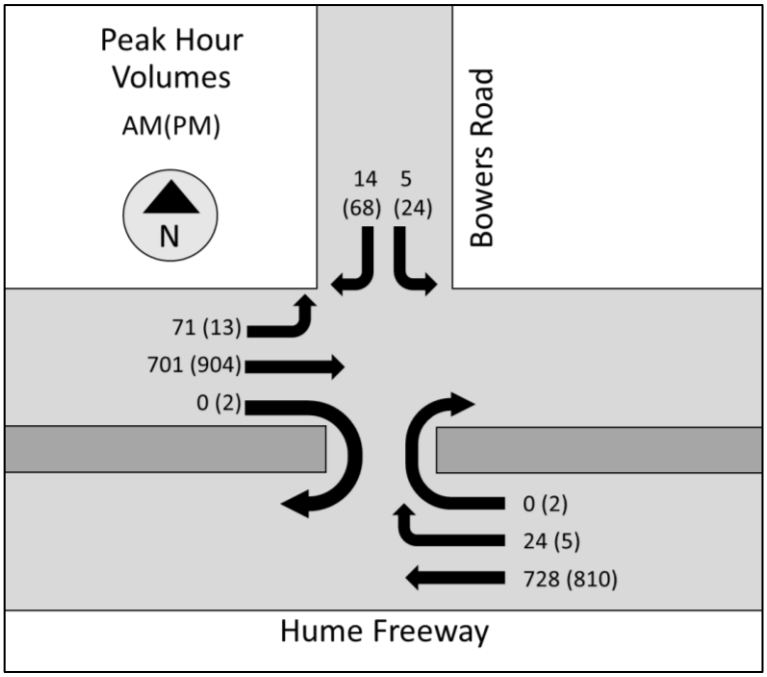


Figure 6.1 Construction Peak Hour Bowers Road Traffic Volumes

6.3 SIDRA ANALYSIS

SIDRA Intersection is a computer package developed to assess the operating characteristics of an intersection including Degree of Saturation, Average Delay and 95%ile queue.

Degree of Saturation (DoS) is the ratio of traffic undertaking a particular movement within the intersection compared to the maximum capacity calculated for that movement. The level of service of various DoS ranges are described as:

- Up to 0.6 Excellent
- 0.6 to 0.7 Very Good
- 0.7 to 0.8 Good
- 0.8 to 0.9 Fair
- 0.9 to 1.0 Poor
- 1.0+ Very Poor

A DoS of 0.80 – 0.085 is generally considered acceptable to an unsignalized intersection such as provided at the intersection of Bowers Road and the Hume Freeway.

Average Delay is the delay, in seconds, which can be expected over all the vehicles making a particular movement in the intersection during the peak hour.

The **95%ile Queue** represents the maximum queue length, in metres, expected in 95% of the calculated queue events during the peak hour.

As noted prior, during peak construction periods for the development, it is anticipated that in the order of 230 daily vehicle movements may be generated by the site, with approximately 100 -110 of these movements occurring in each of the AM and PM peak periods.

SIDRA analysis has subsequently been undertaken on the intersection of Bowers Road and the Hume Freeway for both existing and peak construction traffic conditions in order to ascertain any potential impact that the anticipated traffic may have on the operations of the intersection and surrounding road network.

This analysis and the subsequent outcomes are presented as follows:

6.3.1 EXISTING CONDITIONS ANALYSIS

In order to generate a baseline for assessment, SIDRA analysis has been undertaken on the existing operation of the Whitehorse Road and Walkers Road intersection based on the above collected traffic volume data. Analysis has been conducted for both the AM and PM traffic volumes as presented within Section 2.3.1.

The detailed outputs of this assessment are included within Appendix C to this report with a summary of the outputs presented within Table 6.1 and Table 6.2 following.

Table 6.1 Key SIDRA Outputs – Existing AM Conditions

APPROACH	MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC)	95TH PERCENTILE QUEUE (M)
West (Hume Freeway Eastbound)	Left	0.04	5.5	0
	Through	0.17	0	0
North (Bowers Road Southbound)	Left	0.007	5.7	0.1
	Right	0.007	9.2	0.1
East (Hume Freeway Westbound)	Through	0.196	0.1	0
	Right	0.004	8.8	0
Critical Intersection Outputs		**0.196**	**9.2**	**0.1**

Table 6.2 Key SIDRA Outputs – Existing PM Conditions

APPROACH	MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC)	95TH PERCENTILE QUEUE (M)
West (Hume Freeway Eastbound)	Left	0.04	5.6	0
	Through	0.22	0.1	0
North (Bowers Road Southbound)	Left	0.003	5.8	0
	Right	0.003	11.8	0
East (Hume Freeway Westbound)	Through	0.219	0.1	0
	Right	0.012	12.6	0.1
Critical Intersection Outputs		**0.219**	**12.6**	**0.1**

The above outputs show that under existing conditions for both the AM and PM peak, the intersection operates under 'excellent' conditions with negligible delays or queues for vehicles along any of the intersection legs. This is to be expected for a rural intersection like this given its apparent minimal utilisation.

6.3.2 PEAK CONSTRUCTION TRAFFIC CONDITIONS – SIDRA ANALYSIS

Based on the anticipated peak construction period traffic volumes as presented within Section 4.1.1, SIDRA analysis has been conducted to assess the potential impacts that this may have on the current operation of the Bowers Road intersection.

The detailed outputs of this assessment are included within Appendix C to this report with a summary of the outputs presented within Table 6.3 an Table 6.4 following.

Table 6.3 Key SIDRA Outputs – Peak Construction AM Conditions

APPROACH	MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC)	95TH PERCENTILE QUEUE (M)
West (Hume Freeway Eastbound)	Left	0.04	5.5	0
	Through	0.19	0	0
North (Bowers Road Southbound)	Left	0.031	5.5	0.3
	Right	0.031	9.9	0.3
East (Hume Freeway Westbound)	Through	0.196	0.1	0
	Right	0.052	9.6	0.6
Critical Intersection Outputs		**0.196**	**9.9**	**0.2**

Table 6.4 Key SIDRA Outputs – Peak Construction PM Conditions

APPROACH	MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC)	95TH PERCENTILE QUEUE (M)
West (Hume Freeway Eastbound)	Left	0.05	5.6	0
	Through	0.23	0.1	0
North (Bowers Road Southbound)	Left	0.191	5.8	2.1
	Right	0.191	13.2	2.1
East (Hume Freeway Westbound)	Through	0.219	0.1	0
	Right	0.021	14.8	0.2
Critical Intersection Outputs		**0.219**	**14.8**	**2.1**

The above outputs show that under peak construction conditions, the Bowers Road intersection will continue to operate under 'excellent' with minimal delays or queues experienced. During the PM peak, when the majority of site movements will be outbound onto the Hume Freeway, the above analysis shows that que lengths are only anticipated to be in the order of 2.1m (less than a single vehicle) and therefore will be adequately accommodated within the provided central median storage space without causing any impedance to traffic flow along the Hume Freeway.

6.3.3 COMPARISON EXISTING VS FUTURE CONDITIONS – SIDRA ANALYSIS

As a point of comparison, Table 6.5 and Table 6.6 have been prepared to show the resultant changes in key outputs between existing and peak construction conditions.

Table 6.5 Change in SIDRA Outputs – AM Conditions

APPROACH	MOVEMENT	CHANGE IN DEGREE OF SATURATION	CHANGE IN AVERAGE DELAY (SEC)	CHANGE IN 95TH PERCENTILE QUEUE (M)
West (Hume Freeway Eastbound)	Left	0.005	0.0	0.0
	Through	0.016	0.0	0.0
North (Bowers Road Southbound)	Left	0.024	-0.2	0.2
	Right	0.024	0.7	0.2
East (Hume Freeway Westbound)	Through	0.000	0.0	0.0
	Right	0.048	0.8	0.6
Critical Intersection Change		**0.048**	**0.8**	**0.6**

Table 6.6 Change in SIDRA Outputs – PM Conditions

APPROACH	MOVEMENT	CHANGE IN DEGREE OF SATURATION	CHANGE IN AVERAGE DELAY (SEC)	CHANGE IN 95TH PERCENTILE QUEUE (M)
West (Hume Freeway Eastbound)	Left	0.001	0.0	0.0
	Through	0.003	0.0	0.0
North (Bowers Road Southbound)	Left	0.188	0.0	2.1
	Right	0.188	1.4	2.1
East (Hume Freeway Westbound)	Through	0.000	0.0	0.0
	Right	0.009	2.2	0.1
Critical Intersection Change		**0.188**	**2.2**	**2.1**

Review of the above comparisons between existing and peak construction conditions show that the increase in traffic movements are not anticipated to result in any significant changes to the existing operations or functionality of the Bowers Road intersection.

Subsequently it is considered that the additional traffic as generated by the proposed development during the peak construction period will be adequately accommodated within the intersection and surrounding road network.

7 CONCLUSIONS

The proposal will see the development of an energy hub at 386 Lee Road, Winton with vehicle access facilitated via connection to Bowers Road and its existing intersection with the Hume Freeway.

A summary of the proposal and preceding assessment is provided as follows:

- Construction of the site will take 12-18 months, during which time peak construction periods of 4 – 5 months duration are anticipated to occur.
- The proposed development of the site is anticipated to generate in the order of 230 daily vehicle movements during the peak construction stage. These movements are anticipated to comprise:
  - 200 light vehicle movements (Based on 100 staff travelling to and from the site each day).
  - 30 heavy vehicle movements.
- Sight lines and turn treatment provisions at the existing Bowers Road and Hume Freeway intersection are all in accordance with the relevant design requirements and are considered appropriate to facilitate access to the proposed development.
- Swept path diagrams confirm that the Bowers Road and Hume Freeway intersection will adequately accommodate construction vehicle movements up to the size of a 19.0m semi-trailer, with larger vehicles also accommodated subject to traffic management and the potential removal of signage to allow for vehicle overhang.
- Due to their length and the need to avoid impeding traffic flows along the Hume Freeway, B-double vehicles departing the site will be required to turn left from Bowers Road and utilise the next interchange at Winton-Glenrowan Road (8km east) in order turn around and travel back to Melbourne. These movements will be controlled through the implementation of a vehicle access management plan.
- Traffic volumes as generated by the site during peak construction are anticipated to be adequately accommodated within the wider surrounding road network with minimal change to existing operations and functionality at the Bowers Road and Hume Freeway intersection.

Based on the preceding assessment, the proposed site development is considered appropriate from a traffic engineering perspective given surrounding conditions and the nature of the development.

8 LIMITATIONS

This Report is provided by WSP Australia Pty Limited (*WSP*) to Lochard Energy (*Client*) in response to specific instructions from the Client and in accordance with WSP's proposal under the Consultancy Agreement between WSP and the Client signed 10-9-2019.

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APPENDIX A

SOURCED TRAFFIC VOLUME DATA

A1 SATURDAY 29/07/17

TIME			ROAD								TOTAL
			Hume Freeway (Eastbound)			Bowers Road (Southbound)		Hume Freeway (Westbound)			
			Left	Thru	U-turn	Left	Right	U-turn	Right	Thru	
Daily			22	6503	8	6	17	3	4	6491	13054
AM	10:15	11:15	2	544	2	0	0	1	0	574	1123
PM	12:00	13:00	1	608	1	1	1	0	0	487	1099

Source: *http://www.benalla.vic.gov.au/files/assets/public/all-pdfs/vicroads-statistics-for-bowers-road.pdf*

A2 SUNDAY 30/07/17

TIME			ROAD								TOTAL
			Hume Freeway (Eastbound)			Bowers Road (Southbound)		Hume Freeway (Westbound)			
			Left	Thru	U-turn	Left	Right	U-turn	Right	Thru	
Daily			20	7320	5	2	8	2	2	8622	15981
AM	11:00	12:00	1	616	0	0	4	0	0	575	1196
PM	15:15	16:15	0	667	0	0	1	0	0	986	1654

Source: *http://www.benalla.vic.gov.au/files/assets/public/all-pdfs/vicroads-statistics-for-bowers-road.pdf*

A3 MONDAY 31/07/17

TIME			ROAD								TOTAL
			Hume Freeway (Eastbound)			Bowers Road (Southbound)		Hume Freeway (Westbound)			
			Left	Thru	U-turn	Left	Right	U-turn	Right	Thru	
Daily			18	7498	4	4	15	2	3	6889	18
AM	10:45	11:45	0	510	0	1	1	0	0	467	979
PM	14:15	15:15	3	606	0	0	0	0	1	553	1163

Source: *http://www.benalla.vic.gov.au/files/assets/public/all-pdfs/vicroads-statistics-for-bowers-road.pdf*

A4 TUESDAY 01/08/17

TIME			ROAD								TOTAL
			Hume Freeway (Eastbound)			Bowers Road (Southbound)		Hume Freeway (Westbound)			
			Left	Thru	U-turn	Left	Right	U-turn	Right	Thru	
Daily			17	6851	10	3	16	3	2	6873	13775
AM	11:00	12:00	0	446	0	0	2	0	0	456	904
PM	15:00	16:00	2	535	0	0	0	0	1	536	1074

Source: *http://www.benalla.vic.gov.au/files/assets/public/all-pdfs/vicroads-statistics-for-bowers-road.pdf*

A5 WEDNESDAY 02/08/17

TIME			ROAD								TOTAL
			Hume Freeway (Eastbound)			Bowers Road (Southbound)		Hume Freeway (Westbound)			
			Left	Thru	U-turn	Left	Right	U-turn	Right	Thru	
Daily			18	6961	9	2	15	1	3	6941	13950
AM	7:45	8:45	1	428	0	0	1	0	1	471	902
PM	15:00	16:00	2	558	1	0	2	0	0	472	1035

Source: *http://www.benalla.vic.gov.au/files/assets/public/all-pdfs/vicroads-statistics-for-bowers-road.pdf*

A6 THURSDAY 03/08/17

TIME			ROAD								TOTAL
			Hume Freeway (Eastbound)			Bowers Road (Southbound)		Hume Freeway (Westbound)			
			Left	Thru	U-turn	Left	Right	U-turn	Right	Thru	
Daily			14	7771	10	5	8	1	5	7613	15427
AM	11:00	12:00	0	465	1	0	0	0	2	520	988
PM	16:00	17:00	1	617	0	0	2	0	1	556	1177

Source: *http://www.benalla.vic.gov.au/files/assets/public/all-pdfs/vicroads-statistics-for-bowers-road.pdf*

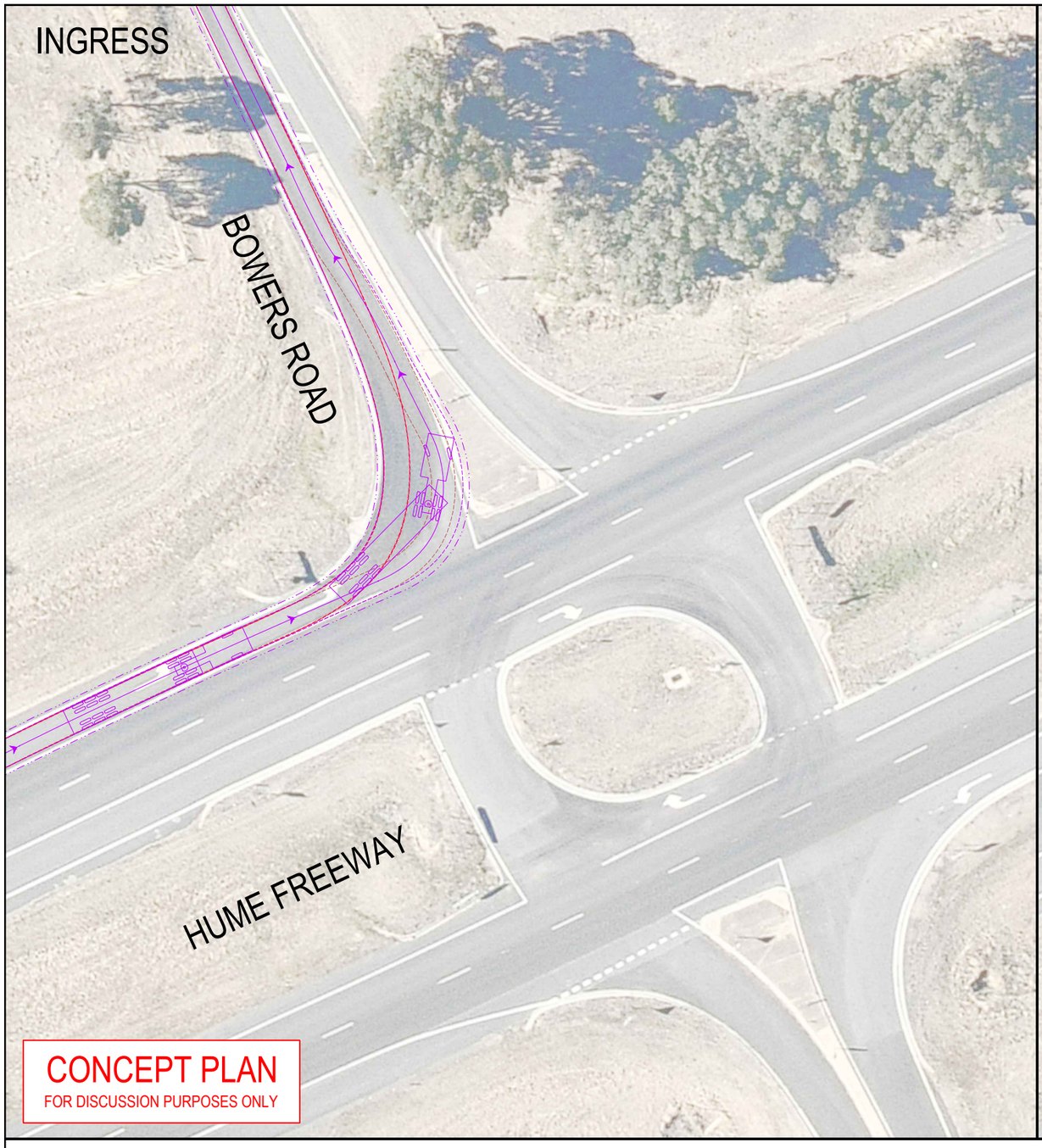
A7 FRIDAY 04/08/17

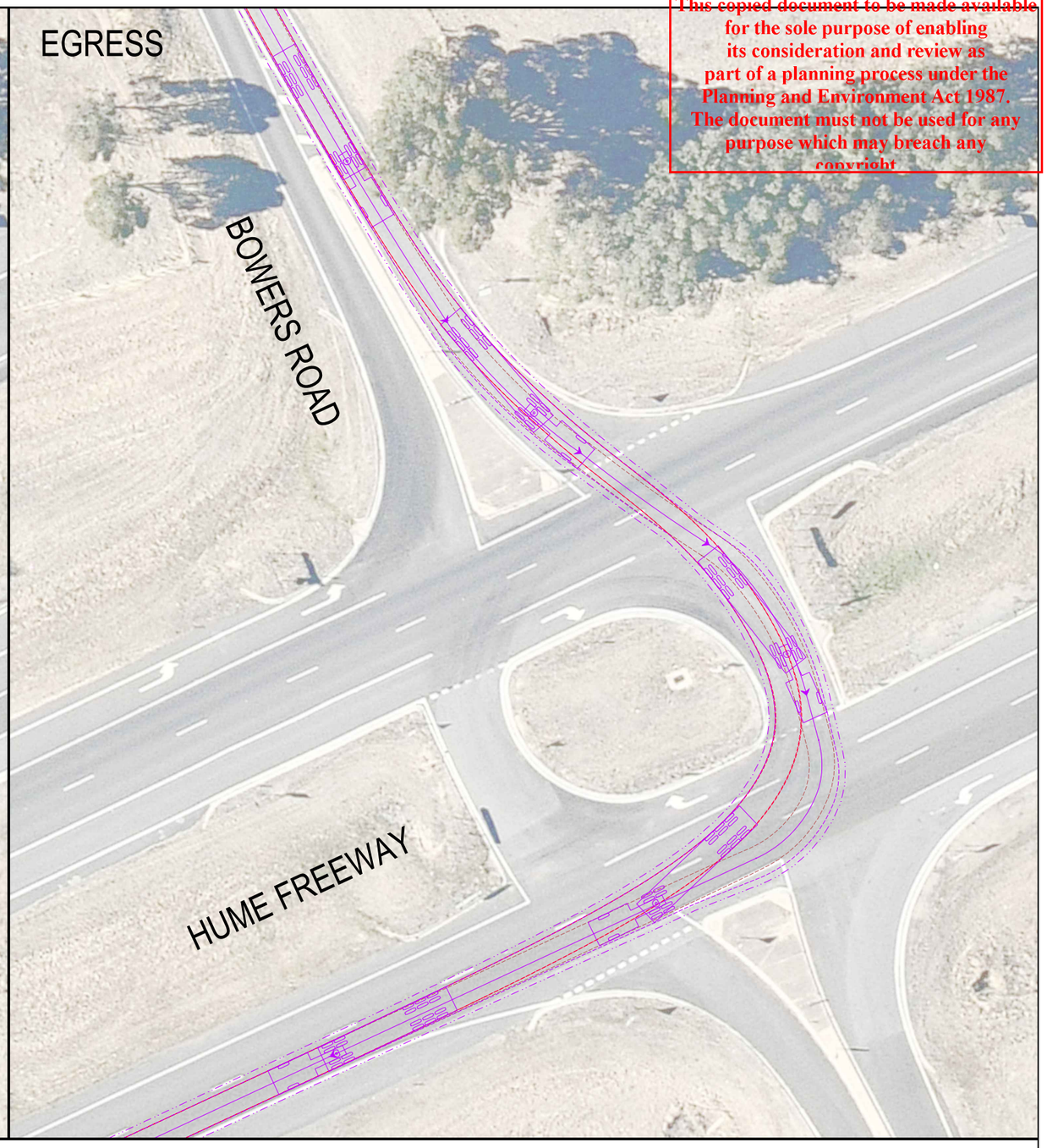
TIME			ROAD								TOTAL
			Hume Freeway (Eastbound)			**Bowers Road (Southbound)**		**Hume Freeway (Westbound)**			
			Left	Thru	U-turn	Left	Right	U-turn	Right	Thru	
Daily			21	10384	8	3	13	3	4	8956	19392
AM	11:00	12:00	2	622	0	1	2	0	0	646	1273
PM	16:00	17:00	1	803	1	0	0	1	1	719	1526

Source: *http://www.benalla.vic.gov.au/files/assets/public/all-pdfs/vicroads-statistics-for-bowers-road.pdf*

APPENDIX B

SWEPT PATH DIAGRAMS



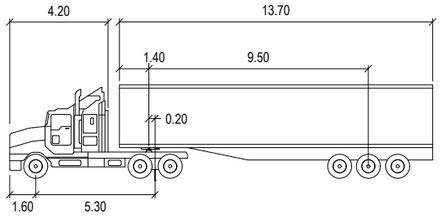


CONCEPT PLAN
FOR DISCUSSION PURPOSES ONLY

VEHICLE LEGEND

- 19m SEMI 600mm CLEARANCE
- 19m SEMI OVERHANG
- 19m SEMI FRONT WHEEL LINE
- 19m SEMI REAR WHEEL LINE
- 19m SEMI CENTRELINE

AUSTROADS 19m SEMI



19.0m SEMI-TRAILER
meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 27.7
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

ADVERTISED PLAN

PS125526 SK001

19.0m SEMI-TRAILER
BOWERS ROAD INGRESS / EGRESS
MANOEUVRE
C.H. 19.08.2021

0 10 20m
SCALE 1:500 @A3

wsp

NORTH

GENERAL NOTE: DIAGRAMS HAVE BEEN PREPARED ON AERIAL IMAGE ONLY. FURTHER SITE INVESTIGATIONS OR FEATURE SURVEY MAY BE REQUIRED TO CONFIRM VEHICLE ACCESSIBILITY AND ANY IMPACTS THAT MAY BE EXPERIENCED ON THE EXISTING CARRIAGEWAY CONFIGURATION.

INGRESS

EGRESS

BOWERS ROAD

BOWERS ROAD

MINOR OVERHANG OF VEHICLE LOAD OVER ISLAND. MAY REQUIRE REMOVAL OF SOME SIGNAGE.

HUME FREEWAY

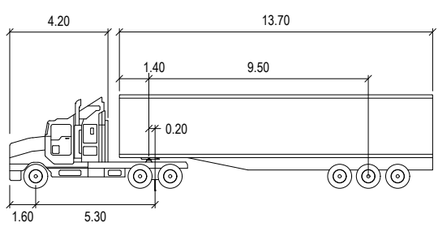
HUME FREEWAY

CONCEPT PLAN
FOR DISCUSSION PURPOSES ONLY

VEHICLE LEGEND

- 4.0m WIDE 19m SEMI 600mm CLEARANCE
- 4.0m WIDE 19m SEMI OVERHANG
- 4.0m WIDE 19m SEMI FRONT WHEEL LINE
- 4.0m WIDE 19m SEMI REAR WHEEL LINE
- 4.0m WIDE 19m SEMI CENTRELINE

4.0m WIDE 19m SEMI



19.0m SEMI-TRAILER + 4.0m WIDE LOAD
meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 4.00	Steering Angle	: 27.7
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

ADVERTISED PLAN

PS125526 SK002

19.0m SEMI-TRAILER + 4.0m WIDE LOAD
BOWERS ROAD INGRESS / EGRESS
MANOEUVRE
C.H. 19.08.2021

0 10 20m

SCALE 1:500 @A3

NORTH

GENERAL NOTE: DIAGRAMS HAVE BEEN PREPARED ON AERIAL IMAGE ONLY. FURTHER SITE INVESTIGATIONS OR FEATURE SURVEY MAY BE REQUIRED TO CONFIRM VEHICLE ACCESSIBILITY AND ANY IMPACTS THAT MAY BE EXPERIENCED ON THE EXISTING CARRIAGEWAY CONFIGURATION.

INGRESS

EGRESS

BOWERS ROAD

BOWERS ROAD

OVERHANG OF VEHICLE LOAD OVER ISLAND. MAY REQUIRE REMOVAL OF SOME SIGNAGE.

REAR TRAILER EXTENDS ACROSS TRAFFIC LANE WHEN STAGING IN CENTRAL MEDIAN AND MAY IMPEDE TRAFFIC MOVEMENTS.

HUME FREEWAY

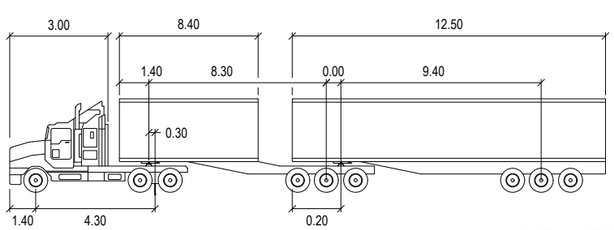
HUME FREEWAY

CONCEPT PLAN
FOR DISCUSSION PURPOSES ONLY

VEHICLE LEGEND

- 26m BDOUBLE 600mm CLEARANCE
- 26m BDOUBLE OVERHANG
- 26m BDOUBLE FRONT WHEEL LINE
- 26m BDOUBLE REAR WHEEL LINE
- 26m BDOUBLE CENTRELINE

AUSTROADS 26m BDOUBLE



B-DOUBLE 26M

	meters		
Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 22.2
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

ADVERTISED PLAN

PS125526 SK003

26.0m B-DOUBLE
BOWERS ROAD INGRESS / EGRESS
MANOEUVRE
C.H. 19.08.2021

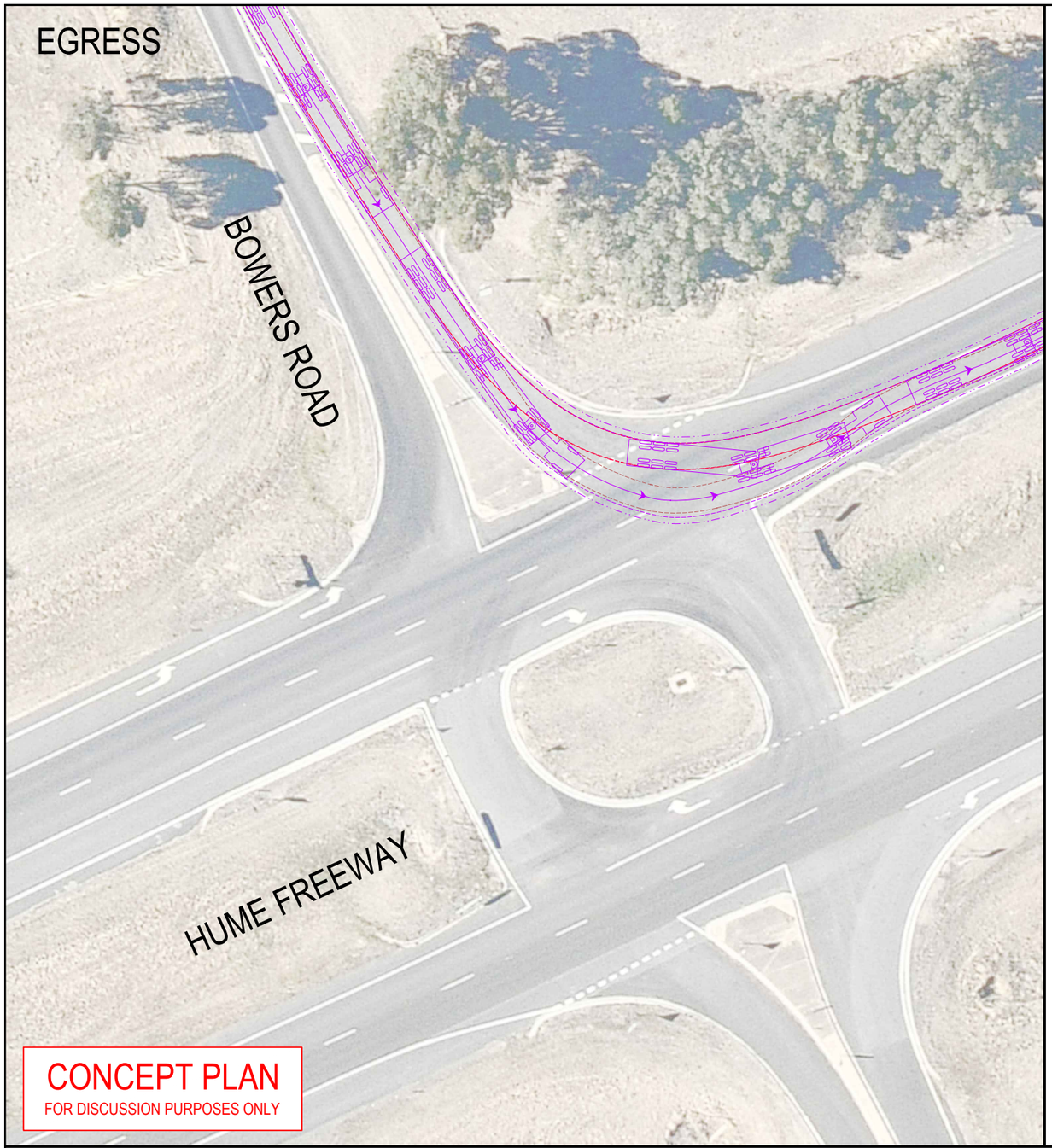
0 10 20m

SCALE 1:500 @A3

wsp

NORTH

GENERAL NOTE: DIAGRAMS HAVE BEEN PREPARED ON AERIAL IMAGE ONLY. FURTHER SITE INVESTIGATIONS OR FEATURE SURVEY MAY BE REQUIRED TO CONFIRM VEHICLE ACCESSIBILITY AND ANY IMPACTS THAT MAY BE EXPERIENCED ON THE EXISTING CARRIAGEWAY CONFIGURATION.

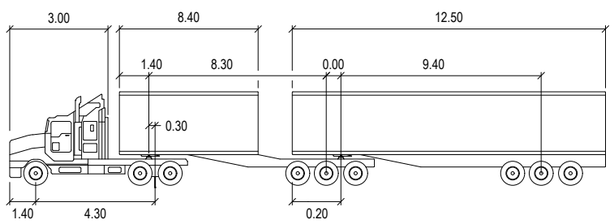


CONCEPT PLAN
FOR DISCUSSION PURPOSES ONLY

VEHICLE LEGEND

- 26m BDOUBLE 600mm CLEARANCE
- 26m BDOUBLE OVERHANG
- 26m BDOUBLE FRONT WHEEL LINE
- 26m BDOUBLE REAR WHEEL LINE
- 26m BDOUBLE CENTRELINE

AUSTROADS 26m BDOUBLE



B-DOUBLE 26M

meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 22.2
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

PS125526 SK004

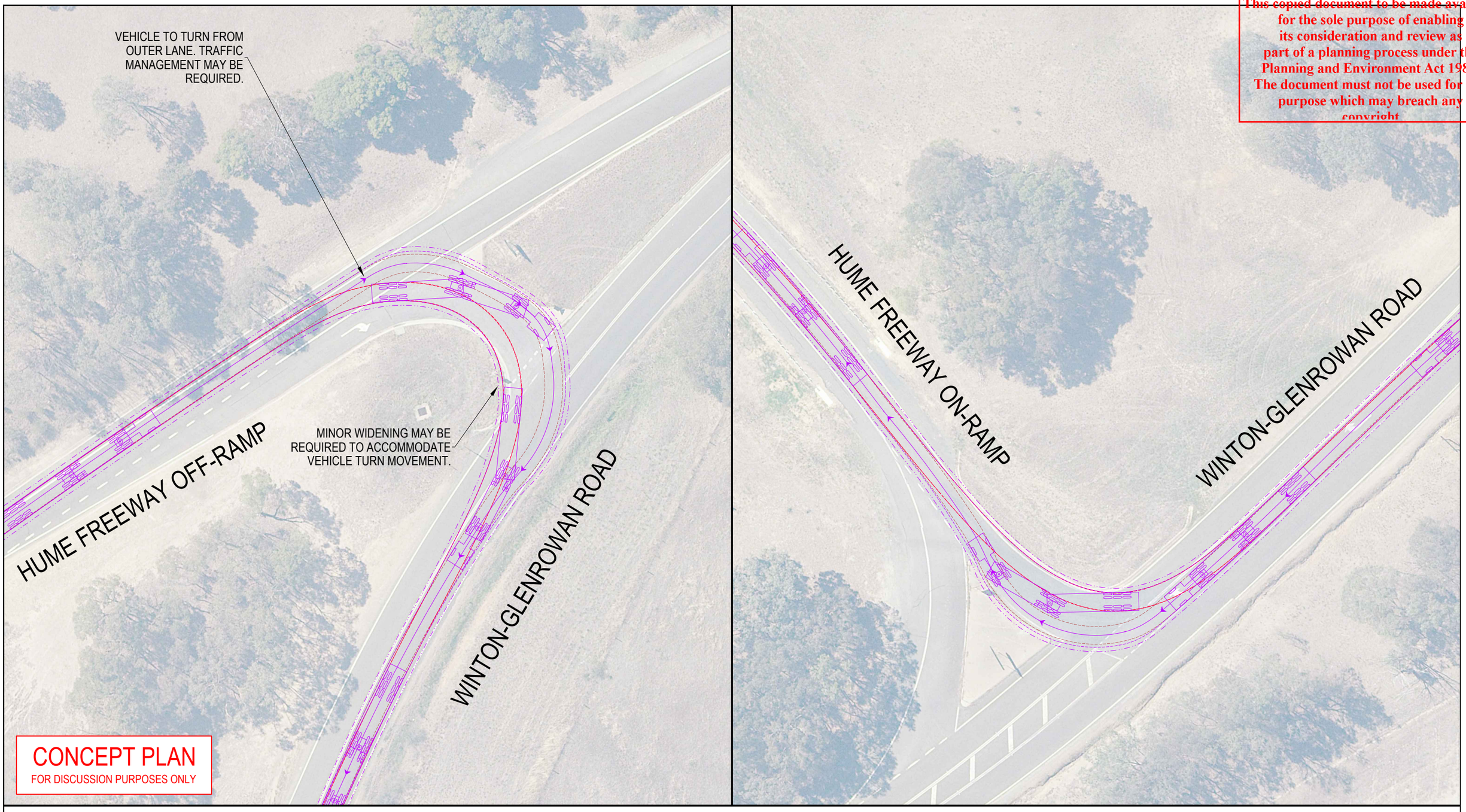
26.0m B-DOUBLE
BOWERS ROAD LEFT TURN EGRESS
MANOEUVRE
C.H. 19.08.2021

0 10 20m

SCALE 1:500 @A3

NORTH

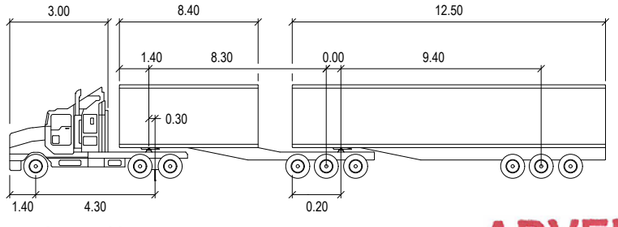
GENERAL NOTE: DIAGRAMS HAVE BEEN PREPARED ON AERIAL IMAGE ONLY. FURTHER SITE INVESTIGATIONS OR FEATURE SURVEY MAY BE REQUIRED TO CONFIRM VEHICLE ACCESSIBILITY AND ANY IMPACTS THAT MAY BE EXPERIENCED ON THE EXISTING CARRIAGEWAY CONFIGURATION.



VEHICLE LEGEND

- 26m BDOUBLE 600mm CLEARANCE
- 26m BDOUBLE OVERHANG
- 26m BDOUBLE FRONT WHEEL LINE
- 26m BDOUBLE REAR WHEEL LINE
- 26m BDOUBLE CENTRELINE

AUSTROADS 26m BDOUBLE



B-DOUBLE 26M

meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 22.2
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

ADVERTISED PLAN

PS125526 SK005

26.0m B-DOUBLE

HUME FREEWAY / WINTON GLENROWAN ROAD

U-TURN MANOEUVRE

C.H. 25.08.2021

0 10 20m

SCALE 1:500 @A3

NORTH

GENERAL NOTE: DIAGRAMS HAVE BEEN PREPARED ON AERIAL IMAGE ONLY. FURTHER SITE INVESTIGATIONS OR FEATURE SURVEY MAY BE REQUIRED TO CONFIRM VEHICLE ACCESSIBILITY AND ANY IMPACTS THAT MAY BE EXPERIENCED ON THE EXISTING CARRIAGEWAY CONFIGURATION.

APPENDIX C

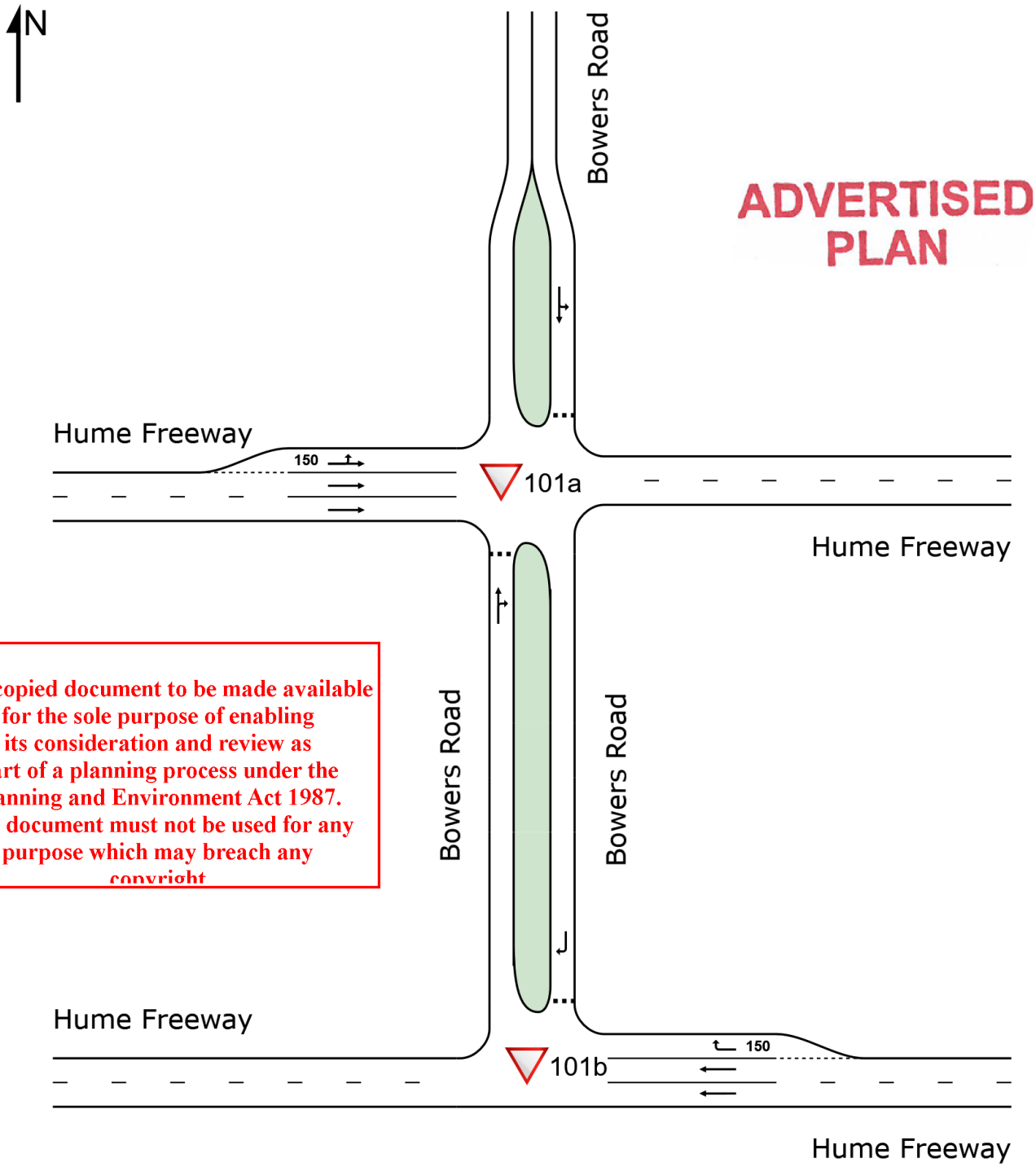
SIDRA OUTPUTS

NETWORK LAYOUT

Network: N101 [Bowers Road and Hume Freeway (Network Folder: General)]

New Network
Network Category: (None)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



SITES IN NETWORK		
Site ID	**CCG ID**	**Site Name**
▽101a	NA	Eastbound Hume Freeway Section
▽101b	NA	Westbound Hume Freeway Section

MOVEMENT SUMMARY

Site: 101a [Existing Conditions - AM Peak - Bowers/Hume - Eastbound (Site Folder: Existing Conditions - AM Peak - Bowers/Hume)]

Network: N102 [Existing Conditions - AM Peak - Bowers/Hume (Network Folder: General)]

Intersection of Bowers Road and Hume Freeway
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bowers Road														
2	T1	1	0.0	1	0.0	0.004	6.7	LOS A	0.0	0.0	0.61	0.64	0.61	46.8
3	R2	1	0.0	1	0.0	0.004	8.8	LOS A	0.0	0.0	0.61	0.64	0.61	45.4
Approach		2	0.0	2	0.0	0.004	7.8	LOS A	0.0	0.0	0.61	0.64	0.61	46.1
North: Bowers Road														
7	L2	2	0.0	2	0.0	0.007	5.7	LOS A	0.0	0.1	0.23	0.54	0.23	51.9
8	T1	3	0.0	3	0.0	0.007	9.2	LOS A	0.0	0.1	0.23	0.54	0.23	47.9
Approach		5	0.0	5	0.0	0.007	7.8	LOS A	0.0	0.1	0.23	0.54	0.23	50.1
West: Hume Freeway														
10	L2	3	0.0	3	0.0	0.035	5.5	LOS A	0.0	0.0	0.00	0.03	0.00	58.1
11	T1	738	0.0	738	0.0	0.173	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		741	0.0	741	0.0	0.173	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles		748	0.0	748	0.0	0.173	0.1	NA	0.0	0.1	0.00	0.01	0.00	59.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 101b [Existing Conditions - AM Peak - Bowers/Hume - Westbound (Site Folder: Existing Conditions - AM Peak - Bowers/Hume)]

Network: N102 [Existing Conditions - AM Peak - Bowers/Hume (Network Folder: General)]

Intersection of Bowers Road and Hume Freeway
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hume Freeway														
5	T1	766	0.0	766	0.0	0.196	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
6	R2	1	0.0	1	0.0	0.001	5.7	LOS A	0.0	0.0	0.00	0.63	0.00	50.6
Approach		767	0.0	767	0.0	0.196	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
North: Bowers Road														
9	R2	3	0.0	3	0.0	0.006	7.4	LOS A	0.0	0.1	0.59	0.67	0.59	45.7
Approach		3	0.0	3	0.0	0.006	7.4	LOS A	0.0	0.1	0.59	0.67	0.59	45.7
All Vehicles		771	0.0	771	0.0	0.196	0.1	NA	0.0	0.1	0.00	0.00	0.00	59.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 101a [Existing Conditions - PM Peak - Bowers/Hume - Eastbound (Site Folder: Existing Conditions - PM Peak - Bowers/Hume)]

Network: N101 [Existing Conditions - PM Peak - Bowers/Hume (Network Folder: General)]

Intersection of Bowers Road and Hume Freeway
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bowers Road														
2	T1	2	0.0	2	0.0	0.012	9.5	LOS A	0.0	0.1	0.72	0.77	0.72	43.3
3	R2	2	0.0	2	0.0	0.012	12.6	LOS B	0.0	0.1	0.72	0.77	0.72	42.1
Approach		4	0.0	4	0.0	0.012	11.0	LOS B	0.0	0.1	0.72	0.77	0.72	42.7
North: Bowers Road														
7	L2	1	0.0	1	0.0	0.003	5.8	LOS A	0.0	0.0	0.27	0.54	0.27	51.2
8	T1	1	0.0	1	0.0	0.003	11.8	LOS B	0.0	0.0	0.27	0.54	0.27	46.7
Approach		2	0.0	2	0.0	0.003	8.8	LOS A	0.0	0.0	0.27	0.54	0.27	49.6
West: Hume Freeway														
10	L2	2	0.0	2	0.0	0.044	5.6	LOS A	0.0	0.0	0.00	0.01	0.00	58.2
11	T1	952	0.0	952	0.0	0.222	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		954	0.0	954	0.0	0.222	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles		960	0.0	960	0.0	0.222	0.1	NA	0.0	0.1	0.00	0.01	0.00	59.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 101b [Existing Conditions - PM Peak - Bowers/Hume - Westbound (Site Folder: Existing Conditions - PM Peak - Bowers/Hume)]

Network: N101 [Existing Conditions - PM Peak - Bowers/Hume (Network Folder: General)]

Intersection of Bowers Road and Hume Freeway
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hume Freeway														
5	T1	853	0.0	853	0.0	0.219	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
6	R2	4	0.0	4	0.0	0.002	5.7	LOS A	0.0	0.0	0.00	0.63	0.00	50.5
Approach		857	0.0	857	0.0	0.219	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
North: Bowers Road														
9	R2	1	0.0	1	0.0	0.002	8.3	LOS A	0.0	0.0	0.64	0.65	0.64	44.7
Approach		1	0.0	1	0.0	0.002	8.3	LOS A	0.0	0.0	0.64	0.65	0.64	44.7
All Vehicles		858	0.0	858	0.0	0.219	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 101a [Future Conditions - AM Peak - Bowers/Hume - Eastbound (Site Folder: Future Conditions - AM Peak - Bowers/Hume)]

Network: N101 [Future Conditions - AM Peak - Bowers/Hume (Network Folder: General)]

Intersection of Bowers Road and Hume Freeway
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bowers Road														
2	T1	25	0.0	25	0.0	0.052	7.9	LOS A	0.1	0.6	0.64	0.76	0.64	46.6
3	R2	1	0.0	1	0.0	0.052	9.6	LOS A	0.1	0.6	0.64	0.76	0.64	45.2
Approach		26	0.0	26	0.0	0.052	8.0	LOS A	0.1	0.6	0.64	0.76	0.64	46.5
North: Bowers Road														
7	L2	5	0.0	5	0.0	0.031	5.5	LOS A	0.0	0.3	0.00	0.53	0.00	51.2
8	T1	15	0.0	15	0.0	0.031	9.9	LOS A	0.0	0.3	0.00	0.53	0.00	46.8
Approach		20	0.0	20	0.0	0.031	8.7	LOS A	0.0	0.3	0.00	0.53	0.00	48.5
West: Hume Freeway														
10	L2	75	0.0	75	0.0	0.040	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	53.6
11	T1	738	0.0	738	0.0	0.189	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		813	0.0	813	0.0	0.189	0.6	NA	0.0	0.0	0.00	0.05	0.00	59.3
All Vehicles		859	0.0	859	0.0	0.189	1.0	NA	0.1	0.6	0.02	0.09	0.02	58.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 101b [Future Conditions - AM Peak - Bowers/Hume - Westbound (Site Folder: Future Conditions - AM Peak - Bowers/Hume)]

Network: N101 [Future Conditions - AM Peak - Bowers/Hume (Network Folder: General)]

Intersection of Bowers Road and Hume Freeway
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hume Freeway														
5	T1	766	0.0	766	0.0	0.196	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
6	R2	1	0.0	1	0.0	0.001	5.7	LOS A	0.0	0.0	0.00	0.63	0.00	50.6
Approach		767	0.0	767	0.0	0.196	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
North: Bowers Road														
9	R2	15	0.0	15	0.0	0.027	7.6	LOS A	0.0	0.3	0.59	0.75	0.59	45.5
Approach		15	0.0	15	0.0	0.027	7.6	LOS A	0.0	0.3	0.59	0.75	0.59	45.5
All Vehicles		782	0.0	782	0.0	0.196	0.2	NA	0.0	0.3	0.01	0.01	0.01	59.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101a [Future Conditions - PM Peak - Bowers/Hume - Eastbound (Site Folder: Future Conditions - PM Peak - Bowers/Hume)]

Network: N101 [Future Conditions - PM Peak - Bowers/Hume (Network Folder: General)]

Intersection of Bowers Road and Hume Freeway
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bowers Road														
2	T1	5	0.0	5	0.0	0.021	9.8	LOS A	0.0	0.2	0.73	0.81	0.73	43.2
3	R2	2	0.0	2	0.0	0.021	14.8	LOS B	0.0	0.2	0.73	0.81	0.73	42.0
Approach		7	0.0	7	0.0	0.021	11.2	LOS B	0.0	0.2	0.73	0.81	0.73	42.8
North: Bowers Road														
7	L2	25	0.0	25	0.0	0.191	5.8	LOS A	0.3	2.1	0.39	0.65	0.39	49.5
8	T1	72	0.0	72	0.0	0.191	13.2	LOS B	0.3	2.1	0.39	0.65	0.39	44.0
Approach		97	0.0	97	0.0	0.191	11.2	LOS B	0.3	2.1	0.39	0.65	0.39	46.1
West: Hume Freeway														
10	L2	14	0.0	14	0.0	0.045	5.6	LOS A	0.0	0.0	0.00	0.09	0.00	57.5
11	T1	952	0.0	952	0.0	0.225	0.1	LOS A	0.0	0.0	0.00	0.01	0.00	59.8
Approach		965	0.0	965	0.0	0.225	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles		1069	0.0	1069	0.0	0.225	1.2	NA	0.3	2.1	0.04	0.07	0.04	58.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 101b [Future Conditions - PM Peak - Bowers/Hume - Westbound (Site Folder: Future Conditions - PM Peak - Bowers/Hume)]

Network: N101 [Future Conditions - PM Peak - Bowers/Hume (Network Folder: General)]

Intersection of Bowers Road and Hume Freeway
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Hume Freeway														
5	T1	853	0.0	853	0.0	0.219	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
6	R2	7	0.0	7	0.0	0.004	5.7	LOS A	0.0	0.0	0.00	0.63	0.00	50.5
Approach		860	0.0	860	0.0	0.219	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
North: Bowers Road														
9	R2	72	0.0	72	0.0	0.148	9.2	LOS A	0.2	1.5	0.67	0.86	0.67	43.9
Approach		72	0.0	72	0.0	0.148	9.2	LOS A	0.2	1.5	0.67	0.86	0.67	43.9
All Vehicles		932	0.0	932	0.0	0.219	0.8	NA	0.2	1.5	0.05	0.07	0.05	58.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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