



Denman Road Solar Park

Traffic Impact Assessment

ASLAT Consulting

18 March 2020



Gold Coast

Suite 26, 58 Riverwalk Avenue
Robina QLD 4226
P: (07) 5562 5377

Brisbane

Level 2, 428 Upper Edward Street
Spring Hill QLD 4000
P: (07) 3831 4442

Sydney

Studio 203, 3 Gladstone Street
Newtown NSW 2042
P: (02) 9557 6202

W: www.bitziosconsulting.com.au

E: admin@bitziosconsulting.com.au

Copyright in the information and data in this document is the property of Bitzios Consulting. This document and its information and data is for the use of the authorised recipient and this document may not be used, copied or reproduced in whole or in part for any purpose other than for which it was supplied by Bitzios Consulting. Bitzios Consulting makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or its information and data.

Document Issue History

Report File Name	Prepared	Reviewed	Issued	Date	Issued to
P4480.001R Denman Road Solar Park TIA	B. James J. Imai	S. Brooke	B. James	18/03/2020	Ian Reed < ian.reed@aslat.com.au >

CONTENTS

	Page
1. INTRODUCTION	1
1.1 Background	1
1.2 Scope	1
2. PROPOSED DEVELOPMENT	2
2.1 Development Details	2
2.2 Operational Traffic	2
2.3 Construction Traffic	2
3. EXISTING CONDITIONS	3
3.1 Road network	3
3.2 Traffic Volumes	3
3.2.1 Background Traffic	3
3.2.2 Background Traffic Growth	4
3.3 Pavement Conditions	4
4. TRAFFIC ASSESSMENT	6
4.1 Trip Generation	6
4.1.1 Operational Trip Breakdown	6
4.1.2 Construction Trip Breakdown	6
4.2 Trip Distribution	6
4.3 Operational Trip Distribution	6
4.4 Construction Trip Distribution	7
4.5 Traffic Impact	8
4.5.1 Operational Traffic Impact	8
4.5.2 Construction Traffic Impact	8
5. PAVEMENT ASSESSMENT	9
5.1 Road Section	9
5.2 Existing Pavement Loading	9
5.3 Development Pavement Loading Estimation	10
5.4 Operational Pavement Loading	11
5.5 Construction Pavement Loading	11
5.6 Pavement Impact and Recommendations	12
6. ACCESS ASSESSMENT	13
6.1 Sight Distance Assessment	13
6.2 Turn Warrants Assessment	13
6.3 Proposed Site Access Configuration	14
6.4 Design Vehicle Swept Paths	15
7. CONCLUSIONS AND RECOMMENDATIONS	16
7.1 Conclusions	16
7.2 Recommendations	16

Tables

Table 2.1:	Construction Generation Estimate (24 week construction period)
Table 3.1:	Surrounding Road Network
Table 4.1:	Road Network Traffic
Table 4.2:	Denman Road Survey Data
Table 4.3:	Background Traffic Growth
Table 3.2:	Denman Road Segments
Table 5.1:	Operational Trip Generation
Table 5.2:	Construction Trip Generation Summary
Table 6.1:	Denman Road AADT Heavy Vehicle Axle Configuration
Table 6.2:	Development Generated ESAs
Table 6.3:	Construction Pavement Loading
Table 6.4:	Development Pavement Impact
Table 7.1:	Turn Warrant Volumes
Table 7.2:	Rural Basic Left-Turn Treatment

Figures

Figure 1.1:	Subject Site Location
Figure 3.1:	Denman Road Segments
Figure 5.1:	Heavy Vehicle Route Options
Figure 6.1:	Denman Road assessment scope
Figure 7.1:	Sight Distance from Proposed Access (Left: East. Right: West)
Figure 7.2:	Major Road Turn Treatment Warrant $\geq 100\text{km/h}$
Figure 7.3:	Rural BAL Treatment (Austroads Guide to Road Design)

Appendices

Appendix A:	Proposed Development Plan
Appendix B:	Proposed Construction Traffic Details
Appendix C:	Traffic Survey Data
Appendix D:	Access Swept Path Diagram

1. INTRODUCTION

1.1 Background

Bitzios Consulting has been engaged by ASLAT Consulting on behalf of DPI Australia to undertake a traffic and pavement impact assessment for a proposed 30MW Solar Park located at Lot 400 on DP791860, Denman Road, Muswellbrook. The proposed development site is located within the Muswellbrook Shire Council Region (Council). Development plans are located at **Appendix A**.

The subject site is shown in Figure 1.1.



Source: Google Maps

Figure 1.1: Subject Site Location

1.2 Scope

The scope of the assessment is detailed below:

- Assessment of the proposed development's traffic impacts on the surrounding road network
- Assessment of the proposed development's pavement impacts
- Assessment of development access including:
 - Sight distance review
 - Turn warrants assessment

2. PROPOSED DEVELOPMENT

2.1 Development Details

The proposed development consists of a 30MW Solar Park on a greenfield site located at Lot 400 on DP791860 on Denman Road, Muswellbrook.

Construction for the solar park is expected to occur over 24 weeks in three (3) eight (8) week phases, with each week running Monday through Saturday for the duration of construction. It is expected that equipment (e.g. frames, solar panels) will be transported to site from the Port of Newcastle and assembled on site.

2.2 Operational Traffic

It is understood that the solar park will be operated by two (2) full time employees, performing routine maintenance and servicing. It has been conservatively assumed that maintenance would take place twice a month from employees living in Denman or Muswellbrook.

2.3 Construction Traffic

Development construction will be undertaken over 24 weeks in three (3) phases.

- **Phase 1** (8 weeks) – initial works on mounting frames and access tracks
- **Phase 2** (8weeks) – excavation and construction including cabling and PV module delivery
- **Phase 3** (8 weeks) – delivery and installation of inverter substations

It is understood that each construction phase will generate in the order of 30 construction worker trips. Worker trips are expected to arrive in the AM hour period and depart in the PM peak hour period.

Table 2.1 summarises the anticipated number of vehicles per construction phase. A table of construction vehicle and material details by phase is provided at **Appendix B**.

Table 2.1: Construction Generation Estimate (24 week construction period)

Item	First Phase		Second phase		Third Phase	
	Project construction	Average per day	Project construction	Average per day	Project construction	Average per day
Heavy Vehicles	640	7	420	9	130	3
Light Vehicles	1448	30	1448	30	1448	30
Total	1768	74	1868	39	1578	33

**No construction traffic proposed on Sunday of each week*

3. EXISTING CONDITIONS

3.1 Road network

The subject site is fronted by Denman Road, a regional road (RMS) connecting Muswellbrook to Denman. The road is used by a significant proportion of mine traffic on the eastern section between the Bengalla Link Road and Muswellbrook. Other key roads surrounding the development include:

- The Golden Highway
- The New England Highway
- Thomas Mitchell Drive.

Both the Golden Highway and the New England Highway form the primary routes from Denman/Muswellbrook to the Newcastle hub and to a lesser extent Sydney.

Table 3.1 details the surrounding road network.

Table 3.1: Surrounding Road Network

Road	Speed Limit (km/h)	Hierarchy	Cross Section	Jurisdiction
Denman Road	100	Arterial road	Two lane, two way undivided	RMS
Golden Highway	100	Arterial road	Two lane, two way undivided	RMS
N-England Highway	100	Arterial road	Two lane, two way undivided	RMS
Thomas Mitchell Drive	100	Local collector / distributor	Two lane, two way undivided	Council

3.2 Traffic Volumes

3.2.1 Background Traffic

Bitzios Consulting obtained traffic data for the local road network surrounding the development site from historical traffic surveys in the region and available online survey data. Traffic data is summarised Table 3.2.

Table 3.2: Road Network Traffic

Road	Vehicles / Day (VPD)	Survey Year	Light Vehicles	Heavy Vehicles
Denman Road	2,000 – 3,000	2020	75%	25%
Golden Highway	4,000 – 5,000	2010	89%	11%
N-England Highway	10,000+	2019	80%	20%
Thomas Mitchell Drive	9,000 – 10,000	2018	93%	7%

Denman Road has the lowest average daily traffic (ADT) volume of any of the construction phase affected road networks. Due to the low volume of ADT it is anticipated that the development construction will have the highest impact on Denman Road. As such, this assessment focuses on Denman Road in regards to pavement impact (if any).

It is also of note that Thomas Mitchell Drive has been marked for future upgrades due to the mining activities and that the New England Highway and Golden Highway are considered major heavy vehicle routes under TfNSW guidelines servicing many large scale development sites in the Muswellbrook region (i.e. mines, farms, equine).

Bitzios Consulting obtained traffic data from 2013, 2018 and 2020 for the state controlled road of Denman Road. Survey data is summarised in Table 3.3 and available at **Appendix C**.

Table 3.3: Denman Road Survey Data

Surveyor	Survey Year	Average Weekday Traffic Volume	AM Peak	PM Peak	Heavy Vehicles
Data Audit Systems	2013	2446	180	211	13.9%
TPE Quality Surveys	2018	-	183	249	6.7%
Austraffic	2020	2466	206	203	24.6%

Peak volumes are based on Weekdays

3.2.2 Background Traffic Growth

Background traffic growth on Denman Road has been estimated considering the following:

- historical traffic data along Denman Road, as outlined in Table 3.3
- variations in the level of mining and industrial activity within the surrounding areas
- data from the Muswellbrook Shire Council reported a population growth of 1.9% for the years 2016-2018

As such, a 2% p.a. compounding annually was applied to the 2020 traffic counts to achieve a 10 year design horizon. Traffic volumes for the 10 year design horizon are summarised in Table 3.4.

Table 3.4: Background Traffic Growth

Year	Direction	AM Peak	PM Peak	Daily
2020	Eastbound	130	86	1218
	Westbound	89	127	1248
	Combined	219	213	2466
2% p.a. Compounding Growth				
2030	Eastbound	159	105	1485
	Westbound	109	155	1522
	Combined	267	260	3007

3.3 Pavement Conditions

Data provided by Transport for NSW (TfNSW) shows nine (9) segments of Denman Road to be utilised by the proposed developments heavy vehicle traffic. Six (6) segments are beyond the pavements design life within only minor resurfacing treatments in recent years and three (3) have been recently rehabilitated in 2015. Figure 3.1 illustrates the pavement segments between the subject site and Thomas Mitchell Drive.



Source: TfNSW

Figure 3.1: Denman Road Segments

Table 3.5 summarises the current pavement conditions for Denman Road between the subject site and Thomas Mitchell Drive.

Table 3.5: Denman Road Segments

Road Segment	Segment Length (km)	Seg. Rehab	Seg. Resurface	Comments
209040	1.280	1981	2014	Pavement beyond design life
0209050	1.720	1985	2004	Pavement beyond design life
209060	1.160	1985	2016	Pavement beyond design life
0209070	1.030	1985	2010	Pavement beyond design life
0209080	1.357	2014	2015	Pavement insitu stab heavily bound in 2015, 15 year design life remaining
0209090	1.600	2015	2016	Pavement insitu stab heavily bound in 2015, 15 year design life remaining
0209100	0.380	2015	2016	Pavement insitu stab heavily bound in 2015, 15 year design life remaining
0209110	0.670	1981	2019	Pavement beyond design life
0209120	1.080	1982	2016	Pavement beyond design life
0209130	1.380	1983	2019	Pavement beyond design life

TfNSW outlined that road sections past their design life are currently managed by patching and resealing as necessary with no indication of major rehabilitation works in the near future.

4. TRAFFIC ASSESSMENT

4.1 Trip Generation

4.1.1 Operational Trip Breakdown

Once completed, the full time maintenance staff are expected to generate in the order of 4 vehicle trips per day when conducting maintenance, with two (2) trips in the AM peak hour and two (2) trips in the PM peak hour. For the purposes of this assessment it has also been conservatively assumed that a single heavy rigid vehicle will also service the site once every six (6) months.

Table 4.1 summarised the expected operational trip generation.

Table 4.1: Operational Trip Generation

Stage	LV Trips	HV Trips	Total LV Trips	Total HV Trips
Operational	4 per day	1 per 6 months	4	1 per 6 months

4.1.2 Construction Trip Breakdown

During the construction phase, the typical heavy vehicle is expected to be a 15.4m articulated vehicle (AV), but also includes 8.8m rigid service vehicles, 10m rigid trucks and 10m tipper trucks. Light vehicle trips generated by workers have been estimated to arrive and depart during the AM and PM peak hours respectively and heavy vehicle trips will be distributed throughout the day as trucks travel to and from the subject site carrying construction loads. Construction trip generation has been summarised in Table 4.2.

Table 4.2: Construction Trip Generation Summary

Phase	Daily LV Trips	Daily HV Trips	Total LV Trips	Total HV Trips	Total Vehicle Trips
Phase 1	60	14	2880	672	3552
Phase 2	60	18	2880	864	3744
Phase 3	60	6	2880	288	3168
Total			8640	1824	10,464

As seen in Table 4.2, the highest number of heavy vehicle trips occurs during Stage 2 with 864 trips from heavy vehicles. Phase 2 of the construction is expected to generate 73 trips per day on average.

4.2 Trip Distribution

4.3 Operational Trip Distribution

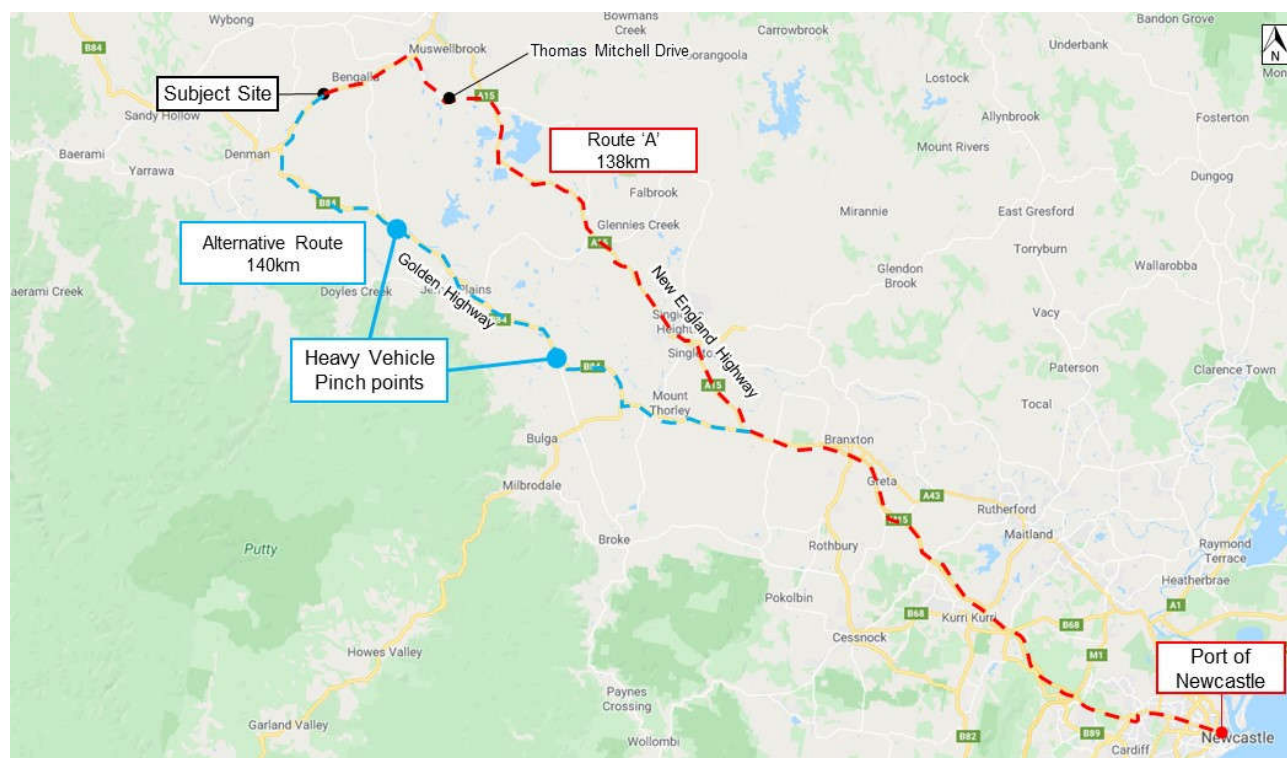
It is anticipated that the maintenance staff will arrive and depart from the development site from the same direction, adding two light vehicle trip to both the AM and PM Peaks. Distribution of the Trips will be determined once the construction phase has been completed and are most likely to originate from Muswellbrook town to the east.

4.4 Construction Trip Distribution

Distribution of construction trips is expected to include:

- **Construction Workers** (light vehicles) - originate and return along Denman Road from Muswellbrook each day. With majority of trips turning left into the development during the AM peak hour and right out of the development during the PM peak hour.
- **Material Delivery Traffic** (heavy vehicles) - originate and return from the Port of Newcastle. Expected route is via the New England Highway, Thomas Mitchell Drive and Denman Road approaching the site from the east (i.e. left-in/right-out movements).

Alternative route options for Material Deliveries are shown in Figure 4.1. However, for the purposes of this assessment it is expected all Material Delivery traffic will utilise Route A along the New England Highway. This is due to the alternate route being marginally longer and crossing two heavy vehicle pinch points.



Source: Google Maps

Figure 4.1: Heavy Vehicle Route Options

For the purposes of this assessment the following traffic distribution has been conservatively applied:

- **AM Peak Hour**
 - 100% of daily Construction Worker traffic arriving from the east
 - 50% of Material Delivery traffic arriving and departing from the east
- **PM Peak Hour**
 - 100% of daily Construction Worker traffic departing to the east
 - 50% of Material Delivery traffic arriving and departing from the east

4.5 Traffic Impact

4.5.1 Operational Traffic Impact

Based on the 2020 average weekday (AWD) volume of 2466 vehicles, the additional 4 trips generated by the site's operation will increase traffic by 0.16% of the total average weekday volume. The impact of proposed development traffic on the surrounding road network is considered negligible and no mitigation measures are proposed.

4.5.2 Construction Traffic Impact

Construction traffic is estimated to generate a maximum of 78 daily trips over the course of construction. Based on a 2020 daily traffic volume of 2466 vehicles, the additional 78 trips generated by the development's construction will increase traffic by less than 3%.

The impact of construction development traffic on the surrounding road network is therefore considered negligible and no mitigation measures are proposed.

5. PAVEMENT ASSESSMENT

5.1 Road Section

A pavement impact assessment was undertaken for the proposed development during construction and post-construction. The road segments assessed were those between the subject site and Thomas Mitchell Drive. Figure 5.1 highlights the segment of Denman Road that has been assessed.



Source: Nearmap

Figure 5.1: Denman Road assessment scope

As outlined in Section 3.3, much of Denman Road is past its design life and is currently maintained by patching and resealing by TfNSW as required. The proportional impact of the development on the road's design life has been assessed against an approximate design life of 20 years and based on current traffic volumes on Denman Road, 2446 vehicles per day with 24.6% Heavy Vehicles.

5.2 Existing Pavement Loading

Pavement loading is broken down to the number of equivalent standard axles (ESA) a road is anticipated to experience within its design life. For the purposes of assessing pavement impacts ESAs are determined from the number of heavy vehicles utilising the road. Heavy vehicles (HV) can be categorised based on the following various axles groups:

- Single axle single tire (SAST)
- Single axle dual tire (SADT)
- Tandem axle single tire (TAST)
- Tandem axle dual tire (TADT)
- Tri-axle dual tire (TRDT)
- Quad-axle dual tire (QADT)

In accordance with *Austroads Guide to Pavement Technology Part 2: Pavement Structural Design*, data from an appropriate surrogate weigh-in-motion (WIM) road supplied by road agencies was used to form a traffic load distribution (TLD) for Denman Road. The Capricorn Highway in Bore Creek QLD was chosen as an example road due to similarities and the following factors:

- Proximity to a rural town
- Proximity to surrounding mining operations
- Road alignment
- Road cross section
- Similar Average Daily Traffic
- Similar Heavy Vehicle mode share (%)

An estimated typical axle configuration of heavy vehicles on this route has been summarised in Table 5.1.

Table 5.1: Denman Road AADT Heavy Vehicle Axle Configuration

Direction	N _{HVAG}	N _{DT}	ESA/ H _{VAG}	SAST	SADT	TAST	TADT	TRDT	QADT	ESA Group per HVAG	ESA per HV
WB	3.23	4,506,095	0.45	29.5	9.1	1.5	32.1	27.8	0	0.45	1.45
EB	3.19	7,525,196	0.795	29.8	12	1.6	30.3	26.3	0.1	0.795	2.53

N_{HVAG} = Average number of Axle Group

HVAG = Heavy Vehicles per Axle Group

ESA/HVAG = Average number of ESA per HVAG for Traffic Load Distribution

N_{DT} = Cumulative HV axle group during design period

Design Equivalent Standard Axles (DESA) for Denman Road were calculated by adopting the axle share of the Capricorn Highway and applying the 'ESA/HVAG' factor to the heavy vehicle AWD volume multiplied out over a 20 year design period.

$$DESA = (ESA/HVAG) * Ndt$$

Considering the above, the DESA for Denman Road is expected to be 2.02*10⁶ ESA (westbound) and 5.98*10⁶ ESA (eastbound) over a 20 year design life.

5.3 Development Pavement Loading Estimation

ESAs produced by the development are estimated based on the proposed heavy vehicle types and volume of traffic to/ from the site both during construction and post-construction.

ESAs vary based on the heavy vehicle axle group, vehicle type and weight (i.e. loaded and unloaded). For the purposes of this assessment unloaded and loaded ESAs have been approximated considering *Austrroads Guide to Pavement Technology* and developed in conjunction with QLD Transport & Main Roads for the *Guide to Traffic Impact Assessments* (2018). Table 5.2 summarises the inbound and outbound ESA added to Denman Road from the construction phase. During the construction phases, heavy vehicles travelling westward on Denman Road will be 'loaded' with construction material for drop off, while heavy vehicles travelling eastward will be 'unloaded'.

Table 5.2: Development Generated ESAs

HV Type	Approx. Veh Type	Class	Traffic Volume			ESAs			
			Phase 1	Phase2	Phase 3	Phase 1	Phase 2	Phase 3	Total
Westbound (Inbound)									
15.4m AV	Five Axle Articulated	5	120	210	30	245.4	429.45	61.35	736.2
10m Tipper Truck	Three Axle Truck	4	90	90	0	160.65	160.65	0	321.3
8.8m MRV	Two Axle Truck	3	60	60	60	89.4	89.4	89.4	268.2
10m Rigid HV	Three Axle Truck	4	20	30	10	35.7	53.55	17.85	107.1
Daily HVs			290	390	100	531.15	733.05	168.6	1432.8
Eastbound (Outbound)									
15.4m AV	Five Axle Articulated	5	120	210	30	27.6	48.3	6.9	82.8
10m Tipper Truck	Three Axle Truck	4	90	90	0	22.5	22.5	0	45
8.8m MRV	Two Axle Truck	3	60	60	60	16.2	16.2	16.2	48.6
10m Rigid HV	Three Axle Truck	4	2	30	10	5	7.5	2.5	15
Daily HVs			290	390	100	71.3	94.5	25.6	191.4

5.4 Operational Pavement Loading

Operational activities requiring heavy vehicles are expected to occur once every six months and will generate loading of 7.14 ESA annually. Over the 20 year design life, this will represent less than 0.01% of the total ESA experienced by Denman Road.

5.5 Construction Pavement Loading

Table 5.2 shows the total number of inbound and outbound ESAs on Denman Road is calculated as 1,433 and 192 respectively.

The total ESAs of all construction phases is expected to be 1,625 over the 24 weeks of construction. Table 5.3 compares the construction pavement loading with Denman Road's approximate annual pavement loading.

Table 5.3: Construction Pavement Loading

Direction	Total Construction ESAs	Annual Background ESAs	Annual Percent share
Westbound (Inbound)	1,433	69,622	2%
Eastbound (Outbound)	192	117,726	0.16%
Combined	1,625	187,348	0.87%

The construction generated ESA is considered insignificant as it is well below 5% of the annual ESA experienced by Denman Road.

5.6 Pavement Impact and Recommendations

Construction activities of the solar farm are expected to impact 10km section of Denman Road between the subject site and Thomas Mitchell Drive. Table 5.4 illustrates the total pavement impact generated from the development (construction and operational) over a 20 year design life.

Table 5.4: Development Pavement Impact

Direction	Total ESAs	Design Life ESAs	Percent share
WB	2,751	2.02×10^6	0.136%
EB	377	5.98×10^6	0.006%

As can be seen in Table 5.4, the ESA generated by the development's construction phase does not exceed 1% of all approximated ESAs during the design life of the project and contributes to less than 5% of ESAs during the year of construction.

No contribution would typically be required for maintaining the road as a result of development impacts. However, TfNSW data indicates that Denman Road is currently past its design life and has been maintained through patching and resealing as required.

Considering the current condition of Denman Road, it is recommended that a similar approach is taken to provide patch work and resealing fronting the proposed development access during the construction period only to offset any wear and tear from heavy vehicles performing turn manoeuvres on Denman Road.

6. ACCESS ASSESSMENT

6.1 Sight Distance Assessment

Sight distance from the proposed access onto Denman Road was observed to be relatively straight and level in both the east and west directions. *Austroads Guide to Safe Road Design Part 4a* states that a safe intersection sight distance (SISD) for a road with a 110km/h design speed requires 285m.

Figure 6.1 shows the sight distance available from the proposed site access.



Source: Google Maps

Figure 6.1: Sight Distance from Proposed Access (Left: East. Right: West)

An unimpeded sight distance greater than 285m is achieved to both the east and west of the proposed access.

6.2 Turn Warrants Assessment

A turn warrants assessment for the development was undertaken in accordance with *Austroads Guide to Road Design Part 4: Intersections and Crossings*.

Peak period traffic has been estimated based on traffic distributions and volumes outlined in Section 4. Turn volumes for both the AM and PM period are summarised in Table 6.1.

Table 6.1: Turn Warrant Volumes

	Turn Volumes	
	AM	PM
Q_{T1}	116	79
Q_R	0	0
Q_{T2}	58	132
Q_L	39	9
Q_M (Left)	58	132
Q_M (Right)	213	220

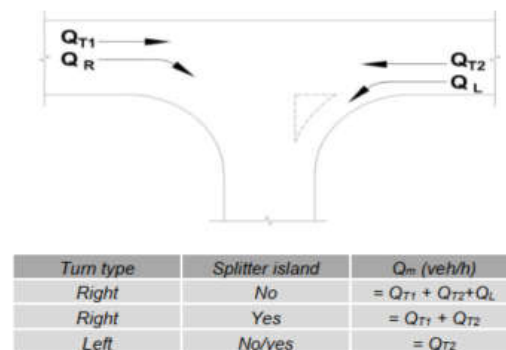


Figure 6.2 demonstrates the turn warrants assessment for the development using the values summarised in Table 6.1.

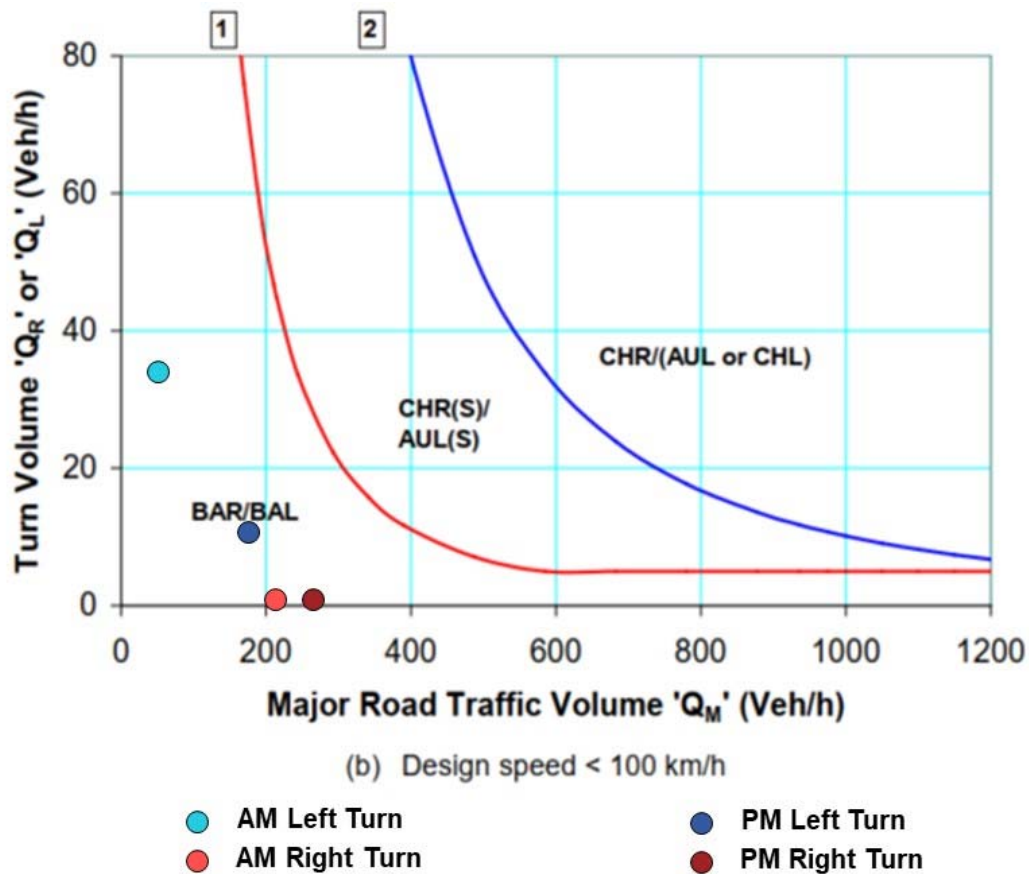


Figure 6.2: Major Road Turn Treatment Warrant $\geq 100\text{km/h}$

6.3 Proposed Site Access Configuration

Considering the above sight distance and turn warrants assessment, it is recommended that a basic left-turn (BAL) treatment be provided to cater for the proposed developments construction traffic. Following the completion of construction, traffic volumes and heavy vehicle movements generated by the development are not expected to exceed that of a residential property (i.e. 1-2 vehicle movements per day). As such, post-construction the access does not warrant the need for a turning facility.

Dimensions for the proposed BAL are recommended in accordance with *Austrroads Guide to Road Design* and summarised in Table 6.2. Figure 6.3 illustrates a BAL access in accordance with *Austrroads Guide to Road Design: Unsignalised and Signalised Intersections*.

Table 6.2: Rural Basic Left-Turn Treatment

Parameter	Description	Value
W	Nominal through lane width (m)	3.5m
C	Through lane width plus minimum length of parallel shoulder width	7m
A	Minimum parallel shoulder taper length	53.5m
V	Design speed for major road approach	110 km/hr
F	Formation/carriageway widening (m)	3.5m
P	Minimum length of parallel widened shoulder	35m
S _b	Setback distance between the centre of the major road and give way line in minor road	7m

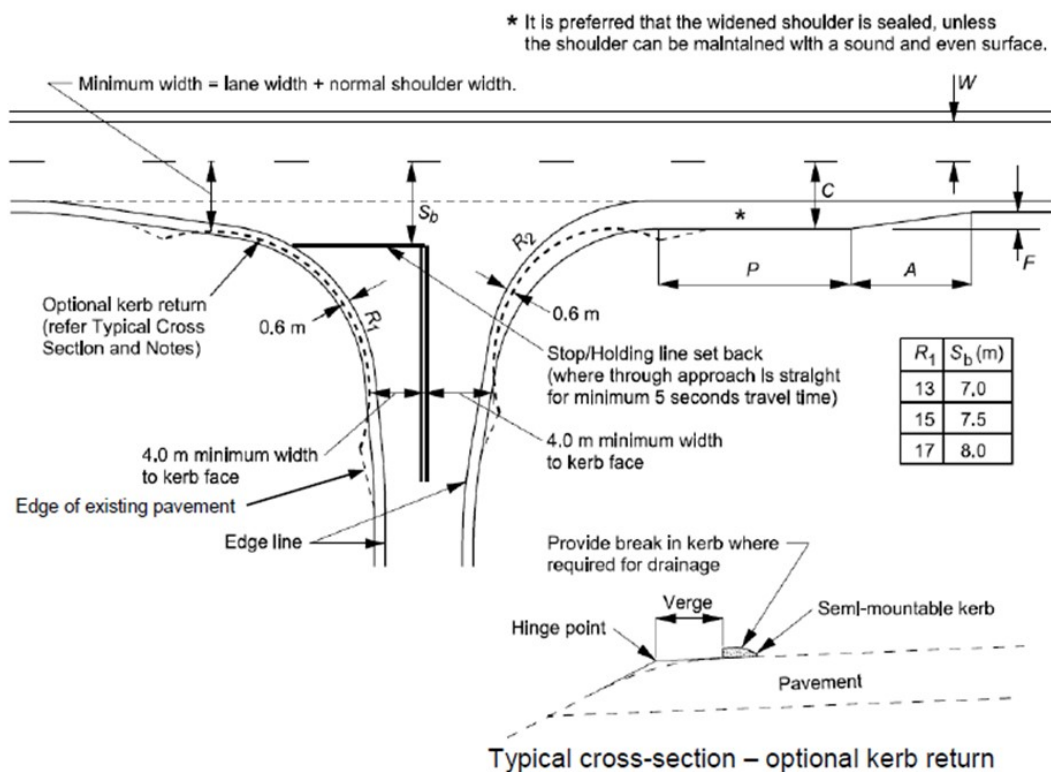


Figure 6.3: Rural BAL Treatment (Austroads Guide to Road Design)

6.4 Design Vehicle Swept Paths

Bitzios Consulting has prepared swept paths for a 15.4m AV, entering and exiting the proposed site access using a BAL turn treatment. Vehicles are expected to enter via a left turn manoeuvre and exit via a right turn manoeuvre. Swept paths of the proposed access have been provided at **Appendix D**.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Based on the findings of this assessment, it is concluded that:

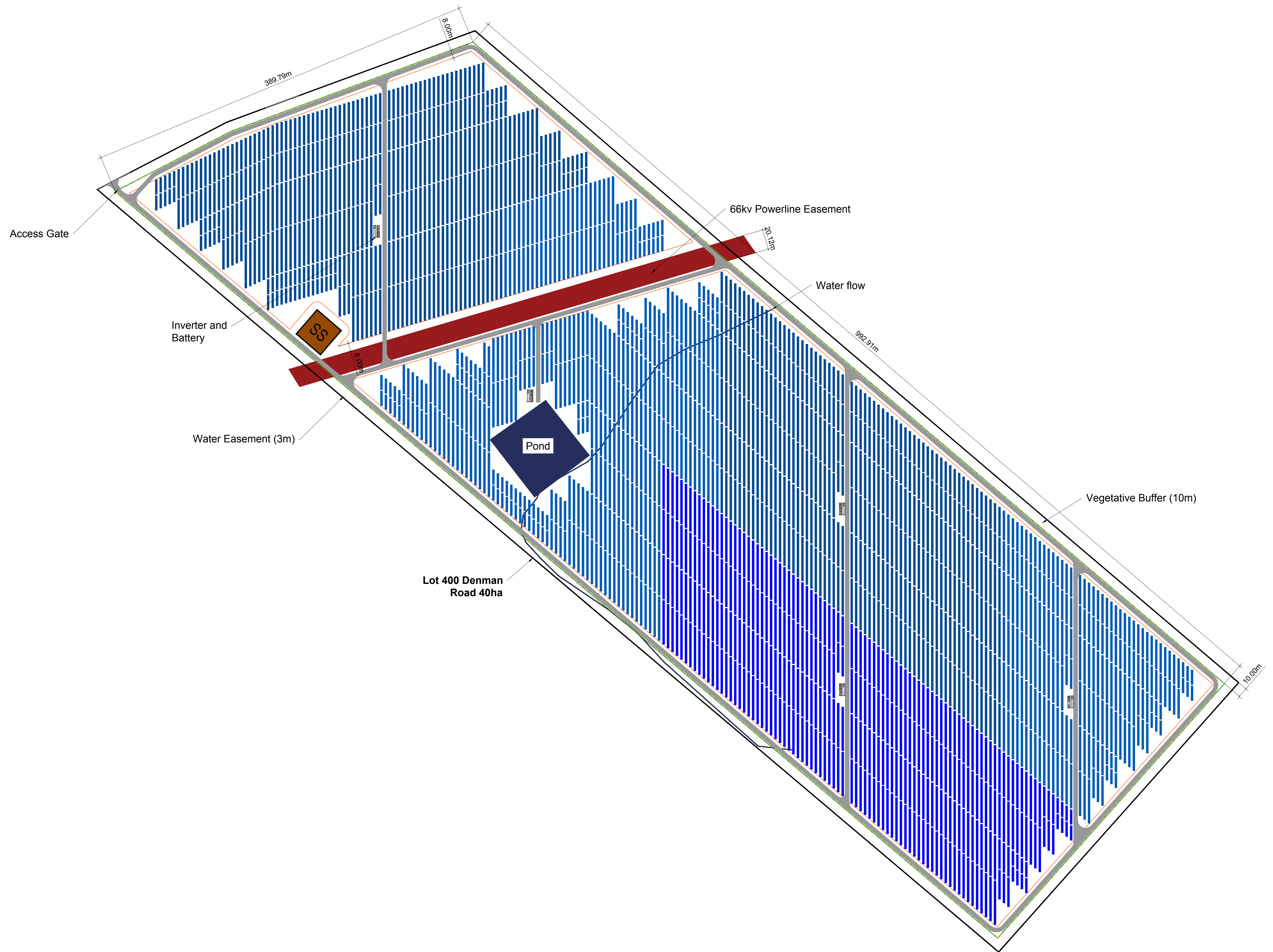
- The proposed development will generate 4 daily trips during the operational period
- Construction is separated into three (3) phases over 24 weeks
- The proposed development will generate 10,464 trips during construction including:
 - 8,640 light vehicle trips
 - 1,824 heavy vehicle trips
- Denman Road is noted by TfNSW as beyond its pavement design life and is currently managed by patching and resealing as required
- Heavy vehicles are expected to travel on the New England Highway to Thomas Mitchell Drive before turning onto Denman Road to reach the development site
- Operational traffic will increase Denman Road traffic by 0.16% and does not require mitigation measures
- Construction traffic will increase Denman Road traffic by 3% and does not require mitigations measures
- Operational traffic will generate a loading of 7.14 ESA annually, less than 0.01% of the Design Equivalent Standard Axles (DESA) of Denman Road
- Construction traffic will generate 1,625 ESA on Denman Road, less than 1% of the annual ESA of Denman Road
- A compliant sight distance of 285m is achieved in both the east and west direction of the proposed access
- A turn warrants assessment requires a BAL turn treatment for vehicles entering the site from the east

7.2 Recommendations

Based on the findings of this assessment, it is recommended that:

- Operational and construction traffic does not require mitigation measures
- A dilapidation survey be undertaken at the proposed site access including a pre-development road pavement condition report
- General maintenance at the site frontage is undertaken during construction period in the form of patchwork, consistent with TfNSW's current measures
- A Basic Auxiliary Left (BAL) turning facility for construction vehicles is implemented at the site access.

Appendix A: Development Plans



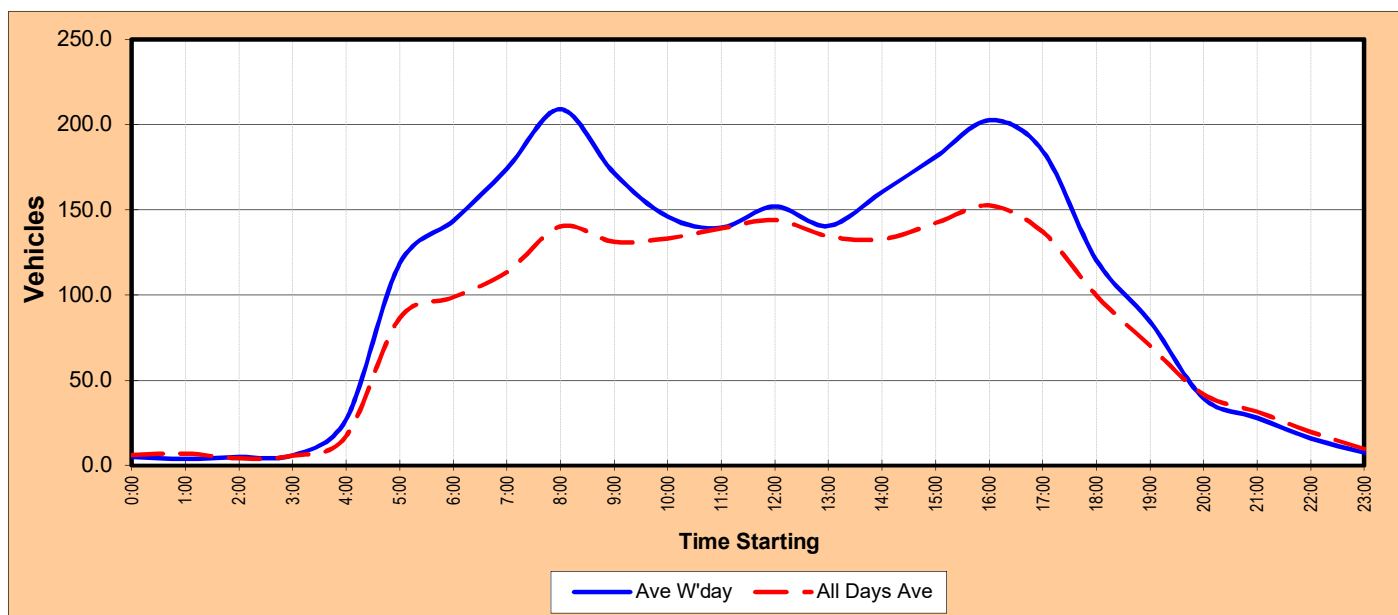
Appendix B: Proposed Construction Traffic Details

30MW Solar Park	Duration:	24.00	Weeks								
30 Item	No.	Total Trips (loaded)	First Phase - 8 weeks		Second Phase - 8 weeks		Final Phase - 8 weeks		Vehicle	Notes	
			Project contruction (total trips)	Average trips per day	Project contruction (total trips)	Average trips per day	Project contruction (total trips)	Average trips per day			
Phase Weeks			8		8		8				
PV Modules	120,000	180.00		0.00	180	3.75		0.00	15.4m articulated	Assuming 28 modules per pallet, 26 pallets per shipping container	
Mounting Frame	0	120.00	120	2.50		0.00		0.00	15.4m articulated		
Cabling	0	30.00		0.00	30	0.63		0.00	15.4m articulated		
Inverter Substations	30	30.00		0.00		0.00	30	0.63	15.4m articulated		
Access Tracks	0	180.00	90	1.88	90	1.88		0.00	10m tipper trucks	Access track construction at the start of the build plus any repairs required during the build	
Dust suppression	0	180.00	60	1.25	60	1.25	60	1.25	8.8m service vehicle (water tanker)	Main dust creating activities would be access track construction and piling, water tankers to be used as required to suppress any dust	
Foundation excavation and construction	0	30.00		0.00	30	0.63		0.00	10m rigid	For inverter substations and any monitoring equipment required onsite	
Small equipment, materials and supplies	0	90.00	30	0.63	30	0.63	30	0.63	Light vehicles	Provision for extras and small materials, compound supplies and cleaners	
Compound Setup	2	60.00	20	0.42		0.00	10	0.21	10m rigid	Provision if additional compound is required	
Workers	100	4,343.33	1,448	30.16	1,448	30.16	1,448	30.16	Light vehicles (30%) and buses (30 person)	Bearing in mind that site staff will peak at times, and less at other times. Staff will be encouraged to car pool where possible.	
		5,243.33	1,768	37	1,868	39	1,578	33			

Appendix C: Traffic Survey Data

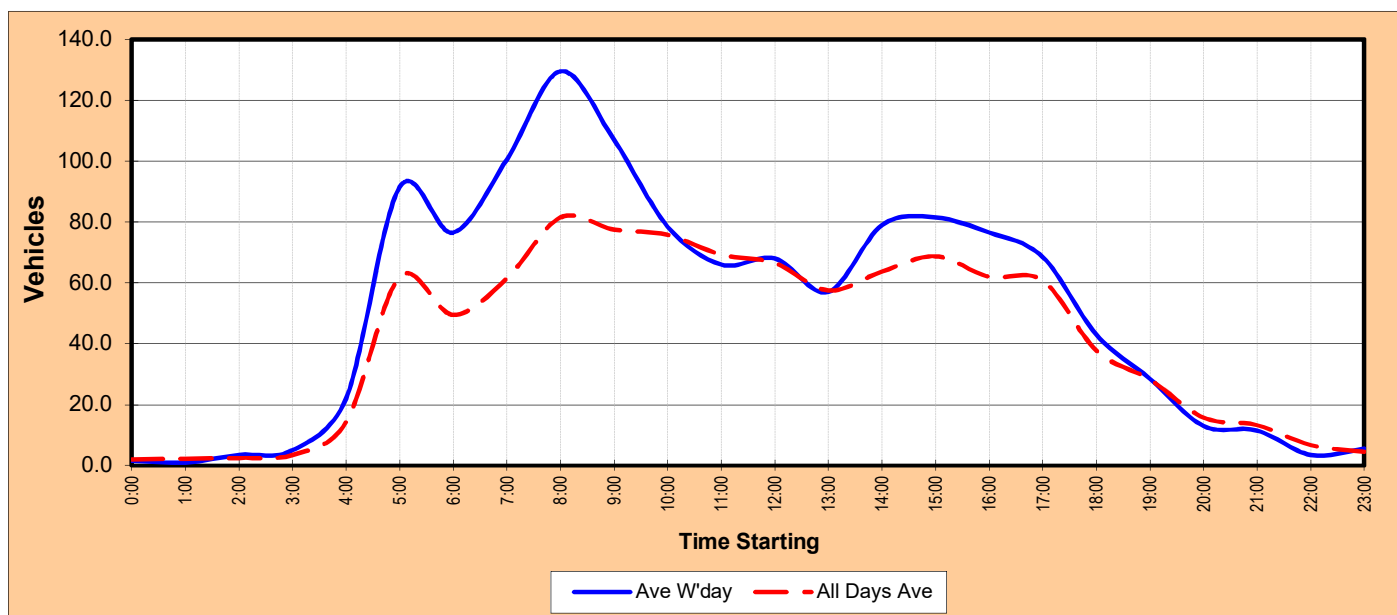
Road	Denman Rd	Average Weekday	2466
Location	Near Pukara Estate	All Day Average	1999
Suburb	Denman	Weekday Heavy's	24.6%
Site No.	8734_1	All Day Heavy's	22.2%
Start Date	Saturday 15/02/2020		
Direction	Two ways		

Starting Time	Day of Week							Ave W'day	All Days Ave
	Mon 17-Feb	Tue 18-Feb	Wed	Thu	Fri	Sat 15-Feb	Sun 16-Feb		
AM Peak	220	198				174	127		
PM Peak	184	221				141	133		
0:00	6	4				9	6	5	6
1:00	2	6				11	9	4	7
2:00	4	6				4	3	5	4
3:00	10	2				6	5	6	6
4:00	26	28				8	7	27	17
5:00	117	120				63	46	119	87
6:00	141	146				65	43	144	99
7:00	156	192				73	33	174	114
8:00	220	198				96	47	209	140
9:00	186	157				107	75	172	131
10:00	141	151				114	127	146	133
11:00	146	133				174	103	140	139
12:00	165	139				139	133	152	144
13:00	149	132				141	116	141	135
14:00	164	157				98	112	161	133
15:00	176	186				105	102	181	142
16:00	184	221				112	93	203	153
17:00	164	205				86	93	185	137
18:00	116	125				82	76	121	100
19:00	60	109				55	57	85	70
20:00	34	45				39	49	40	42
21:00	25	31				25	45	28	32
22:00	17	15				22	25	16	20
23:00	5	10				14	10	8	10
Total	2414	2518				1648	1415	2466	1999
% Heavy's	24.9%	24.3%				17.3%	19.3%	24.6%	22.2%



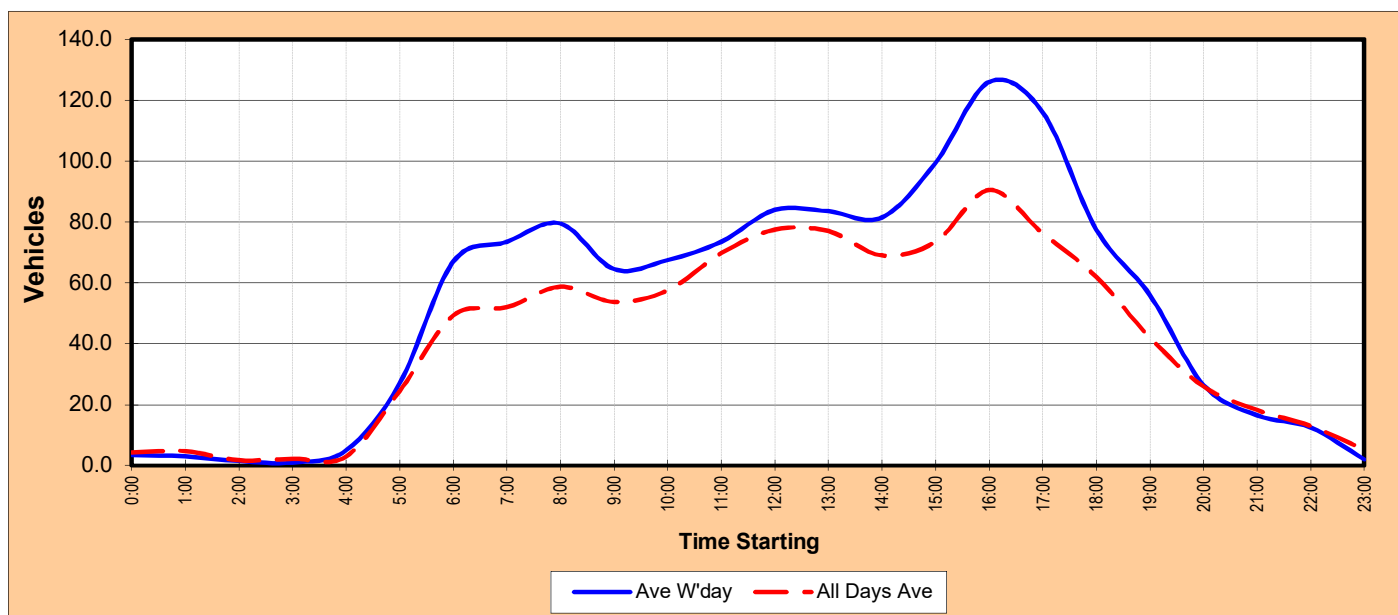
Road	Denman Rd	Average Weekday	1218
Location	Near Pukara Estate	All Day Average	987
Suburb	Denman	Weekday Heavy's	30.8%
Site No.	8734_1	All Day Heavy's	28.6%
Start Date	Saturday 15/02/2020		
Direction	Eastbound		

Starting Time	Day of Week							Ave W'day	All Days Ave
	Mon 17-Feb	Tue 18-Feb	Wed	Thu	Fri	Sat 15-Feb	Sun 16-Feb		
AM Peak	133	126				89	78		
PM Peak	78	94				71	59		
0:00	2	1				3	2	2	2
1:00	0	2				5	2	1	2
2:00	3	4				2	1	4	3
3:00	8	2				2	2	5	4
4:00	19	25				7	6	22	14
5:00	88	95				34	31	92	62
6:00	72	81				24	21	77	50
7:00	99	102				35	10	101	62
8:00	133	126				42	25	130	82
9:00	118	96				54	42	107	78
10:00	81	76				68	78	79	76
11:00	73	59				89	56	66	69
12:00	73	63				71	59	68	67
13:00	59	55				71	45	57	58
14:00	77	81				46	51	79	64
15:00	78	85				66	46	82	69
16:00	59	94				52	43	77	62
17:00	60	77				55	51	69	61
18:00	44	42				32	33	43	38
19:00	19	38				26	30	29	28
20:00	13	13				24	13	13	16
21:00	11	12				12	18	12	13
22:00	4	3				10	10	4	7
23:00	4	7				5	2	6	5
Total	1197	1239				835	677	1218	987
% Heavy's	31.0%	30.7%				23.5%	26.9%	30.8%	28.6%



Road	Denman Rd	Average Weekday	1248
Location	Near Pukara Estate	All Day Average	1012
Suburb	Denman	Weekday Heavy's	18.5%
Site No.	8734_1	All Day Heavy's	15.9%
Start Date	Saturday 15/02/2020		
Direction	Westbound		

Starting Time	Day of Week							Ave W'day	All Days Ave
	Mon 17-Feb	Tue 18-Feb	Wed	Thu	Fri	Sat 15-Feb	Sun 16-Feb		
AM Peak	87	90				85	49		
PM Peak	125	128				70	74		
0:00	4	3				6	4	4	4
1:00	2	4				6	7	3	5
2:00	1	2				2	2	2	2
3:00	2	0				4	3	1	2
4:00	7	3				1	1	5	3
5:00	29	25				29	15	27	25
6:00	69	65				41	22	67	49
7:00	57	90				38	23	74	52
8:00	87	72				54	22	80	59
9:00	68	61				53	33	65	54
10:00	60	75				46	49	68	58
11:00	73	74				85	47	74	70
12:00	92	76				68	74	84	78
13:00	90	77				70	71	84	77
14:00	87	76				52	61	82	69
15:00	98	101				39	56	100	74
16:00	125	127				60	50	126	91
17:00	104	128				31	42	116	76
18:00	72	83				50	43	78	62
19:00	41	71				29	27	56	42
20:00	21	32				15	36	27	26
21:00	14	19				13	27	17	18
22:00	13	12				12	15	13	13
23:00	1	3				9	8	2	5
Total	1217	1279				813	738	1248	1012
% Heavy's	19.0%	18.1%				10.9%	12.3%	18.5%	15.9%



Data, Speed & Class Overview

Job#	8734	Location	Near Pukara Estate
Client	BITZIOS	Street	Denman Rd
Reference	DenmanRdNearPukaraEstate.txt	Suburb	Denman
Speed Limit	80	Siteld	8734_1
Map/GPS Reference			

Date Record	Saturday 15/02/2020			Sunday 16/02/2020			Monday 17/02/2020			Tuesday 18/02/2020			
Interval (min)	60	Eastbound	Westbound	Two ways	Eastbound	Westbound	Two ways	Eastbound	Westbound	Two ways	Eastbound	Westbound	Two ways
Short	%	77%	89%	83%	73%	88%	81%	69%	81%	75%	69%	82%	76%
Med	%	21%	8%	15%	23%	9%	16%	27%	14%	21%	28%	14%	21%
Long	%	3%	3%	3%	4%	3%	3%	4%	5%	4%	3%	4%	4%
7am-7pm	Volume	681	646	1327	539	571	1110	954	1013	1967	956	1040	1996
24Hr Vol		835	813	1648	677	738	1415	1197	1217	2414	1239	1279	2518
85%ile	(Kmh)	109.8	106.1	108.4	108.9	104.7	107.8	107.3	103.2	105.4	108.3	103.9	105.3
Mean Spd		101.0	96.8	98.9	101.1	96.2	98.6	97.1	94.1	95.6	99.0	96.0	97.5
Std Dev		11.2	11.8	11.7	10.6	13.0	12.2	11.5	11.4	11.5	11.3	9.4	10.4
AM PK Interval Vol		89	85	174	78	49	127	133	87	220	126	90	198
AM Pk Factor		0.11	0.10	0.11	0.12	0.07	0.09	0.11	0.07	0.09	0.10	0.07	0.08
AM Pk 85%		106.5	100.8	105.4	108.3	105.6	108.1	105.5	99.8	101.6	105.5	102.5	104.3
AM PK starts		11:00	11:00	11:00	10:00	10:00	10:00	8:00	8:00	8:00	8:00	7:00	8:00
PM Pk Interval Vol		71	70	141	59	74	133	78	125	184	94	128	221
PM Pk Factor		0.09	0.09	0.09	0.09	0.10	0.09	0.07	0.10	0.08	0.08	0.10	0.09
PM Pk 85%		108.4	106.5	108.7	110.2	101.3	108.2	107.3	104.1	104.8	108.9	105.3	106.2
PM Pk starts		12:00	13:00	13:00	12:00	12:00	12:00	15:00	16:00	16:00	16:00	17:00	16:00

Volume Distribution

Speed Stats

Eastbound Speed Dist. 50th & 85th Percentiles

Westbound Speed Dist. 50th & 85th Percentiles

1: Car+MotorCycle	626	704	1,330	474	623	1,097	815	973	1,788	848	1,028	1,876
2: Car + Trailer	13	20	33	21	24	45	11	13	24	11	20	31
3: 2 axle truck	170	64	234	153	66	219	299	155	454	317	146	463
4: 3 axle truck	3	2	5	2	1	3	14	14	28	14	20	34
5: 4 axle truck	2	2	4	1	1	2	9	7	16	12	9	21
6: 3 axle semi	5	3	8	4	0	4	6	1	7	2	2	4
7: 4 axle semi	7	5	12	11	8	19	6	2	8	14	9	23
8: 5 axle semi	2	1	3	0	0	0	2	3	5	1	2	3
9: 6 axle semi	5	5	10	3	7	10	18	21	39	9	20	29
10: 7/8 axle truck	2	7	9	8	8	16	17	28	45	11	21	32
11: Road Train	0	0	0	0	0	0	0	0	0	0	2	2
12: Road Train	0	0	0	0	0	0	0	0	0	0	0	0

Pace Min	94.0	89.0	93.0	93.0	89.0	93.0	91.0	88.0	89.0	93.0	89.0	90.0
%Vol	69%	67%	66%	73%	70%	68%	59%	65%	62%	67%	73%	68%

Definitions

85th Percentile Speed = The speed at or below which 85% of volume is observed to travel

15kph Pace Speed = The 15kph speed range within which the largest percentage of volume is observed to travel

13/6/2018 - DENMAN RD / EDDERTON RD, MUSWELLBROOK

17:30 <<< HOUR ENDING

Wednesday

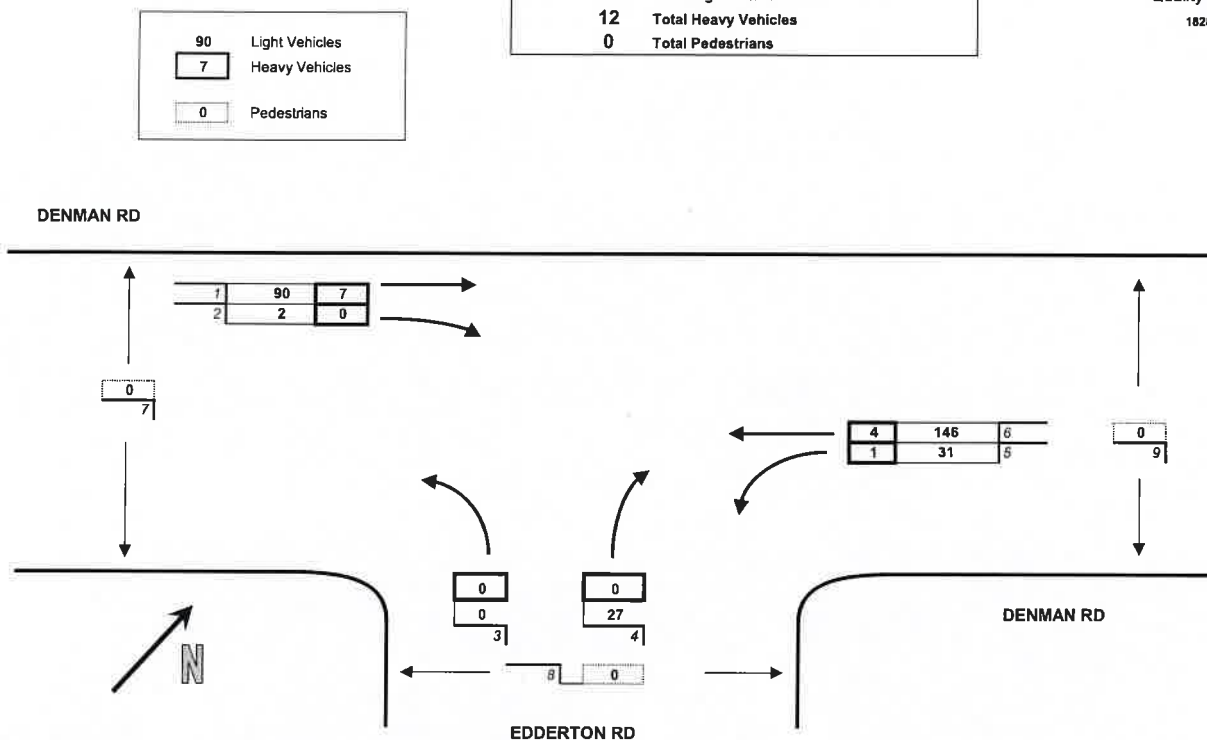
Summary:

DENMAN RD / EDDERTON RD

296 Total Light Vehicles
12 Total Heavy Vehicles
0 Total Pedestrians



Quality Surveys
182812



13/6/2018 - DENMAN RD / EDDERTON RD, MUSWELLBROOK

Light Vehicles							Total Vehicles			Pedestrians		
1	2	3	4	5	6	15 MIN HOUR	7	8	9			
16:15	26	1	1	4	10	25	67			0	0	0
16:30	13	0	0	9	4	20	46			0	0	0
16:45	28	2	0	5	6	40	81			0	0	0
17:00	23 <	0 <	0	4	9	36	72	266		0	0	0
17:15	16	0	0	9 <	9	33	67	266		0	0	0
17:30	23 <	0	0	9 <	7	37 <	76	296 <		0	0	0
17:45	11	0	1	4	12 <	38	66	281		0	0	0
18:00	13	0	0	4	7	21	45	254		0	0	0
18:15	14	0	1 <	8	11 <	27	61	248		0	0	0
18:30	5	0	0 <	6	1	26	38	210		0	0	0
18:45	11	0	0	1	5	16	33	177		0	0	0
19:00	5	0	0	3	1	19	28	160		0	0	0

Heavy Vehicles							Total Vehicles					
1	2	3	4	5	6	15 MIN HOUR	7	8	9			
16:15	3	0	0	0	0	0	3					
16:30	6	0	0	0	1	3	10					
16:45	4	0	0	0	0	0	4					
17:00	1 <	0	0	0	1 <	2	4	21 <				
17:15	0	0	0	0	0 <	2	2	20				
17:30	2	0	0	0	0	0	2	12				
17:45	2	0	0	0	1 <	1	4	12				
18:00	2	0	0	1	1 <	5 <	9	17				
18:15	3	0	0	0	0 <	1	4	19				
18:30	0	0	0	1 <	0 <	0	1	18				
18:45	0	0	0	0 <	1 <	0	1	15				
19:00	0	0	0	0	0	1	1	7				

All Vehicles							Total Vehicles					
1	2	3	4	5	6	15 MIN HOUR	7	8	9			
16:15	29	1	1	4	10	25	70					
16:30	19	0	0	9	5	23	56					
16:45	32	2	0	5	6	40	85					
17:00	24 <	0 <	0	4	10	38	76	287				
17:15	16	0	0	9 <	9	35	69	286				
17:30	25	0	0	9 <	7	37 <	78	308 <				
17:45	13	0	1	4	13 <	39	70	293				
18:00	15	0	0	5 <	8	26	54	271				
18:15	17	0	1 <	8	11 <	28	65	267				
18:30	5	0	0 <	7	1	26	39	228				
18:45	11	0	0	1	6	16	34	192				
19:00	5	0	0	3	1	20	29	167				

Note: Arrows "<" indicate the end time for the peak hour for each turning movement.

14/6/2018 - DENMAN RD / EDDERTON RD, MUSWELLBROOK

7:00 <<< HOUR ENDING

Thursday

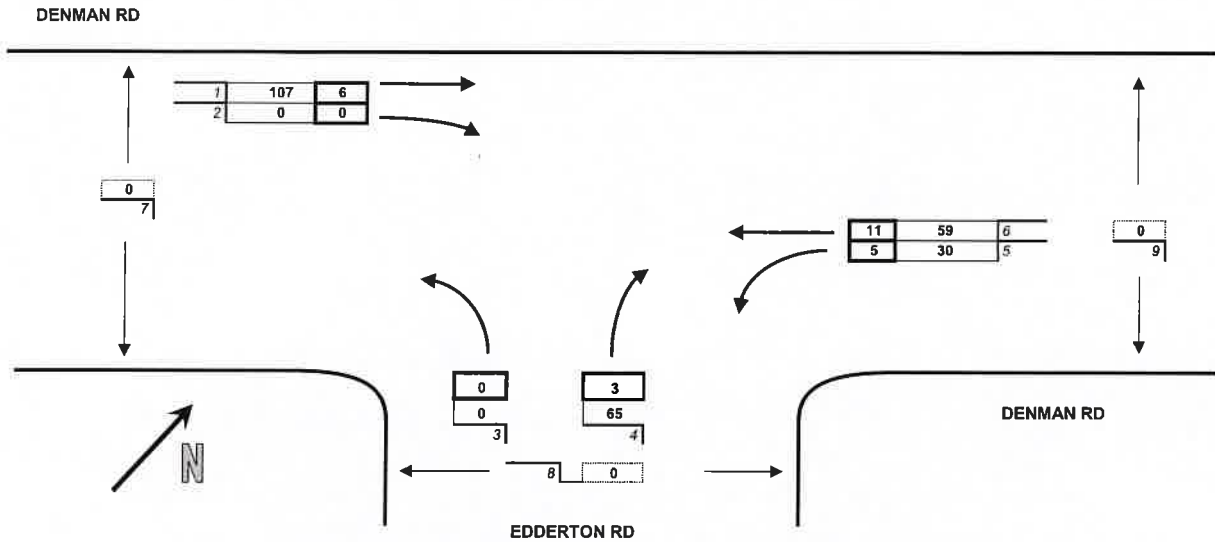
Summary:

DENMAN RD / EDDERTON RD

261 Total Light Vehicles
 25 Total Heavy Vehicles
 0 Total Pedestrians



107	Light Vehicles
6	Heavy Vehicles
0	Pedestrians



14/6/2018 - DENMAN RD / EDDERTON RD, MUSWELLBROOK

Light Vehicles							Pedestrians		
1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	7	8	9
05:15	10	0	0	2	3	4	0	0	0
05:30	19	0	0	8	5	5	0	0	0
05:45	38	0	0	6	13	5	0	0	0
06:00	28	0	0	5	7	5	0	0	0
06:15	32	0	0	27	10	13	0	0	0
06:30	26 <	0	0	10	11 <	8	0	0	0
06:45	31	0	0	11	6	9	0	0	0
07:00	18	0	0	17 <	3	29	0	0	0
07:15	13	0	0	8	6	11	0	0	0
07:30	18	0	0	14	3	5	0	0	0
07:45	16	0	0	6	3	20 <	0	0	0
08:00	27	0	0	5	3	20	0	0	0

Heavy Vehicles							Total Vehicles 15 MIN HOUR		
1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	7	8	9
05:15	1	0	0	0	0	0	1		
05:30	1	0	0	0	0	2	3		
05:45	0	0	0	0	0	0	0		
06:00	2	0	0	0	1	1	4	8	
06:15	1	0	0	1	3	2	7	14	
06:30	1	0	0	0	1	2	4	15	
06:45	3	0	0	1	1 <	4	9	24	
07:00	1	0	0	1 <	0	3	5	25	
07:15	1	0	0	0	0	2	3	21	
07:30	3	0	0	0	0	4	7	24	
07:45	3	0	0	0	2	4	9	24	
08:00	4 <	0	0	0	0	7 <	11	30 <	

All Vehicles							Total Vehicles 15 MIN HOUR		
1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	7	8	9
05:15	11	0	0	2	3	4	20		
05:30	20	0	0	8	5	7	40		
05:45	38	0	0	6	13	5	62		
06:00	30	0	0	5	8	6	49	171	
06:15	33	0	0	28	13	15	89	240	
06:30	27 <	0	0	10	12 <	10	59	259	
06:45	34	0	0	12	7	13	66	263	
07:00	19	0	0	18 <	3	32	72	286 <	
07:15	14	0	0	8	6	13	41	238	
07:30	21	0	0	14	3	9	47	226	
07:45	19	0	0	6	5	24 <	54	214	
08:00	31	0	0	5	3	27	66	208	

Note: Arrows "<" indicate the end time for the peak hour for each turning movement.

Job No	N1232		
Client	Cardno		
Road	Denman Rd - btw Golden Hwy and Edderton Rd		
Location	Muswellbrook	Average Weekday	2,446
Site No.	T1	7 Day Average	2,219
Start Date	6-Nov-13		
Description	Volume Summary		
Direction	Combined		

Direction

Combined

Time	Day of Week							Ave W'day	7 Day Ave
	Mon 11-Nov	Tue 12-Nov	Wed 6-Nov	Thu 7-Nov	Fri 8-Nov	Sat 9-Nov	Sun 10-Nov		
AM Peak	65	57	67	61	59	54	47		
PM Peak	24	22	24	23	17	22	23		
0:00	0	2	1	2	2	0	7	1	2
0:15	0	0	1	2	1	0	4	1	1
0:30	0	1	3	0	2	2	1	1	1
0:45	0	0	1	0	3	1	4	1	1
1:00	0	0	0	1	0	1	4	0	1
1:15	1	1	1	0	0	2	2	1	1
1:30	1	0	0	2	0	2	0	1	1
1:45	0	1	0	0	0	5	4	0	1
2:00	0	0	2	0	1	1	0	1	1
2:15	2	1	0	0	1	2	3	1	1
2:30	0	1	1	1	1	1	0	1	1
2:45	2	1	0	1	1	1	1	1	1
3:00	3	1	1	2	1	1	0	2	1
3:15	2	2	3	2	1	0	2	2	2
3:30	2	2	3	1	2	0	1	2	2
3:45	2	2	0	2	2	2	3	2	2
4:00	5	4	6	4	2	2	1	4	3
4:15	4	7	0	5	3	5	0	4	3
4:30	2	6	7	5	8	2	0	6	4
4:45	9	8	6	7	10	1	3	8	6
5:00	13	11	18	13	15	5	4	14	11
5:15	23	20	21	23	16	7	8	21	17
5:30	18	19	18	18	31	16	10	21	19
5:45	32	37	34	40	31	18	10	35	29
6:00	33	44	28	30	27	11	13	32	27
6:15	29	34	48	42	40	14	7	39	31
6:30	42	42	39	36	35	13	6	39	30
6:45	32	36	37	35	39	10	19	36	30
7:00	25	29	29	30	28	9	19	28	24
7:15	31	42	35	39	41	17	15	38	31
7:30	43	51	40	52	34	20	10	44	36
7:45	42	43	48	42	50	33	7	45	38
8:00	37	48	45	48	50	26	10	46	38
8:15	48	50	33	36	59	18	10	45	36
8:30	37	32	44	51	48	35	23	42	39
8:45	38	44	39	50	42	26	16	43	36
9:00	45	40	39	33	44	49	30	40	40
9:15	35	46	46	55	54	35	23	47	42
9:30	46	37	48	42	47	32	33	44	41
9:45	29	32	40	42	38	42	23	36	35
10:00	48	23	31	27	47	33	36	35	35
10:15	50	33	42	47	46	32	26	44	39
10:30	36	44	32	40	48	45	22	40	38
10:45	41	45	26	46	40	49	36	40	40
11:00	25	32	39	42	42	42	31	36	36
11:15	41	32	39	36	41	40	33	38	37
11:30	47	24	42	45	52	54	33	42	42
11:45	26	43	44	37	44	31	29	39	36
12:00	30	32	32	40	42	50	38	35	38
12:15	42	38	45	36	46	41	35	41	40
12:30	34	37	34	50	50	33	27	41	38
12:45	33	32	45	36	47	36	29	39	37
13:00	39	30	34	41	52	31	16	39	35
13:15	39	29	49	31	38	33	30	37	36
13:30	42	32	35	48	43	25	32	40	37
13:45	38	33	28	25	45	30	20	34	31
14:00	32	34	33	28	36	28	29	33	31
14:15	44	31	36	31	47	21	22	38	33
14:30	41	35	49	36	45	30	47	41	40
14:45	39	45	46	38	41	20	22	42	36
15:00	45	28	56	43	52	32	22	45	40
15:15	54	34	43	51	49	19	34	46	41
15:30	38	54	49	39	50	32	32	46	42
15:45	47	51	54	61	57	39	37	54	49
16:00	59	41	46	38	49	30	23	47	41
16:15	59	41	56	58	48	27	34	52	46
16:30	62	57	67	60	46	23	21	58	48
16:45	65	44	47	50	53	36	28	52	46
17:00	39	46	52	58	40	27	28	47	41
17:15	39	52	44	46	51	23	28	46	40
17:30	38	35	54	43	32	23	22	40	35
17:45	35	36	58	44	25	34	18	40	36
18:00	39	35	36	37	41	21	23	38	33
18:15	33	27	42	46	33	32	10	36	32
18:30	26	28	32	27	29	31	18	28	27
18:45	22	28	33	27	21	28	15	26	25
19:00	28	19	24	22	23	16	17	23	21
19:15	18	15	14	29	17	21	23	19	20
19:30	24	22	24	16	14	10	10	20	17
19:45	17	11	11	23	15	22	19	15	17
20:00	15	6	15	13	12	7	7	12	11
20:15	8	11	15	19	8	15	12	12	13
20:30	10	7	23	18	13	10	3	14	12
20:45	13	14	14	14	8	9	6	13	11
21:00	9	8	8	12	11	9	0	10	8
21:15	7	6	6	13	12	4	5	9	8
21:30	7	10	5	10	7	11	7	8	8
21:45	3	15	3	12	10	7	3	9	8
22:00	3	9	5	6	9	8	7	6	7
22:15	8	8	5	6	7	7	4	7	6
22:30	0	6	7	3	4	7	1	4	4
22:45	2	3	8	4	8	18	0	5	6
23:00	5	6	4	3	5	15	1	5	6
23:15	1	2	2	3	2	10	3	2	3
23:30	4	1	4	6	5	6	1	4	4
23:45	1	6	2	2	5	9	2	3	4
Total	2363	2283	2494	2516	2573	1849	1454	2446	2219

T1, Denman Rd - btw Golden Hwy and Edderton Rd

W.Day Hourly 7 Day Hourly

4	6
3	5
3	5
2	4
2	4
2	4
2	4
3	4
4	4
5	5
7	6
7	6
10	9
12	10
15	13
22	17
31	25
48	39
63	53
90	76
109	91
127	105
145	116
146	117
141	115
140	116
146	121
155	129
172	143
180	148
178	150
176	149
170	151
172	157
174	159
168	158
163	153
159	150
155	148
158	153
159	154
153	152
155	156
155	152
154	154
157	157
156	152
156	153
160	150
156	145
155	144
150	138
144	135
144	133
145	136
153	141
166	149
174	157
179	158
191	172
193	173
199	178
211	184
209	181
210	182
204	176
186	163
173	153
164	145
154	136
142	128
128	117
96	93
88	83
77	75
66	64
60	57
54	52
51	46
49	44
45	39
39	35
35	31
32	30
30	29
26	25
22	23
20	22
16	19
16	19
14	17
AM Peak	7:30:00 AM
180	159
PM Peak	3:45:00 PM
211	184
Daily	2446
	2219

7-19	1923	1815	2016	2008	2103	1503	1205	1973	1796
6-22	2218	2115	2330	2352	2394	1692	1362	2282	2066
6-24	2242	2156	2367	2385	2439	1772	1381	2318	2106
0-24	2383	2283	2494	2516	2573	1849	1454	2446	2219

Job No	N1232		
Client	Cardno		
Road	Denman Rd - btw Golden Hwy and Edderton Rd		
Location	Muswellbrook	Average Weekday	1,213
Site No.	T1	7 Day Average	1,102
Start Date	6-Nov-13		
Description	Volume Summary		
Direction	EB		

Direction

EB

Time	Day of Week							Ave W'day	7 Day Ave
	Mon 11-Nov	Tue 12-Nov	Wed 6-Nov	Thu 7-Nov	Fri 8-Nov	Sat 9-Nov	Sun 10-Nov		
AM Peak	33	37	33	37	36	31	21		
PM Peak	9	9	7	10	9	12	14		
0:00	0	0	0	1	1	0	6	0	1
0:15	0	0	0	0	0	0	4	0	1
0:30	0	0	1	0	2	1	2	1	1
0:45	0	0	0	0	1	1	1	0	0
1:00	0	0	0	0	0	1	1	0	0
1:15	0	1	1	0	0	0	1	0	0
1:30	0	0	0	1	0	1	0	0	0
1:45	0	0	0	0	0	3	0	0	0
2:00	0	0	1	0	0	0	0	0	0
2:15	0	0	0	0	1	0	2	0	0
2:30	0	0	1	0	0	1	0	0	0
2:45	0	0	0	0	0	0	0	0	0
3:00	2	1	0	1	1	0	0	1	1
3:15	0	1	1	2	1	0	1	1	1
3:30	1	0	1	1	0	0	0	1	0
3:45	0	0	0	1	1	1	2	0	1
4:00	3	3	4	2	2	2	0	3	2
4:15	2	3	0	2	1	3	0	2	2
4:30	2	5	6	4	6	0	0	5	3
4:45	5	7	4	6	8	1	2	6	5
5:00	8	8	14	8	10	2	2	10	7
5:15	18	17	16	21	14	5	6	17	14
5:30	16	15	16	17	28	12	7	18	16
5:45	31	33	29	29	26	13	9	30	24
6:00	23	37	27	25	24	7	8	27	22
6:15	24	27	30	33	27	10	4	28	22
6:30	33	28	25	29	23	6	5	28	21
6:45	20	23	19	19	17	5	11	20	16
7:00	12	20	16	12	15	4	11	15	13
7:15	19	22	20	20	19	7	7	20	16
7:30	25	26	22	27	18	9	6	24	19
7:45	24	22	31	29	29	12	3	27	21
8:00	22	30	27	25	24	13	7	26	21
8:15	26	29	21	27	32	13	5	27	22
8:30	22	23	26	27	36	18	12	27	23
8:45	30	31	29	35	36	20	10	32	27
9:00	31	30	22	19	32	31	16	27	26
9:15	22	24	29	37	30	29	15	28	27
9:30	28	19	33	25	36	22	20	28	26
9:45	15	22	18	26	25	21	18	21	21
10:00	31	13	18	15	27	19	21	21	21
10:15	28	20	22	24	23	16	16	23	21
10:30	19	25	14	24	31	26	12	23	22
10:45	19	23	13	20	15	26	19	18	19
11:00	16	19	27	22	27	24	10	22	21
11:15	17	13	23	23	17	20	19	19	19
11:30	31	13	19	29	15	31	15	21	22
11:45	14	15	21	14	26	18	13	18	17
12:00	15	15	12	21	21	27	19	17	19
12:15	18	23	24	18	34	19	19	23	22
12:30	10	17	20	24	18	15	12	18	17
12:45	17	16	23	15	18	16	14	18	17
13:00	24	13	13	19	21	13	8	18	16
13:15	19	10	17	12	18	14	12	15	15
13:30	24	17	13	19	23	9	7	19	16
13:45	18	14	14	14	22	17	5	16	15
14:00	18	15	12	12	16	7	10	15	13
14:15	17	15	13	16	29	8	9	18	15
14:30	10	15	23	13	22	11	13	17	15
14:45	19	21	24	13	19	6	7	19	16
15:00	14	10	24	23	19	13	12	18	16
15:15	25	11	20	28	18	9	16	20	18
15:30	14	17	22	20	22	14	15	19	18
15:45	16	18	17	14	23	18	21	18	18
16:00	19	10	19	16	21	14	17	17	17
16:15	21	19	20	20	16	7	19	19	17
16:30	28	24	24	31	19	12	10	25	21
16:45	25	17	22	21	10	12	8	19	16
17:00	16	18	17	19	10	11	12	16	15
17:15	8	14	18	17	18	8	13	15	14
17:30	12	14	20	15	8	9	12	14	13
17:45	12	14	23	18	13	20	13	16	16
18:00	11	15	18	15	20	9	17	16	15
18:15	17	15	18	14	11	15	6	15	14
18:30	6	3	14	11	9	12	13	9	10
18:45	5	9	6	5	3	15	4	6	7
19:00	8	10	10	9	7	5	6	9	8
19:15	5	5	5	10	6	6	14	6	7
19:30	9	7	7	5	4	4	4	6	6
19:45	6	2	5	9	9	9	7	6	7
20:00	6	3	6	7	5	6	3	5	5
20:15	1	3	5	9	2	8	5	4	5
20:30	2	1	3	5	7	3	2	4	3
20:45	6	3	5	7	5	2	5	5	5
21:00	3	5	2	5	6	4	0	4	4
21:15	3	1	2	3	7	1	3	3	3
21:30	3	3	3	5	4	4	4	4	4
21:45	1	9	1	6	2	2	0	4	3
22:00	0	5	2	4	4	4	2	3	3
22:15	3	3	1	5	4	3	2	3	3
22:30	0	4	4	2	2	7	1	2	3
22:45	1	0	1	2	1	12	0	1	2
23:00	2	1	1	0	2	12	1	1	3
23:15	0	2	1	1	0	4	0	1	1
23:30	3	0	2	1	0	3	0	1	1
23:45	0	1	1	0	3	6	1	1	2
Total	1159	1135	1224	1260	1288	919	732	1213	1102

T1, Denman Rd - btw Golden Hwy and Edderton Rd

W.Day Hourly 7 Day Hourly

1	3
1	2
1	2
1	1
1	1
1	1
1	1
1	1
1	1
2	2
3	2
3	3
5	4
5	5
9	8
15	12
22	17
37	29
51	42
75	61
92	76
103	84
113	89
103	81
90	73
82	67
78	64
86	70
96	78
103	83
106	88
112	94
113	98
114	103
116	106
105	99
99	94
94	89
88	84
85	83
86	83
81	80
80	81
80	79
75	77
80	80
76	75
76	74
77	72
69	64
70	63
69	61
65	58
68	59
66	58
68	59
72	63
74	65
77	68
75	70
74	71
73	70
79	73
80	72
79	70
75	66
64	58
61	57
61	58
61	58
55	55
45	45
38	38
29	32
27	28
28	28
24	25
22	22
19	20
18	18
17	16
16	14
16	15
15	13
14	13
14	13
12	12
10	11
8	11
5	9
4	8
4	7
AM Peak	8:45:00 AM
116	106
PM Peak	4:00:00 PM
80	73
Daily	1213
	1102

7-19	909	858	961	963	1014	739	598	941	863
6-22	1062	1025	1116	1149	1169	821	679	1104	1003
6-24	1071	1041	1129	1164	1185	872	686	1118	1021
0-24	1159	1135	1224	1260	1288	919	732	1213	1102

Job No
Client
Road
Location
Site No.
Start Date
Description
Direction

N1232
Cardno
Denman Rd - btw Golden Hwy and Edderton Rd
Muswellbrook
T1
6-Nov-13
Volume Summary
WB

Average Weekday
7 Day Average

1,233
1,116

Direction

WB

Time	Day of Week							Ave W'day	7 Day Ave
	Mon 11-Nov	Tue 12-Nov	Wed 6-Nov	Thu 7-Nov	Fri 8-Nov	Sat 9-Nov	Sun 10-Nov		
AM Peak	40	38	43	47	43	24	34		
PM Peak	15	15	20	19	11	15	12		
0:00	0	2	1	1	1	0	1	1	1
0:15	0	0	1	2	1	0	0	1	1
0:30	0	1	2	0	0	1	0	1	1
0:45	0	0	1	0	2	0	3	1	1
1:00	0	0	0	1	0	0	3	0	1
1:15	1	0	0	0	0	2	1	0	1
1:30	1	0	0	1	0	1	0	0	0
1:45	0	1	0	0	0	2	4	0	1
2:00	0	0	1	0	1	1	0	0	0
2:15	2	1	0	0	0	2	1	1	1
2:30	0	1	0	1	1	0	0	1	0
2:45	2	1	0	1	1	1	1	1	1
3:00	1	0	1	1	0	1	0	1	1
3:15	2	1	2	0	0	0	1	1	1
3:30	1	2	2	0	2	0	1	1	1
3:45	2	2	0	1	1	1	1	1	1
4:00	2	1	2	2	0	0	1	1	1
4:15	2	4	0	3	2	2	0	2	2
4:30	0	1	1	1	2	2	0	1	1
4:45	4	1	2	1	2	0	1	2	2
5:00	5	3	4	5	5	3	2	4	4
5:15	5	3	5	2	2	2	2	3	3
5:30	2	4	2	1	3	4	3	2	3
5:45	1	4	5	11	5	5	1	5	5
6:00	10	7	1	5	3	4	5	5	5
6:15	5	7	18	9	13	4	3	10	8
6:30	9	14	14	7	12	7	1	11	9
6:45	12	13	18	16	22	5	8	16	13
7:00	13	9	13	18	13	5	8	13	11
7:15	12	20	15	19	22	10	8	18	15
7:30	18	25	18	25	16	11	4	20	17
7:45	18	21	17	13	21	21	4	18	16
8:00	15	18	18	23	26	13	3	20	17
8:15	22	21	12	9	27	5	5	18	14
8:30	15	9	18	24	12	17	11	16	15
8:45	8	13	10	15	6	6	6	10	9
9:00	14	10	17	14	12	18	14	13	14
9:15	13	22	17	18	24	6	8	19	15
9:30	18	18	15	17	11	10	13	16	15
9:45	14	10	22	16	13	21	5	15	14
10:00	17	10	13	12	20	14	15	14	14
10:15	22	13	20	23	23	16	10	20	18
10:30	17	19	18	16	17	19	10	17	17
10:45	22	22	13	26	25	23	17	22	21
11:00	9	13	12	20	15	18	21	14	15
11:15	24	19	16	13	24	20	14	19	19
11:30	16	11	23	16	37	23	18	21	21
11:45	12	28	23	23	18	13	16	21	19
12:00	15	17	20	19	21	23	19	18	19
12:15	24	15	21	18	12	22	16	18	18
12:30	24	20	14	26	32	18	15	23	21
12:45	16	16	22	21	29	20	15	21	20
13:00	15	17	21	22	31	18	8	21	19
13:15	20	19	32	19	20	19	18	22	21
13:30	18	15	22	29	20	16	25	21	21
13:45	20	19	14	11	23	13	15	17	16
14:00	14	19	21	16	20	21	19	18	19
14:15	27	16	23	15	18	13	13	20	18
14:30	31	20	26	23	23	19	34	25	25
14:45	20	24	22	25	22	14	15	23	20
15:00	31	18	32	20	33	19	10	27	23
15:15	29	23	23	23	31	10	18	26	22
15:30	24	37	27	19	28	18	17	27	24
15:45	31	33	37	47	34	21	16	36	31
16:00	40	31	27	22	28	16	6	30	24
16:15	38	22	36	38	32	20	15	33	29
16:30	34	33	43	29	27	11	11	33	27
16:45	40	27	25	29	43	24	20	33	30
17:00	23	28	35	39	30	16	16	31	27
17:15	31	38	26	29	33	15	15	31	27
17:30	26	21	34	28	24	14	10	27	22
17:45	23	22	35	26	12	14	5	24	20
18:00	28	20	18	22	21	12	6	22	18
18:15	16	12	24	32	22	17	4	21	18
18:30	20	25	18	16	20	19	5	20	18
18:45	17	19	27	22	18	13	11	21	18
19:00	20	9	14	13	16	11	11	14	13
19:15	13	10	9	19	11	15	9	12	12
19:30	15	15	17	11	10	6	6	14	11
19:45	11	9	6	14	6	13	12	9	10
20:00	9	3	9	6	7	1	4	7	6
20:15	7	8	10	10	6	7	7	8	8
20:30	8	6	20	13	6	7	1	11	9
20:45	7	11	9	7	3	7	1	7	6
21:00	6	3	6	7	5	5	0	5	5
21:15	4	5	4	10	5	3	2	6	5
21:30	4	7	2	5	3	7	3	4	4
21:45	2	6	2	6	8	5	3	5	5
22:00	3	4	3	2	5	4	5	3	4
22:15	5	5	4	1	3	4	2	4	3
22:30	0	2	3	1	2	0	0	2	1
22:45	1	3	7	2	7	6	0	4	4
23:00	3	5	3	3	3	3	0	3	3
23:15	1	0	1	2	2	6	3	1	2
23:30	1	1	2	5	5	3	1	3	3
23:45	1	5	1	2	2	3	1	2	2
Total	1204	1148	1270	1256	1285	930	722	1233	1116

T1, Denman Rd - btw Golden Hwy and Edderton Rd

W.Day Hourly

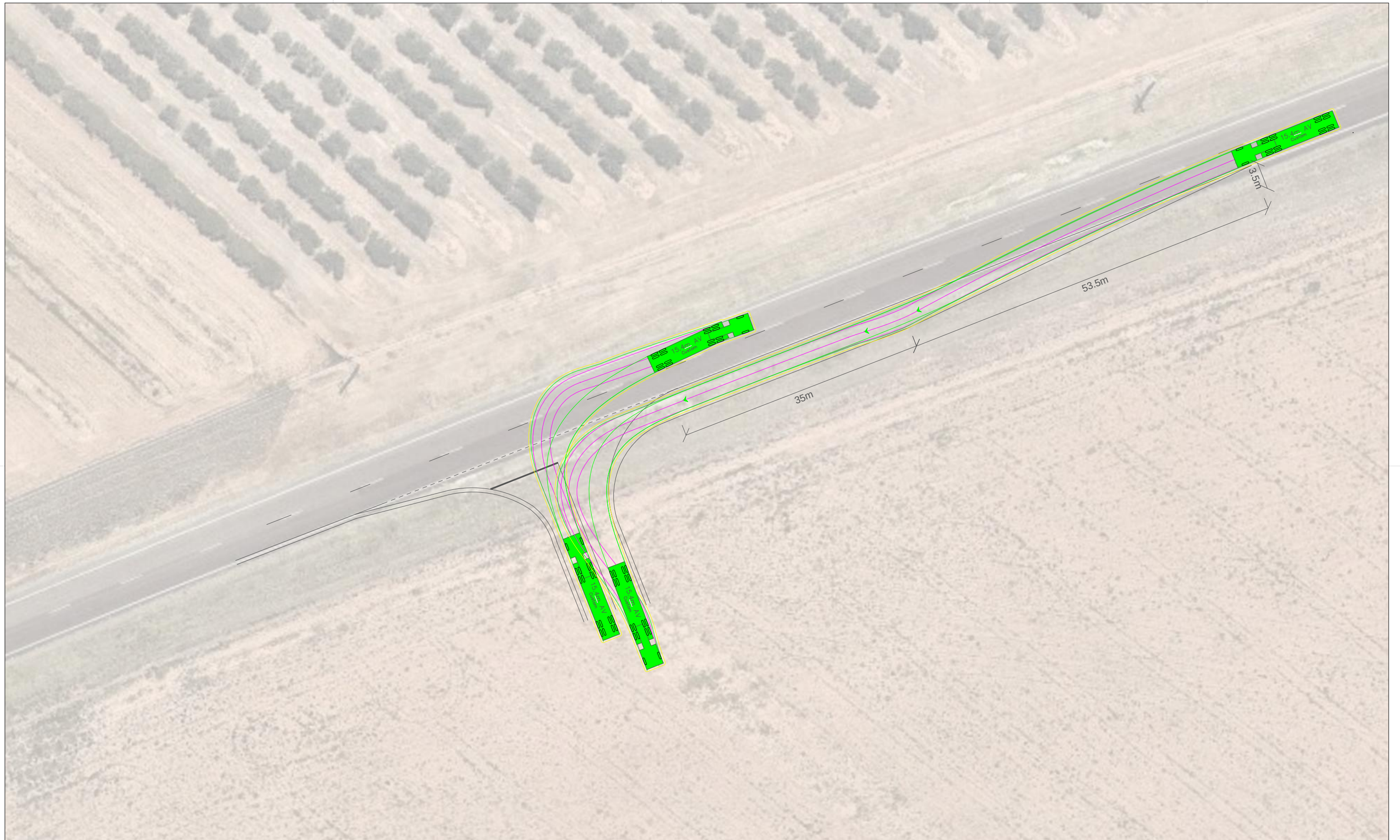
7 Day Hourly

3	3
2	3
2	3
1	2
1	3
1	2
2	3
2	3
3	3
3	3
4	4
4	4
5	4
6	5
6	5
7	6
10	8
11	9
12	11
15	14
16	15
23	21
32	27
43	36
51	42
58	49
67	57
69	60
76	65
77	64
72	63
64	55
58	53
58	54
58	53
63	59
64	59
65	62
67	64
74	70
73	71
72	72
75	76
74	74
79	77
78	77
80	78
80	79
83	78
87	81
85	80
81	77
78	77
76	74
80	78
85	82
94	87
100	91
102	90
116	101
119	102
126	109
132	111
129	110
130	112
128	110
122	106
113	95
103	87
93	78
86	73
83	72
76	67
67	61
61	55
50	47
42	39
38	35
35	32
33	29
32	28
29	24
23	20
20	18
18	17
16	16
13	13
13	12
13	11
10	10
11	11
10	10
80	79
132	112
1233	1116

Daily

7-19	1014	957	1055	1045	1089	764	607	1032	933
6-22	1156	1090	1214	1203	1225	871	683	1178	1063
6-24	1171	1115	1238	1221	1254	900	695	1200	1085
0-24	1204	1148	1270	1256	1285	930	722	1233	1116

Appendix D: Access Swept Path Diagram



BITZIOS

consulting

Issue	REVISIONS Revisions/Descriptions	Drawn	Date
001	Construction Access Swept Path	J.I	18/03/2020

Scale @ A3

0

5

10

15

20

25

1:500

Project

Denman Road Solar Park

Title

Construction Phase Site Access Swept Path

Design	Drawn	Checked
J.I	J.I	B.J
FOR INFORMATION ONLY		Date
Project Number		18/03/2020
P4480	Sheet Number	Issue
	1	001