Colac Northern Development Area

Colac Northern Development Area Traffic Impact Assessment

Holcim (Australia) Pty Ltd

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Document prepared by:

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Aurecon Centre
Level 8, 850 Collins Street
Docklands, Melbourne VIC 3008
PO Box 23061
Docklands VIC 8012
Australia

[redacted]

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1 Introduction

1.1 Project Background

Aurecon Australasia Pty Ltd (Aurecon) has been engaged by Holcim Pty Ltd (Holcim) to prepare a new Work Plan for the proposed expansion of the existing Colac Quarry at Ondit, Victoria (the Project).

Holcim are seeking to expand their existing basalt quarry extraction area to an additional parcel of land north of Colac Quarry, Northern Development Area (NDA). As part of this process, Holcim are preparing the necessary assessments required to accompany any applications and planning permits required for this work. Aurecon was commissioned to produce a Traffic Impact Assessment (TIA) for the inclusion of the NDA, to identify and mitigate against the potential impact that the new NDA operations may have on the surrounding road network.

1.2 Location

The Project study area (Figure 1) is located in Ondit, approximately 15 kilometres north of Colac in Victoria's western district. The Project area is situated at 170 Ondit-Warrion Road, Ondit, directly north of the existing quarry at 75-95 Potters Road, Ondit which currently operates under extractive Work Authority #158 and various approved planning permits (WA 158) and various planning approvals. The Project area or NDA comprises approximately 41 hectares of land. The Project area is bounded by private farmlands in addition to the existing quarry which is situated to the south.

Figure 1: Study Area

1.3 Study area

The operating capacity of the existing quarry will not change following the approval of the NDA, and no additional traffic will therefore be generated by the quarry onto the surrounding road network. However, material movement will occur between the NDA and WA158.

This new movement of material will occur along Potters Road and Rattrays Road, via the Ondit-Warrion Road / Potters Road / Rattrays Road intersection, thereby being the only intersection that is expected to be impacted once approval of the NDA is received.

The TIA's study area therefore only encompassed Ondit-Warrion Road, Potters Road and Rattrays Road's extents along both the existing quarry and NDA's borders, as well as the Ondit-Warrion Road / Potters Road / Rattrays Road intersection.

2 Existing conditions

2.1 Existing quarry operations

The existing quarry operation is situated on the south-eastern corner of the Ondit-Warrion Road / Potters Road/ Rattray's Road intersection. The location of the existing quarry and the surrounding road network is shown in Figure 2.Existing Quarry Operation

Figure 2: Existing quarry location

2.1.1 Existing quarry access and distribution

The existing quarry is accessed directly from Potters Road via a 9.4m paved crossover, which runs along the western boundary. It is noted that the existing quarry has existing permit approval allowing access to be taken from Potters Road, with the stipulation that Potters Road had to be constructed, sealed and regularly maintained to the satisfaction of the local road authority.

As per the 2005 Traffic and Car Parking Report, the assumed trip distribution of 40% arriving from / heading to the west (via Coragulac-Beeac Road) and 60% from / to the east (via Colac Ballarat Road) is still applicable, as had been advised by Holcim.

2.1.2 Existing quarry car parking

In excess of ten (10) car spaces are currently available at the existing quarry's on-site car parking area, to cater for staff and visitors. This provision complies with the current permit for the existing quarry which requires the provision of ten (10) car spaces.

2.1.3 Existing quarry operations

The quarry currently produces approximately 300,000 tonnes of product per annum, averaging at approximately 1,000 tonnes per day, although on exceptional days production may reach 3,000 tonnes. The

current quarry operations (quarry to plant material movement) occur within the confines of the existing quarry area, with the only vehicle movements that interact with the surrounding road network being movements associated with the movement of processed material to end users, staff movements and supporting services (such as waste removal).

The quarry operates six days of a week, from Monday to Saturday, between the hours or 06:00 – 18:00. The quarry is operational for approximately 300 days of a typical year.

2.2 Road network

2.2.1 Key roads

The identified study area encompasses three (3) key roads. These three roads are presented in Table 1 and the characteristics of each are discussed along with the associated road hierarchy.

Table 1: Surrounding key road network

Road	Description
Ondit-Warrion Road	Ondit-Warrion Road has the following characteristics: ■ Function – Local road; ■ Alignment – Aligned in an east-west direction; ■ Reserve width – Approximate 20m road reserve; ■ Layout – A two-way road configured with a 2-lane, 6.7m sealed carriageway; and ■ Shoulder – Gravel verges of approximately 2.0m width are provided on each side of the carriageway. ■ Speed limit: No posted speed limit, however, in Victoria's rural areas the default speed limit outside of built-up areas is 100 km/hr
Potters Road	Potters Road has the following characteristics: ■ Function – Rural road; ■ Alignment – Aligned in a north-south direction; ■ Reserve width – Approximate 20m road reserve; ■ Layout – A two-way road configured with a 2-lane, 6.3m sealed carriageway; and ■ Shoulder – Grass and gravel verges of approximately 2.0m width are provided on each side of the carriageway.
Rattrays Road	Rattrays Road has the following characteristics: ■ Function – Rural road; ■ Alignment – Aligned in a north-south direction; ■ Reserve width – Approximate 40m road reserve; ■ Layout – A two-way unpaved road configured with a width of about 6.0m; and ■ Shoulder – Grass and gravel verges of approximately 2.0m width are provided on each side of the carriageway.

2.2.2 Key intersections

The identified study area encompasses one (1) key intersection, namely the intersection of Ondit-Warrion Road / Potters Road / Rattrays Road. The intersection forms an unsignalised four-way junction, controlled by stop signs on both Potters Road and Rattrays Road approaches. The intersection has no turning lanes on any of its approaches – refer to Figure 3 for an aerial image of the Ondit-Warrion Road / Potters Road / Rattrays Road intersection, presenting its geometry.

Figure 3: Ondit-Warrion Road / Potters Road / Rattray Road intersection layout (Source: Bing Map)

Existing peak hour traffic volumes

To mitigate against the inability to perform traffic surveys which is further discussed under limitations, the current traffic at the Ondit-Warrion Road / Potters Road / Rattrays Road intersection was estimated from a combination of the following traffic information sources:

- Traffic and Car Parking Report prepared for Readymix Quarry, Corner Potters Rd and Ondit – Warrion Rd, Colac, GTA Traffic and Transport Consultants, 6 May 2005;
- Historic traffic counts on Colac Ballarat Road sourced from Victoria Department of Transport Open Data; and
- 2014 AADT traffic data for Colac Ballarat Road sourced from Colac Otway Shire.

The traffic and car parking report prepared for the Readymix Quarry was the only available source of traffic information for the Ondit-Warrion Road / Potters Road / Rattrays Road intersection. This traffic information was however outdated (surveyed in 2004) and needed to be grown to estimate the current 2020 traffic at this intersection.

The year-on-year traffic growth rates calculated from the historic traffic counts that were sourced from the Victoria Department of Transport Open Data for Colac Ballarat Road was the only available source of traffic growth information which could be used to grow the intersection's 2004 traffic information. The 2014 AADT traffic data for Colac Ballarat Road sourced from Colac Otway Shire were used to benchmark and compare against the VicRoads traffic data – refer to Figure 4 for a data comparison between these two sources.

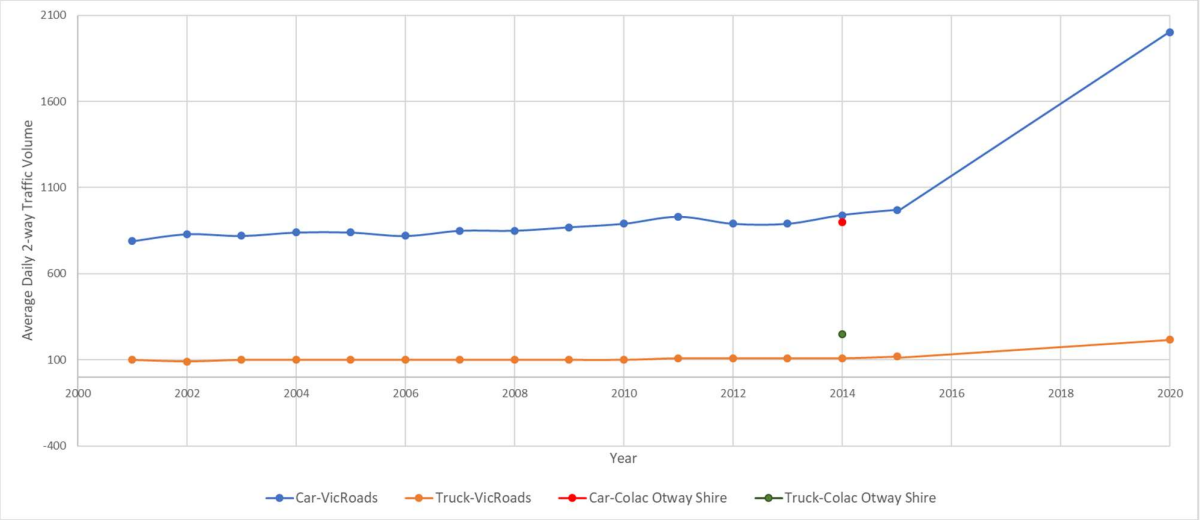

Figure 4: Traffic Profile for Colac Ballarat Road

The traffic growth rates on Colac Ballarat Road could therefore be inferred on the Ondit-Warrion Road / Potters Road / Rattrays Road intersection's traffic growth from 2004 to 2020 – refer to Table 2 for the year traffic growth on Colac Ballarat Road as was recorded / estimated by Victoria Department of Transport.

Table 2: The Yearly Growth Rate on Colac Ballarat Road (Source: Victoria Department of Transport Open Data)

Year	AADT	AADTT	Growth rate per year (AADT)
2001	790	100	-
2002	830	90	5%
2003	820	100	-1%
2004	840	100	2%
2005	840	100	0%
2006	820	100	-2%
2007	850	100	4%
2008	850	100	0%
2009	870	100	2%
2010	890	100	2%
2011	930	110	4%
2012	890	110	-4%
2013	890	110	0%
2014	940	110	6%
2015	970	120	3%
2020 (est)	2000	220	16%

It is noted that the year 2020's traffic volume on Colac Ballarat Road was estimated and not surveyed. It will further be noted that the estimated year 2020 traffic volume results in a sizable year-on-year traffic growth rate of 16% between year 2015 and year 2020. In contrast, the prior period 2001 to 2015 only achieved a maximum growth rate of 6% during an isolated year. During a discussion with Colac Otway Shire mention was made of upgrades done to Princes Highway, which was recently completed, which may be the cause of the high estimated growth rate.

However, following the methodology of inferring Colac Ballarat Road's traffic growth rates for the Ondit-Warrion Road / Potters Road / Rattrays Road intersection, it is expected that the traffic volumes at the intersection will be over-estimated by some margin, especially considering the difference in road type, road function and the areas served between Colac Ballarat Road and Ondit-Warrion Road. Taking this into consideration, the following assumptions were made with regards to the traffic growth at the Ondit-Warrion Road / Potters Road / Rattrays Road intersection:

- For the period 2004 to 2015, the traffic growth rate derived from the Colac Ballarat Road traffic data would be inferred directly for the Ondit Warrion Road / Potters Road / Rattrays Road intersection's traffic growth. This equated to a year-on-year growth rate of approximately 1% per annum between 2004 and 2015.
- For the period 2015 to 2020, considering that the 16% year-on-year growth rate seemed unrealistic for the Ondit Warrion Road / Potters Road / Rattrays Road intersection's traffic growth, the 2nd highest recorded growth rate of 6% per annum was assumed more reasonable as a worst-case (over-estimate) scenario, and assumed between 2015 and 2020.

These assumed traffic growth rates was applied to the 2005 Traffic and Car Parking Report's peak hour traffic surveys (AM and PM) for the Ondit Warrion Road / Potters Road / Rattrays Road intersection, to yield the estimated 2020 peak hour volumes for this intersection for the AM and PM peak hours – refer to Figure 5 and Figure 6 for the respective estimated year 2020 AM and PM peak hour traffic volumes.

It is noted that the traffic growth rates was not applied to the left and right-turn movements into and out of Potters Road, considering that the traffic volumes on this road should have remained constant as the quarry operations have not changed since 2004, and that this road only provides access to one other property (a residential property).

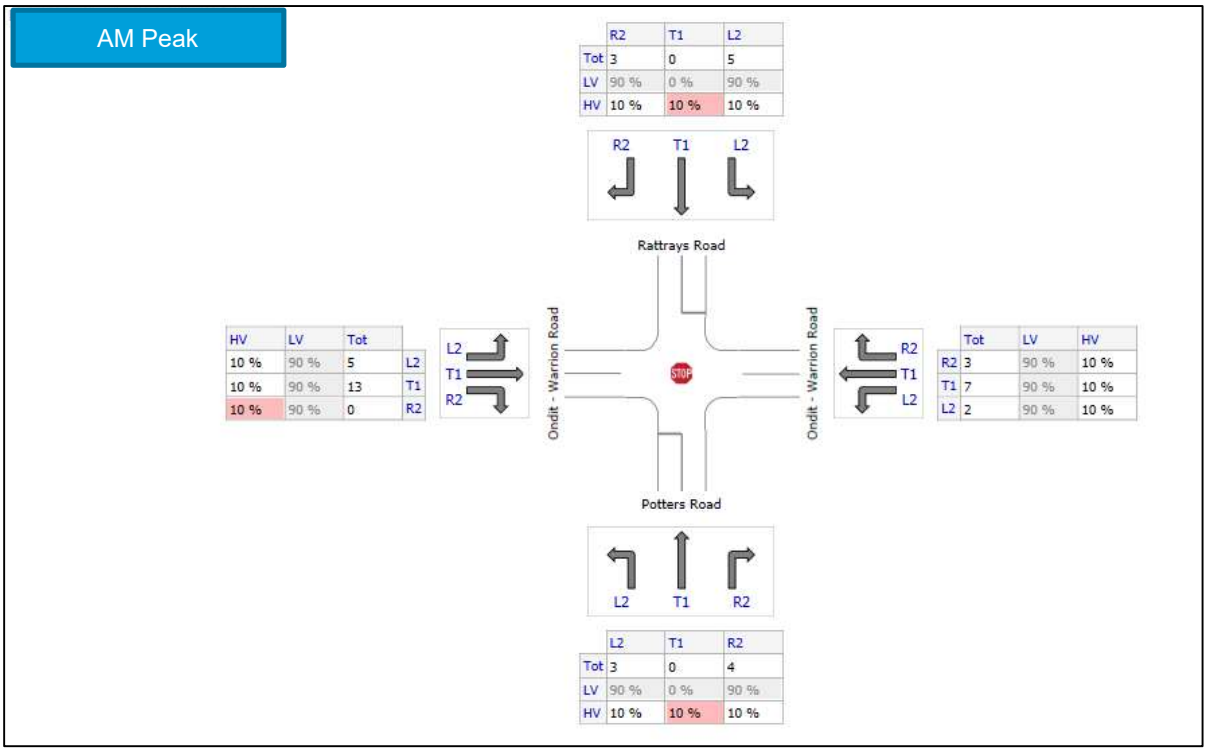

Figure 5: Estimated year 2020 AM peak hour traffic volume at the intersection of Ondit-Warrion Rd / Potters Rd / Rattrays Rd (Existing condition)

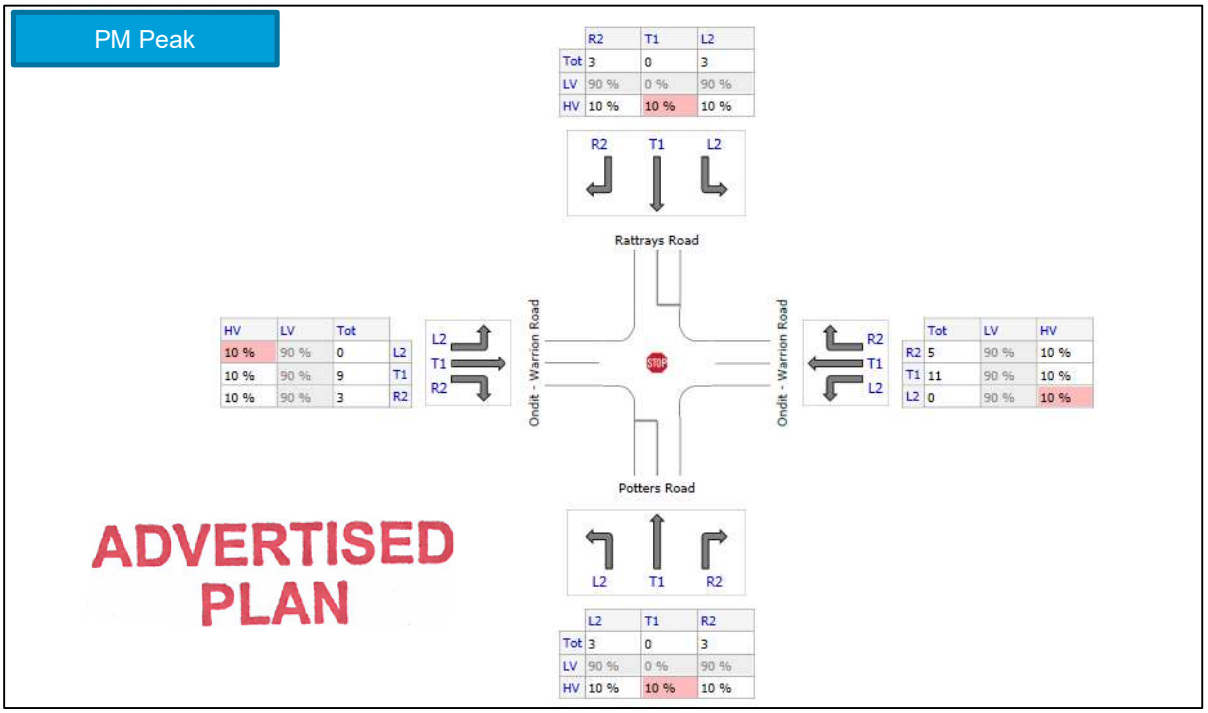

Figure 6: Estimated year 2020 PM peak hour traffic volume at the intersection of Ondit-Warrion Rd / Potters Rd / Rattrays Rd (Existing condition)

2.3 Traffic operation

The existing operating condition of the Ondit-Warrion Road / Potters Road / Rattrays Road intersection was assessed using SIDRA 9, a computer-based modelling package, which calculates the intersection performance in terms of, amongst other parameters, the demand to flow ratio (degree of saturation), queue lengths and delay experienced during peak hours.

The analysis assumed the intersection geometry shown in Figure 7 (informed by Figure 3) and the estimated intersection traffic volumes shown in Figure 5 and Figure 6 respectively for the AM and PM peak hours.

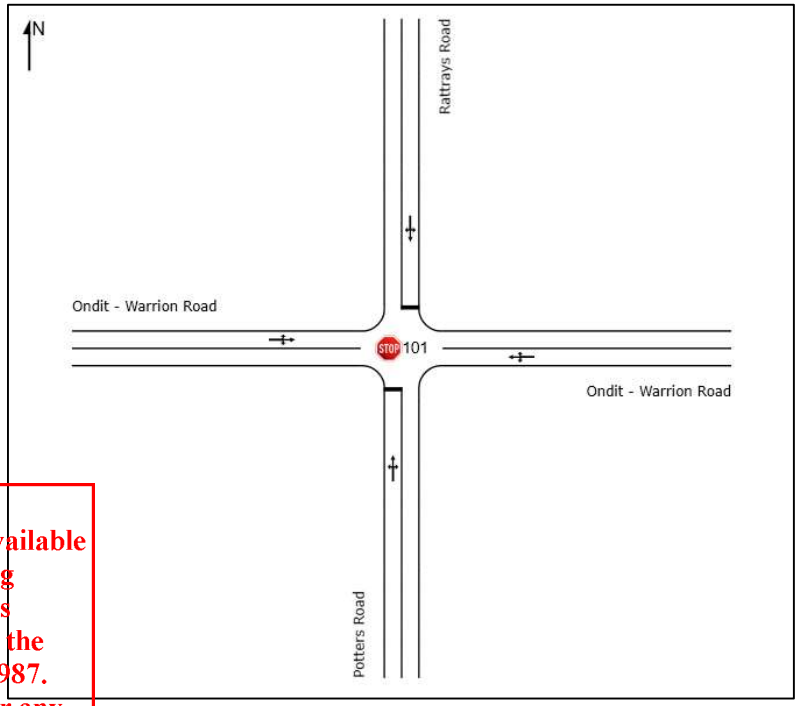

Figure 7: Intersection geometry assumed for Ondit-Warrion Road / Potters Road / Rattrays Road intersection

The results obtained from the SIDRA analysis, assuming the aforementioned geometric layout and traffic volumes, are set out within Table 3.

Table 3: Sidra results for existing operation – AM and PM peak hours

SIDRA Analysis – Existing Condition									
Approach	Lane	AM Peak Hour				PM Peak Hour			
		DOS	Queue (m)	Delay (s)	LOS	DOS	Queue (m)	Delay (s)	LOS
South: Potters Road	Left	0.008	0.2	8.5	LOS A	0.007	0.2	8.5	LOS A
	Through	0.008	0.2	8.3	LOS A	0.007	0.2	8.3	LOS A
	Right	0.008	0.2	8	LOS A	0.007	0.2	8	LOS A
	Approach	0.008	0.2	8.2	LOS A	0.007	0.2	8.3	LOS A
East: Ondit - Warrion Road	Left	0.007	0.2	5.7	LOS A	0.01	0.2	5.7	LOS A
	Through	0.007	0.2	0	LOS A	0.01	0.2	0	LOS A
	Right	0.007	0.2	5.6	LOS A	0.01	0.2	5.6	LOS A
	Approach	0.007	0.2	2.4	NA	0.01	0.2	2	NA
North: Rattrays Road	Left	0.008	0.2	8.5	LOS A	0.007	0.2	8.5	LOS A
	Through	0.008	0.2	8.3	LOS A	0.007	0.2	8.3	LOS A
	Right	0.008	0.2	8	LOS A	0.007	0.2	8	LOS A
	Approach	0.008	0.2	8.3	LOS A	0.007	0.2	8.3	LOS A
West: Ondit - Warrion Road	Left	0.011	0.1	5.7	LOS A	0.008	0.1	5.7	LOS A
	Through	0.011	0.1	0	LOS A	0.008	0.1	0	LOS A
	Right	0.011	0.1	5.6	LOS A	0.008	0.1	5.6	LOS A
	Approach	0.011	0.1	1.8	NA	0.008	0.1	1.7	NA
All Vehicles		0.011	0.2	4.2	NA	0.01	0.2	3.9	NA

From Table 3, it is apparent that the Ondit-Warrion Road / Potters Road / Rattrays Road intersection comfortably accommodates the quarry's current operations with all movements operating at LOS A, and the overall intersection operating at an average intersection delay of 4.2s during the AM peak hour and 3.9s during the PM peak hour.

2.4 Public transport

There are currently no active public transport services or stops near the existing quarry.

2.5 Non-motorised transport

There are currently no formal pedestrian and cyclist paths near the existing quarry.

2.6 Crash statistics

Three crashes, within the wider area surrounding the existing quarry, could be identified from VicRoads' crash statistics information for the five-year period 2014 to 2019. All three crashes occurred on Colac Ballarat Road south of the Ondit - Warrion Road intersection – refer to Figure 8 for crash locations.

It is noted that two of the crashes occurred in 2014, with the third occurring in 2018. Six persons were involved in the crashes, two being fatalities, one serious injury, two other injuries and one non-injury. There were also one motorcycle and one bicycle involved in these crashes – refer to crash data presented in Figure 8.

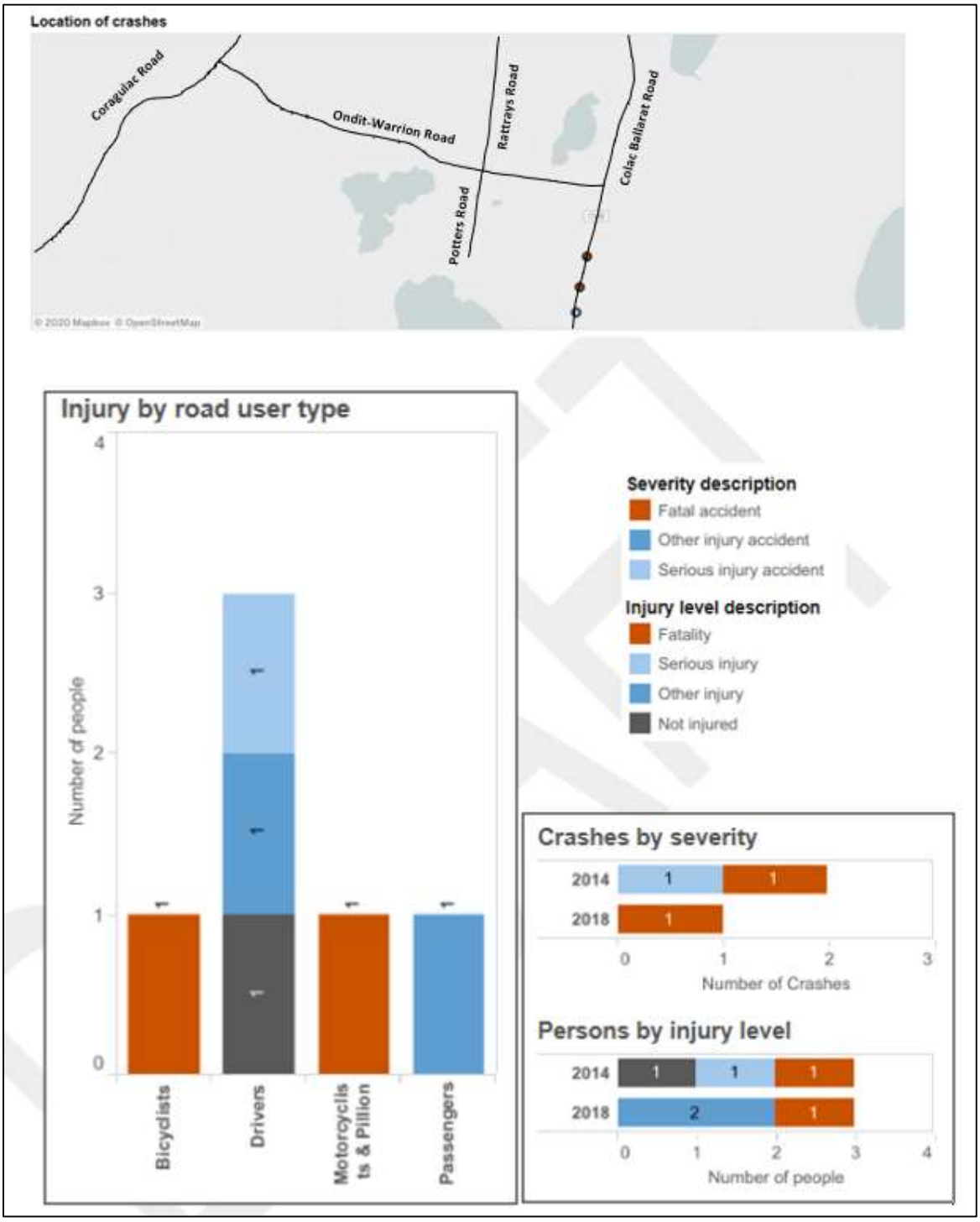

Figure 8: Crash Data

3 Traffic impact assessment

3.1 Proposed operation changes

Given the operating capacity of the quarry is not anticipated to change, no additional traffic will be generated related to the quarry's capacity. The only expected change, in terms of traffic, will be the new proposed movement of material between the NDA located north of Ondit-Warrion Road and the existing quarry located south of Ondit-Warrion Road.

It is planned to utilise a mobile primary/secondary crushing plant at the NDA, where the material will be quarried, and once processed through the crushing plant the material will be transported via either rock bodied road trucks, or articulated dump trucks, to the existing fixed tertiary screening plant at the existing quarry. From the existing quarry the processed material will be transported to the end users, as usual.

This traffic assessment considered the addition of the proposed movement of material between the NDA and existing quarry, in addition to the existing quarry's current operations. This proposed movement was assumed to take place through the Ondit-Warrion Road / Potters Road / Rattrays Road intersection, adding new traffic on both the northern (Rattrays Road) and southern (Potters Road) approaches' through movements. Figure 9 highlights the movements which are expected to be affected by the operation change.

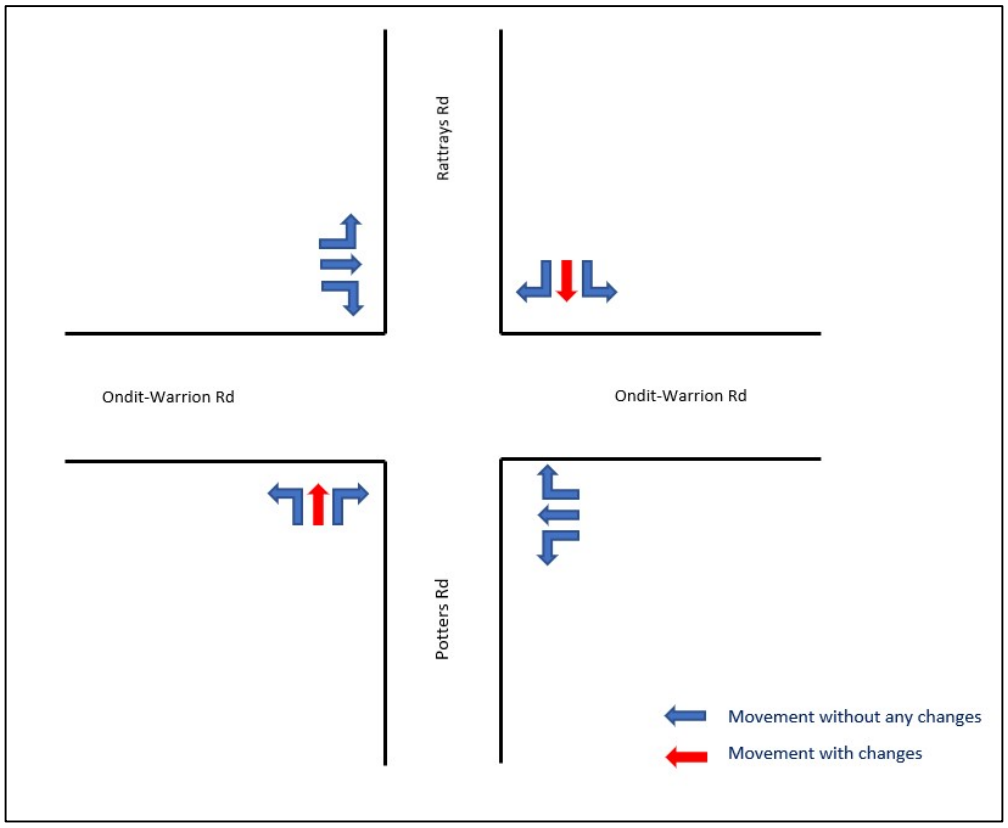

Figure 9: Intersection movements to be affected by operation change

3.1.1 Access arrangement changes

Apart from the provision of a new access on Rattrays Road toward the NDA, located north of Ondit-Warrion Road, there will be no change in the current access arrangements associated with the existing quarry.

3.1.2 Traffic generation and distribution changes

Traffic generation changes

To match the plant capacity of 180 tonnes/ hour, a total of six truckloads per hour (30t per load) will be required to be transported between the NDA and existing quarry, equating to approximately 33 truckloads per day, with a peak of approximately 100 truckloads on exceptional days. As the plant's capacity remains unchanged, there will not be any change in staffing numbers at the quarry.

The only additional traffic expected from the operational change at the quarry will therefore be:

- Six (6) new truck movements per hour (loaded with material) from the NDA to the existing quarry via the Ondit-Warrion Road / Potters Road / Rattrays Road intersection's northern approach (Rattrays Road) through movement; and
- Six (6) new truck movements per hour (returning empty) from the existing quarry to the NDA via the Ondit-Warrion Road / Potters Road / Rattrays Road intersection's southern approach (Potters Road) through movement.

Trip distribution

As there will be no change in the quarry's current production, the resulting movement of material to end users will also remain unchanged. The trip distribution onto the surrounding road network will therefore remain unchanged from the current distribution.

3.2 Traffic analysis

As described in Section 3.1.2, the operational change associated with the addition of the NDA operations is expected to result in six (6) new truck movements per hour on both the southern (Potters Road) and northern (Rattrays Road) approaches of the Ondit-Warrion Road / Potters Road / Rattrays Road intersection during the morning and afternoon peak hours. Refer to Figure 10 and Figure 11 for the assumed morning and afternoon peak hour traffic volumes considered for operational change scenario .

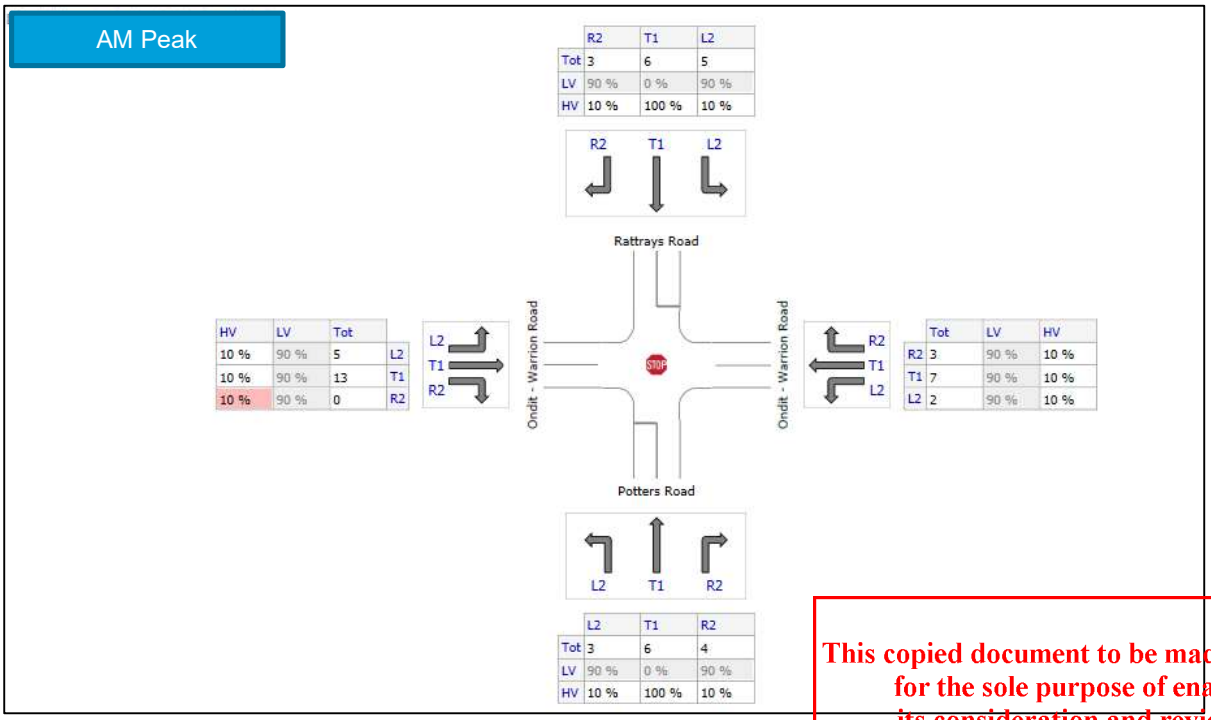

Figure 10: Estimated year 2020 AM peak hour traffic volume at the intersection of Ondit-Warrion Rd / Potters Rd / Rattrays Rd (With operational change)

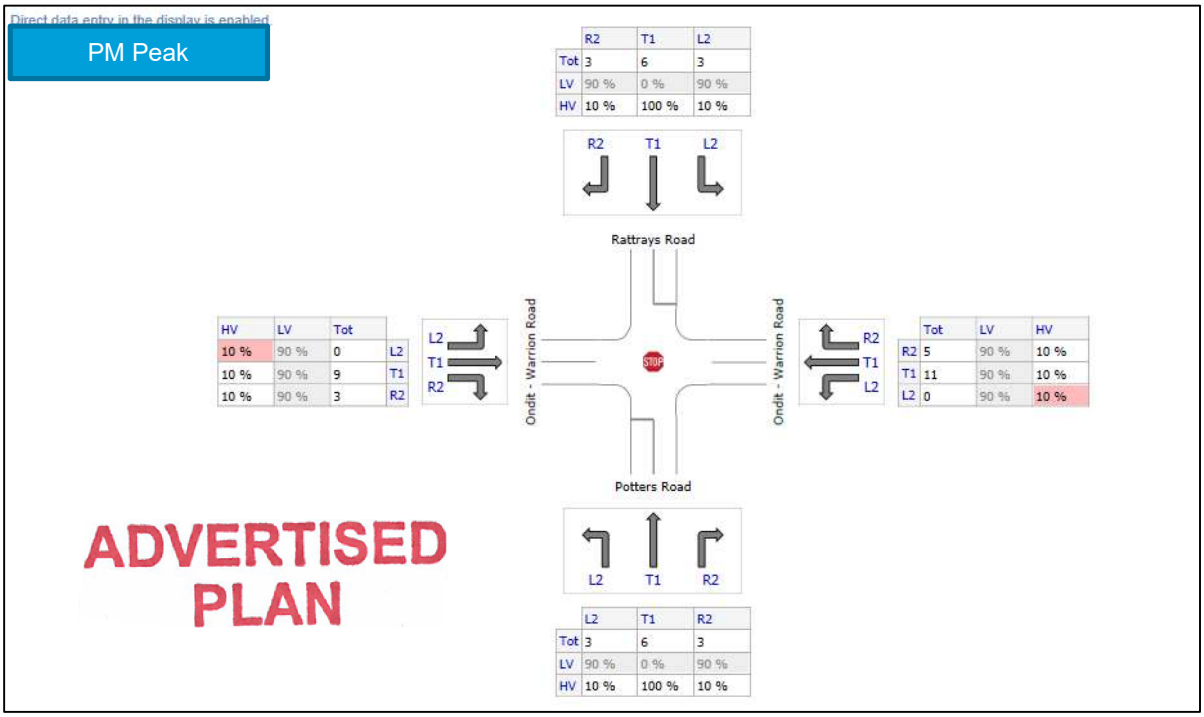

Figure 11: Estimated year 2020 PM peak hour traffic volume at the intersection of Ondit-Warrion Rd / Potters Rd / Rattrays Rd (With operational change)

The operational change at the Ondit-Warrion Road / Potters Road / Rattrays Road intersection was assessed assuming the current intersection geometry Table 4 and the assumed intersection traffic volumes shown in Figure 10 and Figure 11 respectively for the AM and PM peak hours. The analysis results obtained from the SIDRA analysis, assuming the aforementioned geometric layout and traffic volumes, are set out within Table 4.

Table 4: Sidra results for operational change (with NDA)– AM and PM peak hours

SIDRA Analysis – Northern Development Area Opening									
Approach	Lane	AM Peak Hour				PM Peak Hour			
		DOS	Queue (m)	Delay (s)	LOS	DOS	Queue (m)	Delay (s)	LOS
South: Potters Road	Left	0.015	0.5	8.5	LOS A	0.014	0.5	8.5	LOS A
	Through	0.015	0.5	12.8	LOS B	0.014	0.5	12.8	LOS B
	Right	0.015	0.5	8.1	LOS A	0.014	0.5	8.1	LOS A
	Approach	0.015	0.5	10.4	LOS B	0.014	0.5	10.6	LOS B
East: Ondit - Warrion Road	Left	0.007	0.2	5.7	LOS A	0.01	0.2	5.7	LOS A
	Through	0.007	0.2	0	LOS A	0.01	0.2	0	LOS A
	Right	0.007	0.2	5.6	LOS A	0.01	0.2	5.6	LOS A
	Approach	0.007	0.2	2.4	NA	0.01	0.2	2	NA
North: Rattrays Road	Left	0.016	0.5	8.5	LOS A	0.014	0.5	8.5	LOS A
	Through	0.016	0.5	12.8	LOS B	0.014	0.5	12.8	LOS B
	Right	0.016	0.5	8.1	LOS A	0.014	0.5	8.1	LOS A
	Approach	0.016	0.5	10.3	LOS B	0.014	0.5	10.6	LOS B
West: Ondit - Warrion Road	Left	0.011	0.1	5.7	LOS A	0.008	0.1	5.7	LOS A
	Through	0.011	0.1	0	LOS A	0.008	0.1	0	LOS A
	Right	0.011	0.1	5.6	LOS A	0.008	0.1	5.6	LOS A
	Approach	0.011	0.1	1.8	NA	0.008	0.1	1.7	NA
All Vehicles		0.016	0.5	5.9	NA	0.014	0.5	5.7	NA

From Table 4, it is apparent that the addition of the NDA operations will have no material impact on the Ondit-Warrion Road / Potters Road / Rattrays Road intersection. The worst level of service expected will be LOS B, which will be on the Potters Road and Rattrays Road through movements, where the additional traffic will be added. The intersection is still expected to operate at acceptable level of performance, with

average intersection delays only expected to increase slightly to 5.9s (increase of 1.7s) during the AM peak hour and 5.7s (increase of 1.8s) during the PM peak hour.

3.3 Road condition

As with the current quarry's existing permit, allowing access to be taken from Potters Road, the same is expected to allow access to be taken from Rattrays Road toward the NDA. Rattrays Road will need to be constructed and sealed from site entry of the NDA to the Intersection of Rattrays Road and Ondit-Warrion Road.

3.4 Sight restrictions

A desktop sight distance assessment was undertaken to ascertain whether the intersection of Ondit-Warrion Road / Potters Road / Rattray Road has potential road safety risks associated with the addition of the Northern Development Area's traffic.

The methodology followed for the desktop sight distance assessment comprised of the use of on street imagery to determine the visibility from Potters Road and Rattrays Road onto Ondit-Warrion Road's eastern and western directions. The estimated sight visibility distances to the east and west along Ondit-Warrion Road were then compared to Austroads' required minimum Stopping Sight Distance (SSD) for a road with characteristics such as Ondit-Warrion Road, to determine whether the additional north-south heavy vehicle crossings posed any road safety risks.

The following assumptions were made for the sight distance assessment:

- A high-speed rural freeways and intersections reaction time of 2.5s was assumed for the sight distance calculations along Ondit-Warrion Road;
- The coefficient of deceleration (d) was assumed to be 0.36 and 0.29 respectively for cars and trucks, being the desirable values for calculating minimum stopping distances for typical urban and rural road types; and
- Speed limit of 100 km/hr along Ondit-Warrion Road.

From Austroads Guide to Road Design Part 3 – Geometric Design, and the above assumptions on the reaction time and speed environment, the desirable minimum SSD along Ondit-Warrion Road for cars is 179m, increasing to 205m for trucks.

Based on the desktop assessment, the sight distance to the east were estimated to be approximately 340m, whereas to the west the sight distance were estimated at 215m. Based on this high level assessment, both eastern and western sight distances are beyond the minimum required SSD for both cars and trucks and therefore deemed safe. It is however still advised, for road safety reasons, to install truck crossing warning signs on both approaches along Ondit-Warrion Road toward this intersection.

4 Car parking

Statutory requirements (Clause 52.06 of the Colac Otway Planning Scheme) call for car parking to be provided to the satisfaction of the responsible authority for developments such as the quarry. Based on this requirement, the current permit for the existing quarry stipulates that ten (10) car spaces need to be provided on the site for use by staff and visitors. As is indicated in Section 2.1.2, these ten car spaces are currently provided on site.

Considering that the addition of the NDA will not result in the increase in either staff or visitor numbers, as the level of production from the quarry will remain the same, and all ancillary services such as offices will remain unchanged at the existing quarry, no additional car spaces will be required over and above the ten that is already provided at the existing quarry.

5 Limitations

At the time of writing this report, Victoria was managing the Covid-19 pandemic which has had an effect on the traffic volumes. Victoria's current travel requirements under Covid-19 Stages 3 and 4 restrictions has meant that travel behaviour has been severely impacted.

Based on the Covid 19 travel restrictions, undertaking traffic surveys during this time was therefore not possible as the surveyed data would have been skewed and would not have provided a true reflection of normal travel behaviour on the road network surrounding the quarry.

6 Conclusions and recommendations

6.1 Conclusions

The following conclusions can be drawn from the Traffic Impact Assessment (TIA) investigation:

- Holcim (Australia) Pty Ltd is seeking to add approximately 41 hectares additional land (the Northern Development Area (NDA)) to their existing quarry (WA158), to extend their operations and reserve the life of the quarry.
- The operating capacity of the quarry will not change with the addition of the NDA to WA158, and no additional traffic will therefore be generated by the quarry onto the surrounding road network. However, material movement will occur between the NDA and the existing quarry. This new movement of material will occur along Potters Road and Rattrays Road, via the Ondit-Warrion Road / Potters Road / Rattrays Road intersection, thereby being the only intersection that is expected to be impacted on by the addition of the NDA to WA158.
- The current (2020) traffic volumes at the intersection were estimated from a combination of a historic (2004) intersection count and the application, and assumptions on, observed traffic growth rates from the nearby Colac Ballarat Road between 2004 and 2020.
- With the addition of the NDA it is expected that an additional six truckloads per hour will need to be transported between the NDA and existing quarry, to match the plant's capacity. The NDA's operations will therefore add six new truck movements per hour (loaded with material) from the NDA to the existing quarry via the Ondit-Warrion Road / Potters Road / Rattrays Road intersection's northern approach (Rattrays Road) through movement, as well as six new truck movements per hour (returning empty) from the existing quarry to the NDA via the Ondit-Warrion Road / Potters Road / Rattrays Road intersection's southern approach (Potters Road) through movement.
- To assess the potential impact of the addition of the NDA to the existing quarry's operations, the existing operating condition (Existing Condition) of the Ondit-Warrion Road / Potters Road / Rattrays Road intersection, was compared with operational change to investigate how this may change following the addition of the NDA to the quarry operations. The result yielded minimal change in average intersection delays (all below 10s) for the operational change. The worst performing movements related to the through movements on both Potters Road and Rattrays Road, which is expected to operate at LOS B. The addition of the NDA's operations therefore yielded negligible changes to ether the LOS or average intersection delays at the intersection.
- To allow access to be taken from Rattrays Road toward the NDA, it is expected that Rattrays Road will need to be constructed and sealed at a width of approximately 6.9m from the proposed NDA entry gate south to the intersection of Ondit-Warrion Road.
- The current permit for the existing quarry operations stipulate that ten car spaces need to be provided on site for use by staff and visitors. These are currently provided and considering that the addition of the NDA will not increase staff or visitor numbers, or change the current provision of ancillary services such as offices, no additional car spaces will be required over and above those that are currently provided at the existing quarry.

- There is no sight restrictions for turning movements from Potters Road and Rattrays Road onto Ondit-Warrion Road.

6.2 Recommendations

The following recommendations is made from the Traffic Impact Assessment (TIA) investigation findings:

- That no intersection upgrading be required at the Ondit-Warrion Road / Potters Road / Rattrays Road intersection, or any other surrounding intersections, to support the addition of the NDA operations;
- Truck crossing warning signs be installed on both approaches along Ondit-Warrion Road toward this intersection, for road safety reasons;
- No additional car spaces be required to support the addition of the NDA operations; and
- That Rattrays Road be constructed, and sealed between the intersection of Ondit-Warrion Road and the entry gate of the NDA to allow for access to be taken, and to support the vehicle movements along this road.

Appendix A: SIDRA Results – AM Peak

LANE SUMMARY – (Existing Operation) AM Peak

Site: 101 [Ondit-Warrion Rd/Potters Rd AM -Existing Condition (Site Folder: Growth 6%)]

New Site
Site Category: (None)
Stop (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Potters Road													
Lane 1	8	10.0	1088	0.008	100	8.2	LOS A	0.0	0.2	Full	773	0.0	0.0
Approach	8	10.0		0.008		8.2	LOS A	0.0	0.2				
East: Ondit - Warrion Road													
Lane 1	13	10.0	1762	0.007	100	2.4	LOS A	0.0	0.2	Full	2074	0.0	0.0
Approach	13	10.0		0.007		2.4	NA	0.0	0.2				
North: Rattrays Road													
Lane 1	9	10.0	1157	0.008	100	8.3	LOS A	0.0	0.2	Full	549	0.0	0.0
Approach	9	10.0		0.008		8.3	LOS A	0.0	0.2				
West: Ondit - Warrion Road													
Lane 1	20	10.0	1794	0.011	100	1.8	LOS A	0.0	0.1	Full	763	0.0	0.0
Approach	20	10.0		0.011		1.8	NA	0.0	0.1				
Intersection	51	10.0		0.011		4.2	NA	0.0	0.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY – (Existing Operation) AM Peak

Site: 101 [Ondit-Warrion Rd/Potters Rd AM -Existing Condition (Site Folder: Growth 6%)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Potters Road														
1	L2	3	10.0	3	10.0	0.008	8.5	LOS A	0.0	0.2	0.05	0.99	0.05	54.2
2	T1	1	10.0	1	10.0	0.008	8.3	LOS A	0.0	0.2	0.05	0.99	0.05	53.2
3	R2	4	10.0	4	10.0	0.008	8.0	LOS A	0.0	0.2	0.05	0.99	0.05	56.5
Approach		8	10.0	8	10.0	0.008	8.2	LOS A	0.0	0.2	0.05	0.99	0.05	55.6
East: Ondit - Warrion Road														
4	L2	2	10.0	2	10.0	0.007	5.7	LOS A	0.0	0.2	0.05	0.24	0.05	58.4
5	T1	7	10.0	7	10.0	0.007	0.0	LOS A	0.0	0.2	0.05	0.24	0.05	59.1
6	R2	3	10.0	3	10.0	0.007	5.6	LOS A	0.0	0.2	0.05	0.24	0.05	58.0
Approach		12	10.0	13	10.0	0.007	2.4	NA	0.0	0.2	0.05	0.24	0.05	58.7
North: Rattrays Road														
7	L2	5	10.0	5	10.0	0.008	8.5	LOS A	0.0	0.2	0.07	0.97	0.07	56.4
8	T1	1	10.0	1	10.0	0.008	8.3	LOS A	0.0	0.2	0.07	0.97	0.07	53.1
9	R2	3	10.0	3	10.0	0.008	8.0	LOS A	0.0	0.2	0.07	0.97	0.07	52.9
Approach		9	10.0	9	10.0	0.008	8.3	LOS A	0.0	0.2	0.07	0.97	0.07	55.4
West: Ondit - Warrion Road														
10	L2	5	10.0	5	10.0	0.011	5.7	LOS A	0.0	0.1	0.01	0.19	0.01	57.1
11	T1	13	10.0	14	10.0	0.011	0.0	LOS A	0.0	0.1	0.01	0.19	0.01	59.4
12	R2	1	10.0	1	10.0	0.011	5.6	LOS A	0.0	0.1	0.01	0.19	0.01	57.1
Approach		19	10.0	20	10.0	0.011	1.8	NA	0.0	0.1	0.01	0.19	0.01	59.0
All Vehicles		48	10.0	51	10.0	0.011	4.2	NA	0.0	0.2	0.04	0.48	0.04	57.8

LANE SUMMARY – Operational Change Scenario (with NDA) AM Peak

Site: 101 [Ondit-Warrion Rd/Potters Rd AM-NDA (Site Folder: Growth 6%)]

New Site
Site Category: (None)
Stop (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Potters Road													
Lane 1	14	51.5	905	0.015	100	10.4	LOS B	0.1	0.5	Full	773	0.0	0.0
Approach	14	51.5		0.015		10.4	LOS B	0.1	0.5				
East: Ondit - Warrion Road													
Lane 1	13	10.0	1762	0.007	100	2.4	LOS A	0.0	0.2	Full	2074	0.0	0.0
Approach	13	10.0		0.007		2.4	NA	0.0	0.2				
North: Rattrays Road													
Lane 1	15	48.6	948	0.016	100	10.3	LOS B	0.1	0.5	Full	549	0.0	0.0
Approach	15	48.6		0.016		10.3	LOS B	0.1	0.5				
West: Ondit - Warrion Road													
Lane 1	20	10.0	1794	0.011	100	1.8	LOS A	0.0	0.1	Full	763	0.0	0.0
Approach	20	10.0		0.011		1.8	NA	0.0	0.1				
Intersection	61	28.6		0.016		5.9	NA	0.1	0.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY – Operational Change Scenario (with NDA) AM Peak

Site: 101 [Ondit-Warrion Rd/Potters Rd AM-NDA (Site Folder: Growth 6%)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Potters Road														
1	L2	3	10.0	3	10.0	0.015	8.5	LOS A	0.1	0.5	0.07	1.11	0.07	53.0
2	T1	6	100.0	6	100.0	0.015	12.8	LOS B	0.1	0.5	0.07	1.11	0.07	49.2
3	R2	4	10.0	4	10.0	0.015	8.1	LOS A	0.1	0.5	0.07	1.11	0.07	55.8
Approach		13	51.5	14	51.5	0.015	10.4	LOS B	0.1	0.5	0.07	1.11	0.07	52.9
East: Ondit - Warrion Road														
4	L2	2	10.0	2	10.0	0.007	5.7	LOS A	0.0	0.2	0.05	0.24	0.05	58.4
5	T1	7	10.0	7	10.0	0.007	0.0	LOS A	0.0	0.2	0.05	0.24	0.05	59.1
6	R2	3	10.0	3	10.0	0.007	5.6	LOS A	0.0	0.2	0.05	0.24	0.05	58.0
Approach		12	10.0	13	10.0	0.007	2.4	NA	0.0	0.2	0.05	0.24	0.05	58.7
North: Rattrays Road														
7	L2	5	10.0	5	10.0	0.016	8.5	LOS A	0.1	0.5	0.09	1.09	0.09	55.7
8	T1	6	100.0	6	100.0	0.016	12.8	LOS B	0.1	0.5	0.09	1.09	0.09	49.3
9	R2	3	10.0	3	10.0	0.016	8.1	LOS A	0.1	0.5	0.09	1.09	0.09	51.7
Approach		14	48.6	15	48.6	0.016	10.3	LOS B	0.1	0.5	0.09	1.09	0.09	52.9
West: Ondit - Warrion Road														
10	L2	5	10.0	5	10.0	0.011	5.7	LOS A	0.0	0.1	0.01	0.19	0.01	57.1
11	T1	13	10.0	14	10.0	0.011	0.0	LOS A	0.0	0.1	0.01	0.19	0.01	59.4
12	R2	1	10.0	1	10.0	0.011	5.6	LOS A	0.0	0.1	0.01	0.19	0.01	57.1
Approach		19	10.0	20	10.0	0.011	1.8	NA	0.0	0.1	0.01	0.19	0.01	59.0
All Vehicles		58	28.6	61	28.6	0.016	5.9	NA	0.1	0.5	0.05	0.62	0.05	56.4

Appendix B: SIDRA Results – PM Peak

LANE SUMMARY – (Existing Operation) PM Peak

Site: 101 [Ondit-Warrion Rd/Potters Rd PM -Existing Condition (Site Folder: Growth 6%)]

New Site
Site Category: (None)
Stop (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Potters Road													
Lane 1	7	10.0	1110	0.007	100	8.3	LOS A	0.0	0.2	Full	773	0.0	0.0
Approach	7	10.0		0.007		8.3	LOS A	0.0	0.2				
East: Ondit - Warrion Road													
Lane 1	18	10.0	1766	0.010	100	2.0	LOS A	0.0	0.2	Full	2074	0.0	0.0
Approach	18	10.0		0.010		2.0	NA	0.0	0.2				
North: Rattrays Road													
Lane 1	7	10.0	1111	0.007	100	8.3	LOS A	0.0	0.2	Full	549	0.0	0.0
Approach	7	10.0		0.007		8.3	LOS A	0.0	0.2				
West: Ondit - Warrion Road													
Lane 1	14	10.0	1774	0.008	100	1.7	LOS A	0.0	0.1	Full	763	0.0	0.0
Approach	14	10.0		0.008		1.7	NA	0.0	0.1				
Intersection	46	10.0		0.010		3.9	NA	0.0	0.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY – (Existing Operation) PM Peak

Site: 101 [Ondit-Warrion Rd/Potters Rd PM -Existing Condition (Site Folder: Growth 6%)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Potters Road														
1	L2	3	10.0	3	10.0	0.007	8.5	LOS A	0.0	0.2	0.07	0.98	0.07	54.2
2	T1	1	10.0	1	10.0	0.007	8.3	LOS A	0.0	0.2	0.07	0.98	0.07	53.1
3	R2	3	10.0	3	10.0	0.007	8.0	LOS A	0.0	0.2	0.07	0.98	0.07	56.5
Approach		7	10.0	7	10.0	0.007	8.3	LOS A	0.0	0.2	0.07	0.98	0.07	55.4
East: Ondit - Warrion Road														
4	L2	1	10.0	1	10.0	0.010	5.7	LOS A	0.0	0.2	0.03	0.21	0.03	58.5
5	T1	11	10.0	12	10.0	0.010	0.0	LOS A	0.0	0.2	0.03	0.21	0.03	59.3
6	R2	5	10.0	5	10.0	0.010	5.6	LOS A	0.0	0.2	0.03	0.21	0.03	58.1
Approach		17	10.0	18	10.0	0.010	2.0	NA	0.0	0.2	0.03	0.21	0.03	58.9
North: Rattrays Road														
7	L2	3	10.0	3	10.0	0.007	8.5	LOS A	0.0	0.2	0.06	0.98	0.06	56.4
8	T1	1	10.0	1	10.0	0.007	8.3	LOS A	0.0	0.2	0.06	0.98	0.06	53.1
9	R2	3	10.0	3	10.0	0.007	8.0	LOS A	0.0	0.2	0.06	0.98	0.06	52.9
Approach		7	10.0	7	10.0	0.007	8.3	LOS A	0.0	0.2	0.06	0.98	0.06	55.0
West: Ondit - Warrion Road														
10	L2	1	10.0	1	10.0	0.008	5.7	LOS A	0.0	0.1	0.03	0.18	0.03	57.1
11	T1	9	10.0	9	10.0	0.008	0.0	LOS A	0.0	0.1	0.03	0.18	0.03	59.4
12	R2	3	10.0	3	10.0	0.008	5.6	LOS A	0.0	0.1	0.03	0.18	0.03	57.1
Approach		13	10.0	14	10.0	0.008	1.7	NA	0.0	0.1	0.03	0.18	0.03	58.9
All Vehicles		44	10.0	46	10.0	0.010	3.9	NA	0.0	0.2	0.04	0.45	0.04	57.9

LANE SUMMARY – Operational Change Scenario (with NDA) PM Peak

Site: 101 [Ondit-Warrion Rd/Potters Rd PM-NDA (Site Folder: Growth 6%)]

New Site
Site Category: (None)
Stop (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Potters Road													
Lane 1	13	55.0	902	0.014	100	10.6	LOS B	0.0	0.5	Full	773	0.0	0.0
Approach	13	55.0		0.014		10.6	LOS B	0.0	0.5				
East: Ondit - Warrion Road													
Lane 1	18	10.0	1766	0.010	100	2.0	LOS A	0.0	0.2	Full	2074	0.0	0.0
Approach	18	10.0		0.010		2.0	NA	0.0	0.2				
North: Rattrays Road													
Lane 1	13	55.0	903	0.014	100	10.6	LOS B	0.0	0.5	Full	549	0.0	0.0
Approach	13	55.0		0.014		10.6	LOS B	0.0	0.5				
West: Ondit - Warrion Road													
Lane 1	14	10.0	1774	0.008	100	1.7	LOS A	0.0	0.1	Full	763	0.0	0.0
Approach	14	10.0		0.008		1.7	NA	0.0	0.1				
Intersection	57	30.0		0.014		5.7	NA	0.0	0.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY – Operational Change Scenario (with NDA) PM Peak

Site: 101 [Ondit-Warrion Rd/Potters Rd PM-NDA (Site Folder: Growth 6%)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Potters Road														
1	L2	3	10.0	3	10.0	0.014	8.5	LOS A	0.0	0.5	0.09	1.11	0.09	52.9
2	T1	6	100.0	6	100.0	0.014	12.8	LOS B	0.0	0.5	0.09	1.11	0.09	49.1
3	R2	3	10.0	3	10.0	0.014	8.1	LOS A	0.0	0.5	0.09	1.11	0.09	55.7
Approach		12	55.0	13	55.0	0.014	10.6	LOS B	0.0	0.5	0.09	1.11	0.09	52.5
East: Ondit - Warrion Road														
4	L2	1	10.0	1	10.0	0.010	5.7	LOS A	0.0	0.2	0.03	0.21	0.03	58.5
5	T1	11	10.0	12	10.0	0.010	0.0	LOS A	0.0	0.2	0.03	0.21	0.03	59.3
6	R2	5	10.0	5	10.0	0.010	5.6	LOS A	0.0	0.2	0.03	0.21	0.03	58.1
Approach		17	10.0	18	10.0	0.010	2.0	NA	0.0	0.2	0.03	0.21	0.03	58.9
North: Rattrays Road														
7	L2	3	10.0	3	10.0	0.014	8.5	LOS A	0.0	0.5	0.08	1.11	0.08	55.6
8	T1	6	100.0	6	100.0	0.014	12.8	LOS B	0.0	0.5	0.08	1.11	0.08	49.1
9	R2	3	10.0	3	10.0	0.014	8.1	LOS A	0.0	0.5	0.08	1.11	0.08	51.5
Approach		12	55.0	13	55.0	0.014	10.6	LOS B	0.0	0.5	0.08	1.11	0.08	52.0
West: Ondit - Warrion Road														
10	L2	1	10.0	1	10.0	0.008	5.7	LOS A	0.0	0.1	0.03	0.18	0.03	57.1
11	T1	9	10.0	9	10.0	0.008	0.0	LOS A	0.0	0.1	0.03	0.18	0.03	59.4
12	R2	3	10.0	3	10.0	0.008	5.6	LOS A	0.0	0.1	0.03	0.18	0.03	57.1
Approach		13	10.0	14	10.0	0.008	1.7	NA	0.0	0.1	0.03	0.18	0.03	58.9
All Vehicles		54	30.0	57	30.0	0.014	5.7	NA	0.0	0.5	0.06	0.60	0.06	56.4

Document prepared by

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Aurecon Centre
Level 8, 850 Collins Street
Docklands, Melbourne VIC 3008
PO Box 23061
Docklands VIC 8012
Australia

[redacted]

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