Proposed Expansion of Faheys Pit Quarry Activities

Traffic Impact Assessment

Lot 31 DP 1203488, No. 9720 Armidale Road, Tyringham, NSW

for

Outline Planning Consultants Pty Ltd
Town Planning & Project Management

On behalf of

A Richards & T Sheridan

28 November 2022

Traffic Impact Assessment Details

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APPENDICES

1. BACKGROUND

1.1 Introduction

StreetWise Road Safety and Traffic Services have been engaged by Outline Planning Consultants, on behalf of quarry operators, Abbey Richards and Toby Sheridan, to prepare a Traffic Impact Assessment (TIA) for the continuation and expansion of an existing quarry operation known as "Faheys Pit located at Armidale Road, Tyringham, New south Wales.

The quarry material won from Faheys Pit is used for a range of purposes, primarily as a road base or select fill. The owners (Abbey Richards and Toby Sheridan) propose to increase the capacity of Faheys Pit to extract and to process up to 150,000 tonnes per annum of quarry material within an enlarged quarry footprint. It is also proposed to deepen the existing quarry.

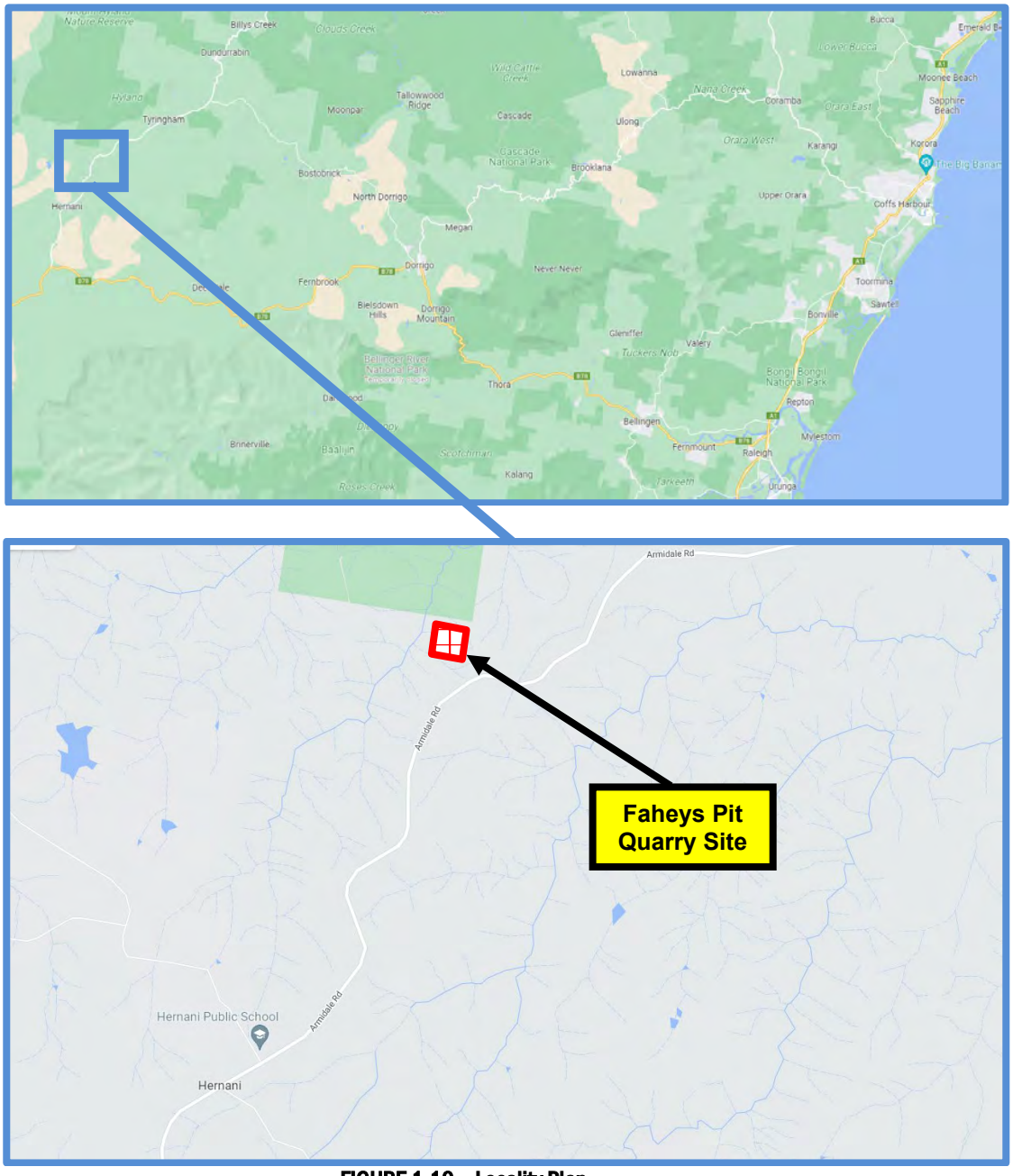


FIGURE 1.10 – Locality Plan

1.2 Quarry Location

Faheys Pit is located at No.9720 (Lot 31 DP 1203488) Armidale Road, Tyringham New South Wales. The quarry is located approximately 37km by road to the west of the township of Dorrigo on the Dorrigo Plateau, in the Clarence Valley local government area. The project site has an area of 11.46ha. It is currently utilised as an operating quarry. A locality plan is provided at Figure 1.10.

Faheys Pit is located in the south-west sector of the Clarence Valley. The surrounding section of the LGA is mainly forested land covering a land area of 2,501 square kilometres.

A Clarence Valley Council quarry (Ellis Pit) abuts the north-eastern side of the Faheys Pit site, at No. 9632 (Lot 1 DP 1139996) Armidale Road. There is an existing sawmill located to the east of the site at No. 9630 (Lot 2 DP 1139996) Armidale Road. See Figure 1.20.

FIGURE 1.20 – Aerial photo of Faheys Pit and Surrounding Area

1.3 Existing Operation

The existing Faheys Pit quarry operation is privately owned by Abbey Richards and Toby Sheridan. Quarry material is won from the quarry by Sheridans Hard Rock Quarry Pty Ltd, the quarry operator. The slopes below the quarry have been recently cleared by the adjoining sawmill.

The topography of Faheys Pit is undulating to flat within the active quarry, with slopes outside of the quarry footprint considered to be steep (plus 30%), with ridges having generally moderate slopes.

Transport of quarry product from the site is via an internal haul route back onto Armidale Road.

1.4 Previous Approvals

Faheys Pit has been in operation since before 1960. In conjunction with the neighbouring quarry pit, known as Ellis' Pit, an Environmental Impact Statement (EIS)

was prepared in 1995. An EIS was prepared by Local Government Engineering Services Pty Ltd in August 1995 in support of the continued operation of the two subject quarry operations, described in the EIS as follows:

- Ellis' Pit: Part Portion 1 DP 752847, Parish of Tyringham Shire of Nymboida (now Clarence Valley) Owner: PL Ellis (now Clarence Valley Council) Operator: formerly Nymboida Shire Council (now Clarence Valley Council)
- Fahey's Pit: Lot 31 DP 752826, Parish of Tyringham Shire of Nymboida (now a part of the Clarence Valley local government area) Owner: JC Fahey (now Abbey Richards and Tobey Sheridan) Operator: formerly M Withrington (currently Sheridans Hard Rock Quarry Pty Ltd)

1.5 Assessment Scope of Work

This traffic impact assessment will assess the expansion of the Faheys Pit operation including:

- Estimate of additional quarry-generated trips resulting from proposed increased annual extraction limits.
- Assess impacts on local road network (ie. Armidale Road).
- Prepare a Traffic Impact Assessment report in accordance with the TfNSW Guide to Traffic Generating Developments.

Further to the above Scope of Work for this traffic impact assessment the NSW Department of Planning has provided its Secretary's Environmental Assessment Requirements (SEARs) for the quarry expansion in relation to traffic and transport. The following is a summary of the provided SEARs:-

- Accurate predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products;
- Assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road networks, detailing the nature of the traffic generated, transport routes, traffic volumes and potential impacts on local and regional roads;
- Description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road network (particularly the proposed transport routes) over the life of the development; - evidence of any consultation with relevant roads authorities, regarding the establishment of agreed contributions towards road upgrades or maintenance; and
- Description of access roads, specifically in relation to nearby Crown roads and fire trails;

1.6 Consultation

As part of completing the assessment of this quarry expansion StreetWise Road Safety & Traffic Services has consulted with:-

- Clarence Valley Council, and
- Transport for NSW Development North.

2. ROAD NETWORK

2.1 Local Road Network

The existing Faheys Pit quarry operation is located approximately 10.8km northeast of the intersection of The Waterfall Way (MR76) and Armidale Road (MR74) at the street address of 9720 Armidale Road, Tyringham.

The main haul route (road) will be via the Armidale Road (MR74) south back to The Waterfall Way (MR76 / B78) then approximately 4.30km to Bald Hill Road and then travelling onto the Sheridans Hard Rock Quarry operation at Cornells Road, Hernani.

2.1.1 Armidale Road (MR74)

Armidale Road (MR74) provides connection between Armidale (The Waterfall Way) in the south and Grafton to the northeast. The formation generally provides for a single travel lane in each direction with widenings at intersections as required.

The travel lanes are generally 3.20 to 3.50m wide in each direction with 0.50 to 2.00m wide sealed and unsealed gravel shoulders.

The posted speed limit in the vicinity of the quarry operation is 100km/h.

Armidale Road (north of The Waterfall Way intersection) is a gazetted as up to a 19m long B Double route north to Grafton.

2.1.2 The Waterfall Way (MR 76 / B78)

The Waterfall Way Road (MR76 / B78) provides connection to Dorrigo, Bellingen and Raleigh to the east and Armidale to the south and Grafton to the northeast via Armidale Road (The Waterfall Way). The formation generally provides for a single travel lane in each direction with widenings at intersections as required.

The travel lanes are generally 3.30 to 3.50m wide in each direction with 1.00 to 1.50m wide sealed and unsealed gravel shoulders.

The posted speed limit in the vicinity of the quarry operation is 80km/h.

The Waterfall Way is a gazetted as up to a 25m long B Double route.

2.1.3 Un-named Quarry Access Road

Access to the quarry operation is via a "Crown Road Reserve" from Armidale Road (MR 74) directly to the quarry site. The access road is currently a gravel formation of varying width but generally being a minimum of 4.0m wide.

2.1.4 Fire Trail

There is an informal fire trail that intersects at approximately 80m along the Faheys Pit access road from the intersection with Armidale Road. There is no formal formation that the trail follows only being a cleared width through the vegetation. An access gate is located on the eastern boundary of the quarry site providing access to the fire trail.

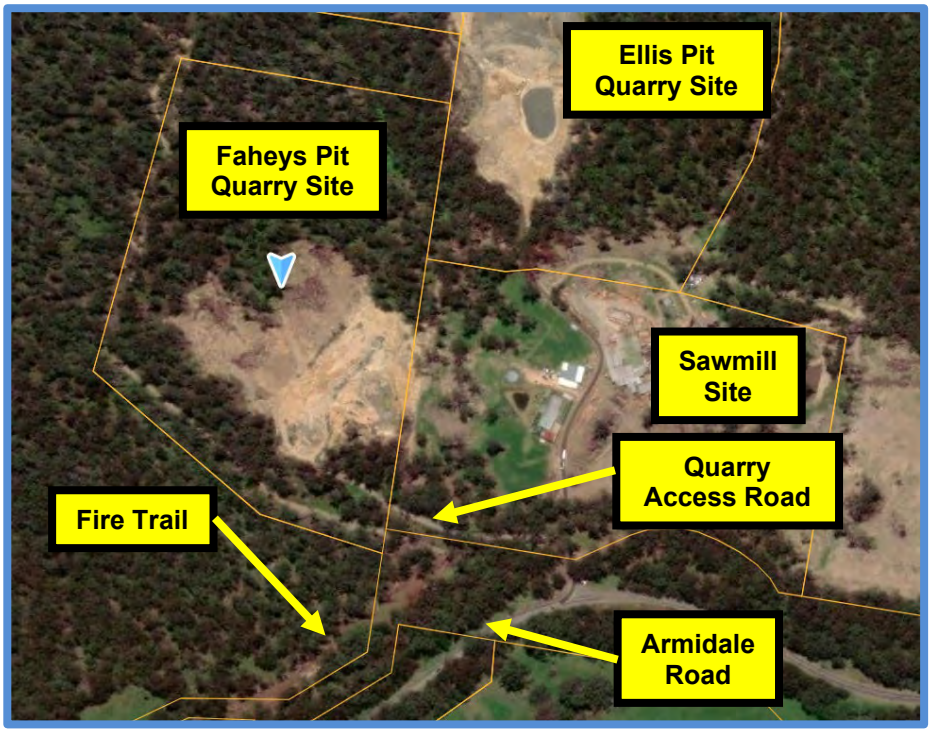


FIGURE 2.10 – Location of Fire Trail

FIGURE 2.11 – Locked Gate Fire Trail

2.1.5 Intersection of Armidale Road & Un-named Quarry Access Road

The intersection of Armidale Road (MR 74) and the Un-named Quarry Access Road generally conforms to a minimum standard BAR intersection treatment. The configuration of this intersection arrangement was completed as part of a previous Development Application approval (DA 40/95) where 2.0m wide sealed shoulders were to be provided for a distance of 50m each side of the quarry access road.

There is edgeline and centreline linemarking provided through the intersection. This intersection is also utilised by the adjoining Ellis Pit quarry operation and the existing sawmill.

The travel lanes on Armidale Road (MR 74) are 3.50m wide in each direction with a sealed 2.0m wide shoulder tapering back to 1.0m on departure on the eastern side of the intersection. A similar shoulder treatment is provided on the western side of the intersection widening from 1.0m to 2.0m wide at the access road.

FIGURE 2.10 – Intersection of Armidale Road & Un-named Access Road (Faheys Pit) Looking South

FIGURE 2.11 – Intersection of Armidale Road & Un-named Access Road (Faheys Pit) Looking North

FIGURE 2.12 – Intersection of Armidale Road & Un-named Access Road (Faheys Pit) at Un-named Access Road

2.1.6 Intersection of The Waterfall Way (MR 76 / B78) & Armidale Road (MR 74)

The intersection of The Waterfall Way (MR76 / B78) and Armidale Road (MR 74) generally conforms to a minimum standard BAR intersection treatment.

The travel lanes on Armidale Road (MR 74) / The Waterfall Way (MR76 / B78) are 3.50m wide in each direction with unsealed 1.0 to 1.5m wide gravel shoulders along each side of the intersection. There is only centreline linemarking provided through the intersection.

3. EXISTING TRAFFIC VOLUMES

3.1 Armidale Road (MR 74)

Traffic volume data obtained from Clarence Valley Council indicates that in 2017 at a location just south of the Cedar Creek Road intersection the Annual Average Daily Traffic (AADT) were 420 vehicles per day. Cedar Creek Road is located approximately 6.50km north of Faheys Pit off Armidale Road.

At a location approximately 1.80km north of Cedar Creek Road indicated that in 2005 the AADT was 328 vehicles per day. Based on these figures this represents an annual increase of 2.33% in traffic growth for this section of Armidale Road.

Therefore to bring these figures up to the year 2022 a calculated AADT of 470 vehicles per day is derived.

3.2 Ellis Pit (Clarence Valley Council)

StreetWise Road Safety & Traffic Services contacted Clarence Valley Council who operate the Ellis Pit to obtain traffic data for the number of trips generated by that quarry quarry.

The following data was provided for the period between August 23, 2021, to April 28, 2022.

Total of Work Days During Period	91 days (excluding weekend days)
Total Number of Laden Trips	914
Average Number Laden of Daily Trips	10 trips
Average Number Return Daily Trips (Laden / Unladen)	20 trips
Average Number Laden of Peak Hr Trips	1 trip (10 hr work day)
Average Number Return Peak Hr Trips (Laden / Unladen)	2 trips (10 hr work day)

3.3 Existing Saw Mill

Information obtained by StreetWise Road Safety & Traffic Services from the sawmill operators indicates the operation generates 6 laden (& 6 unladen) trips per week or an average of 1 laden (& 1 unladen) trip per day.

4. FUTURE TRAFFIC ASSESSMENT

4.1 Expanded Quarry Traffic Generation

The quarry material won from Faheys Pit is used for a range of purposes, primarily as a road base or select fill.

It is planned to expand the operation of the Fahey Pit up to 150 000 tonnes per annum.

A mix of truck and dog combinations (32 & 37.50 tonnes), with larger and smaller trucks used where road weight limits allow. It is estimated that the future expanded quarry may generate up to 60 laden quarry trucks per day.

Table 4.10 provides a summary of the annual average operation for the expanded quarry.

	Proposed Expanded Operation (Average)
Annual Output (tonnes)	**150 000**
Average Vehicle Capacity (Truck & Dog / tonnes)	32 or 37.50
Total Average No. of Laden Trucks (Yr)	**4 688 or 4000**
Available working weeks per year	48
Max. Working Hours (wk) (1)	61
Av. No. of Laden Trucks (wk)	**97 or 83**
Av. No. of Laden Trips (day)	**17.50 or 14.97**
Av. No. of Laden Trips (hr)	**1.59 or 1.36**
Av. No. of Return Trips (day) - Laden & Unladen	**35 or 29.93**

TABLE 4.10 – Annual Average Expanded Quarry Operation Calculation

Based on a maximum of 60 laden trips per day Table 4.11 provides a summary of the annual maximum operation for the expanded quarry.

	Proposed Expanded Operation (Maximum)
Annual Output (tonnes)	**150 000**
Vehicle Capacity (Truck & Dog / tonnes)	32 or 37.50
Available working weeks per year	48
Maximum No. of Laden Trucks (Yr)	**4 688 or 4000**
Max. Working Hours (wk) (1)	61
Max. No. of Laden Trips (day)	*60*
Max. No. of Laden Trips (week)	**330**
Max. No. of Laden Trips (hr)	**5.50**
Max. No. of Return Trips (day) - Laden & Unladen	**120**
No. of Max Days (Yr)	*78 or 66*

TABLE 4.11 – Annual Maximum Expanded Quarry Operation Calculation

Notes:-
Hours of Operation
- *7.00am to 6.00pm (Monday to Friday)*
- *7.00am to 1.00pm (Saturdays)*
- *No Work Sundays*

From the above calculations it can be found the maximum output of 60 laden trips per day will greatly reduce the number of days the operation will have an increased impact on the local road network. However, the daily impacts will be increased to just under four (4) fold compared to the average daily generated laden trips of 16 laden trips per day.

It shall be noted given Armidale Road is an approved 19m B Double Truck Route there is a possibility the quarry operator may include the use of these types of vehicles into the future. A 19m B Double Truck has a capacity of between 55.5 to 62.5 tonnes (GML) depending on the axle configuration. The use of these vehicles can further reduce the number of laden and unladen truck movements for the quarry operation.

4.2 Summary Traffic Generation

The following is a summary of the existing and predicted traffic generation to be used in the assessment of the existing access road with Armidale Road.

Table 4.20 provides a summary of a predicted peak hour scenario.

Land Use Operation	Existing or Predicted Peak Hour Traffic Generation
Ellis Pit Quarry Laden Trips	1 (Section 3.3)
Sawmill	0.1 (Section 3.4)
Faheys Pit Laden Trips (Average / Maximum)	1.50 / 5.50 (Section 4.1)
Total Peak Hour Trip Generation	**2.60 (3) / 6.60 (7) laden trips** ***(4.60 (5) / 13.20 (13.0) laden / unladen return trips)***

TABLE 4.20 – Summary of Total Peak Hour Trip Generation

4.3 Traffic Growth

As discussed in Section 3.1 of this assessment based on the existing provided traffic volumes between 2005 and 2017 the annual average traffic growth increase is 2.33%. For the purposes of future traffic volume assessment on Armidale Road an annual traffic growth rate of 2.50% will be applied to the Armidale Road volumes.

Therefore, based on the above assumptions the future predicted traffic flows on Armidale Road are assumed to be 610 trips in both directions for ten (10) years into the future.

4.4 Traffic Distribution

For the purposes of this assessment the following traffic distribution has been assumed:-

- 60% of return (laden / unladen) trips out in a peak hour, and
- 40% of return (laden / unladen) trips in in a peak hour.

For both the average and maximum peak hour expanded quarry operation.

4.5 Traffic Assignment

It is expected material form the quarry expansion will be used on local roads in the first instance as well as other projects in the region reconstruction projects. In detail this material will mainly be used on projects located along The Waterfall Way in the first instance.

It is envisaged that further into the life of the quarry materials will be used on upgrades to Armidale Road as well as other projects in the region.

For the purposes of this assessment the following traffic distribution is provided:-

- 90% to the south (The Waterfall Way)
- 10% to the north (Armidale Road)

4.6 Future Predicted Traffic Volumes

Using the existing peak period traffic volumes for Armidale Road and incorporating the predicted traffic generation (Table 4.20) and traffic growth for ten (10) years into the future, the predicted Armidale Road traffics volumes are provided in Figure 4.60 for the average and maximum operation of Faheys Pit operation).

As there is no data available to determine when or if there are AM or PM peak periods the predicted daily two way flows (610 trips, at ten years into the future) have been adjusted by 50% to obtain a one way flow (305) and then obtained 10% of that flow to provide a peak hour flow (34).

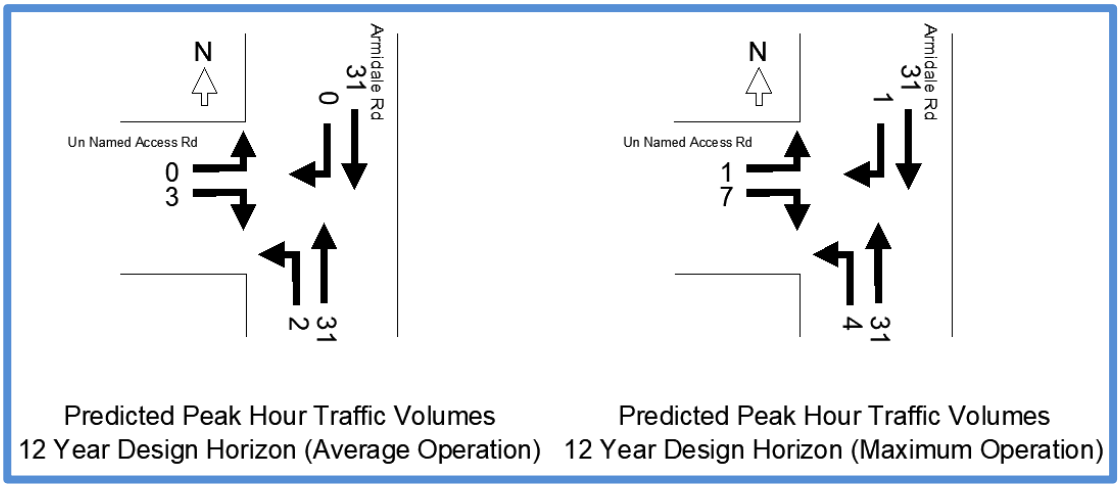


FIGURE 4.60 – Predicted Peak Hour Traffic Volumes
(12 Year Design Horizon for Average & Maximum Operation Outputs)

4.7 Intersection Requirements

Section 2.1.4 of this assessment indicated the existing access configuration conforms to a Type BAR intersection layout in accordance with the Austroads Guide to Road Design.

This section will assess if there is any requirement to upgrade the access intersection for the Faheys Pit quarry expansion and the existing operations of Ellis Pit quarry and the sawmill who utilise the same access location.

Based on Figure 3.25a of the Austroads Guide to Traffic Management, Part 6 – Intersections, Interchanges and Crossings the following intersection warrant assessment is provided in relation to the predicted peak hour traffic flows (Figures 4.70 & 4.71) for the access intersection.

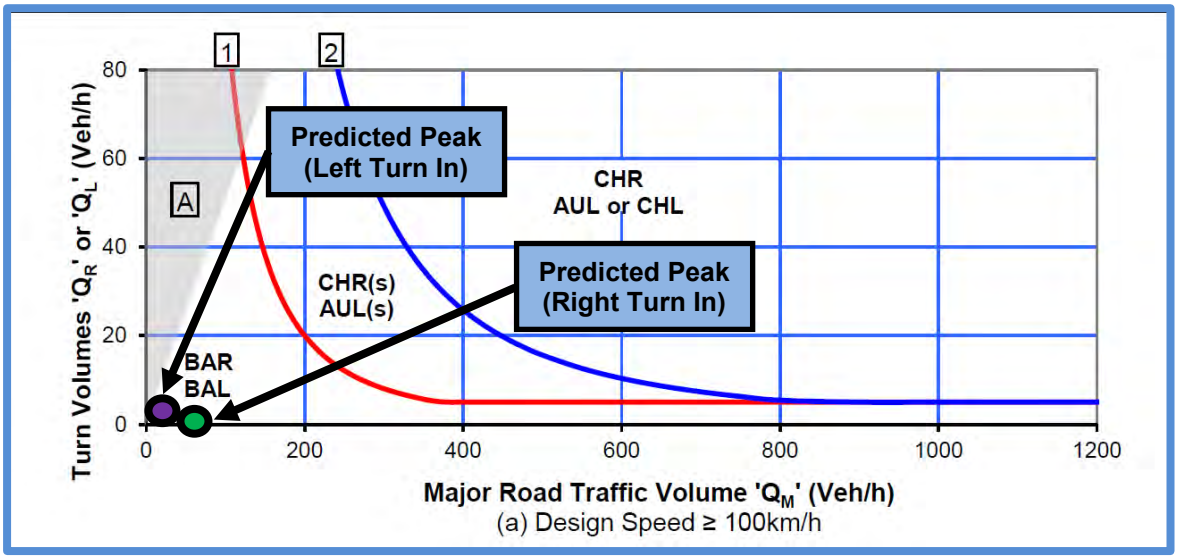


FIGURE 4.70 – WARRANTS FOR TURN TREATMENTS FOR THE MAJOR ROAD AT UNSIGNALISED INTERSECTIONS (FAHEYS PIT, ELLIS PIT & SAWMILL ACCESS – AVERAGE OUTPUT OPERATION)

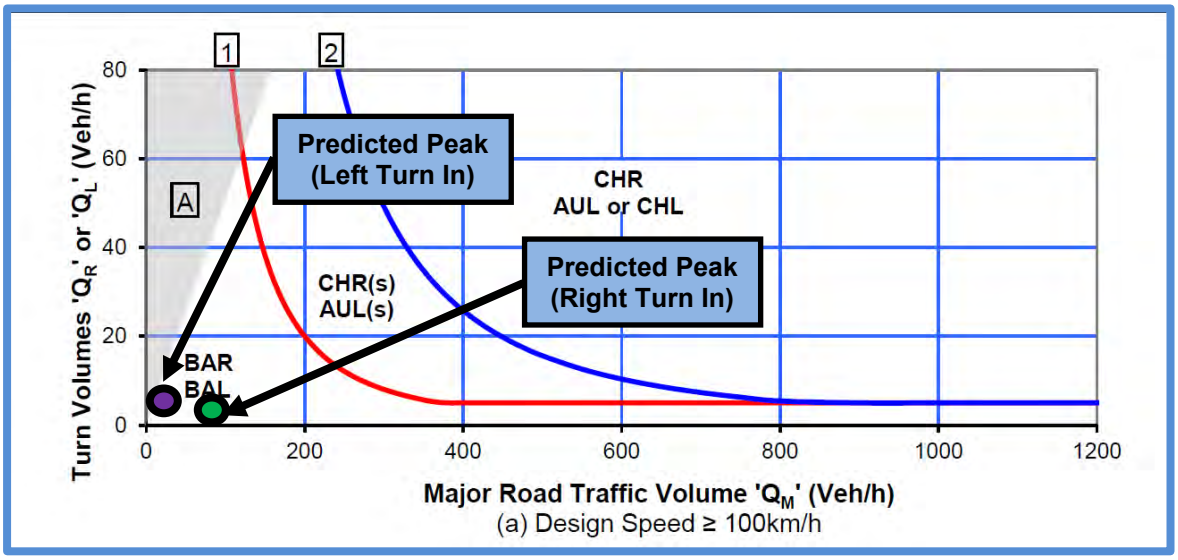


FIGURE 4.71 – WARRANTS FOR TURN TREATMENTS FOR THE MAJOR ROAD AT UNSIGNALISED INTERSECTIONS (FAHEYS PIT, ELLIS PIT & SAWMILL ACCESS – MAXIMUM OUTPUT OPERATION)

The assessment above, indicates the access intersection will adequately operate for the life of the quarry expansion for both the average (full 12 month operation) and maximum (up to 60 laden trips per day operation) operations being a Type BAR intersection layout.

5. ROAD SAFETY

As part of assessing the future intersection requirements for the expanded operation of the Fahey Pit road safety for all road users will need to be considered given the traffic mix. Therefore, the following assessment will be completed with regard to road safety around the access intersection:-

- Safe Intersection Sight Distance (SISD).
- Crash History, and
- Road Capacity.

5.1 Safe Intersection Sight Distance

In accordance with Table 3.2 of the Austroads Guide to Road Design, Part 4a – Unsignalised and Signalised Intersections considering the posted speed limit on Armidale Road in the vicinity of the quarry access is 100km/h the SISD required is 248m for a desirable reaction time (R_T) of 2 seconds.

Figure 5.10 provides an indication of the SISD requirements for the horizontal plane for the quarry access.

In both directions from the quarry access road the required SISD is reduced by a pre-existing condition where there is an existing amount vegetation growing along the inside edge of the curved road alignment. There is approximately 75 to 80m of SISD available to the south of the access road while there is approximately 140m available to the north of the intersection in the horizontal plane.

For there to be adequate SISD in accordance with the Austroads requirements approximately 70m of vegetation clearing on the southern side of the intersection will be required and approximately 100m of vegetation clearing will be required on the northern side of the intersection.

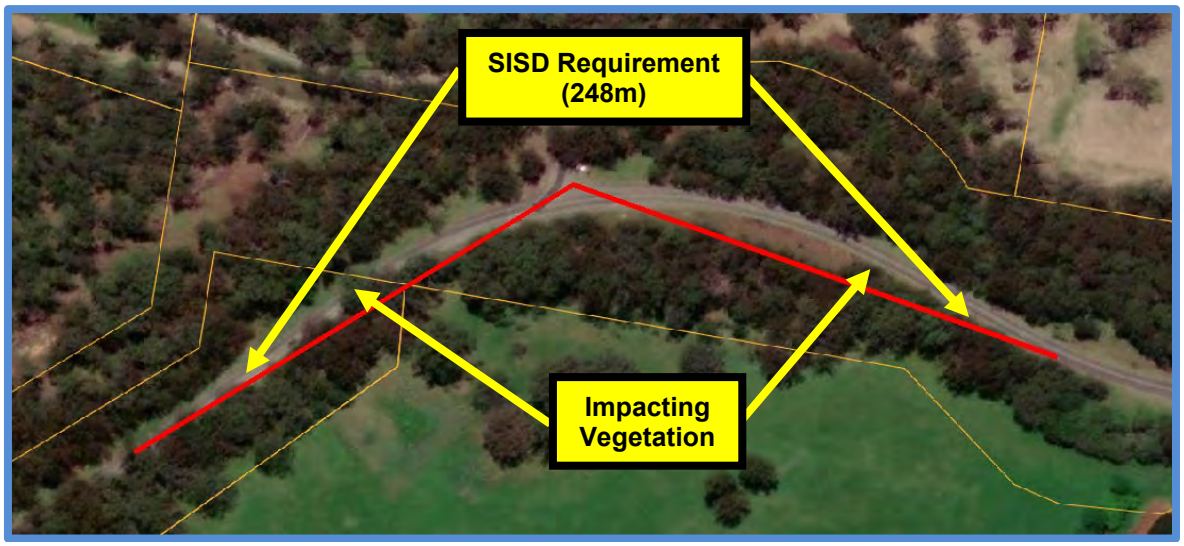


FIGURE 5.10 – SAFE INTERSECTION SIGHT DISTANCE ASSESSMENT (HORIZONTAL PLANE)

Further site assessments will need to be completed to determine more accurately the extent of vegetation to be removed to attain the SISD requirements.

When considering the vertical plane for SISD the intersection sits on a slight crest. There is the required SISD to both the south and the north of the intersection.

It is noted typical SISD assessment provides for a driver's eye height of 1.10m sighting to a height of 1.25m (top / roof of car). Given the majority of vehicles using this access are heavy vehicles the drivers eye height can be adjusted up to 2.40m thus improving sight distance.

In order to make drivers more aware of heavy vehicles in area and to improve road safety around the quarry access it is recommended W5 – 22 (A size) signs be erected 150m on approach to each side of the quarry access.

FIGURE 5.11 – TYPICAL W5-22 SIGN FACE (TfNSW)

The installation of the above sign can be used as a mitigation measure for the limited sight distance that warns drivers to expect the possibility of turning heavy vehicles ahead.

As there will be a minor increase in traffic volumes (up to 13 peak period trips or approximately 1 trip every 4.5 minutes) the pre-existing sight distance to the north will not be a prohibitive constraint for the quarry expansion. As previously assessed the looping of vegetation will further improve the sight distance at the quarry access intersection for this requirement.

5.2 Crash History

The Transport for New South Wales website does not indicate any heavy vehicle crashes in the vicinity of the existing quarry within the past 10 years. However, the website indicates 6 light vehicle crashes between The Waterfall Way intersection and the quarry site, which occurred between 2016 and 2020 and resulted in minor to serious injuries.

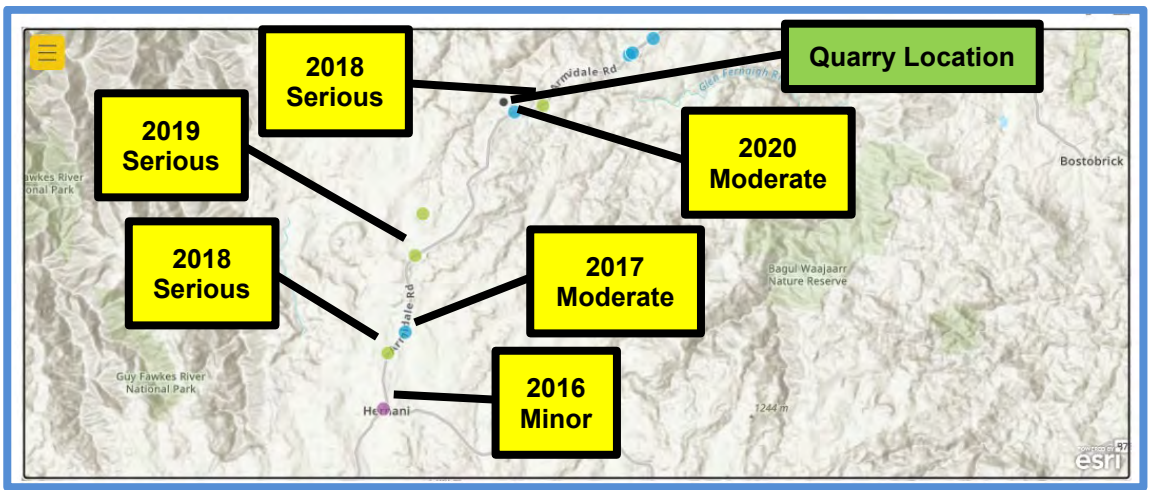


FIGURE 5.20 – Extract of Armidale Road Crash Map (NSW Centre for Road Safety)

None of the reported crashes are attributed to or involve heavy vehicles.

5.3 Road Capacity

Road capacity can have a major impact on the road safety of a road. These impacts can relate to gaps in traffic, impatience by drivers where gaps in traffic flows are minimal, acceptable travel times, ability for traffic to merge with through traffic.

Figure 5.30 provides an extract from the TfNSW Guide to Generating Developments in relation to roadway capacities on rural roads.

Terrain	Level of Service	Percent of Heavy Vehicles			
		0	5	10	15
Level	B	630	590	560	530
	C	1030	970	920	870
	D	1630	1550	1480	1410
	E	2630	2500	2390	2290
Rolling	B	500	420	360	310
	C	920	760	650	570
	D	1370	1140	970	700
	E	2420	2000	1720	1510
Mountainous	B	340	230	180	150
	C	600	410	320	260
	D	1050	680	500	400
	E	2160	1400	1040	820

Table 4.5
peak hour flow on two-lane rural roads (veh/hr)
(Design speed of 100km/hr)

FIGURE 5.30 – Rural Road Capacities for 2 lane rural roads with a design speed of 100km/h (Extract TfNSW Guide to Traffic Generating Developments)

When considering Armidale Road the terrain is considered to rolling and the percentage of heavy vehicles to be up to 10% where the roadway capacity can be from 360 to 1720 vehicles per hour for two way flows. For Armidale Road, the future daily traffic flows have been predicted to be 610 per day or 61 vehicles per hour for two way flows. Therefore, based on Figure 5.30 the Level of Service (LoS) is considered to be A with ample capacity for any future increase in traffic volumes.

6. PUBLIC TRANSPORT

Currently there are no approved bus routes in the vicinity of the quarry access on Armidale Road. However, there are school bus pickup and setdown locations along Armidale Road namely in the village of Hernani. The extent of these services is unsure as services are operated by small contractor bus companies.

7. SITE SERVICING

As stated previously in this assessment this assessment for the expansion of an existing quarry operation known as Fahey Pit. There is an existing access road from Armidale Road to the quarry site. This access road also services an existing sawmill and another quarry operation owned by Clarence Valley Council known as Ellis Pit.

The existing access road (to Faheys Pit) is a gravel formation on varying width with a minimum width of 4.50m. This access will remain adequate for the future expanded quarry operation.

8. SUMMARY

StreetWise Road Safety and Traffic Services have been engaged by Outline Planning Consultants, on behalf of quarry operators, Abbey Richards and Toby Sheridan, to prepare a Traffic Impact Assessment (TIA) for the expansion of an existing quarry operation known as “Faheys Pit located at Armidale Road, Tyringham, New south Wales.

The quarry material won from Faheys Pit is used for a range of purposes, primarily as a road base or select fill. The owners (Abbey Richards and Toby Sheridan) propose to

increase the capacity of Faheys Pit to extract and to process up to 150,000 tonnes per annum of quarry material within an enlarged quarry footprint. It is also proposed to deepen the existing quarry.

The expanded quarry operation will provide for an average of 16 laden daily truck movements. The expanded operation is seeking approval for a maximum of 60 laden daily trips. The operation will be serviced by truck & dog vehicles ranging from 32 to 37.50 tonnes in capacity.

As Armidale Road is an approved 19m B Double Truck Route there is a possibility the quarry operator may include the use of these types of vehicles into the future. A 19m B Double Truck has a capacity of between 55.5 to 62.5 tonnes (GML) tonnes depending on the axle configuration. The use of these vehicles can further reduce the number of laden and unladen truck movements for the quarry operation.

The existing Faheys Pit operation is serviced by an un-named access road which also jointly services a sawmill and another quarry operation owned by Clarence Valley Council known as Ellis Pit.

An assessment of all of the land use operations services by the access road indicates they will generate into the future between an average of 3 and a maximum of 7 peak hour laden trips.

Traffic flows on Armidale Road are currently in the vicinity of 470 per day. Using a traffic growth rate of 2.50% per annum over 10 years into the future the two way flows will increase to 610 trips per days.

The existing intersection access is configured to an Austroads BAR intersection layout. The configuration of this intersection arrangement was completed as part of a previous Development Application approval (DA 40/95) where 2.0m wide sealed shoulders were to be provided for a distance of 50m each side of the quarry access road. This assessment has found the BAR configuration will adequately service the land uses into the future at least for the life of Fahey Pit.

This assessment has assumed most of the trips form the Faheys Pit operation will be made to the south to service expected upgrades of The Waterfall Way. There is evidence that into the future there may be a requirement to service upgrades to the north of the quarry site for Armidale Road.

When considering the road safety of the intersection access this assessment found Safe Intersection Sight Distance (SISD) is currently not achievable for desirable SISD as there is a pre-existing condition where there a large amount vegetation growing along the edge of the formation on both sides of the intersection reducing the amount of SISD required. It is recommended further site assessments be completed to determine the extent of clearing required to attain the required SISD.

Given the expansion of the quarry will generate slightly more peak period heavy vehicle movement, it is recommended W5-22 advanced warning signage be erected each side of the approach to the intersection to make drivers more aware of heavy vehicles in the area.

The future predicted traffic flows on Armidale Road will have a very minimal increase in roadway capacity to the existing flows.

9. RECOMMENDATIONS

- The resultant expansion of the Faheys Pit operation will not require any upgrade of the existing BAR intersection layout for the life of the quarry.

- In order to attain the required Stopping Intersection Sight Distance (SISD) further on site assessment of the existing vegetation to be removed along the edge of the intersection formation will need to be completed to improve road safety around the intersection.

- W5-22 Advanced Warning signage is to be erected on both sides of the approach to the intersection to make drivers more aware of heavy vehicles in this location thus improving road safety.

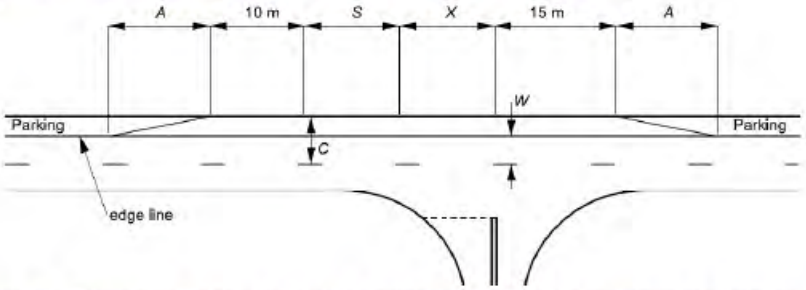
Appendix A
Austroads BAR / BAL Intersection Layout

7.5 Urban Right-turn Treatments – Undivided Roads

7.5.1 Urban Basic Right-turn Treatment (BAR)

The BAR turn treatment shown in Figure 7.6 is applicable at intersections of two-lane urban roads and minor local roads where traffic volumes do not warrant a higher order treatment. It should provide sufficient pavement width for the design through vehicle to pass a vehicle waiting to turn right. The absolute minimum pavement width on a horizontal straight should be 6.0 m between the centreline and the edge of the pavement or kerb line while 6.5 m is the preferred minimum as it is adequate for heavy vehicles (excluding road trains) to pass right-turning vehicles.

Figure 7.6: Basic right-turn treatment (BAR) for a two-lane urban road



Notes: This diagram does not show any specific bicycle facilities. Where required bicycle facilities should be provided in accordance with this Part.
The dimensions of the treatment are defined thus:

- *W* = *Nominal through lane width (m) (including widening for curves). Width to be continuous through the intersection.*
- *C* = *On straights* – *6.0 m minimum*
  – *6.5 m minimum for 19 m semi-trailers and B-doubles*
  – *7.0 m minimum for Type 1 and Type 2 road trains*
  On curves – *widths as above + curve widening (based on widening for the design turning vehicle plus* – *widening for the design through vehicle).*
- *A* = $\frac{0.5V(C-W)}{3.6}$
  Increase length A on tighter curves (e.g. where side friction demand is greater than the maximum desirable). Where the design through vehicle is larger than or equal to a 19 m semi-trailer, the minimum speed used to calculate A is 80 km/h.
- *V* = *Design speed of major road approach (km/h).*
- *S* = *Storage length to cater for one design turning vehicle (m) (minimum length 12.5 m).*
- *X* = *Distance based on design vehicle turning path, refer to Design Vehicles and Turning Path Templates (Austroads 2013f).*

Source: Department of Main Roads (2006)[30].

A turning radius in accordance with *Design Vehicles and Turning Path Templates* (Austroads 2013f) should be used and the design turning vehicle's swept path should be used to determine the length of approach and departure widening for the site geometrics (i.e. angle of intersection, width of carriageways). No lane lines or right-turn arrows should be marked on the pavement for a BAR turn treatment. The provision of bicycle lanes should be considered, refer to *AGTM Part 6* (Austroads 2013a) and *AGRD Part 4* (Austroads 2017) for further information.

30 Department of Main Roads (2006) has been superseded and Figure 7.6 has not been carried forward into Queensland Department of Transport and Main Roads (2016).