STANBURY
TRAFFIC PLANNING
TRAFFIC, PARKING & TRANSPORT CONSULTANTS

TRAFFIC ASSESSMENT

CLAY / SHALE QUARRY
275 ADAMS ROAD, LUDDENHAM

PREPARED FOR EPIC MINING
OUR REF: 17-027

APRIL 2017

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TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

1.1 Background & Scope of Assessment

Stanbury Traffic Planning has been commissioned by Epic Mining to undertake an assessment of operational performance and capacity of the access arrangements currently servicing a clay / shale quarry located at 275 Adams Road, Luddenham.

The quarry, which is serviced by an access road intersecting with Elizabeth Drive approximately 550m to the east of Adams Road, has been operating for a number of years in accordance with a 2004 approval. The 2004 approval limits the production of quarry products to 300,000 tonnes per annum. This production limit has been previously assessed and approved to generate an average of approximately 40 trucks servicing the site on a daily basis, generating a total of 80 movements (being 40 ingress and 40 egress movements).

Notwithstanding the above, traffic generation associated with the quarry operations is somewhat sporadic in nature. In this regard, the quarry operation is weather dependent (it cannot operate during heavy rainfall) and product sales vary on a day to day and week to week basis. The quarry site access road therefore, at times, accommodates traffic demands over and above the abovementioned previously assessed and approved average of 40 trucks per day.

This aim of this assessment is to investigate and report upon the existing traffic generating potential of the quarry and the ability or otherwise of the existing site access arrangements and adjoining road network to accommodate this traffic generating potential. Further, a capacity analysis of the site access arrangements is undertaken to determine the ability of the immediately adjoining road network to accommodate any possible increases in traffic generating potential of the quarry, should it occur in the future.

This report provides the following scope of assessment:

- Section 1 provides a summary of the site location, details in conjunction with the existing and surrounding land-uses;
- Section 2 describes the existing operational and traffic generation characteristics of the quarry;
- Section 3 describes the existing quarry access arrangements and assesses the existing traffic conditions surrounding and servicing the quarry including a description of the surrounding road network, traffic demands and operational performance; and
- Section 4 undertakes a capacity analysis of the existing quarry access arrangements in order to determine the ability or otherwise of the immediately adjoining public road network to accommodate potential increases in traffic generating capacity, should it occur in the future.

1.2 Reference Documents

Reference is made to the following documents during the preparation pf this report:

- The Roads & Maritime Services' *Guide to Traffic Generating Developments*;
- Austroads' *Guide to Road Design Part 4a: Unsignalised and Signalised Intersections*; and
- Epic Mining's R*oad Transport Protocol: Luddenham Quarry 275 Adams Road, Luddenham* (January 2017).

1.3 Site Details

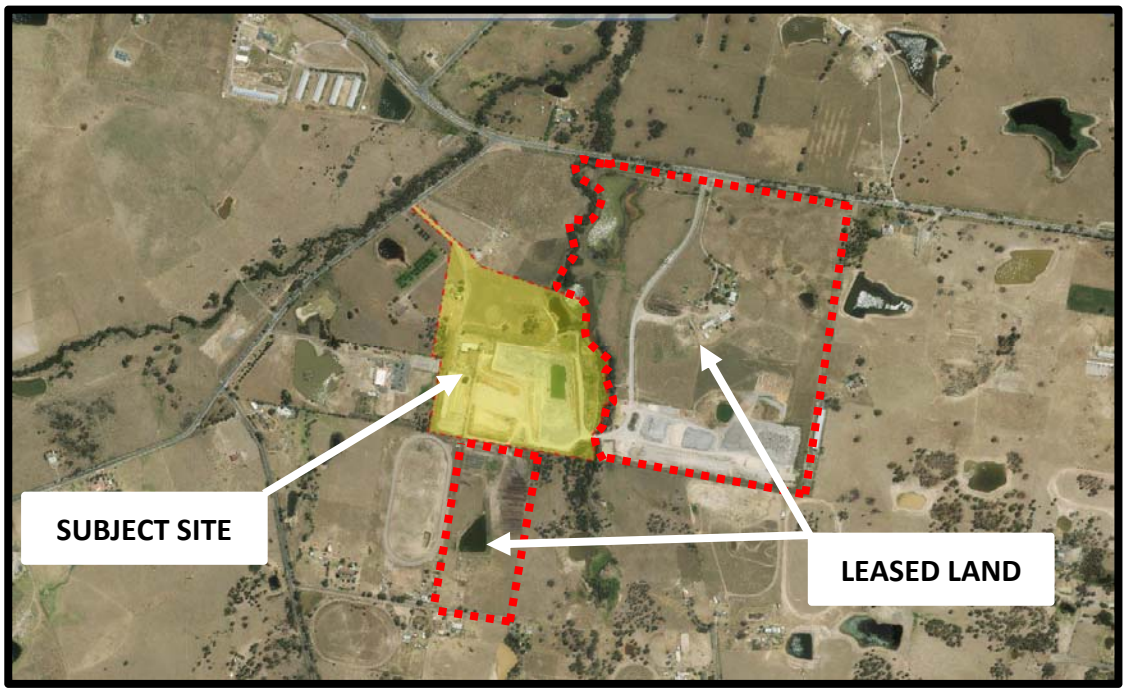
1.3.1 Site Location

The land within which the quarry excavations are restricted to is located on the eastern side of Adams Road, approximately 500m to the south of Elizabeth Drive, Luddenham. The quarry operations however also occur over adjoining land to the east, north-east and south of this site, being Commonwealth land leased by Epic Mining. The site and adjoining leased land location is illustrated below and overleaf within a local and aerial context by **Figure 1** and **Figure 2**, respectively.

FIGURE 1
SITE LOCATION WITHIN A LOCAL CONTEXT

Source: UBD's Australian City Streets – Version 4

FIGURE 2
SITE LOCATION WITHIN AN AERIAL CONTEXT



Source: Six Maps (accessed 12/04/17)

1.3.2 Site Description

The land within which the quarry excavations are restricted to provides a real property description of Lot 3 DP 623799 and a street address of 275 Adams Road, Luddenham. This land provides a battle axe type connection to Adams Road approximately 300m to the south of Elizabeth Drive, however this access is not utilised by quarry operations.

The quarry administration and support facilities and all vehicular access to / from the quarry via Elizabeth Drive is provided via an adjoining allotment to the east / north-east and south, being leased from the Commonwealth, being portions of Lot 1 DP 838361.

1.3.3 Existing Site Use

The site currently accommodates an approved clay / shale quarry in accordance with DA 315-7-2003, issued in 2004. It has previously been presented that all quarry excavations are restricted to Lot 3 DP 623799, however the quarry administration and support activities, including all vehicular access to / from Elizabeth Drive, is accommodated within adjoining land leased from the Commonwealth, being parts of Lot 1 DP 838361.

1.3.3 Surrounding Uses

The site is primarily surrounded by rural residential properties.

2. OPERATIONAL CHARACTERISITCS

2.1 Approved Operational Characteristics

2.1.1 Summary of Approved Use

The use involves a clay / shale quarry, whereby clay and shale products are excavated from the site in stages, operating under a 2004 approval which limits the scale of quarry production to 300,000 tonnes per annum. The consent is valid to 24 August 2024.

Quarry excavations are restricted to Lot 3 DP 623799 and are to be undertaken in stages, dependent on extraction rates.

The quarry administration and support facilities and access to the quarry have been established on Lot 1 DP 838361. A bridge has been constructed across Oaky Creek to connect to two allotments and a sealed road constructed over Lot 1 DP 838361, primarily providing a north-south connection between the Oaky Creek Bridge and Elizabeth Drive. The abovementioned sealed road facilitates all vehicular ingress / egress to / from the quarry. Pavement widening is provided within Elizabeth Drive at the private access road junction to facilitate the provision of an auxiliary right turn lane in conjunction with an exclusive left turn deceleration lane.

A weighbridge is located adjacent to the abovementioned internal site access road, approximately 250m to the south of Elizabeth Drive.

Offices, workshop, amenities and a manager's residence are located in existing buildings a further 150m south of the weighbridge. Workshop facilities associated with the undertaking of routine daily servicing of vehicles and the overnight storage of earthmoving and quarry equipment is accommodated within the existing shed buildings. A passenger vehicle parking for staff cars is located within a sealed area adjacent to these buildings.

2.1.2 Approved Hours of Operation

The existing operations are approved as follows:

- 7:00am – 6:00pm Monday to Friday for site operations and haulage; and
- 7:00am – 1:00pm Saturdays for maintenance activities only (no haulage).

No operations are to occur on Sundays or public holidays.

2.1.3 On-Site Staffing Levels

The existing site operation results in a maximum of six staff being required to be on site at any one time.

Staff typically arrive between 7:00am – 9:00am and depart between 2:00pm – 6:00pm.

2.1.4 Approved Haulage Volumes

Quarry products are transported from the site within vehicles up to and including 19m long truck and dog articulated vehicles. The 2004 approval was assessed and approved on the basis that a yearly production capacity of 300,000 tonnes would necessitate an average of 40 trucks per day. This was calculated at a nominal rate of 32 tonnes per vehicle, operating five days per week and 48 weeks per year whereby 300,000 / (32 x 5 x 48).

2.1.5 Approved Haulage Routes

Haulage routes are determined by the customer location, with the customer base largely being the following local brickworks:

- Austral Bricks at Horsley Park;
- CSR PGH Bricks & Pavers at Cecil Park, Horsley Park and Schofields; and
- Boral Bricks at Bringelly and Badgerys Creek.

A majority of the above brickworks are located to the east of the site, thereby haulage routes necessitate a left turn ingress from Elizabeth Drive followed by a right turn egress to Elizabeth Drive.

Notwithstanding the above, Boral Bricks at Bringelly is located to the south-west, such that haulage routes require a right turn ingress from Elizabeth Drive followed by a left turn egress to Elizabeth Drive.

Current management plans implemented by Epic Mining require all truck drivers and site staff to undergo an induction process which, amongst other things, specifies the conducts expected by these truck drivers and staff when working for Epic Mining.

2.1 Existing Traffic Generation Characteristics

The quarry was previously assessed and approved to provide an average traffic generating capacity of 40 haulage vehicles per day. This equates to a total of 80 daily truck movements, comprising 40 ingress movements and 40 egress movements.

Traffic generation associated with the quarry operations is however somewhat sporadic in nature. In this regard, the quarry operation is weather dependent (it cannot operate during heavy rainfall) and accordingly, product sales vary on a day to day and week to week basis. The quarry access road connecting with Elizabeth Drive therefore, at times, accommodates traffic demands over and above the abovementioned previously assessed and approved average of 40 trucks (or 80 movements) per day.

In order to obtain an accurate indication of the truck traffic generation associated with the current site operations, this Practice has obtained six months of weighbridge data between September 2016 and February 2017, inclusive. All heavy vehicles entering and departing the site are recorded via the weighbridge **Table 1** below provides a summary of the site access movements as accessed from the weighbridge data.

TABLE 1
SUMMARY OF QUARRY TRUCK MOVEMENTS
SEPTEMBER 2016 – FEBRUARY 2017

Month	Total Movements	Average Daily Movements	Maximum Daily Movements
September 2016	1354	62	132
October 2016	1492	65	124
November 2016	1920	87	132
December 2016	754	38	100
January 2017	510	26	52
February 2017	1012	51	98

Table 1 indicates the following:

- The traffic generation of the quarry varies significantly over time, with the number of movements during November 2016 being approximately four times that during January 2017;

- The average daily number of movements is generally less than the 80 movements approved (with November 2016 being the only exception, during which an average of 87 daily truck movements were recorded); and

- The maximum daily number of movements was significantly higher than the respective average, being up to 132 movements occurring on the 6th of September and the 15th of November, 2016.

Further to the above, this Practice was able to determine from the weighbridge data that traffic movements to and from the site subject site are reasonably evenly distributed during the operational periods (between 7:00am and 6:00pm).

3. EXISTING TRAFFIC CONDITIONS

3.1 Surrounding Road Network

Elizabeth Drive performs a State Road function under the care and control of the Roads & Maritime Services. It provides an east-west arterial link between Hume Highway at Liverpool in the east and The Northern Road at Luddenham in the west.

In the vicinity of the subject site, Elizabeth Drive provides one through lane of traffic in each direction separated by a BB line. Traffic flow is governed by a sign posted speed limit of 80km/h.

Pavement widening is provided within Elizabeth Drive at the junction of the private access road servicing the quarry to facilitate the provision of an auxiliary right turn lane in conjunction with an exclusive left turn deceleration lane. The junction is governed by sign posted Give Way control with Elizabeth Drive performing the priority route.

Figure 3 below provides an aerial photograph of the junction of Elizabeth Drive and the quarry access road to the north of the subject site.

FIGURE 3
JUNCTION OF ELIZABETH DRIVE & THE QUARRY ACCESS ROAD LUDDENHAM

Source: Six Maps (accessed 12/04/17)

Figure 3 indicates that the quarry access road is serviced by a 100m long left turn deceleration lane, a 130m long auxiliary right turn lane. The provided left turn deceleration lane and auxiliary right turn arrangements suitably comply with the design specifications provided within Table 5.2 and Figure 7.5 of Austroads' *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*, respectively, for the sign posted speed limit of 80km/h applicable within Elizabeth Drive.

The quarry access road provides a pavement width of approximately 11m, accommodating one lane of traffic in each direction, separated and defined by centre and edge line marking.

Elizabeth Drive forms T-junctions with Adams Road and Taylors Road approximately 550m and 1.4km to the west and east of the site, respectively, with both junctions operating under Give Way control with the arterial road performing the priority route.

Elizabeth Drive forms channelised T-junctions with Luddenham Road and Badgerys Creek Road approximately 800m and 1.8km to the west and east of the site, respectively, pavement widening within Elizabeth Drive accommodating formalised exclusive right and left turn lanes.

Further to the west, Elizabeth Drive forms a T-junction with The Northern Road, under two lane circulating roundabout control.

3.2 Existing Traffic Volumes

Staff of Stanbury Traffic Planning have undertaken surveys of the junction of Elizabeth Drive and the Quarry Access Road in order to accurately ascertain existing traffic demands. Surveys were undertaken between 7:00am – 9:00am and 4:00pm – 6:00pm on the 29th and 28th of March, 2017, respectively.

Figure 4 overleaf provides a summary of the surveyed peak hour (7:00am – 8:00am and 4:00pm – 5:00pm) traffic flows at the surveyed junction. Full details are contained within **Appendix 1** for reference.

FIGURE 4
EXISTING WEEKDAY PEAK HOUR TRAFFIC VOLUMES
JUNCTION OF ELIZABETH DRIVE & QUARRY ACCESS ROAD

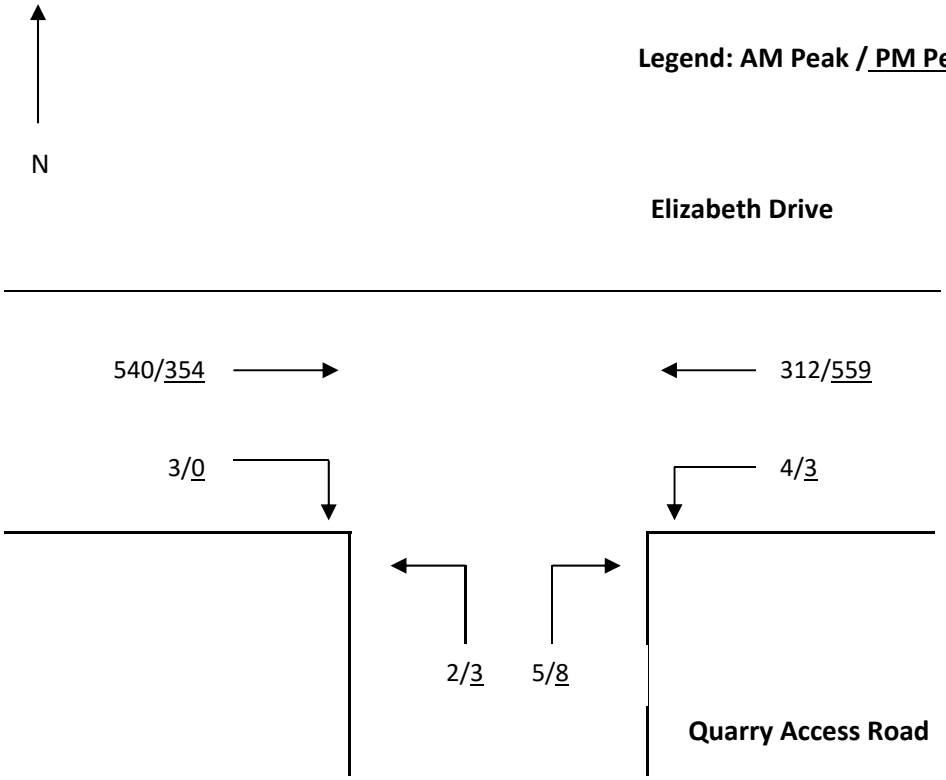


Figure 3 indicates the following:

- Elizabeth Drive accommodates directional traffic demands in the order of 300 – 550 vehicles per hour during peak periods;
- Elizabeth Drive through traffic flow is tidal during weekday peak periods, with eastbound flow dominating during the morning peak and westbound flow dominating during the afternoon peak;
- Traffic demands within the Quarry Access Road are very low, with directional demands generally being less than 10 vehicles per hour; and
- Turning movements between Elizabeth Drive and the Quarry Access Road primarily comprise left turn ingress movements and right turn egress movements from and to the east.

It should be noted that the above surveyed turning movements at the Quarry Access Road were observed to be approximately 50% heavy vehicles and 50% passenger vehicles associated with quarry product transport and quarry staff movements to and from the site.

3.3 Existing Road Network Operation

3.3.1 Junction of Elizabeth Drive & Quarry Access Road

3.3.1.1 SIDRA Modelling Output

The surveyed junction of Elizabeth Drive and the Quarry Access Road has been analysed utilising the SIDRA computer intersection analysis program in order to objectively assess the operation of the primary access junction servicing the subject site. SIDRA is a computerised traffic arrangement program which, when volume and geometrical configurations of an intersection are imputed, provides an objective assessment of the operation efficiency under varying types of control (i.e. signs, signal and roundabouts). Key indicators of SIDRA include level of service where results are placed on a continuum from A to F, with A providing the greatest intersection efficiency and therefore being the most desirable by the Roads and Maritime Services.

SIDRA uses detailed analytical traffic models coupled with an iterative approximation method to provide estimates of the abovementioned key indicators of capacity and performance statistics. Other key indicators provided by SIDRA are average vehicle delay, the number of stops per hour and the degree of saturation. Degree of saturation is the ratio of the arrival rate of vehicles to the capacity of the approach. Degree of saturation is a useful and professionally accepted measure of intersection performance.

SIDRA provides analysis of the operating conditions that can be compared to the performance criteria set out in **Table 3** below (being the RMS NSW method of calculation of Level of Service).

TABLE 3
LEVEL OF SERVICE CRITERIA FOR INTERSECTIONS
GIVE WAY & STOP SIGNS

Level of Service	Average Delay per Vehicle (secs/veh)	Expected Delay
A	Less than 14	Good
B	15 to 28	Acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Near capacity
E	57 to 70	At capacity and requires other control mode
F	> 70	Unsatisfactory and requires other control mode

The existing conditions have been modelled utilising the peak hour traffic volumes presented within **Figure 4**. **Table 4** provides a summary of the SIDRA output data whilst more detailed summaries are included as **Appendix 2**.

TABLE 4 SIDRA OUTPUT – EXISTING WEEKDAY PEAK HOUR PERFORMANCE JUNCTION OF ELIZABETH DRIVE & QUARRY ACCESS ROAD		
	AM	**PM**
Quarry Access Road Approach		
Delay	24.5	24.6
Degree of Saturation	0.03	0.06
Level of Service	B	C
Eastern Elizabeth Drive Approach		
Delay	6.1	6.1
Degree of Saturation	0.17	0.30
Level of Service	A	A
Western Elizabeth Drive Approach		
Delay	9.0	12.5
Degree of Saturation	0.21	0.14
Level of Service	A	A
Total Intersection		
Delay	0.2	0.4
Degree of Saturation	0.21	0.30
Level of Service	A	A

3.3.1.2 SIDRA Modelling Output

Table 4 indicates the that the junction of Elizabeth Drive and the Quarry Access Road provides all movements with a level of service 'A' with the exception of the right turn egress movement from the Quarry Access Road, which provides a level of service of 'B' and 'C' during the morning and evening peak, representing acceptable and satisfactory conditions, respectively.

3.3.1.3 Safety Assessment

Despite the overall intersection operation of the junction of Elizabeth Drive and the Quarry Access Road being good (level of service 'A'), it is standard practice to undertake a safety assessment of signage controlled intersections which provide a movement with a level of service 'C' or worse for any particular movement.

A safety assessment can be undertaken with reference to the following:

- The compliance of the intersection design with established specifications;
- The suitability of the provided intersection sight distance provision; and
- A crash history assessment.

With respect to geometrical design compliance, it has previously been presented that the provided left turn deceleration lane and auxiliary right turn arrangements suitably comply with the design specifications provided within Austroads' *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* for the sign posted speed limit of 80km/h applicable within Elizabeth Drive.

With respect to sight distance provision, the consistent vertical and horizontal alignment of Elizabeth Drive in the vicinity of the Quarry Access Road results in a

sight distance between the Access Road and the State Road exceeding 200m in both directions, thereby being suitably compliant with Safe Intersection Sight Distance (SISD) criteria specified by Austroads' *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* for a sign posted speed limit of 80km/h.

Further to the above, this Practice has been advised by the Roads & Maritime Services that there have been no recorded crashes at the junction Elizabeth Drive and the Quarry Access Road in the last five years. In consideration of this and the above discussion, it is therefore not considered that there is any safety concern at the junction of Elizabeth Drive and the Quarry Access Road.

3.3.2 Elizabeth Drive Route Levels of Service

Reference is made to the Roads & Maritime Services' *Guide to Traffic Generating Developments* in order to undertake an assessment of the operational performance of Elizabeth Drive in the immediate vicinity of the subject site. This publication indicates that a single lane of traffic accommodating peak hour traffic demands of between 300 – 600 vehicles provides a level of service 'B'. Such a level service indicates stable flow where drivers have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream.

4. CAPACITY ANALYSIS

4.1 Existing Peak Traffic Generation

Section 2 of this report indicates that the existing quarry operations provide a maximum daily truck generation of approximately 130 movements. These movements occur in a relatively even distribution over an 11 hour period. The maximum hourly truck traffic generation of the quarry during weekday commuter peaks is therefore in the vicinity of 12 vehicle movements (for the purposes of this assessment, it is assumed to comprise six ingress and six egress movements). A majority of these movements have been observed to involve left turn ingress and right turn egress movements.

Such a level of traffic generation was modelled with SIDRA, the results of which were presented within Section 3 of this report, indicating a satisfactory level of intersection performance.

4.2 Capacity Analysis of Existing Access Intersection Treatment

In order to assess the capacity of the existing treatment at the junction of Elizabeth Drive and the Quarry Access Road, reference is again made to Austroads' *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*. This publication provides warrants for turning treatments based on opposed traffic volume demands.

Figure 4.9(b) of this publication specifies that the existing auxiliary right turn treatment is capable of accommodating an hourly right turn volume of up to approximately 12 vehicles, based on existing through Elizabeth Drive traffic demands. It would therefore appear that the existing Quarry Access Road junction arrangement with Elizabeth Drive is capable of accommodating a doubling of existing peak operational truck generation characteristics, whereby the worst case scenario that all site access / egress movements occur via right turn movements. This equates to a minimum daily traffic generation of some 264 movements, or 132 trucks. Daily traffic generation in excess of this volume would necessitate the provision of a channelised right turn deceleration and / or acceleration lane within Elizabeth Drive.

The existing channelised left turn deceleration lane within Elizabeth Drive is capable of accommodating significant increases in traffic demands, as the existing design allows for vehicles to decelerate and access the site without any unreasonable impedance on trailing or opposing through vehicle movements.

In order to further assess the ability of the existing junction of Elizabeth Drive and the Quarry Access Road to accommodate a doubling of the existing maximum traffic generating characteristics of the quarry, a supplementary SIDRA analysis has been undertaken. For the purposes of this assessment and in order to create an absolute worst case scenario, all turning movements have been increased to 12 movements. **Table 5** overleaf provides a summary of the SIDRA output whilst full details are contained within **Appendix 3**.

TABLE 5 SIDRA OUTPUT – WEEKDAY PEAK HOUR PERFORMANCE JUNCTION OF ELIZABETH DRIVE & QUARRY ACCESS ROAD				
	Existing Site Operational Capacity		Future Site Operational Capacity	
	AM	PM	AM	PM
Quarry Access Road Approach				
Delay	24.5	24.6	26.1	31.4
Degree of Saturation	0.03	0.06	0.09	0.11
Level of Service	B	C	B	C
Eastern Elizabeth Drive Approach				
Delay	6.1	6.1	6.1	6.1
Degree of Saturation	0.17	0.30	0.17	0.30
Level of Service	A	A	A	A
Western Elizabeth Drive Approach				
Delay	9.0	12.5	9.1	12.6
Degree of Saturation	0.21	0.14	0.22	0.16
Level of Service	A	A	A	A
Total Intersection				
Delay	0.2	0.4	0.8	1.0
Degree of Saturation	0.21	0.30	0.22	0.30
Level of Service	A	A	A	A

Table 5 indicates that the existing junction of Elizabeth Drive and the Quarry Access Road is capable of accommodating the potential doubling of existing peak operational traffic demands, without impacting existing key intersection operational performance measures.

4.3 Elizabeth Drive Level of Service

The traffic generating potential of the quarry is limited and accordingly only represents a very minor contribution to existing traffic demands within Elizabeth Drive, being less than 1% of the existing through traffic demands within the State Road. Section 3 of this report presents that Elizabeth Drive currently provides motorists with a good level of service with spare capacity. It is accordingly not expected that any potential increase in traffic generating capability of the quarry (to the extent discussed in this report) will have any noticeable impacts on the overall level of safety and performance of Elizabeth Drive.

5. CONCLUSION

This report assesses the existing traffic generating potential of the existing clay / shale quarry at 275 Adams Road, Luddenham, and the ability or otherwise of the existing site access arrangements and adjoining road network to accommodate this and potential increases in traffic generation. Based on this assessment, the following conclusions are now made:

- The quarry operation was originally assessed and approved to accommodate up to 40 trucks per day, or 80 movements (being 40 ingress and 40 egress movements);

- Traffic generation associated with the quarry operations is however somewhat sporadic in nature, resulting in daily quarry traffic generation occasionally exceeding the 40 trucks previously assessed;

- Recent weighbridge records indicate that the quarry accommodates up to approximately 65 trucks per day, representing 130 movements (being 65 ingress and 65 egress movements);

- SIDRA intersection modelling indicates that the existing junction of Elizabeth Drive and the Quarry Access Road provides a satisfactory level of service during weekday commuter peaks under existing peak operational traffic demands;

- The existing geometrical design and sight distance considerations of the junction of Elizabeth Drive and the Quarry Access Road suitably accords with current design specifications;

- There have been no recorded crashes at the junction of Elizabeth Drive and the Quarry Access Road in the last five years of operation; and

- The existing geometrical design of the junction of Elizabeth Drive and the Quarry Access Road is capable of accommodating up to approximately 130 trucks on a daily basis without upgrading works in accordance with current established specifications; and

- Such an increase in traffic generating capacity of the quarry, representing approximately 260 truck movements (being 130 ingress and 130 egress movements), is over three times that originally assessed and approved and double that of the existing peak operational traffic demands of the quarry.

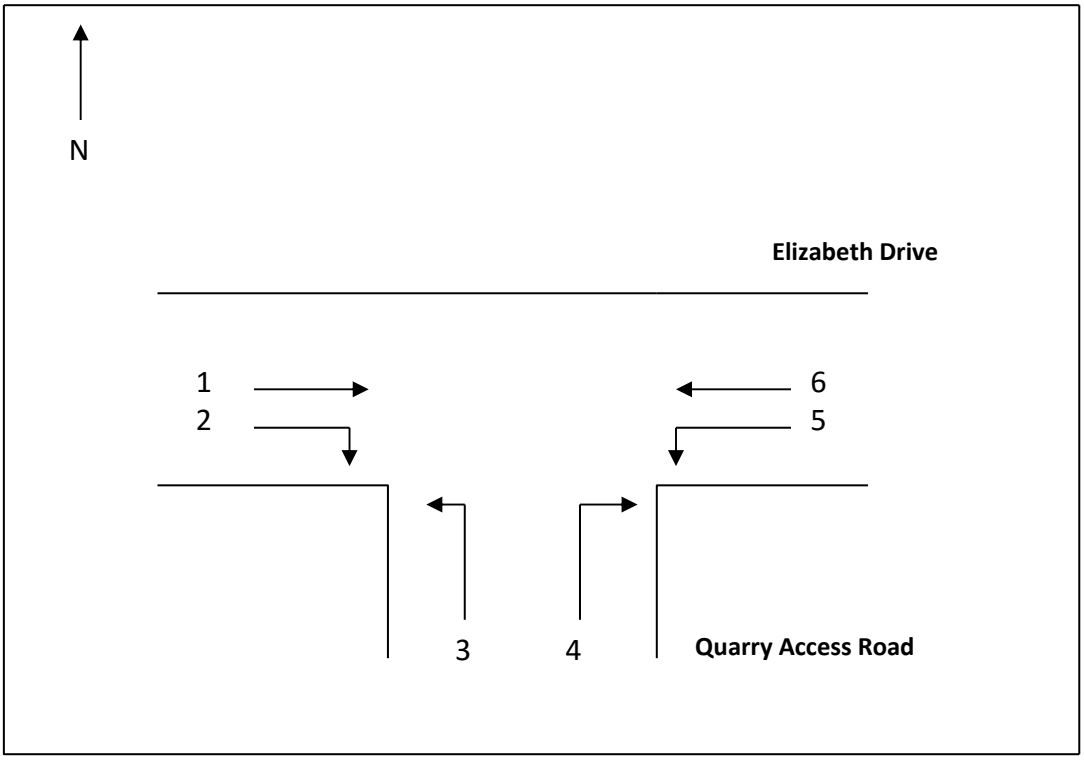
Having regard to the findings of this report, the quarry access arrangements and immediately adjoining public road network is capable of accommodating the existing peak operational demands of the quarry and indeed, provides capacity to accommodate potential increases in demand should it be generated in the future.

APPENDIX 1

STANBURY TRAFFIC PLANNING
TRAFFIC, PARKING & TRANSPORT CONSULTANTS

TRAFFIC COUNTS AT: Elizabeth Drive & Quarry Access Road, Luddenham
DATE: 28th and 29th of March 2017
TIME: Fine

Time	Direction of Vehicular Traffic					
	1	**2**	**3**	**4**	**5**	**6**
7.00 – 7.15am	130	1	0	0	2	80
7.15 – 7.30am	145	0	1	2	1	75
7.30 – 7.45am	135	1	0	1	0	80
7.45 – 8.00am	130	1	1	2	1	77
TOTAL	**540**	**3**	**2**	**5**	**4**	**312**
8.00 – 8.15am	114	0	1	1	3	76
8.15 – 8.30am	106	1	0	2	2	60
8.30 – 8.45am	110	1	1	1	1	70
8.45 – 9.00am	109	1	1	1	1	71
TOTAL	**439**	**3**	**3**	**5**	**7**	**277**
4.00 – 4.15pm	83	0	0	6	1	113
4.15 – 4.30pm	93	0	2	0	0	149
4.30 – 4.45pm	72	0	1	1	2	151
4.45 – 5.00pm	106	0	0	1	0	146
TOTAL	**354**	**0**	**3**	**8**	**3**	**559**
5.00 – 5.15pm	95	0	0	0	0	135
5.15 – 5.30pm	92	0	3	0	0	143
5.30 – 5.45pm	88	0	0	0	0	135
5.45 – 6.00pm	85	0	0	0	0	130
TOTAL	**360**	**0**	**3**	**0**	**0**	**543**



APPENDIX 2

MOVEMENT SUMMARY

Site: [Elizabeth Drive & Quarry Access Road]

Existing AM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Quarry Access Road											
1	L2	2	50.0	0.031	8.2	LOS A	0.1	1.0	0.71	0.82	43.2
3	R2	5	50.0	0.031	24.5	LOS B	0.1	1.0	0.71	0.82	43.0
Approach		7	50.0	0.031	19.9	LOS B	0.1	1.0	0.71	0.82	43.0
East: Elizabeth Drive East											
4	L2	4	50.0	0.003	6.1	LOS A	0.0	0.0	0.00	0.57	51.6
5	T1	312	5.0	0.165	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		316	5.6	0.165	0.1	NA	0.0	0.0	0.00	0.01	59.8
West: Elizabeth Drive West											
11	T1	540	5.0	0.210	0.0	LOS A	0.1	0.4	0.01	0.00	59.9
12	R2	3	50.0	0.210	9.0	LOS A	0.1	0.4	0.01	0.00	55.1
Approach		543	5.2	0.210	0.1	NA	0.1	0.4	0.01	0.00	59.9
All Vehicles		866	5.7	0.210	0.2	NA	0.1	1.0	0.01	0.01	59.7

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

MOVEMENT SUMMARY

Site: [Elizabeth Drive & Quarry Access Road]

Existing PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Quarry Access Road											
1	L2	3	50.0	0.061	11.4	LOS A	0.2	1.9	0.80	0.91	40.9
3	R2	8	50.0	0.061	29.6	LOS C	0.2	1.9	0.80	0.91	40.7
Approach		11	50.0	0.061	24.6	LOS B	0.2	1.9	0.80	0.91	40.7
East: Elizabeth Drive East											
4	L2	3	50.0	0.002	6.1	LOS A	0.0	0.0	0.00	0.57	51.6
5	T1	559	5.0	0.296	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		562	5.2	0.296	0.1	NA	0.0	0.0	0.00	0.00	59.9
West: Elizabeth Drive West											
11	T1	354	5.0	0.137	0.1	LOS A	0.0	0.2	0.01	0.00	59.9
12	R2	1	50.0	0.137	12.5	LOS A	0.0	0.2	0.01	0.00	55.1
Approach		355	5.1	0.137	0.1	NA	0.0	0.2	0.01	0.00	59.9
All Vehicles		928	5.7	0.296	0.4	NA	0.2	1.9	0.01	0.01	59.6

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

APPENDIX 3

MOVEMENT SUMMARY

Site: [Elizabeth Drive & Quarry Access Road]

Projected AM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Quarry Access Road											
1	L2	12	50.0	0.086	8.3	LOS A	0.3	2.8	0.64	0.78	44.6
3	R2	12	50.0	0.086	26.1	LOS B	0.3	2.8	0.64	0.78	44.3
Approach		24	50.0	0.086	17.2	LOS B	0.3	2.8	0.64	0.78	44.5
East: Elizabeth Drive East											
4	L2	12	50.0	0.009	6.1	LOS A	0.0	0.0	0.00	0.57	51.6
5	T1	312	5.0	0.165	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		324	6.7	0.165	0.2	NA	0.0	0.0	0.00	0.02	59.6
West: Elizabeth Drive West											
11	T1	540	5.0	0.220	0.1	LOS A	0.2	1.6	0.03	0.01	59.7
12	R2	12	50.0	0.220	9.1	LOS A	0.2	1.6	0.05	0.02	54.8
Approach		552	6.0	0.220	0.3	NA	0.2	1.6	0.03	0.01	59.6
All Vehicles		900	7.4	0.220	0.8	NA	0.3	2.8	0.04	0.04	59.1

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

MOVEMENT SUMMARY

Site: [Elizabeth Drive & Quarry Access Road]

Projected PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Quarry Access Road											
1	L2	12	50.0	0.111	11.6	LOS A	0.4	3.6	0.77	0.90	42.4
3	R2	12	50.0	0.111	31.4	LOS C	0.4	3.6	0.77	0.90	42.2
Approach		24	50.0	0.111	21.5	LOS B	0.4	3.6	0.77	0.90	42.3
East: Elizabeth Drive East											
4	L2	12	50.0	0.009	6.1	LOS A	0.0	0.0	0.00	0.57	51.6
5	T1	559	5.0	0.296	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		571	5.9	0.296	0.2	NA	0.0	0.0	0.00	0.01	59.7
West: Elizabeth Drive West											
11	T1	354	5.0	0.155	0.6	LOS A	0.4	2.6	0.08	0.02	59.2
12	R2	12	50.0	0.155	12.6	LOS A	0.4	2.6	0.11	0.03	54.1
Approach		366	6.5	0.155	1.0	NA	0.4	2.6	0.08	0.02	59.0
All Vehicles		961	7.2	0.296	1.0	NA	0.4	3.6	0.05	0.04	58.8

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