OPARURE QUARRY SOUTH-WESTERN PIT

OPARURE ROAD, WAITOMO

TRAFFIC IMPACT ASSESSMENT

Prepared for **Graymont New Zealand Limited**
June 2026

Reference 19081

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Revisions:

Date	Revision Number	Reviewed By	Initials
9 June 2026	Update for Fast Track Application	PB	PB

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1 CODE OF CONDUCT AND USE OF ARTIFICIAL INTELLIGENCE

Traffic Engineering & Management Ltd confirms that the work undertaken and reported in this document has been prepared in accordance with the Code of Conduct for Expert Witnesses as set out in the Environment Court Consolidated Practice Note 2023.

Traffic Engineering & Management Ltd also advises that the significant data set that forms the foundation of the traffic engineering assessment has been extensively updated for this report so that current patterns are considered, rather than relying on data collected some years ago that is now considered to be of historical interest only.

Traffic Engineering & Management Ltd also confirms that none of the work undertaken, including the processing/interpretation of data or the preparation of this report, has used any form of Artificial Intelligence (AI).

2 INTRODUCTION AND BACKGROUND

Traffic Engineering & Management Ltd has been engaged to undertake a Traffic Impact Assessment (**TIA**) of the proposal to expand the current operation of the quarry site on Oparure Road in Waitomo.

This proposal seeks Fast-track consent to allow the site to manage the available resources and operate for circa 53 years.

This TIA addresses the following matters:

- Assessment of the existing road safety, efficiency, and traffic patterns of the existing local road network.
- The traffic likely to be generated by the proposed development.
- The ability of the road network and local traffic environment to accommodate the generated traffic.

The findings of the report have concluded that the proposed activity can occur without adversely impacting on the function, capacity, or safety of the surrounding network and local traffic environment.

2.1 The Proposal

The existing Graymont Limestone Quarry at Oparure in the Waitomo District is understood to produce high quality lime products in New Zealand and provides limestone in various forms for a multitude of activities, including significant New Zealand industrial operations.

In anticipation of extending the life of the quarry, Graymont has applied for Fast-track consent to establish a new pit area in preparation for the continuation of operations on the site. The company is taking a long-term view and is seeking this consent to give certainty beyond the current consented horizon.

It is anticipated that the existing quarry will continue to operate when the proposed new quarry is opened. The overburden will be removed in stages, and this material placed in previously quarried sections, initially in the existing quarry pit. Once the overburden has been removed, the quarrying of each new stage of the new pit area will commence.

A new internal haul road will be constructed and will link the new pit with the current processing plant. Material will be excavated from both the current pit and the new pit and will be processed by the same plant. This will allow the current high-quality vehicle access to Oparure Road to continue to be utilised. This detail is shown visually in **Appendix A**.

Of significance from a traffic engineering perspective is the fact that the volume of limestone extracted is not expected to increase as a result of the South-Western Pit, even though the existing quarry does not have any restrictions on the quantity of material that can be excavated.

Similarly, no increase in the volume of traffic generated by the quarry is expected, even though there is also no limit on the number of heavy vehicle trips that can be made to and from the site.

From an assessment perspective and for establishing a relevant baseline, this is considered to be a significant position for this traffic impact assessment.

2.2 Site Location

The entrance to the Graymont Quarry is located approximately 8 kilometres west along Oparure Road from the intersection with State Highway 3. The location of the site relative to the local road network and a school on Oparure Road is shown in Figure 1, with Figure 2 showing an aerial view of the quarry site.

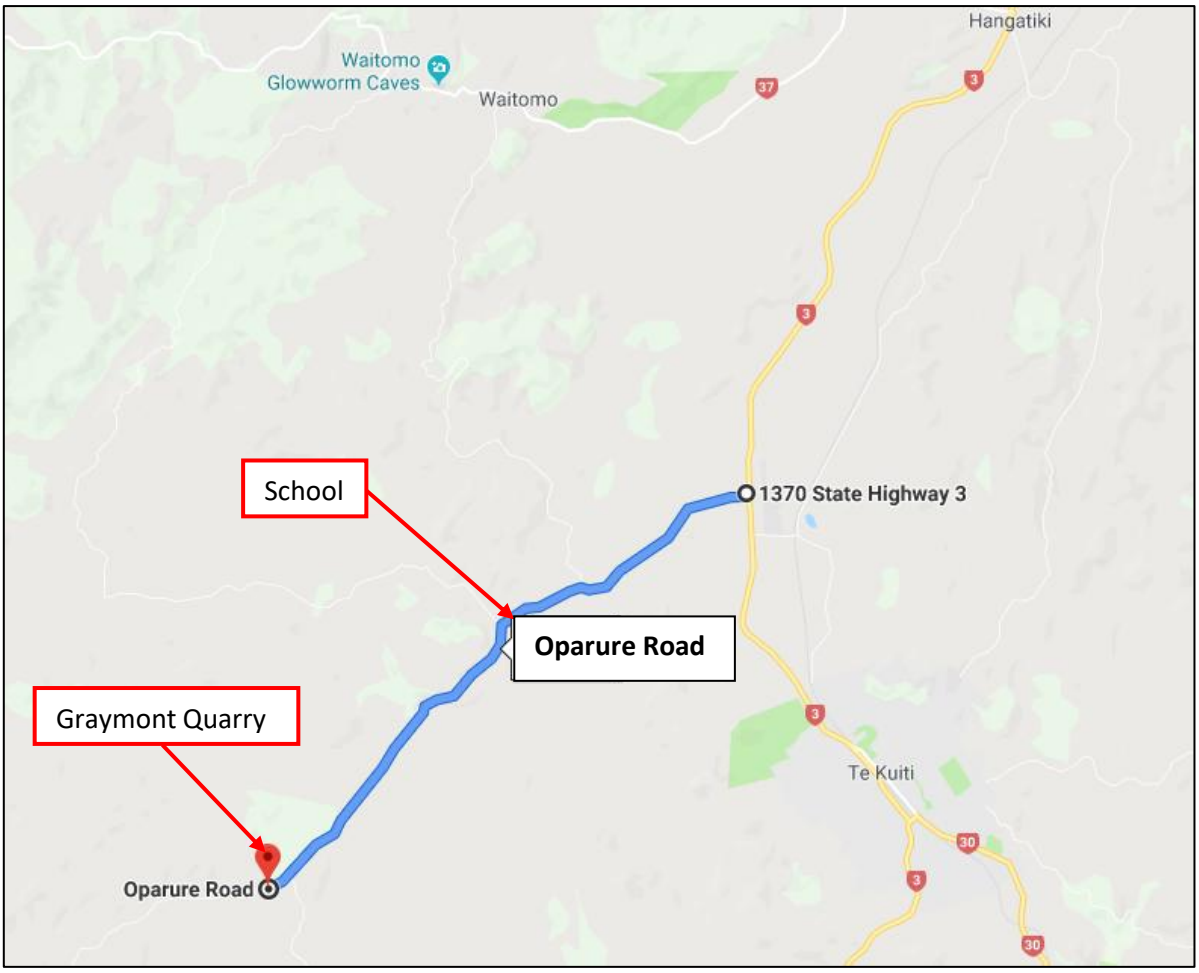


Figure 1: Location of the site relative to the roading network

Figure 2: Aerial view of the quarry

2.3 Local and Regional Roading Network

The three illustrations that make up Figure 3 below show the local and regional roading network and its context near the site.

State Highway 3 provides a key strategic north-south route though the region, with Oparure Road and Troopers Road providing two local routes linking the quarry to State Highway 3.

Oparure Road has typically been constructed to a relatively high standard with formation widths that vary due to the topography of the area and constraints such as bridges and culverts.


SH3
Oparure Road
Te Kuiti
Quarry


SH3
Fullerton Road
Oparure Road
Boddies Road

Figure 3: Local and Regional Roading Network

The details of the cross-sectional widths measured[1] at representative locations along the road between State Highway 3 and the site access are provided in Figure 4 and Table 1 below.

These widths are considered appropriate and allow for the two-way movement of heavy and light vehicular traffic without creating operational problems. This situation has been confirmed from video and on-site observations that have been made at different times of the day and year, as well as during pre and post-Covid times.

The road is typically marked with a dashed white centreline, and solid edge lines are provided on both sides of the seal to delineate the lanes.

Edge Marker Posts (EMP) are provided on the horizontal curves along Oparure Road, with gaps in various locations where the alignment of the road is straight or relatively straight.

When any of these markings, EMPs or pavement marking have been damaged or become unacceptably worn, the Council's general road maintenance program for the District is expected to rectify the situation to the Council's satisfaction.

[1] In some locations the presence of grass or other vegetative growth on the roadside made it difficult to determine the precise measurement. Engineering judgement was therefore used, with this considering the details at the location of the measurement and also the formation characteristics in the immediate area.

Figure 4: Locations of cross-section measurements

Location	Unsealed shoulder	Sealed shoulder	Eastbound lane	Westbound lane	Sealed shoulder	Unsealed shoulder	Total sealed width
A	0.4m	0.6m	4m	3.5m	0.9m	0.6m	9m
B	0.4m	0.6m	3.2m	3.3m	0.7m	*not present*	7.8m
C (bridge)	*n/a*	1.1m	3m	3.0m	0.2m	*n/a*	7.3m
D	0.3m	0.7m	2.9m	3.2m	0.3m	0.3m	7.1m
E	1.4m	0.6m	3.1m	3.3m	0.5m	0.4m	7.5m
F	0.7m	0.6m	3.2m	3.8m	0.7m	0.6m	8.3m
G	0.5m	0.5m	3.3m	3.4m	0.4m	0.2m	7.6m
H	*not present*	0.5m	3.1m	3.2m	0.5m	*not present*	7.3m
I	0.4m	0.6m	3.5m	3.4m	0.7m	0.7m	8.2m
J	1.6m	0.9m	3.8m	3.5m	1.3m	0.6m	9.5m

Table 1: Carriageway cross-section dimensions at defined locations

Troopers Road has been constructed to a lower standard with the one lane provided in each direction separated by a dashed white centre line. The seal width and nature of the roading alignment varies significantly along its length, with the 'mid-section' having significant spatial constraints due to the alignment of the road through the local topography.

Currently some of the quarry trucks utilise Troopers Road as a 'short cut' to SH3 if the load is required to be delivered south of Te Kūiti.

As portions of this road are not considered to be ideal for long term two-way use by truck & trailer or semi-trailer combinations, it has been assumed in this assessment that this road will not be used by the large quarry trucks for the South-Western Pit unless it is necessary to do so. This assumption also reflects the reality of how Troopers Road is presently being used by these vehicles.

2.4 Quarry Operational Details

The quarry currently operates 12 hourly shifts, six days a week. In addition to this work, after-hours access and self-loading options are also understood to be available for registered drivers.

The on-site activities are undertaken by 18 staff (excluding contractors undertaking overburden work) and are divided into three separate operations consisting of stripping of overburden, excavation of the limestone rock and the processing of the material.

The removal of overburden is typically carried out by contractors using a 100-tonne excavator supported by three 100-tonne trucks.

The excavation of the limestone is carried out by two excavators that range in size between 70-tonne and 300-tonne, with these machines supported by two trucks that have a capacity of between 60-tonnes and 100-tonnes.

The site has very few visitors a day (circa 3 on some days).

3 THE EXISTING SITUATION

3.1 Existing Quarry Activity

The operation of the quarry reacts to the demand from clients - as does any business. The demand for good quality limestone in the various forms produced at the quarry is therefore also variable. The annual production volumes at the quarry before, during and after the disruptive effects of Covid are presented in Table 2 below. It should be noted that this activity occurred with no consented limits on the truck movements.

Year	Quantity (tonnes)
2015	400,132 Part year
2016	765,348
2017	749,093
2018	648,031
2019 (Covid effects)	327,626
2020 (Covid effects)	285,445
2021	391,262
2022	365,390
2023	249,239
2024	275,769
2025	307,456

Table 2: Annual limestone extraction

This data shows that historical peaks prior to Covid were higher than current volumes and it is understood that the road network and transport environment were able to accommodate these pre-Covid peaks.

The weighbridge data has been analysed and averaged to provide a 'composite' year to establish a typical production profile through the course of the year. As production and traffic movements are interrelated, this analysis also helps to provide a typical profile of the traffic movements through the course of the year.

To assist with this analysis, the monthly production data has been normalised and referenced to the annual volume and then expressed as a percentage. A graphical summary of this profile through the course of the year, averaged over the more recent period of 2021 to 2025 inclusive, is shown in Figure 5 below.

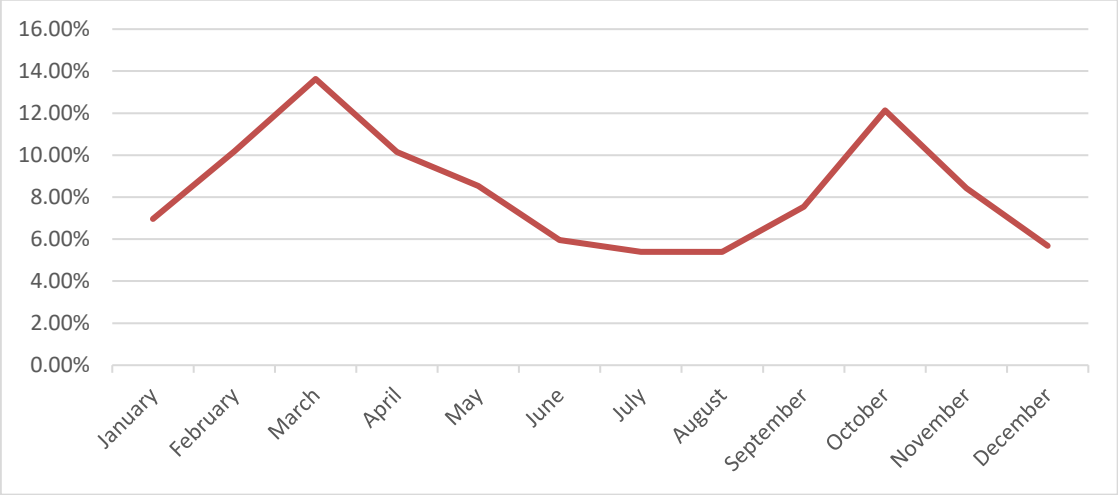


Figure 5: Summary of monthly average tonnage as a percentage of annual tonnage (2021-2025)

Through this time relatively stable patterns have occurred, with the monthly tonnage as a percentage of the annual tonnage for each year being as follows:

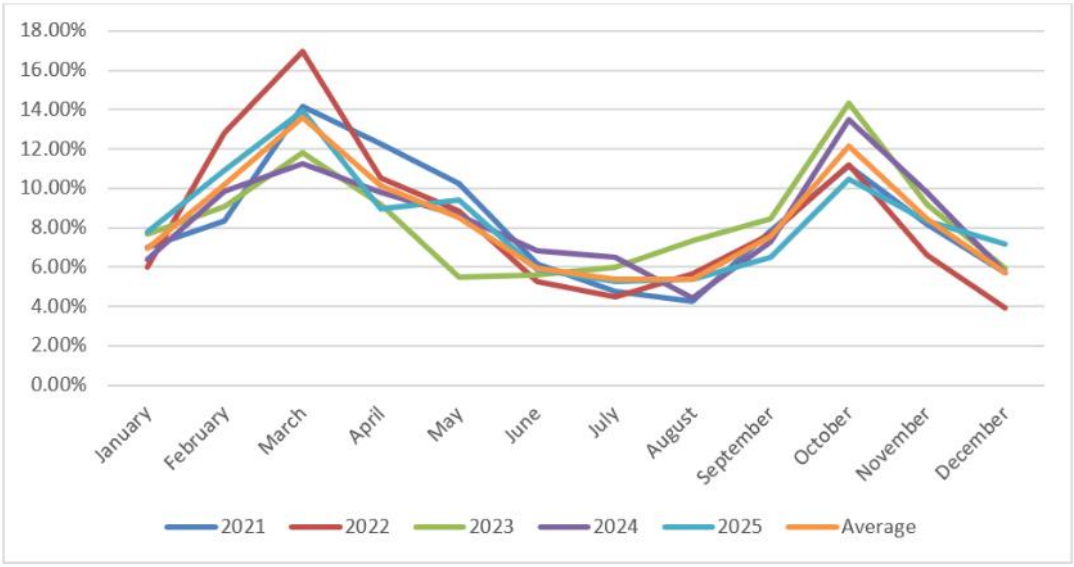


Figure 6: Summary of monthly tonnage as a percentage of annual tonnage (annual basis)

This seasonal variability and the consistency of patterns over the years is clearly evident in the Figures 5 and 6 above, with March and October being the peak months.

The weighbridge data also shows that each vehicle had an average of circa 26 to 27 tonnes. This average tonnage also occurred during, and prior to, the Covid-affected period (back to the earliest provided data from 2015).

In the years preceding and during Covid, the truck numbers were higher than the recent activity.

The following key statistics have been obtained from the weighbridge data of *exiting* vehicles and show the maximum number of trucks that occurred in any one day in each of the stated years:

- Maximum number of trucks exiting the site per day in each month, averaged per month over the course of the year:
    - circa 146 trucks in 2015-2017,
    - 132 trucks/day in 2018
- Maximum number of trucks exiting the site in any one day each year:
    - 2015 (part): 183 exiting trucks (occurred in October)
    - 2016: 197 exiting trucks (occurred in October)
    - 2017: 210 exiting trucks (occurred in February)
    - 2018: 168 exiting trucks (occurred in October)

As these numbers relate only to the exiting vehicles, the total number of trucks moving to and from the site is therefore double these totals on the busiest single day of each year.

With these volumes relating to the number of trucks moving to and from the quarry over the operating hours of the whole day, rather than the number in a single hour, these historical volumes are considered to be low flow from a traffic engineering perspective. This data also shows the variability that is occurring due to fluctuating demand.

It should be noted that there are no consented limits presently set on the number of vehicle trips the quarry can generate. This situation is considered to be a very significant matter for the application and provides a permissive operational baseline for this assessment of effects.

At present some 40% of the extracted tonnage goes to Ōtorohanga or Te Kūiti for further processing into quicklime products, with the balance being transported further afield to a wide range of destinations and receiving activities, including steel production and building products.

3.2 Existing Traffic & Roading Characteristics

3.2.1 Traffic Surveys

A number of traffic surveys were undertaken in 2019 as part of a previous assessment of the surrounding traffic environment. These have since been updated in late February 2026 – a period of time that is:

- Several weeks after the commencement of Term 1 in the primary, intermediate and secondary school years.
- Before the conflicts in Iran resulted in the escalation of fuel prices and the consequential disruptive effects on travel behaviour.

The recent traffic surveys that have been carried out have drawn largely on tube counters which provide significant details on the volumes, vehicle classifications and speed parameters of all vehicles at the measured locations on Oparure Road. Other counts were done on local roads close to their intersections with Oparure Road.

These tube count surveys were carried out at the following locations over a two-week period 10 - 23 February 2026:

- Oparure Road near SH3;
- Oparure Road east of the school;
- Oparure Road west of the school;
- Oparure Road east of the quarry entrance;
- Oparure Road west of the quarry entrance;
- Fullerton Road north of Oparure Road;
- Boddies Road north of Oparure Road;
- Troopers Road near Oparure Road;
- Troopers Road near SH3;
- Quarry entrance.

Complementing this data were detailed video surveys that were carried out to determine the turning volumes and the behaviour of vehicles at the SH3/Oparure Road intersection. This footage, which captured the entirety of the intersection, was also used to establish the level of non-motorised (cycling, pedestrian and equestrian) activity at the intersection and the busier eastern end of Oparure Road.

This video monitoring, for all vehicular and active modes, was carried out over an extended period of the following days:

- Wednesday 11 February 2026;
- Thursday 12 February 2026;
- Saturday 14 February 2026.

In the vicinity of the ‘twin bridges’ located to the east of the school and Fullerton Road a time lapse camera recorded all of the activity on the road between Wednesday 11 February to Sunday 15 February 2026 during the period 0600-1900.

Detailed observations were made on Oparure Road outside, and in the vicinity of, the Te Wharekura o Maniapoto school on Monday 23 February 2026 during the start and end of the school day. These were done in person to obtain a detailed understanding of the vehicular and pedestrian behaviour associated with the arrival and departure of staff and students.

3.2.2 Traffic Volumes, Speeds and Composition

A summary of the tube count surveys has been prepared and provides the existing average daily traffic volumes (vehicles per day), the speeds (km/h) and classifications (percentage) of heavy commercial vehicles (HCVs) on the surveyed local roads. This information is provided in the following illustration on a directional basis at each location.

The data presented is for the second of the two weeks that the tube counters recorded due to this period having slightly higher volumes on Oparure Road in the northern half of the monitored section of road. The percentage of heavy commercial vehicles in the total traffic volume is also provided for both directions, with this relating to the 5-day average daily traffic volumes.

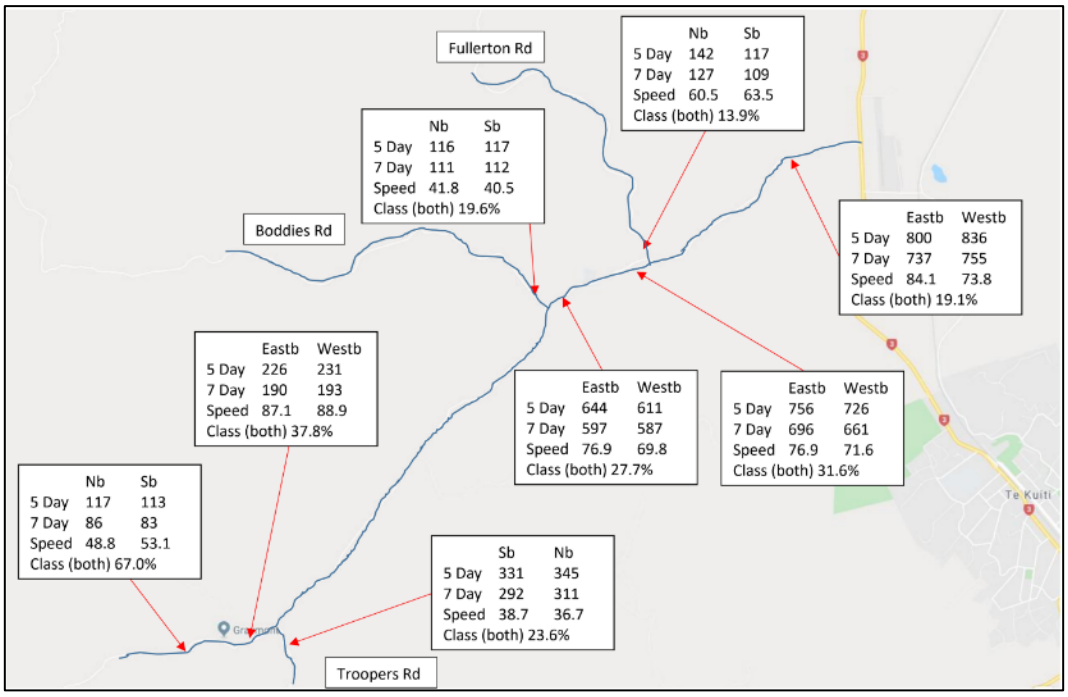


Figure 7: Summary of the tube count data (February 2026)

The recent traffic counts show the following hourly profiles for the vehicle movements[2] into and out of the quarry's access through the course of each day over the monitored two week period in mid-February 2026.

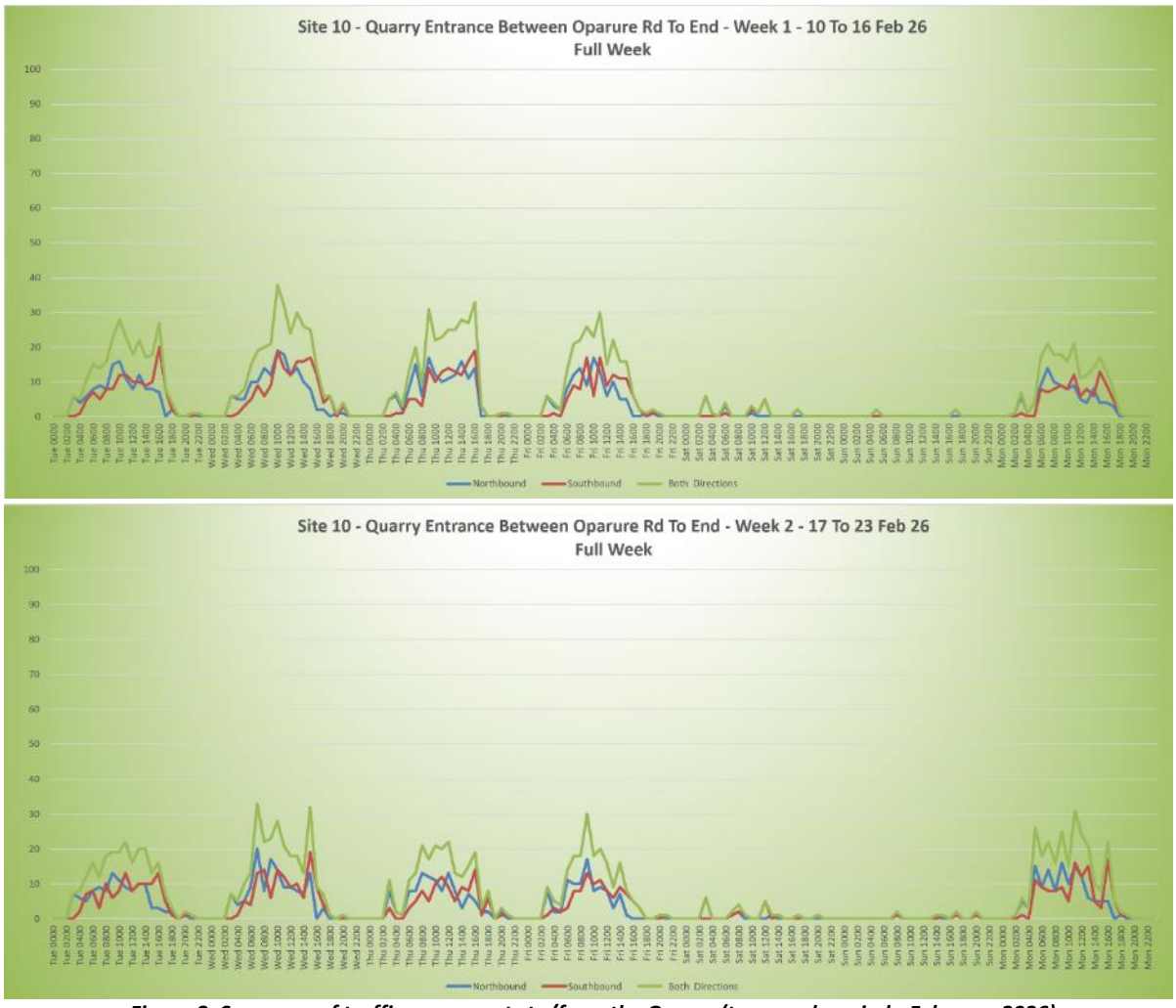


Figure 8: Summary of traffic movements to/from the Quarry (two week period - February 2026)

With the peak hourly movements of circa 10 to 20 vehicles per hour entering and the same number exiting the site. In total, the traffic counter recorded a total of circa 126 vehicles entering, and the same number exiting, the site averaged over the five weekdays in the busiest of the two surveyed weeks. These volumes included not only the truck movements, but also the servicing vehicles and light vehicle movements associated with staff and visitors.

Collectively, these volumes are lower than the peak daily volumes that have occurred prior to Covid, but are still low traffic flows from a traffic engineering perspective.

[2] In considering this information, it should be noted that these graphs provide a record of all the vehicular movements to and from the quarry, and therefore include those associated with staff, maintenance and visitor vehicles as well as truck movements.

The daily directional traffic volume profile in the busier second surveyed week at the eastern end of Oparure Road close to the SH3 intersection is as follows:

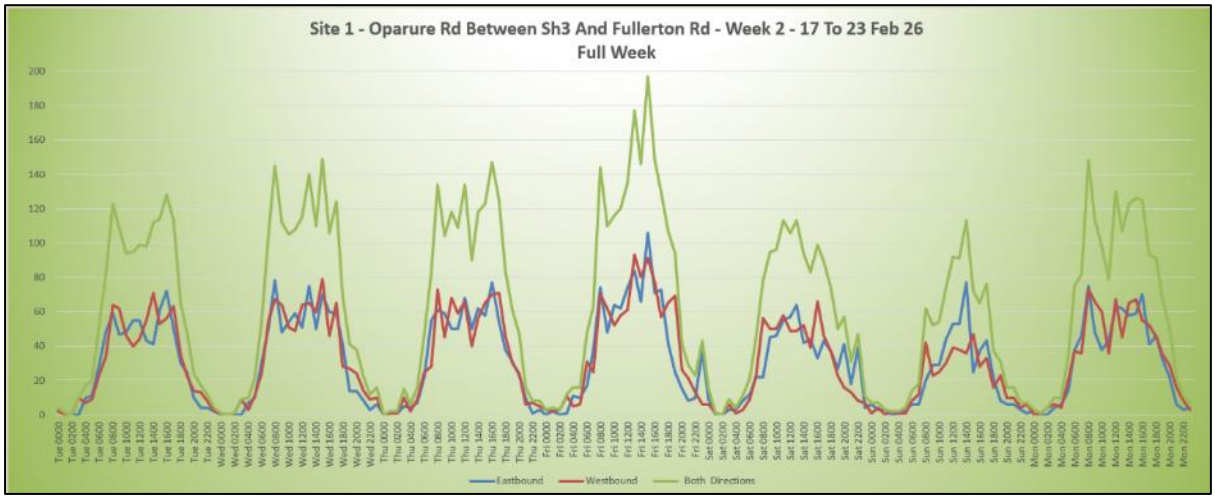
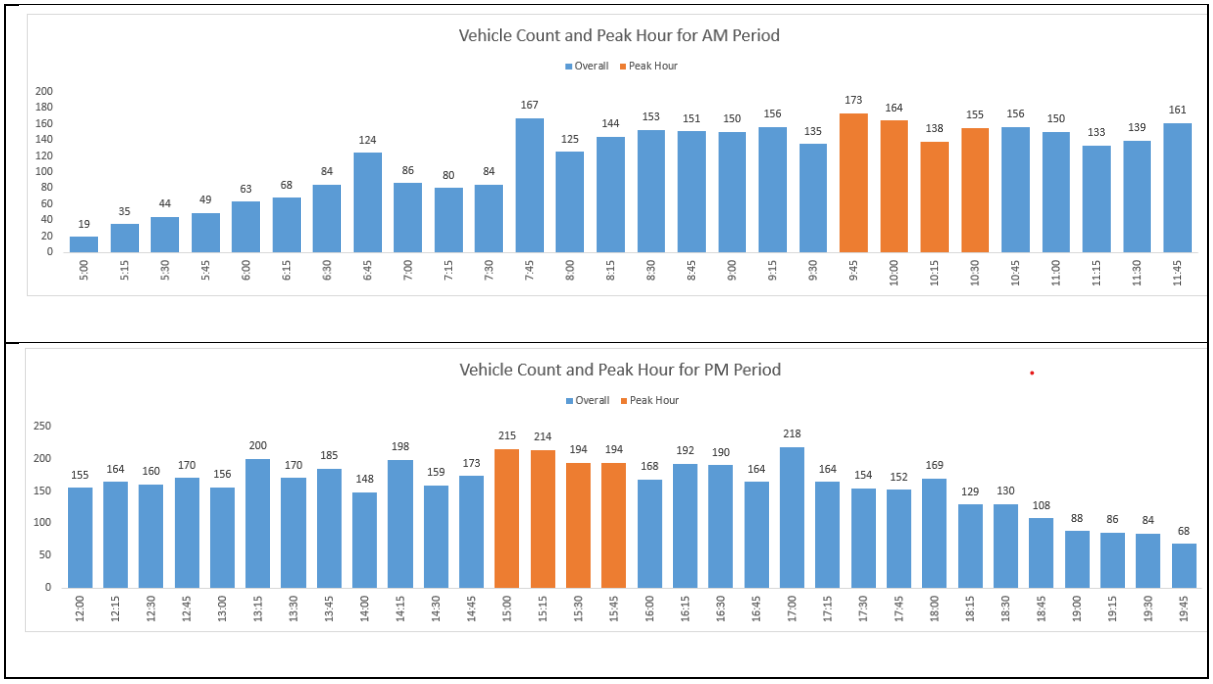


Figure 9: Intraday traffic count profile on Oparure Road close to SH3 (week 2 - February 2026)

At the intersection of SH3 and Oparure Road, the collected traffic survey data for the straight through and turning movements that occurred shows Thursday 12 February 2026 to be the busiest of the three surveyed days. The peak hour when the maximum number of vehicles passed through the intersection on this busiest day occurred between 0945 and 1045 in the morning and 1500-1600 in the afternoon.

The flow profile through each of the AM and PM periods and the detailed composition and turning movement volumes in each direction of these peak hours (including cyclist movements) is provided in the illustrations below. Also shown with the orange bars are the volumes in 15 minute intervals in the busiest hour in the AM and PM periods.



	AM				AM Total	PM				PM Total
	Lights	Heavy vehicles	Buses	Cyclists		Lights	Heavy vehicles	Buses	Cyclists	
State Highway 3 North	**235**	**55**	**1**	**0**	**291**	**288**	**52**	**2**	**0**	**342**
Thru to State Highway 3 South	212	45	1	0	258	267	47	1	0	315
Right into Oparure Road West	23	10	0	0	33	21	5	1	0	27
U-Turn	0	0	0	0	0	0	0	0	0	0
State Highway 3 South	**246**	**36**	**2**	**0**	**284**	**346**	**57**	**2**	**0**	**405**
U-Turn	0	0	0	0	0	0	0	0	0	0
Left into Oparure Road West	26	0	0	0	26	50	3	1	0	54
Thru to State Highway 3 North	220	36	2	0	258	296	54	1	0	351
Oparure Road West	**46**	**9**	**0**	**0**	**55**	**56**	**11**	**3**	**0**	**70**
U-Turn	0	0	0	0	0	0	0	0	0	0
Left into State Highway 3 North	23	7	0	0	30	24	9	1	0	34
Right into State Highway 3 Soutl	23	2	0	0	25	32	2	2	0	36
Grand Total	**527**	**100**	**3**	**0**	**630**	**690**	**120**	**7**	**0**	**817**

Figure 10: Summary of traffic movements 0500-2000 (Thursday 12 February 2026)

Overall, these volumes at the various sections of the surveyed roads and at the SH3/Oparure Road intersection are not high from a traffic engineering perspective.

The surveys also show that there were no pedestrians or cyclists recorded in the two busiest hours at the intersection (including through movements in a north-south direction on SH3)

3.2.3 Speed Environment

Figure 7 above provides 85th percentile speed measurements at the locations of the traffic counts undertaken for this assessment. This speed indicator is an internationally recognised traffic engineering metric for the assessment of speed on a road.

As these KPI details for the speeds relate only to the specific locations of each of the count sites, they are not reflective of the speed profile along the entirety of the route from SH3 to the quarry entrance.

From an assessment on-site it is considered that this speed profile of all vehicles, and in particular the heavy commercial vehicles, is heavily influenced by the horizontal and vertical alignment of the road through the undulating topography of the surrounding area.

To get a representation of the speed profile for 23 metre long truck & trailer heavy vehicles along the full length of the road between the quarry's access and the SH3 intersection, a vehicle with GPS instrumentation was used to obtain speed profile of a representative truck travelling in each direction using the floating car methodology.

The data logging equipment recorded the position of the monitored vehicle at 1 second intervals, and the resulting data set was then processed to determine the speed profile of the monitored and representative vehicle through the full length of the route in each direction on Oparure Road between SH3 and the quarry access.

This has the advantage of showing the speed profile as the laden truck travelling away from the quarry and the unladen truck travelling to the quarry ascends the uphill and downhill grades.

Figures 11 and 12 below show the results of the recorded speed profile along Oparure Road in each direction between SH3 and the quarry entrance. Local reference points have been provided in these graphs to provide context for the interpretation of this data.

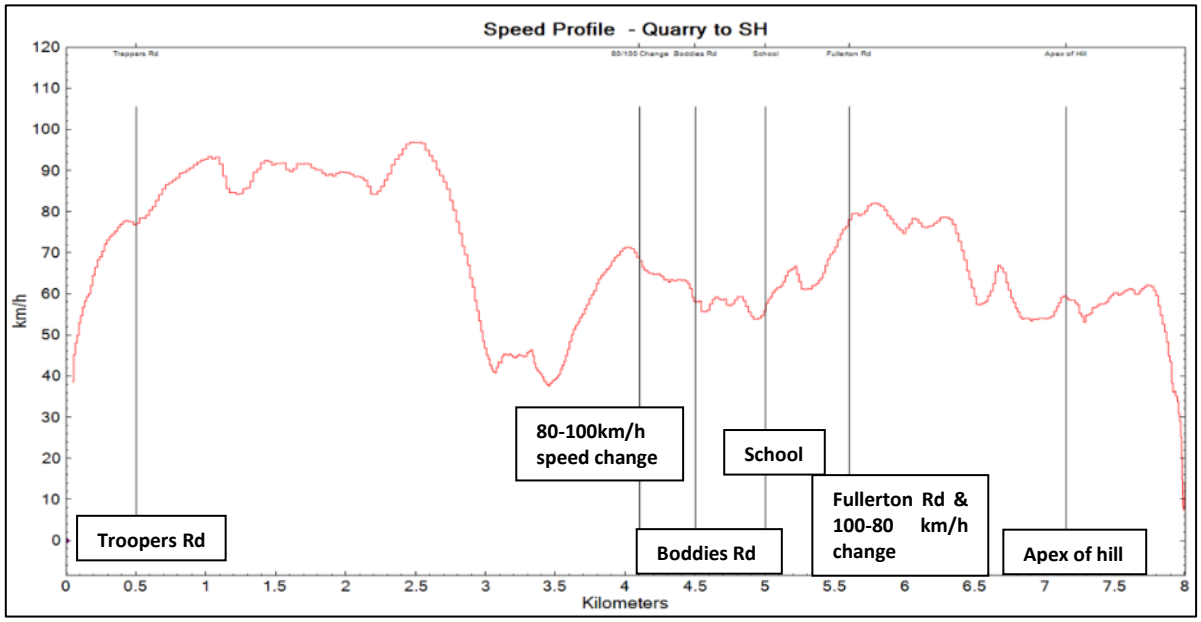


Figure 11: Eastbound speed profile

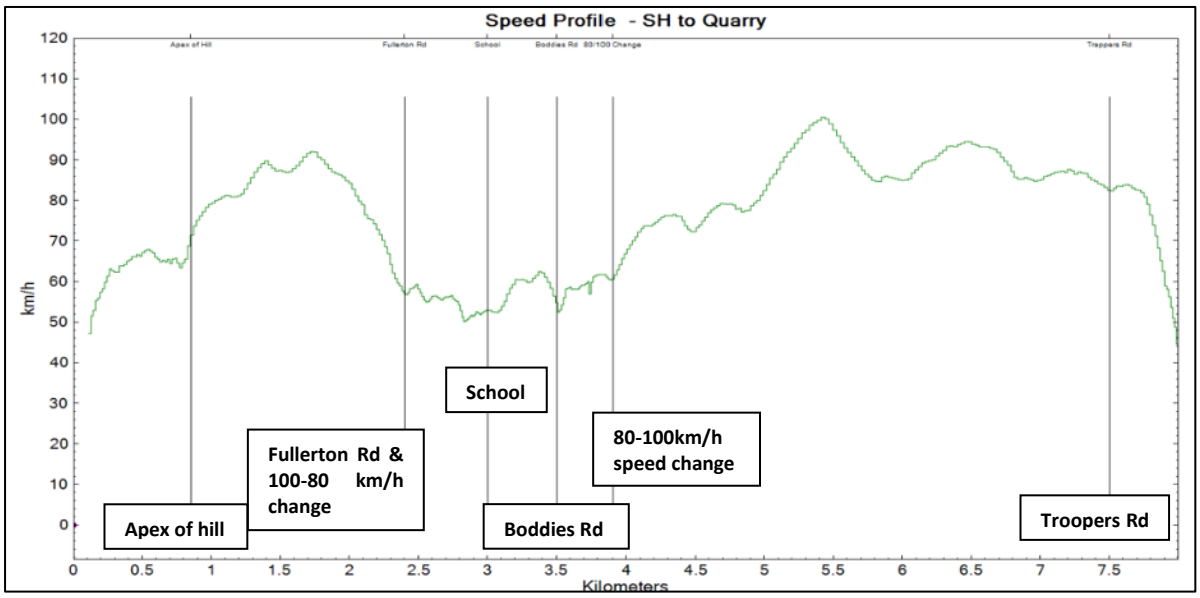


Figure 12: Westbound speed profile

This speed data shows that heavy commercial vehicles are being affected by, and are responding to, the horizontal and vertical alignment of the road.

It also shows that the effect of the speed change from 100km/h (which exists along most of the route) to the posted temporary 50km/h speed limit between Fullerton Road and 401 Oparure Road (Smart Plants) is also noticeable, with the reduction in the speed of heavy commercial vehicles travelling past the Te Wharekura o Maniapoto school being evident. This behaviour has also been observed on-site.

Outside the area with the reduced speed limit, the variability in the speed of all vehicles, including heavy commercial vehicles, is consistent with the behaviour on many other roads and is a normal response to varying road geometry and topography.

Having considered the alignment of the road and the speed profile of vehicles along it in both directions, it is considered that the speed profile is appropriate for the local conditions.

3.2.4 Use of Oparure Road by Non-motorised Users

The time lapse survey undertaken in the vicinity of the 'twin bridges' located to the east of the school and Fullerton Road between 0600-1900 from Wednesday 11 February and Sunday 15 February 2026 showed only one pedestrian (walking a dog). This occurred on Saturday 14 February 2026 at circa 1703.

Observations of the movements relating to pedestrian and cyclist activity (active modes) in all directions at the SH3/Oparure Road intersection over the surveyed period 0500-2000 Wednesday 11 February, Thursday 12 February and Saturday 14 February 2026 showed the following movements occurred between the zones identified in the following illustration.

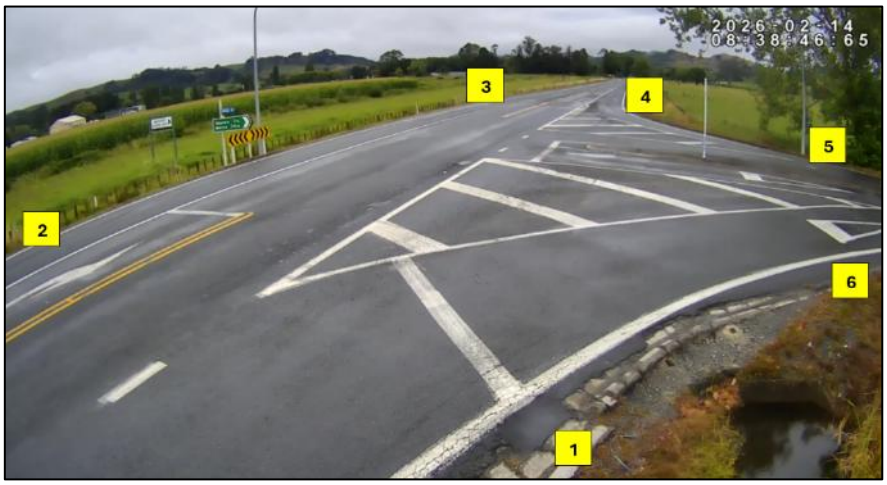


Figure 13: Origin-Destination zones for Active modes at SH3/Oparure Road intersection

Date	Details	Direction of Travel
Wednesday 11 Feb 2026	1 pedestrian, 1015-1030am No cyclist activity	Area 5 to Area 4 No cyclist activity
Thursday 12 Feb 2026	1 pedestrian, 1400-1415 1 cyclist (1245-1300) 1 cyclist (1345-1400) 1 cyclist (1345-1400)	Area 5 to Area 6 Area 2 to Area 3 Area 4 to Area 5 Area 6 to Area 1
Saturday 14 Feb 2026	No pedestrian activity 3 cyclists (0945-1000, 1145-1200, 1645-1700) 2 cyclists (1500-1515, 1645-1700) 1 cyclist (1500-1515)	No pedestrian activity Area 2 to Area 3 Area 4 to Area 1 Area 4 to Area 5

Figure 14: Origin-Destination details for Active modes at SH3/Oparure Road intersection

Observations made on Monday 23 February 2026 of the parking and pedestrian activity associated with the Te Wharekura o Maniapoto school during the morning and afternoon peak periods show that all of this activity is confined either to the car parking area within the site or the off-road recessed parking and drop off area adjacent to the school entrance.

This recessed area was used by the two school buses and light vehicles. Several vehicles were parking for the duration of the school day in this recessed parking area. School buses also dropped off and then collected the students from this area, particularly that part close to the pathway that connects to the school property.

No parking or pedestrian activity associated with the school was observed occurring on either side of the carriageway or its shoulders of the road and nor was any parking or student movement observed occurring across the road or along the shoulders of the road to/from adjacent properties.

All of this activity therefore occurs in locations that are physically separated from the road, with no pedestrian-vehicle interaction observed occurring on the road or with passing quarry trucks.

Representative photographs showing this activity during these time periods are provided below *(faces have been obscured for privacy reasons).*

From the observations outside the school, close to the 'twin bridges' and at the SH3 intersection it has been concluded that:

- There is no evidence of any parking occurring on either side of the sealed lanes associated with the collection or dropping-off of school children at the Te Wharekura o Maniapoto school.
- The pedestrian movements associated with the students and adults all occur from either within the dedicated on-site car park or the recessed pull-in bus loading/standing bay that also doubles as a parking area for some of the buses.
- The use of this facility by the bus services for boarding/alighting and parking, coupled with the availability and use of the on-site car park for parking staff and drop-off-pickup by some parents/guardians results in there being no need for, and no activity associated with, the movement of school students across one or both of the marked lanes used by passing vehicles.
- The use of Oparure Road by non-motorised traffic is exceptionally low and is occurring at a time that corresponds with negligible truck movements from the quarry.
- There were no equestrian movements observed at the surveyed locations and from the visual route assessments that have been made.
- The non-motorised movements in the totality of the intersection of SH3 with Oparure Road are also exceptionally low and are not occurring across SH3.

This data, and the crash history of the area (discussed below), shows that light vehicles and also heavy commercial vehicles are not creating any difficulties that could be cause for concern with pedestrians, cyclists or equestrian traffic.

3.2.5 Crash History

A study has been made of the crash records maintained by NZTA for the five-year period 2020 to 2024 inclusive for the full length of Oparure Road from the SH3 intersection to the quarry's access.

This standard 5-year period has also been extended to include the crashes that had occurred in 2025 that were on file at the time this report was prepared.

In total there were 22 reported crashes which comprised 14 non-injury crashes and seven minor injury crashes, and one serious injury crash. The results of this search are contained in **Appendix B**.

The serious injury crash involved an inexperienced driver that attempted to pass on the left of a tractor that was turning left into a driveway.

The crashes are typically grouped into types depending upon various factors. Table 3 below provides a summary of the number of crashes that were a result of each type.

Crash type	Crash numbers	% All crashes
Overtaking crashes	1	4.55
Straight road lost control/head on	3	13.64
Bend - lost control/Head on	13	59.09
Rear end/obstruction	2	9.09
Crossing/turning	3	13.64
Pedestrian crashes	0	0.00
Miscellaneous crashes	0	0.00
TOTAL	22	100.00

Table 3: Crash types

Each crash has one or more factors that contributed towards its occurrence. A summary of the main crash factors is provided in Table 4 below.

This crash record and the factors that caused it shows that the majority of the factors were the result of human error, with a number of loss-of-control crashes occurring.

Of relevance to this application is the fact that the record also shows that only one of the crashes involved a truck. The details recorded by the Police at the scene described this crash being caused by a quarry truck and trailer having just departed the quarry hitting one of two stray horses that were on the road.

The report also advises that both of the horses ran away as the truck approached, and then one ran back towards the truck, with the driver being unable to brake in sufficient time to avoid hitting it.

There were no pedestrians or cyclists involved in any of the reported crashes, which indicates that the very low level of activity associated with active modes is being accommodated by the passing traffic (including trucks), along the lengthy section of Oparure Road that has been examined, which includes bridges and the SH3 intersection.

Crash factors	Crash numbers	% All crashes
#N/A	15	68.18
Alcohol	3	13.64
Disabled, old age or illness	1	4.55
Failed to give way or stop	3	13.64
Fatigue	2	9.09
Incorrect lanes or position	8	36.36
Miscellaneous factors	2	9.09
Overtaking	1	4.55
Pedestrian factors	0	0.00
Poor handling	3	13.64
Poor judgement	5	22.73
Poor observation	2	9.09
Position on Road	1	4.55
Road factors	5	22.73
Travel Speed	4	18.18
Unknown	0	0.00
Vehicle factors	2	9.09
Weather	1	4.55
TOTAL	58	263.64

Table 4: Crash factors

The crash record also does not indicate any inherent issues with the layout of Oparure Road or the intersection between Oparure Road and State Highway 3 that are affecting the movement of trucks associated with the quarry or any other land use.

From this assessment and observations that have been carried out at other times, it is considered that the vehicles associated with the quarry are coexisting without creating operational difficulties that could be cause for concern from a traffic engineering perspective.

3.2.6 Existing Access Arrangements

As a direct result of a truck crash that occurred at the access to the quarry in 2016, it is understood that Oparure Quarry's management approached Council and NZTA to obtain advice on how to reduce the risk of similar crashes occurring in the future.

This resulted in a substantial upgrade of the intersection of Oparure Road and the main access road that serves the quarry occurring a short time later. The upgrade works undertaken included road widening and the provision of a formal right turn bay.

Imagery of the previous layout and the upgraded layout taken from Google Earth is shown in Figure 15 below.

Before upgrading

After upgrading

Figure 15: Quarry access changes

The upgraded intersection with formal right turn bay has now been in operation for a number of years and has proven to be successful in achieving the much safer and higher quality access than was previously provided.

The upgraded access arrangement for the quarry has been reviewed, and the present design is considered to:

- Still be appropriate for the current volume of vehicle movements generated by the site.
- Be able to comfortably accommodate short-term peaks/higher volumes into and out of the site.

4 CAPACITY OF THE ROUTE

4.1 Capacity of the Road

An assessment of the Oparure Road from SH3 to the quarry has been undertaken to determine the capacity of the route from a traffic engineering perspective.

This route capacity is influenced by the following elements:

- Route capacity analysis;
- Capacity of the intersections.

The capacity of each of these elements is discussed in detail below. This assessment has focused on the weekday traffic environment due to the higher traffic flows occurring during these times.

Route Capacity Analysis

To determine the general capacity of Oparure Road a detailed analysis of the existing road environment has been carried using the *Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis" (2020)*, and in particular the procedures and equations provided in *Section 5.1.1 - Capacity*.

The key aspect of this section is the following quotation:

> *"The capacity of a single traffic lane will be affected by factors such as the pavement width and restricted lateral clearances, the presence of heavy vehicles and grades."*

This section goes on to state:

> *"The capacity of a significant length of a single traffic lane for the prevailing roadway and traffic conditions can be calculated by using the following equation:"*

$$C=1800F_WF_{HV}$$

Where:

C = capacity in vehicles per hour under prevailing roadway and traffic conditions
F_W *= adjustment factor for narrow lanes and lateral clearances.*
F_{HV} *= adjustment factor for heavy vehicles."*

For a very conservative analysis it has been assumed that the land has a moderate topography, there are no shoulders, that the land width is 3.2 metres and the proportion of HCVs is 30%.

Applying the defined analytical process results in the following equation:

$$C=1800 \times 0.60 \times 0.5263$$

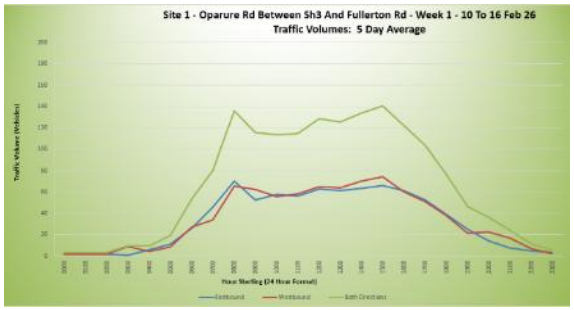
Therefore *C = 568 vehicles per hour per lane.*

For the purposes of carrying out a very conservative assessment, this theoretical capacity has been rounded down to 550 vehicles per hour per lane.

On this basis, the full-width two-way (two lane) traffic volume limit is conservatively estimated to be in the order of 1100 vehicles per hour.

It should be noted that this parameter is a volume *per hour*, not a volume *per day*.

The traffic counts show the following 5-day average hourly volumes in each direction for each of the two weeks surveyed.



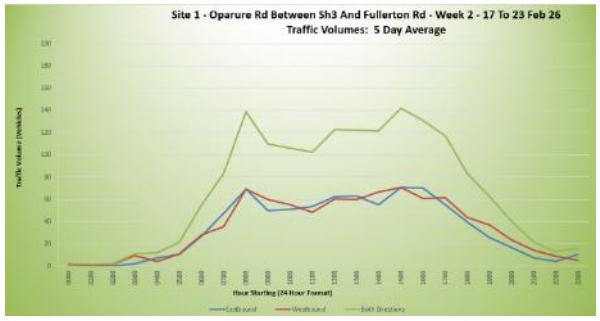


Figure 16: Hourly directional 5-day average traffic flow profile

With the 5-day average daily traffic volume of Oparure Road close to the SH3 intersection being circa 550 vehicles **per day** in each direction, and it typically having less than 100 vehicles **per hour** in each direction in any one hour (on a rolling 15 minute basis through the day) in recent times, the capacity of the route is substantially greater that the volume of traffic using the road, even with consideration given to the seasonal and annual variability that is occurring.

This results in the current demand peaking at no more than circa 18% of the capacity in the peak hour with the conservative assumptions that have been made. Accordingly, the road has substantial reserve capacity and can easily accommodate the variability in the historical demands.

4.1.1 Capacity of the Intersections

From an on-site appraisal of the traffic flows through key intersections along the Oparure Road route, it is considered that the intersections of the local roads with Oparure Road have substantial reserve capacity – even when the quarry has peak traffic movements.

In light of this, it is considered that an analysis of any of these intersections will be of academic interest only due to the exceptionally low flows passing through them, the key performance indicators expected to be exceptionally good, and the intersections having very high reserve capacity.

4.1.2 Capacity and Design of State Highway 3

A survey was carried out at the intersection of Oparure Road and State Highway 3 to determine the existing turning movements at the intersection. Figure 10 provides the volumes in the peak hours that occurred in the morning and afternoon of the busiest day.

In addition, data has been collected at a NZTA regional non-continuous traffic count telemetry site (site reference number 00300066) that is located 800 metres south of the SH37 (Waitomo Caves Road) roundabout.

From the historical data collected at this site, the following annual average daily traffic volumes (AADT) have been published:

- 2021: 6815 vehicles per day (vpd)*
- 2022: 6848 vpd
- 2023: 6784 vpd
- 2024: 7563 vpd
- 2025: *data not published*

** The data for 2021 is expected to be affected by the Covid-related lockdown of Auckland in the first quarter of this year*

This data shows a relatively constant demand over the period 2022-2023 inclusive, with an increase of approximately 780 vehicles per day between 2023 and 2024.

Without the benefit of the 2025 data, it is difficult to determine any longer-term annualised growth rates, although the data for the preceding years suggests that the growth rate could be negligible.

Although the data from a reference site to the north of the Waitomo Caves Road roundabout has the significant tourist-related traffic movements to and from the Waitomo Caves, the data from this site shows the following AADT volumes:

- 2021: 7269 vpd*
- 2022: 8173 vpd
- 2023: 7980 vpd
- 2024: 8135 vpd
- 2025: 8124 vpd

** The data for 2021 is expected to be affected by the Covid-related lockdown of Auckland in the first quarter of that year*

Ignoring the 2021 data due to the potential effects of the Covid lockdown, there was no growth of any consequence between 2022 and 2025 (a nett reduction of 49 vehicles).

From this information it is considered that the traffic volumes on SH3 in the area remain relatively static with no noticeable growth occurring.

In order to evaluate the operational performance of the SH3/Oparure Road intersection, a computer model using the internationally recognised *'SIDRA'* analysis software was prepared for the current morning peak and afternoon peak traffic flow periods and using the intersection's existing geometry.

This analysis has also conservatively assumed that all trucks are, on average, 20 metres long to reflect the longer truck and trailer combinations associated with the quarry and are passing on SH3. This represents a conservative 'override' of the shorter truck length that is the default NZ parameter, and results in longer gap acceptance parameters for the turning vehicles, and shorter theoretical gaps in the northbound and southbound passing traffic streams on SH3.

A second model was also run with the volumes for these time periods with the volumes increased by 20% to consider representative growth in all traffic for the potential operation of the intersection's configuration for an unspecified future time period.

If it is assumed that the annualised growth rate is 1.5% per annum, this 20% growth factor represents a period more than 12 years into the future.

The characteristics for queuing, delay and level of service provided by the modelling show that these key performance indicators are all comfortably within acceptable margins for both the current and future assessment years.

The modelling also shows no appreciable change in the predicted queuing or delay between the two assessment periods that could be cause for concern from a traffic engineering perspective.

The summary output results from the intersection models are attached as **Appendix C**.

In light of this analysis, similar operational performances are expected with the higher truck movements that occurred prior to Covid and with the seasonal and annual variability that is occurring.

The geometric characteristics of the intersection have also been reviewed and are considered to still be appropriate, with significant and lengthy left turn and right turn deceleration lanes on SH3 provided for arriving traffic. The geometric arrangement of the intersection also permits the easy movement of the largest legal truck and trailer vehicle operating without an over-dimension permit to turn.

The visibility from the stopping position on Oparure Road towards the north and south is in excess of 400 metres and 750 metres respectively. The availability of this excellent visibility is due to the straight and flat alignment of the northbound and southbound lanes on each approach to the intersection on SH3.

These distances substantially exceed the NZTA/Austroads Safe Intersection Sight Distance (SISD) requirement for an approach speed of 100km/h. In reality, it is expected that the 85th percentile speed of approaching traffic will be slightly less than 100km/h in this location.

It is also considered that the maintenance of the intersection insofar as pavement surface and roadside vegetation will also be programmed on a regular basis by NZTA, with procedures in place to attend to unexpected events. This is expected to maintain the quality of the trafficable surface and the intersection as a whole to NZTA's requirements and preserve the excellent visibility in both directions.

5 EFFECTS OF THE PROPOSAL

This assessment considers the traffic-related aspects for the development of operation of the proposed South-Western Pit located off Oparure Road in Waitomo.

To assess the impact of the proposal, consideration has been given to a number of key elements that define the traffic-related characteristics and constraints along the routes to and from the site.

These characteristics and constraints are:

- The property's access arrangements.
- The capacity of the roads (based on width and types of vehicles).
- The capacity of the intersections.
- Operational considerations on the roads.
- Safety considerations demonstrated from recent historical patterns.
- Impact on local non-motorised traffic.

The limitations of each of these are discussed below, with this assessment focussing on the weekday traffic environment when the quarry's traffic movements are typically higher.

5.1 Assessed Truck Movements

The existing demand for limestone is expected to remain relatively constant, although there is the possibility that the South-Western Pit project will open up opportunity for new contracts whilst maintaining current supply levels. In the short-medium term there is not anticipated to be any significant longer-term increase in the number of heavy vehicle movements to and from the quarry. Variability on a daily, weekly and seasonal basis will continue, with these continuing to be influenced by market demands.

It is also expected that there will be a continuation of the general traffic patterns to and from the area, with product continuing to go to Ōtorohanga or Te Kūiti for further processing into quicklime products, and the balance being transported further afield to a range of destinations and receiving activities.

The proposal will establish a second quarry pit that will extend the operational life of the quarry. It is anticipated that both pit areas will operate concurrently for a period, being serviced by the existing single vehicle access.

Truck movements to and from the quarry are not expected to significantly change from current levels with the seasonal and annual patterns discussed above expected to continue.

These numbers are particularly low from a traffic engineering perspective and should a modest increase occur in absolute (rather than percentage) terms, it is expected to have no material effect on the outcome of this traffic engineering assessment.

It is also recognised that the current consent for the activities on the site does not limit the quantity of material that can be extracted nor impose a limit on the number of truck movements along Oparure Road.

5.2 The Weigh Bridge

There are currently two weighbridges servicing the quarry operation and each is understood to be able to accommodate in the order of 30 trucks per hour. The quarry will, in the future, be operating for up to 12+ hours per day with the busiest period expected to be between 7.00am and 5.00pm (a 10-hour period). Conservatively, over this 10-hour period, this hourly capacity represents a potential capacity of circa 300 vehicles per day.

With the quarry's traffic movements being spread over the whole day (as evidenced by the recent traffic count data), the capacity of the weighbridge will exceed the anticipated number of vehicles. In the unlikely event of short-term peaks in demand, localised queuing of no more than a couple of vehicles may occur, but the duration and extent of this queuing will not be great and will be confined to the site.

The existing weighbridge is therefore expected to continue being able to accommodate the processing of inbound and outbound trucks.

5.3 Wheel Wash

The quarry will continue to have a wheel wash located in a convenient position so that vehicles associated with the quarry operations can utilise the facility before exiting the site onto the local road network. High pressure water jets in the wheel wash will dislodge the bulk of any detritus material left on the truck.

This whole process typically takes less than one minute and is only required by departing trucks that require this treatment.

Given this processing time and number of vehicles, the single wheel wash is expected to be able to accommodate the anticipated number of trucks leaving the site.

5.4 Property Access Arrangements

The proposal does not require, nor envisage, any changes to the existing access arrangements for the site. As noted above, the access for the site onto Oparure Road was substantially upgraded following a crash in 2016.

The current access arrangements are considered to be of a high standard and therefore will remain acceptable for the continued operation of the quarry.

5.5 Operational Considerations on the Local Roads

From the review of the operating characteristics of the roads in the immediate area, it is considered that there are no issues that could be cause for concern with the continued operation of the quarry.

The capacity of Oparure Road and its intersections with side roads between the quarry and SH3 has sufficient and substantial spare capacity to easily absorb the current flows – including the variability in the truck movements that presently occurs and is expected to continue in the future.

In light of this, it is considered that there are no operational considerations on the local roads or at their intersections with Oparure Road that could be cause for concern and require remediation to mitigate the effects of this application.

5.6 Impact on Oparure Road/SH3 Intersection

The SIDRA analysis undertaken for this intersection has shown that the intersection has significant reserve capacity both now and for the assessed future time horizon. Therefore, the existing operational characteristics of the intersection will be able to continue comfortably accommodating the continuation of the truck traffic and the variability that occurs.

The geometric details of the intersection are also very good, with the significant left turn and right turn deceleration lanes and turning facilities for arriving traffic remaining appropriate, and ideal, for the continuation of the operations.

The maintenance of the intersection insofar as pavement surface and roadside vegetation by NZTA is also expected to continue and form part of NZTA's existing maintenance regimes. This will preserve the quality of the trafficable surface and the excellent visibility in both directions.

On this basis it is considered that no changes are required to the intersection.

5.7 Impact on Local Non-Motorised Travel Modes

From the observations that have been made and also from discussions that have been held with quarry staff, it has been established that there is a very low to negligible level of non-motorised traffic activity occurring in the local area and that these movements are being accommodated without any difficulty by passing truck traffic.

The continued operation of the quarry is not expected to adversely interact with the exceptionally low non-motorised traffic movements that have been observed occurring in the area.

Overall, the continued operation of the quarry and movement of quarry trucks is not expected to result in any noticeable effect on non-motorised travel modes or adverse changes in existing interactions. Therefore, it is expected that the future traffic environment will continue to operate in an acceptable manner.

Despite this, the Applicant will (subject to the agreement of the road controlling authority) erect and maintain heavy traffic warning signs for cyclists entering Oparure Road from:

- Fullerton Road;
- Troopers Road;
- State Highway 3.

5.8 Impact on Wider Roading Network

Beyond the identified local area, the traffic generated by the quarry becomes part of the wider traffic environment and is dispersed over an ever-increasing number of roads as the distance increases away from this local area.

This generation, together with the variability that occurs in the passing traffic flows on the local and wider roading network, is not expected to create any operational problems with the establishment of the South-Western Pit. It is also expected that this generation will continue to be easily absorbed into and become part of the existing flows on the wider network as it presently does.

5.9 Impact on Maniapoto Environmental Management Plan

The Maniapoto Environmental Management Plan (**EMP**) has amongst its aims[3] to:

- Raise awareness and understanding of Maniapoto values, interests and aspirations in the management of physical and natural resources.
- Outline issues that Maniapoto perceive effect Maniapoto values, interests and aspirations in the management of physical and natural resources.
- Outline expectations, through policies and actions, that should resolve these issues.

Therefore, these Maniapoto values and interests and, in particular, the matters covered in the Plan have been considered as they relate to the traffic-related effects of the application.

Examination of the EMP shows that sections 22.3.4 and 22.3.5 relate to the Policies and Actions associated with Transport Network.

Specifically, section 22.3.4.1 is a Policy that seeks to reduce the costs and impacts on the environment through improved energy efficiency, with the Actions of this Policy being to promote energy-efficient transport networks and ensure that land use planning supports and enables all relevant modes of transport.

In this regard it is considered that the expansion of the quarry resources (extraction, processing and transportation) at this location, rather than at a new alternate location in the region, is considered to meet this policy.

[3] Part 1.0, Section 1.1.8

This has significant benefits in that it:

- Avoids the duplication of resources if an alternate site was to be newly created;
- Supports the ongoing use of existing transport infrastructure; and
- Avoids greater exposure of vehicles and distances travelled over a greater and more diverse number of roads.

The application will also continue to support existing and future staff travel patterns, including ride sharing, and the use of existing resources for the transportation of supplies and outputs.

Section 22.3.5 is a Policy that seeks to reduce the risks that Maniapoto are exposed to from transport users. This is by the relevant Action points that seek to ensure that appropriate speed limits and other signage are posted and enforced near marae, kura and other Maniapoto facilities.

As discussed above, it is considered that these measures are already being well met through the:

- Imposition of the reduced speed limit on Oparure Road on the approaches to and past the Te Wharekura o Maniapoto school as well as the neighbouring marae;
- Provision of NZTA advanced permanent warning sign for schools (PW32 code);
- Provision of dedicated parking and drop off facilities for all students and teachers that are removed from the passing traffic flows on Oparure Road.

It is considered that these measures (provided by the Council) fit with the nationally adopted standards.

It is also noted that the provision of additional signage or changing of speed limits in other areas is outside the control of the applicant and can only be changed by Council due to the need for supporting bylaws.

Section 22.3.5 is a Policy that seeks to reduce the adverse effects of transport infrastructure, with the Actions of this Policy being to ensure that the safety and design of transport infrastructure around marae, kura and other Maniapoto facilities protects human safety and health. It also seeks to have regular reviews of the mitigation measures for transport.

As discussed above, it is considered from the comprehensive assessment carried out for this report that the existing roading facilities are appropriate for the intended use and that the off-road facilities presently available for, and extensively used by, the kura minimise the traffic-related effects of the passing quarry traffic.

It is also noted that:

- The existing behaviour of some of the bus drivers approaching the kura from the north-east (SH3) who execute a U-turn at the Boddies Road intersection (rather than turning right into the dedicated drop off area) further enhances the safety of the local traffic environment.
- Council is expected to have, as part of its core business, regular reviews and drive-over assessments of the local and wider roading network made by its contracted network manager.

6 COUNCIL PEER REVIEW

Council engaged Bloxam Burnett and Olliver (**BBO**) to undertake a peer review of a draft of this report that was submitted to Council for their information and comment.

This peer review concluded that the proposal can be supported on the basis of the following conditions:

- Safe-hit delineators are to be installed on the western side of the intersection to prevent vehicles from obstructing the sightline looking west.
- A more stringent use of wheel washing is to be provided as it has been noted that the rise of dust nuisance effects and tracking of sand onto Oparure Road is evident from the quarry.
- The applicant is to provide a pavement levy impact calculation to better understand the potential adverse transportation effects of the proposed pit area.

The calculation of the pavement levy impact charge is outside the scope of this report and will be addressed by others.

Insofar as the remaining two points are concerned, it is understood that the Applicant has accepted:

- The installation of the safe hit delineators on the western side of the intersection of the site's access with Oparure Road to protect the visibility sightlines to the west. These will be installed to the satisfaction of the Council.
- The use of the wheel wash by exiting trucks to reduce the tracking of sand onto Oparure Road.

Conditions of consent to this effect are recommended.

7 CONCLUSION

This report considers the traffic-related impacts of the proposal to establish and operate a new limestone pit, the limestone from which will be transported within the site to the existing limestone quarry for processing and distribution.

It is noted that the current consent for the activities on the site does not limit the quantity of material that can be extracted nor impose a limit on the number of truck movements along Oparure Road.

From the detailed assessment of the traffic environment in the local area and at the Oparure Road/SH3 intersection, it is concluded that:

- The number of heavy vehicle movements to and from the quarry is expected to have varying truck movements which are reflective of the daily, seasonal and annual demand. It is considered that these truck numbers and the variability that is occurring can continue to be successfully accommodated by the existing road network and local traffic environment.

- The variability in the truck numbers that is presently occurring and has occurred historically, and is expected to continue occurring, is low from a traffic engineering perspective and will not have an impact that could be cause for concern.
- There is very little non-vehicular traffic using the road and these modes of transport are interacting in a manner that does not highlight areas of concern from the observations that have been made and also in the crash history. The effects of this application are not expected to change this situation.
- The traffic-related effects of the application are not contrary to the Transport-related Policies and Actions of the Maniapoto Environmental Management Plan.

The level of use in the local and wider traffic environment is low from a traffic engineering perspective and a 'modest' increase from the existing volumes to provide for production changes is not expected to have a material effect on the outcome from a traffic engineering perspective.

This conclusion has been reached from an assessment of the surrounding environment and without relying on the fact that the current consent for the activities on the site does not limit the quantity of material that can be extracted nor impose a limit on the number of truck movements along Oparure Road.

The acceptance by the Applicant of the following traffic-related matters identified in the peer review undertaken for Council is also noted. On this basis it is considered that the following matters should be made Conditions of Consent:

- Safe-hit delineators are to be installed on the western side of the intersection of the site's access and Oparure Road to prevent vehicles from obstructing the sightline looking west. These should be installed to the satisfaction of Council.
- A more stringent use of the wheel wash is to occur to reduce the dust nuisance effects and tracking of sand onto Oparure Road.

The final recommended matter identified by the review regarding the calculation of the pavement levy impact charge is outside the scope of this report.

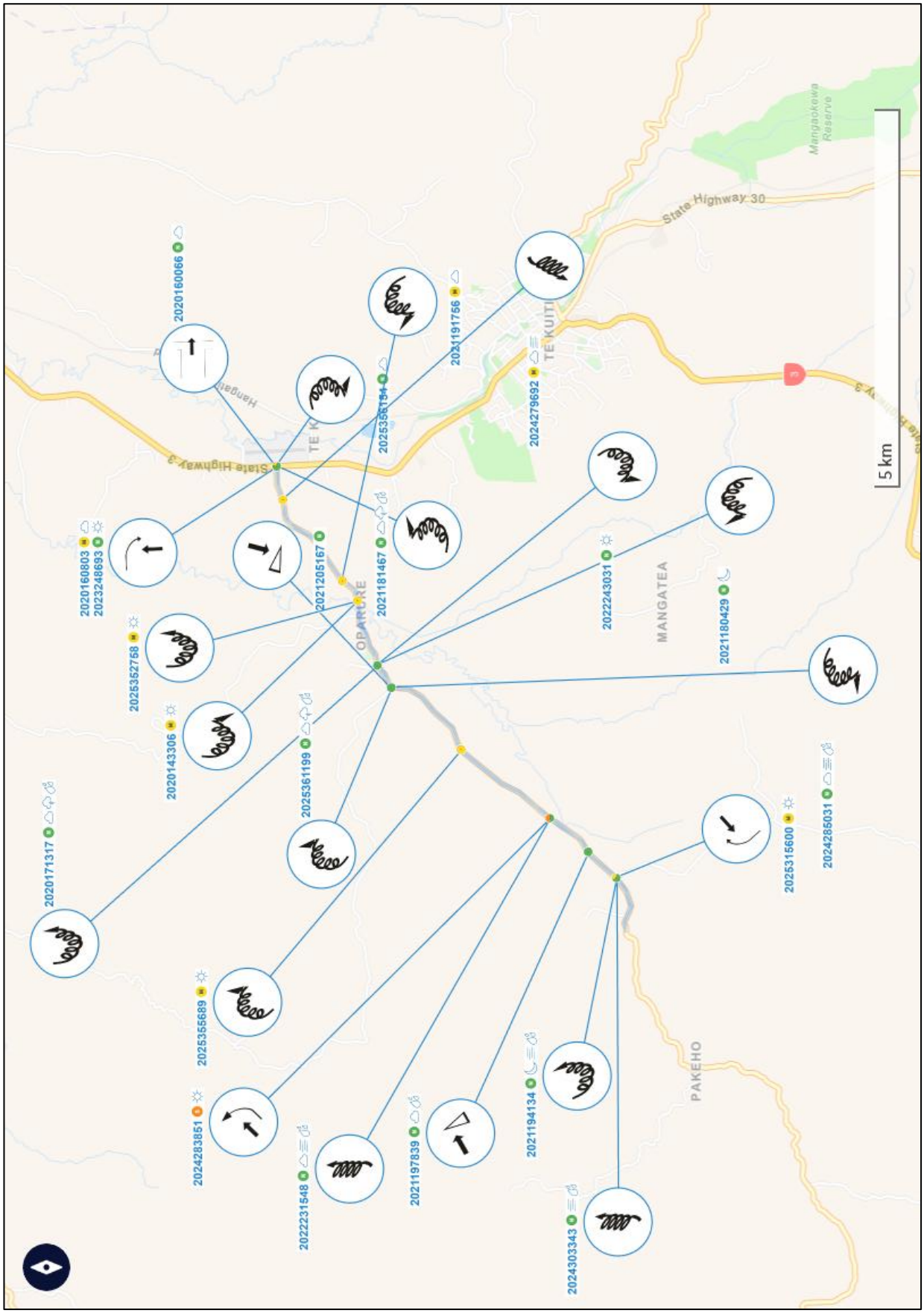
On this basis, it is considered the traffic-related adverse effects of the application are, at worst, minor (most of the adverse traffic effects are smaller than minor) and are acceptable from a traffic engineering perspective noting:

- The recommended traffic-related conditions of consent that have been identified and accepted.
- The Applicant's willingness (subject to the agreement of the road controlling authority) to erect and maintain heavy traffic warning signs in the identified locations.

APPENDIX A: PROPOSED EXPANSION OF THE SITE

Key: *The lighter blue line represents the boundary of the SW Pit.*
The dark blue line is the catchment boundary in the karst landscape.
The green lines represent the new haul road required to link the SW Pit to existing infrastructure at the Quarry.

APPENDIX B: CRASH ANALYSIS SYSTEM OUTPUTS



Crash severity

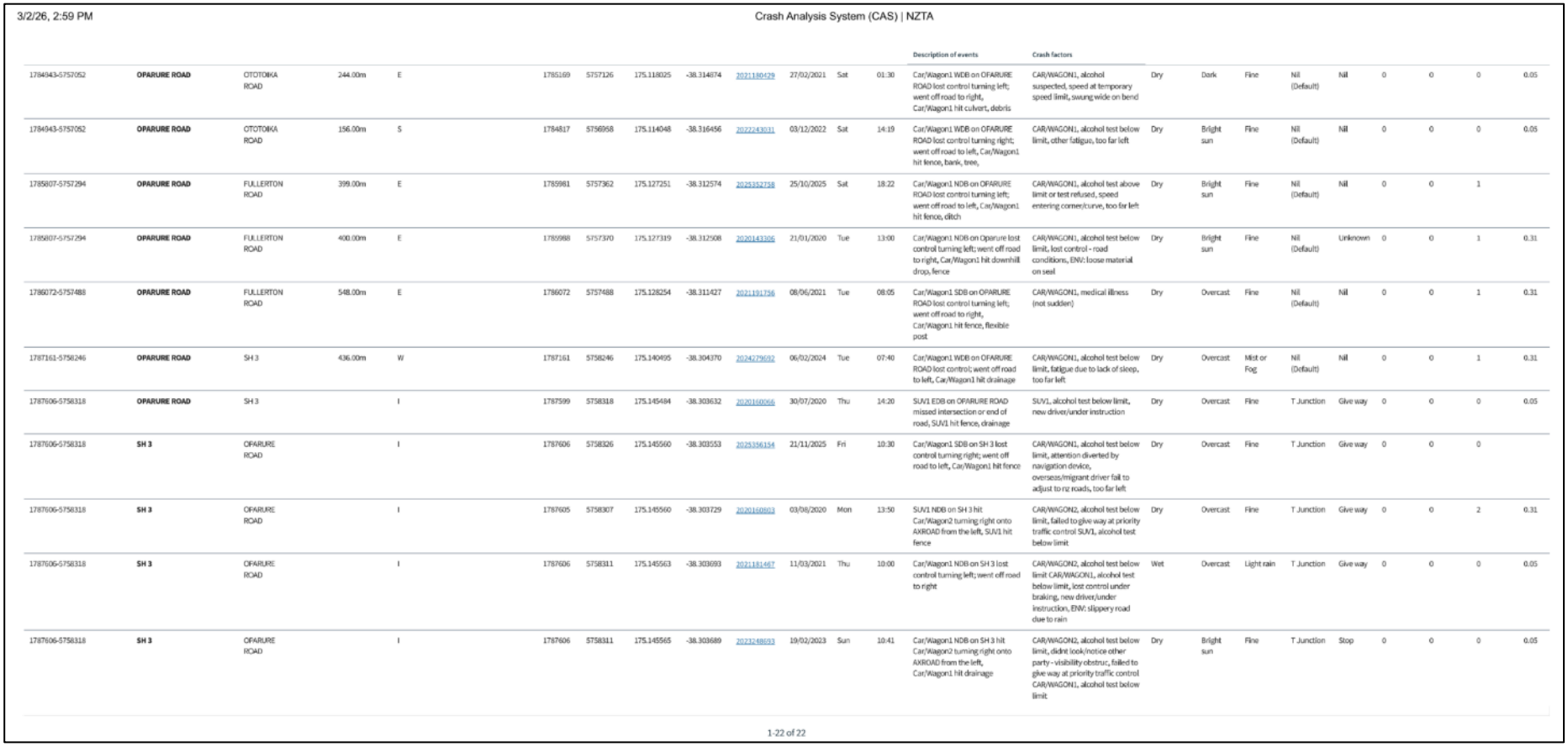
Fatal Crash, Serious Crash, Non-Injury Crash, Minor Crash

Plain English report

22 results from your query.

1-22 of 22

Site Centre: Midpoint	Crash road	Side road	Feature	Distance from side road/feature	Direction	Reference station	Route position	Easting	Northing	Longitude	Latitude	ID	Date	Day of week	Time	Description of events	Crash factors	Surface condition	Natural light	Weather	Junction	Control	Casualty count fatal	Casualty count serious	Casualty count minor	Social cost $(m)
1782060-5753973	**OPARURE ROAD**	TROOPERS ROAD		240.00m	S			1781862	5753841	175.081071	-38.345137	2021194134	04/07/2021	Sun	17:46	Car/Wagon1 NDB on OPARURE ROAD lost control turning left; went off road to left, Car/Wagon1 hit downhill drop, substantial vegetation (causing vehicle damage or stopping the vehicle)	CAR/WAGON1, alcohol test below limit, other lost control, too far left, ENV: road slippery due to frost or ice	Ice or Snow	Dark	Mist or Fog	Nil (Default)	Unknown	0	0	0	0.05
1782060-5753973	**OPARURE ROAD**	TROOPERS ROAD		134.00m	N			1782152	5754074	175.084320	-38.342978	2024303343	05/07/2024	Fri	06:15	Car/Wagon1 NDB on OPARURE ROAD lost control; went off road to left	CAR/WAGON1, lost control - road conditions, ENV: road slippery due to frost or ice	Ice or Snow	Unknown	Mist or Fog	Nil (Default)	Nil	0	0	0	0.05
1782060-5753973	**OPARURE ROAD**	TROOPERS ROAD			I			1782066	5753979	175.083367	-38.343853	2025315600	06/01/2025	Mon	15:07	Car/Wagon1 SDB on OPARURE ROAD hit Van2 turning right onto AXROAD from the left	CAR/WAGON1, alcohol test below limit VAN2, alcohol test below limit, failed to give way at priority traffic control	Dry	Bright sun	Fine	T Junction	Give way	0	0	1	
1782413-5754335	**OPARURE ROAD**	TROOPERS ROAD		299.00m	N			1782272	5754203	175.085663	-38.341794	2021197839	13/08/2021	Fri	12:40	Truck1 NDB on OPARURE ROAD hit obstruction, Truck1 hit farm animals (straying)	TRUCK1, alcohol test below limit, ENV: farm animal straying	Wet	Overcast	Fine	Nil (Default)	Nil	0	0	0	0.05
1782871-5754830	**OPARURE ROAD**	GADSBY ROAD		830.00m	S			1782936	5754911	175.093079	-38.335277	2024283851	30/03/2024	Sat	10:30	Car/Wagon1 NDB on OPARURE ROAD sideswiped by Truck2 NDB on OPARURE ROAD turning left, Car/Wagon1 hit other, fence	TRUCK2, alcohol test below limit CAR/WAGON1, alcohol test below limit, drugs proven, misjudged another vehicle, new driver/under instruction, overtaking on left without due care, vehicle caught fire	Dry	Bright sun	Fine	Driveway	Nil	0	2	0	1.04
1782871-5754830	**OPARURE ROAD**	TROOPERS ROAD		1,053.00m	N			1782806	5754749	175.091628	-38.336765	2022231548	02/08/2022	Tue	08:00	Car/Wagon1 NDB on OPARURE ROAD lost control; went off road to left, Car/Wagon1 hit bank	CAR/WAGON1, too far left	Wet	Overcast	Mist or Fog	Nil (Default)	Nil	0	0	0	0.05
1783804-5755977	**OPARURE ROAD**	GADSBY ROAD		580.00m	N			1783804	5755977	175.102717	-38.325500	2025355689	16/11/2025	Sun	12:33	Car/Wagon1 NDB on OPARURE ROAD lost control turning right; went off road to left, Car/Wagon1 hit ditch, fence	CAR/WAGON1, alcohol test below limit, new driver/under instruction, speed entering corner/curve, while returning to seal from unsealed shoulder	Dry	Bright sun	Fine	Nil (Default)	Nil	0	0	1	
1784643-5756875	**OPARURE ROAD**	BODDIE ROAD			I			1784641	5756868	175.112062	-38.317301	2024285031	16/04/2024	Tue	07:30	Car/Wagon1 WDB on OPARURE ROAD lost control turning left; went off road to right, Car/Wagon1 hit substantial vegetation (causing vehicle damage or stopping the vehicle), roadside drainage channel	CAR/WAGON1, alcohol test below limit, lost control - vehicle fault, puncture or blowout, ENV: fog or mist	Wet	Overcast	Mist or Fog	T Junction	Give way	0	0	0	0.05
1784643-5756875	**OPARURE ROAD**	BODDIE ROAD		155.00m	S			1784628	5756718	175.111950	-38.318655	2021205167	19/03/2021	Fri	19:40	Left scene1 SDB on OPARURE ROAD hit obstruction, Left scene1 hit pets	ENV: household pet rushed out or playing	Null	Unknown	Null	Nil (Default)	Nil	0	0	0	0.05
1784643-5756875	**OPARURE ROAD**	BODDIE ROAD		40.00m	E			1784669	5756901	175.112370	-38.317004	2025361199	30/12/2025	Tue	09:20	Car/Wagon1 EDB on OPARURE ROAD lost control turning right; went off road to left, Car/Wagon1 hit fence, ditch	CAR/WAGON1, alcohol test below limit, inappropriate speed for road conditions, too far left	Wet	Overcast	Light rain	Nil (Default)	Nil	0	0	0	
1784943-5757052	**OPARURE ROAD**	OTOTOIKA ROAD		185.00m	E			1785123	5757091	175.117513	-38.315196	2020171317	27/11/2020	Fri	19:30	Car/Wagon1 EDB on OPARURE ROAD lost control turning left; went off road to left, Car/Wagon1 hit bank	CAR/WAGON1, too far left, ENV: slippery road due to rain	Wet	Overcast	Light rain	Nil (Default)	Nil	0	0	0	0.05



3/2/26, 2:59 PM — Crash Analysis System (CAS) | NZTA

													Description of events	Crash factors									
1784943-5757052	**OPARURE ROAD**	OTOTOIKA ROAD	244.00m	E	1785169	5757126	175.118025	-38.314874	2021180429	27/02/2021	Sat	01:30	Car/Wagon1 WDB on OFARURE ROAD lost control turning left; went off road to right, Car/Wagon1 hit culvert, debris	CAR/WAGON1, alcohol suspected, speed at temporary speed limit, swung wide on bend	Dry	Dark	Fine	Nil (Default)	Nil	0	0	0	0.05
1784943-5757052	**OPARURE ROAD**	OTOTOIKA ROAD	156.00m	S	1784817	5756958	175.114048	-38.316456	2022243031	03/12/2022	Sat	14:19	Car/Wagon1 WDB on OFARURE ROAD lost control turning right; went off road to left, Car/Wagon1 hit fence, bank, tree,	CAR/WAGON1, alcohol test below limit, other fatigue, too far left	Dry	Bright sun	Fine	Nil (Default)	Nil	0	0	0	0.05
1785807-5757294	**OPARURE ROAD**	FULLERTON ROAD	399.00m	E	1785981	5757362	175.127251	-38.312574	2025352758	25/10/2025	Sat	18:22	Car/Wagon1 NDB on OFARURE ROAD lost control turning left; went off road to left, Car/Wagon1 hit fence, ditch	CAR/WAGON1, alcohol test above limit or test refused, speed entering corner/curve, too far left	Dry	Bright sun	Fine	Nil (Default)	Nil	0	0	1	
1785807-5757294	**OPARURE ROAD**	FULLERTON ROAD	400.00m	E	1785988	5757370	175.127319	-38.312508	2020143306	21/01/2020	Tue	13:00	Car/Wagon1 NDB on Oparure lost control turning left; went off road to right, Car/Wagon1 hit downhill drop, fence	CAR/WAGON1, alcohol test below limit, lost control - road conditions, ENV: loose material on seal	Dry	Bright sun	Fine	Nil (Default)	Unknown	0	0	1	0.31
1786072-5757488	**OPARURE ROAD**	FULLERTON ROAD	548.00m	E	1786072	5757488	175.128254	-38.311427	2021191756	08/06/2021	Tue	08:05	Car/Wagon1 SDB on OPARURE ROAD lost control turning left; went off road to right, Car/Wagon1 hit fence, flexible post	CAR/WAGON1, medical illness (not sudden)	Dry	Overcast	Fine	Nil (Default)	Nil	0	0	1	0.31
1787161-5758246	**OPARURE ROAD**	SH 3	436.00m	W	1787161	5758246	175.140495	-38.304370	2024279692	06/02/2024	Tue	07:40	Car/Wagon1 WDB on OFARURE ROAD lost control; went off road to left, Car/Wagon1 hit drainage	CAR/WAGON1, alcohol test below limit, fatigue due to lack of sleep, too far left	Dry	Overcast	Mist or Fog	Nil (Default)	Nil	0	0	1	0.31
1787606-5758318	**OPARURE ROAD**	SH 3		I	1787599	5758318	175.145484	-38.303632	2020160066	30/07/2020	Thu	14:20	SUV1 EDB on OPARURE ROAD missed intersection or end of road, SUV1 hit fence, drainage	SUV1, alcohol test below limit, new driver/under instruction	Dry	Overcast	Fine	T Junction	Give way	0	0	0	0.05
1787606-5758318	**SH 3**	OFARURE ROAD		I	1787606	5758326	175.145560	-38.303553	2025356154	21/11/2025	Fri	10:30	Car/Wagon1 SDB on SH 3 lost control turning right; went off road to left, Car/Wagon1 hit fence	CAR/WAGON1, alcohol test below limit, attention diverted by navigation device, overseas/migrant driver fail to adjust to nz roads, too far left	Dry	Overcast	Fine	T Junction	Give way	0	0	0	
1787606-5758318	**SH 3**	OFARURE ROAD		I	1787605	5758307	175.145560	-38.303729	2020160803	03/08/2020	Mon	13:50	SUV1 NDB on SH 3 hit Car/Wagon2 turning right onto AXROAD from the left, SUV1 hit fence	CAR/WAGON2, alcohol test below limit, failed to give way at priority traffic control SUV1, alcohol test below limit	Dry	Overcast	Fine	T Junction	Give way	0	0	2	0.31
1787606-5758318	**SH 3**	OFARURE ROAD		I	1787606	5758311	175.145563	-38.303693	2021181467	11/03/2021	Thu	10:00	Car/Wagon1 NDB on SH 3 lost control turning left; went off road to right	CAR/WAGON2, alcohol test below limit CAR/WAGON1, , alcohol test below limit, lost control under braking, new driver/under instruction, ENV: slippery road due to rain	Wet	Overcast	Light rain	T Junction	Give way	0	0	0	0.05
1787606-5758318	**SH 3**	OFARURE ROAD		I	1787606	5758311	175.145565	-38.303689	2023248693	19/02/2023	Sun	10:41	Car/Wagon1 NDB on SH 3 hit Car/Wagon2 turning right onto AXROAD from the left, Car/Wagon1 hit drainage	CAR/WAGON2, alcohol test below limit, didnt look/notice other party - visibility obstruc, failed to give way at priority traffic control CAR/WAGON1, alcohol test below limit	Dry	Bright sun	Fine	T Junction	Stop	0	0	0	0.05

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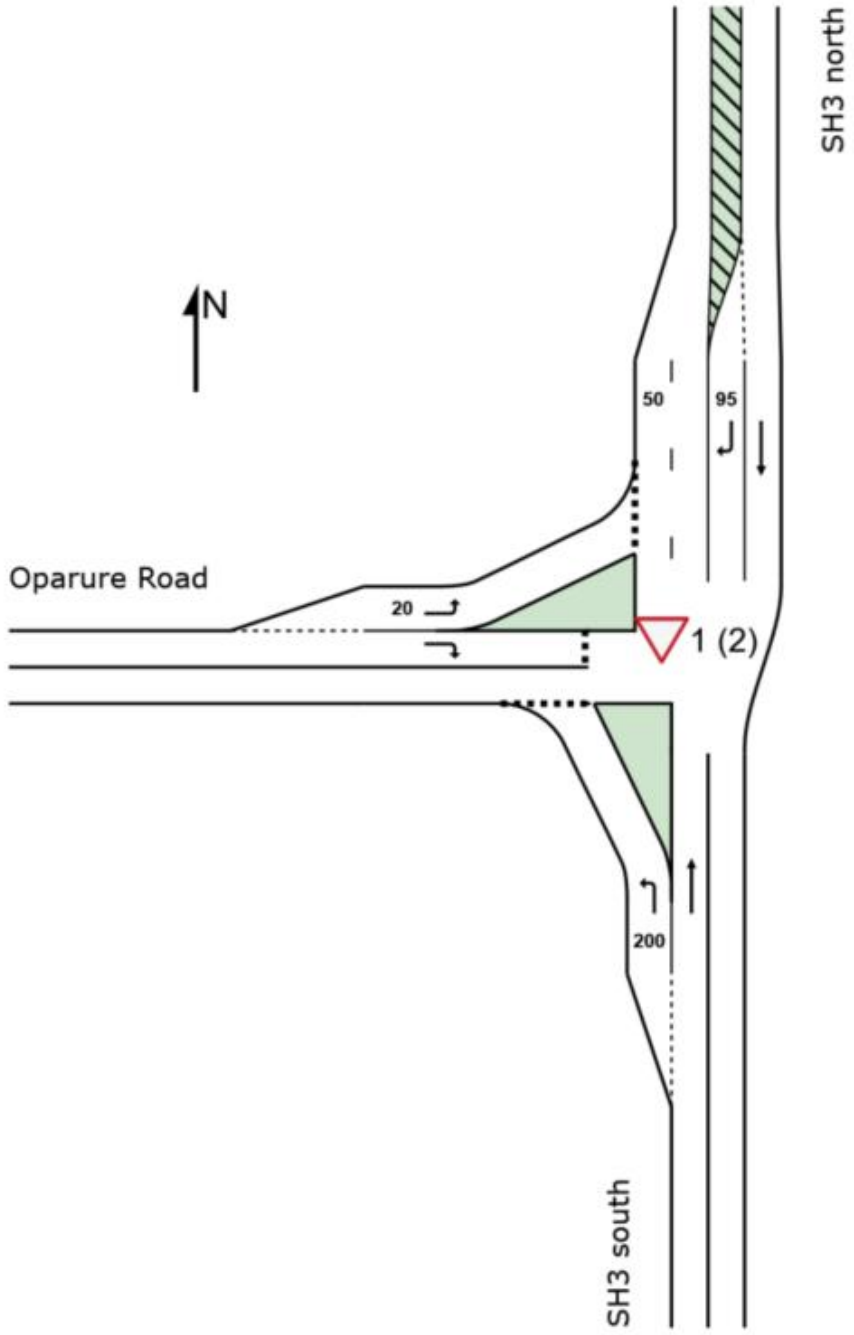
APPENDIX C: *SIDRA* MODELLING OUTPUTS

SITE LAYOUT

Site: [1 (2)] Site1 - without volumes (Folder1)

Oparure SH3 intersection
Site Category: (None)
Give-Way (Two-Way)
Site Scenario: 1 | Local Volumes

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



LANE SUMMARY

Site: [1 (3)] Site1 - AM existing (Folder1)
Output produced by SIDRA INTERSECTION Version: 10.0.9.250

Oparure SH3 intersection
Site Category: (None)
Give-Way (Two-Way)
Site Scenario: 1 | Local Volumes

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival 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: SH3 south															
Lane 1	27	0.0	27	0.0	1584	0.017	100	4.6	LOS A	0.1	0.5	Short	200	0.0	NA
Lane 2	272	14.7	272	14.7	1780	0.153	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	299	13.4	299	13.4		0.153		0.5	LOS A	0.1	0.5				
North: SH3 north															
Lane 1	272	17.8	272	17.8	1747	0.155	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	35	30.3	35	30.3	1124	0.031	100	6.2	LOS A	0.1	1.2	Short	95	0.0	NA
Approach	306	19.2	306	19.2		0.155		0.7	NA	0.1	1.2				
West: Oparure Road															
Lane 1	32	23.3	32	23.3	1076	0.029	100	5.9	LOS A	0.1	0.9	Short	20	0.0	NA
Lane 2	26	8.0	26	8.0	496	0.053	100	10.0	LOS B	0.2	1.4	Full	500	0.0	0.0
Approach	58	16.4	58	16.4		0.053		7.8	LOS A	0.2	1.4				
All Vehicles	663	16.3	663	16.3		0.155		1.2	NA	0.2	1.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

LANE SUMMARY

Site: [1 (5)] Site1 - PM existing (Folder1)
Output produced by SIDRA INTERSECTION Version: 10.0.9.250

Oparure SH3 intersection
Site Category: (None)
Give-Way (Two-Way)
Site Scenario: 1 | Local Volumes

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival 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: SH3 south															
Lane 1	56	5.7	56	5.7	1549	0.036	100	4.6	LOS A	0.1	1.1	Short	200	0.0	NA
Lane 2	369	15.7	369	15.7	1770	0.209	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	425	14.4	425	14.4		0.209		0.7	LOS A	0.1	1.1				
North: SH3 north															
Lane 1	332	15.2	332	15.2	1774	0.187	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	28	22.2	28	22.2	1028	0.028	100	6.6	LOS A	0.1	0.9	Short	95	0.0	NA
Approach	360	15.8	360	15.8		0.187		0.6	NA	0.1	0.9				
West: Oparure Road															
Lane 1	36	29.4	36	29.4	901	0.040	100	6.8	LOS A	0.1	1.3	Short	20	0.0	NA
Lane 2	38	11.1	38	11.1	354	0.107	100	13.7	LOS B	0.4	2.7	Full	500	0.0	0.0
Approach	74	20.0	74	20.0		0.107		10.3	LOS B	0.4	2.7				
All Vehicles	859	15.4	859	15.4		0.209		1.5	NA	0.4	2.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

LANE SUMMARY

Site: [1 (4)] Site1 - AM plus 20% (Folder1)
Output produced by SIDRA INTERSECTION Version: 10.0.9.250

Oparure SH3 intersection
Site Category: (None)
Give-Way (Two-Way)
Site Scenario: 1 | Local Volumes

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival 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: SH3 south															
Lane 1	33	0.0	33	0.0	1573	0.021	100	4.6	LOS A	0.1	0.6	Short	200	0.0	NA
Lane 2	326	14.8	326	14.8	1778	0.183	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	359	13.5	359	13.5		0.183		0.5	LOS A	0.1	0.6				
North: SH3 north															
Lane 1	325	17.8	325	17.8	1748	0.186	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	42	30.0	42	30.0	1041	0.040	100	6.5	LOS A	0.2	1.5	Short	95	0.0	NA
Approach	367	19.2	367	19.2		0.186		0.8	NA	0.2	1.5				
West: Oparure Road															
Lane 1	38	22.2	38	22.2	1008	0.038	100	6.2	LOS A	0.1	1.2	Short	20	0.0	NA
Lane 2	32	6.7	32	6.7	411	0.077	100	11.9	LOS B	0.3	2.0	Full	500	0.0	0.0
Approach	69	15.2	69	15.2		0.077		8.8	LOS A	0.3	2.0				
All Vehicles	796	16.3	796	16.3		0.186		1.4	NA	0.3	2.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

LANE SUMMARY

Site: [1 (6)] Site1 - PM plus 20% (Folder1)
Output produced by SIDRA INTERSECTION Version: 10.0.9.250

Oparure SH3 intersection
Site Category: (None)
Give-Way (Two-Way)
Site Scenario: 1 | Local Volumes

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival 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: SH3 south															
Lane 1	67	6.2	67	6.2	1537	0.044	100	4.7	LOS A	0.2	1.3	Short	200	0.0	NA
Lane 2	443	15.7	443	15.7	1770	0.250	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	511	14.4	511	14.4		0.250		0.7	LOS A	0.2	1.3				
North: SH3 north															
Lane 1	398	15.3	398	15.3	1773	0.224	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	34	21.9	34	21.9	921	0.037	100	7.2	LOS A	0.1	1.2	Short	95	0.0	NA
Approach	432	15.9	432	15.9		0.224		0.6	NA	0.1	1.2				
West: Oparure Road															
Lane 1	43	29.3	43	29.3	804	0.054	100	7.4	LOS A	0.2	1.7	Short	20	0.0	NA
Lane 2	45	11.6	45	11.6	259	0.175	100	18.3	LOS C	0.6	4.3	Full	500	0.0	0.0
Approach	88	20.2	88	20.2		0.175		13.0	LOS B	0.6	4.3				
All Vehicles	1031	15.5	1031	15.5		0.250		1.7	NA	0.6	4.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.