



TRUE NORTH SAFETY GROUP

**SAFETY REVIEW OF THE PROPOSED ACCESS PLAN FOR
A PROPOSED QUARRY EXTENSION**

Location: City of Burlington, Ontario
Our File: 210020

Prepared for:

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A handwritten signature in blue ink that reads 'Josée Dumont'.

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TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	Background	1
1.2	Study Area	2
2.0	ASSESSMENT.....	4
2.1	No 2 Side Road Function and Speed	4
2.2	Existing Truck Access	5
2.3	Existing Administrative Access	10
2.4	Proposed Crossing of No 2 Side Road	10
3.0	CONCLUSIONS	15

APPENDIX A: Collisions History for No 2 Side Road

1.0 INTRODUCTION

1.1 Background

Nelson Aggregates is applying for an extension to its existing aggregate quarry. The existing quarry is located at 2433 No 2 Side Road, in the City of Burlington. The extension is proposed to occur in phases and in two areas:

- ▶ An area to the south of the existing quarry, across No. 2 Side Road, with a proposed at grade crossing; and
- ▶ An area immediately to the west of the existing quarry, with access through the existing quarry.

The current quarry can currently haul an unlimited amount of aggregates but has historically been averaging 1.5 to 2.0 million tonnes per year. Nelson aggregates plans to generate approximately 1.0 million tonnes of aggregate annually with the proposed extensions. Paradigm Transportation Solutions Limited prepared a traffic impact assessment in February 2020 in support of the application (hereafter referred to as 'Paradigm' and the 'Paradigm report'). Paradigm used a production limit of 2.0 million tonnes of aggregate annually in their assessment. The estimated number of daily trips are shown in **Table 1**.¹

Table 1: Number and type of expected vehicles at each driveway.

Vehicle Type and Driveway	AM Peak Period		PM Peak Period	
	Inbound	Outbound	Inbound	Outbound
Existing north driveway				
Light vehicles	1	0	0	13
Heavy vehicles (12-42 tonnes)	56	55	0	3
Heavy vehicles (70 tonnes)	12	12	12	12
Proposed south driveway				
Light vehicles	0	0	0	0
Heavy vehicles (12-42 tonnes)	0	0	0	0
Heavy vehicles (70 tonnes)	12	12	12	12

The trucks will continue to use the existing haul routes. Except for local delivery, all trucks will use No 2 Side Road and Guelph Line.

True North Safety Group (TNS) was engaged by Nelson Aggregate Co. on March 4, 2021, to complete a safety review of the heavy truck operations at the current accesses and proposed crossing. TNS completed a site assessment on April 5, 2021.

¹ Nelson Aggregate Company Burlington Quarry Extension Traffic Report, Paradigm Transportation Solutions Limited, February 2020.

1.2 Study Area

The existing quarry is located north of No 2 Side Road, between Guelph Line and Cedar Springs Road. The proposed extensions are located north of No 2 Side Road, immediately west of the existing quarry, and south of No 2 Side Road, across from the existing quarry. An aerial view of the existing quarry location is shown in **Figure 1**. A site plan for the proposed extension is shown in **Figure 2**.



Figure 1: Aerial view of the quarry area (© Google Earth, 2018).

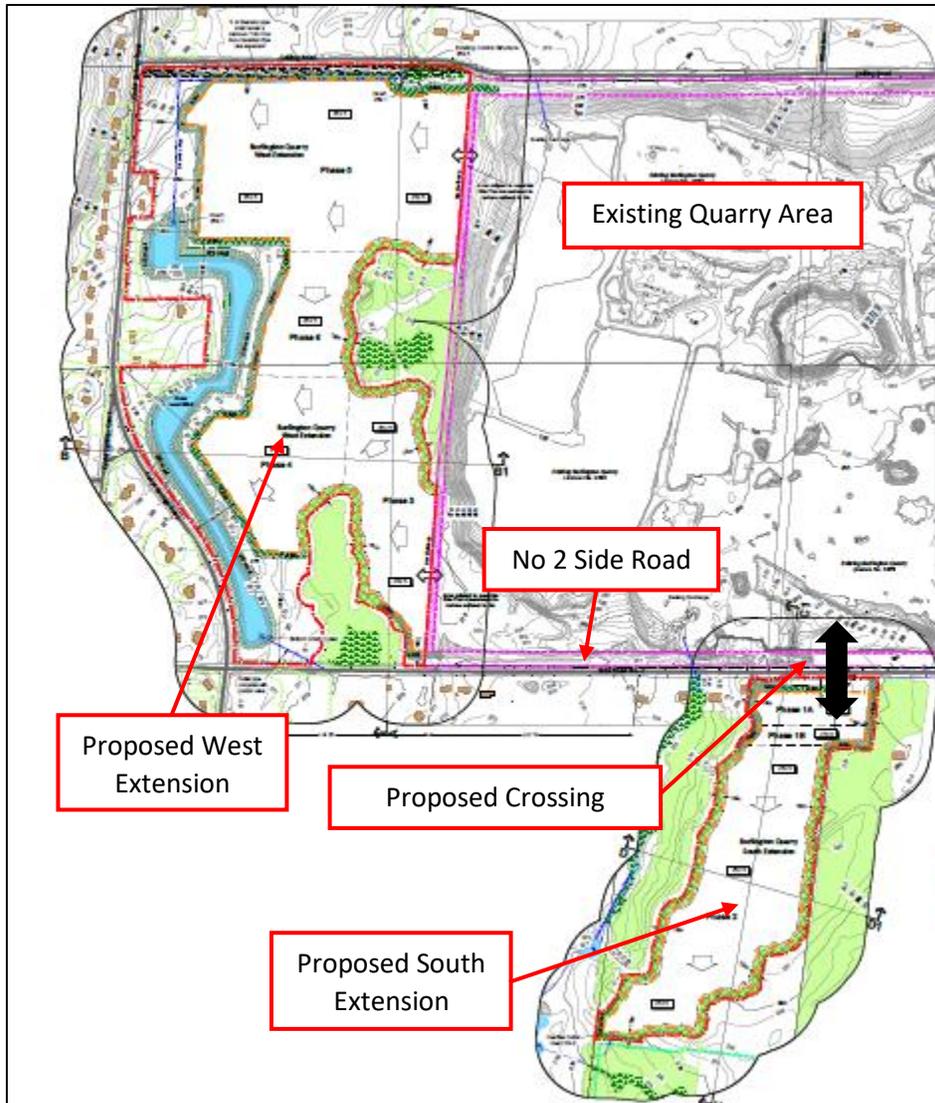


Figure 2: Site plan showing the existing quarry and proposed extensions and crossing (MHBC)².

Primary access to the west quarry extension will be through the existing quarry. Primary access to the south quarry extension will be through the proposed crossing, which will cross No 2 Side Road at grade approximately 300 m west of the existing quarry administrative access. The proposed accesses will be stop-controlled. **Figure 2** shows the proposed crossing.

The scope of our review included the existing accesses and the at-grade intersection of the proposed crossing and No 2 Side Road.

² Nelson Aggregate Co. Burlington Quarry Extension Operational Plan, MHBC Planning Urban Design & Landscape Architecture, April 2020.

2.0 ASSESSMENT

2.1 No 2 Side Road Function and Speed

No 2 Side Road is a rural two-lane collector under the jurisdiction of the City of Burlington. It is a paved roadway with 60 kilometre per hour (km/h) posted speed limit. The pavement was observed to be in fair condition, with areas in poor condition, as shown in **Figure 3**. Some pavement edge drop offs were also observed, particularly on the south shoulder between the existing truck access and the intersection of No 2 Side Road and Guelph Line, as shown in **Figure 4**. Pavement markings were present but faded in areas.

Typically, common practice is to assume a 'design speed' (a road design parameter) of 10 to 20 km/h over the posted speed limit for a paved roadway. The design speed is applied in decision-making regarding the appropriate road design features (i.e., road/shoulder widths, horizontal curves, and vertical curves) and traffic control devices. Based on the character and nature of No 2 Side Road and our visual observations, a design speed of 70 km/h would be appropriate.



Figure 3: Example of poor pavement conditions on No 2 Side Road (TNS, 2021).



Figure 4: Example of pavement edge drop-off conditions on No 2 Side Road (TNS, 2021).

The most recent five-year collision history for No 2 Side Road between Guelph Line and Cedar Springs Road was obtained from the City of Burlington, and provided in **Appendix A**. The collision history showed one collision: a single motor vehicle collision, where a westbound pick-up truck ran off the road in clear, dry and dark conditions in August 2017.

2.2 Existing Truck Access

The existing truck access is located on the north side of No 2 Side Road, approximately 350 m west of the intersection of No 2 Side Road and Guelph Line. It currently serves as the primary access to the property for inbound and outbound truck trips. No changes are proposed to this access and it will remain the primary access for inbound and outbound truck trips. It will also serve as the access to the office building as the administrative access will be closed.

When conducting intersection assessments, consideration must be given to intersection capacity, gap availability and selection, and available sight distances. Sight distance requirements must be considered for vehicles approaching a stop-controlled condition ('approach sight distance') and for vehicles departing from the stop location into the intersection ('departure sight distance'). Intersection capacity has been addressed in the Paradigm report.

2.2.1 Access Configuration

The existing truck access is stop-controlled, with one lane per direction on all approaches. Pavement widths differ for each approach, as shown on **Figure 5**. The access also includes a large turning radius on the east side. The pavement on No 2 Side Road is also wider on the east side of the access, towards Guelph Line. **Figure 6** shows that southbound trucks turning left onto No 2 Side Road use the additional width provided on the east leg, as shown by sand accumulating on the south side of the road. **Figure 7** shows that even with the larger access pavement width at the edge of No 2 Side Road, some trucks encroach upon the northeast shoulder.

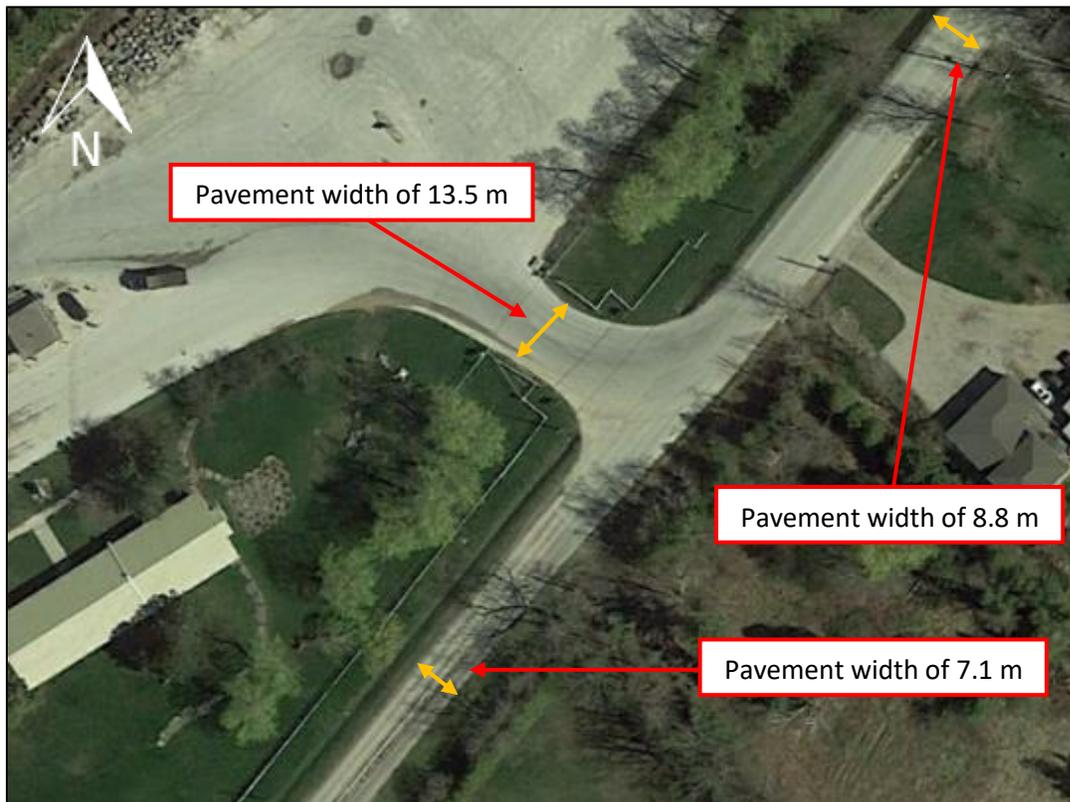


Figure 5: Pavement widths around the existing truck entrance (© Google, 2018)



Figure 6: Sand placement showing the path used by trucks turning left onto No 2 Side Road from the existing truck access (TNS, 2021).



Figure 7: Tire tracks on the shoulder at the northeast corner of the existing truck access and No 2 Side Road location (TNS, 2021).

2.2.2 Intersection Capacity and Gap Selection

The Paradigm report provides intersection capacity analyses of the existing operations at the existing truck access and No 2 Side Road. It shows that the existing truck access is currently operating, and expected to continue operating, well within capacity and with minimal delays at the access.³

Based on our field observations, there are currently ample gaps in No 2 Side Road traffic for trucks and passenger vehicles to access the roadway.

2.2.3 Stopping Sight Distance

The Transportation Association of Canada (TAC) *Geometric Design Guide for Canadian Roads*⁴ (the 'TAC Guide') recommends a minimum stopping sight distance of 105 m and a decision sight distance (stopping conditions) of 125 m for a rural roadway with a design speed of 70 km/h. The decision sight distance should be provided where feasible, and the stopping sight distance should be provided along any roadway to allow drivers to quickly come to a stop if necessary. Stopping and decision sight distances are available along No 2 Side Road, on both approaches to the existing truck driveway.

2.2.4 Approach Sight Distance

The approach sight distance (shown in **Figure 8**) is the sight triangle formed by the position of two opposing vehicles at a hypothetical position 3.0 seconds before they would impact each other, with the vehicle on the through road travelling at the prevailing operating speed (70 km/h design speed) and the vehicle on the side road travelling at a fixed approach speed of 30 km/h. Sight triangle requirements at stop-controlled intersections are intended to provide each vehicle 3.0 seconds of visibility of another vehicle prior to a potential impact. The sight triangle must be clear of visual obstructions so that the vehicles can see each other clearly within that triangle. At the existing truck access and No 2 Side Road location, the required sight triangle across the northeast and northwest corners would be from a distance of 25 m (existing truck access) and 50 m (No 2 Side Road) back from the point of impact for the respective vehicles.

³ Nelson Aggregate Company Burlington Quarry Extension Traffic Report, Paradigm Transportation Solutions Limited, February 2020.

⁴ Geometric Design Guide for Canadian Roads, Transportation Association of Canada, 2017, Chapter 9.8.

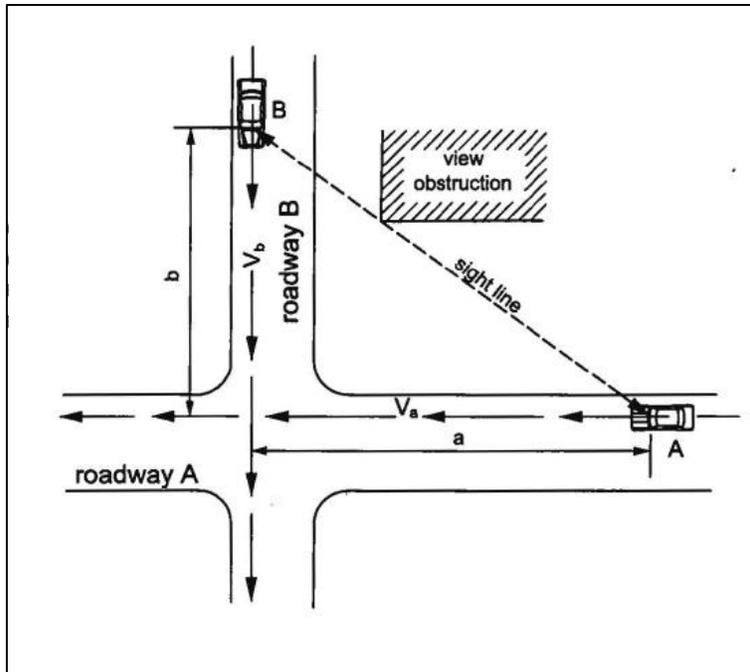


Figure 8: Illustration of an approach sight triangle at a stop-controlled intersection (Figure 2.3.3.1, TAC,⁵ 1999).

Based on our field measurements, the recommended approach sight distance was available to both eastbound and westbound vehicles on No 2 Side Road, who would be able to observe a southbound truck or passenger vehicle leaving the quarry. It should be noted that a white fence is present within that triangle. The fence does not obstruct the view of a truck but may partially obstruct the view of a passenger vehicle. Consideration should be given to maximize the approach sight distances if any work is completed in the area. Given the nature of the access ('T' intersection) and the users (drivers familiar with the access), the risk of southbound traffic disregarding the stop sign is low.

2.2.5 Departure Sight Distance

From a stopped position on the existing truck access, a motorist must have sufficient sight distance along the major roadway (No 2 Side Road) to select a gap in order to enter the traffic stream without significantly impeding traffic flow. The TAC Guide⁶ recommends departure sight distances, shown in **Figure 9**, for left and right turn movements.

⁵ Geometric Design Guide for Canadian Roads, Transportation Association of Canada, 1999, Figure 2.3.3.1.

⁶ Geometric Design Guide for Canadian Roads, Transportation Association of Canada, 2017, Chapter 9.8.

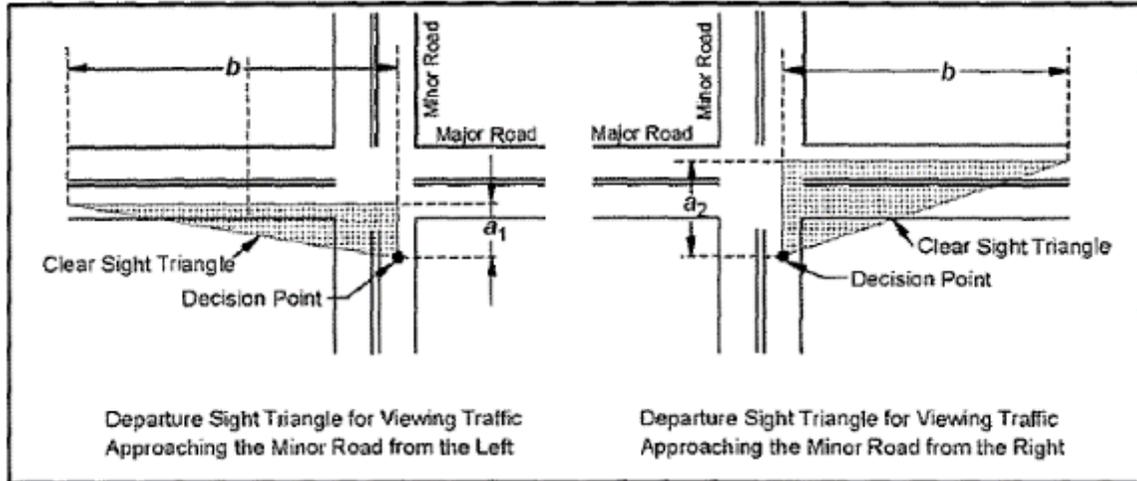


Figure 9: Illustration of departure sight distances (Figure 9.9.2, TAC,⁷ 2017)

Governing sight distances were calculated for right- and left-turn movements onto a two-lane road section with a 70 km/h design speed, following the methodology presented in the TAC Guide.⁸ Calculations were completed using the combination truck time gap values to account for the trucks leaving the quarry. Recommended sight distances at the existing truck access were calculated to be 225 m to the right and 205 m to the left. The observed available sight lines exceed those values. Recommended sight distances for passenger vehicles are shorter than those for combination trucks and are therefore also provided.

2.3 Existing Administrative Access

The existing administrative access is located approximately 490 m west of the intersection of No 2 Side Road and Guelph Line. This access is used by light vehicles accessing the office building on site.⁹ The administrative access will be closed, and access to the office building will be provided through the existing truck access.

2.4 Proposed Crossing of No 2 Side Road

2.4.1 Crossing Configuration

The at-grade crossing will form a four-leg intersection with No 2 Side Road, where each leg will have one lane per direction. It is also expected that the north and south approaches will be directly aligned with each other on either side of No 2 Side Road. The north and south approaches will be stop controlled.

The proposed crossing will be located on the crest of the vertical curve, approximately 300 m west of the administrative access. This section evaluates the proposed crossing of

⁷ Geometric Design Guide for Canadian Roads, Transportation Association of Canada, 2017.

⁸ Geometric Design Guide for Canadian Roads, Transportation Association of Canada, 2017.

⁹ Nelson Aggregate Company Burlington Quarry Extension Traffic Report, Paradigm Transportation Solutions Limited, February 2020.

No 2 Side Road located between the existing driveways to properties located at #2316 and #2330 No 2 Side Road, as shown on Figure 5.1 of the Paradigm Report¹⁰.

2.4.2 Intersection Capacity and Gap Selection

Paradigm provided intersection capacity analyses of the future operations at the proposed crossing of No 2 Side Road.¹¹ The analysis shows that the proposed crossing is expected to operate well within capacity and with minimal delay.

Based on our field observations, there are currently ample gaps in No 2 Side Road traffic for trucks to cross at the proposed crossing.

2.4.3 Stopping Sight Distance

The TAC Guide¹² recommends a minimum stopping sight distance of 105 m and a decision sight distance (stopping conditions) of 125 m for a rural roadway with a design speed of 70 km/h. The decision sight distance should be provided where feasible, and the stopping sight distance should be provided along any roadway to allow drivers to quickly come to a stop if necessary. Stopping sight distances to an object at a height of 0.38 m are available along No 2 Side Road, on both approaches to the proposed crossing. Decision sight distances are available in the eastbound direction to an object at a height of 0.38 m and in the westbound direction to an object at a height of 1.15 m.

2.4.4 Approach Sight Distance

Based on our field measurements, eastbound and westbound vehicles on No 2 Side Road had a generally unhindered approach sight distance to the proposed location for the crossing. The availability of the approach sight distance will however depend on the design of the north and south approaches. The north and south crossing approaches should be designed and constructed to provide an approach sight distance (i.e., visibility triangle) extending, as a minimum, 25 m on each crossing approach to a point 50 m east and west on No 2 Side Road, as shown on **Figure 12**.

It should be noted that berms will be installed parallel to No 2 Side Road to the west of the crossing and perpendicular to No 2 Side Road to the east of the crossing, as shown on Figure 11. Based on their proposed locations, the presence of these berms is not expected to hinder the approach sight distances at the crossing.

¹⁰ Nelson Aggregate Company Burlington Quarry Extension Traffic Report, Paradigm Transportation Solutions Limited, February 2020.

¹¹ HCM Unsignalized Intersection Capacity Analysis, Crosstraffic, Paradigm Transportation Solutions Limited. Undated.

¹² Geometric Design Guide for Canadian Roads, Transportation Association of Canada, 2017.

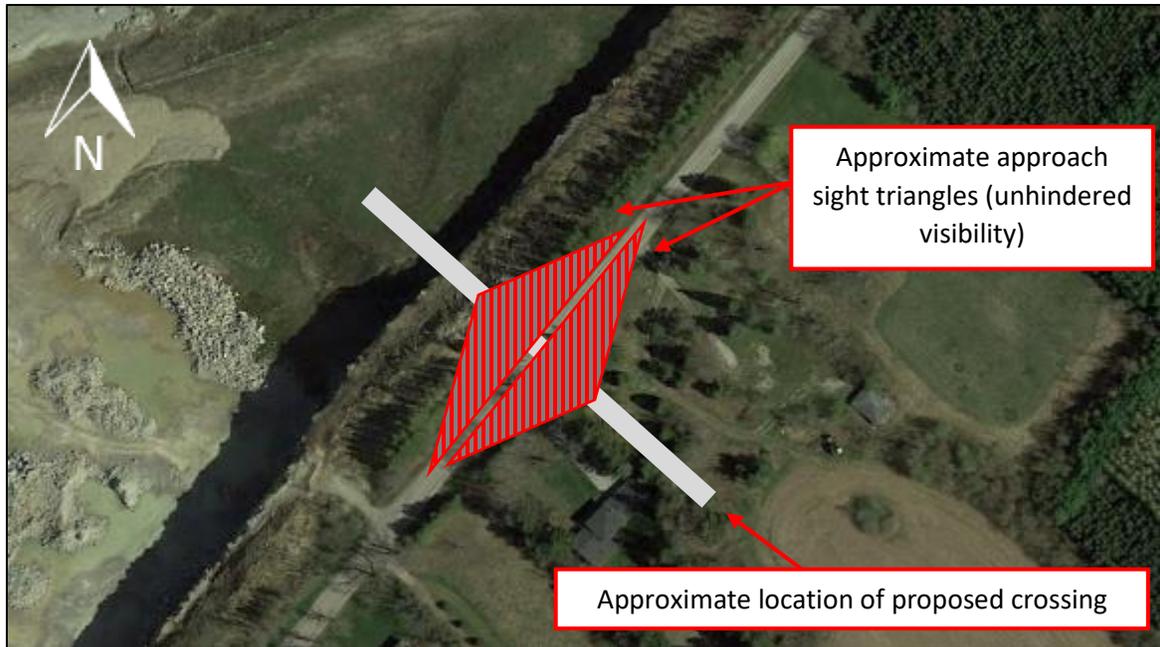


Figure 10: Approximate location of crossing and approach sight triangles (© Google, 2018)

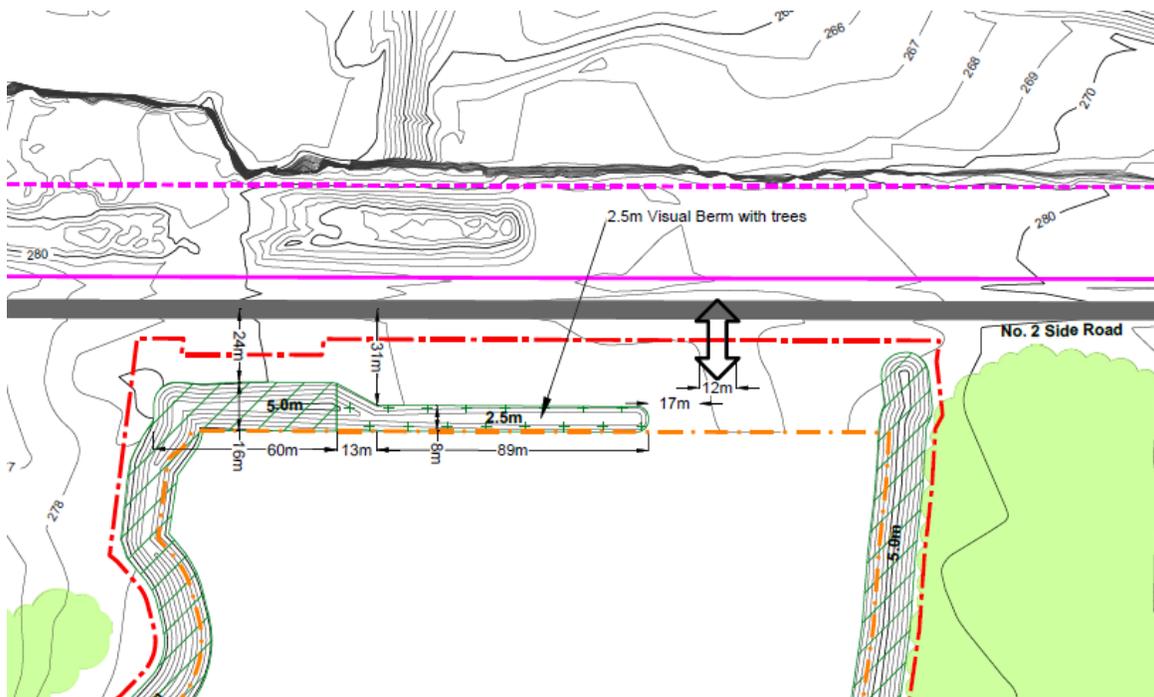


Figure 11: Location of proposed berms and crossing (MHBC)¹³.

¹³ Nelson Aggregate Co. Burlington Quarry Extension: South Extension – Berm Details, MHBC Planning Urban Design & Landscape Architecture, June 2021.

2.4.5 Departure Sight Distance

The proposed crossing will serve crossing movements for 70-tonne rock trucks.¹⁴

TNS reviewed the calculations presented in the Paradigm report for the crossing sight distance. Following the same methodology and accounting for CAT 775 70-tonnes rock trucks as specified in Section 5.2.1 of the Paradigm Report,¹⁵ TNS calculated a recommended sight distance of 220 m in each direction for the 70-tonnes trucks.

For passenger vehicles, recommended sight distances for crossing, right- and left-turn movements onto a two-lane road section with a 70 km/h design speed are 150 m to the right and 130 m to the left, according to the TAC Guide.¹⁶

A summary of sight distance observations taken from the edge of the roadway at the proposed crossing location is included in **Table 2**.

Table 2: Summary of sight distance observations at the proposed crossing.

Location	Passenger Vehicle Eye height of 1.08 m		Quarry Design Vehicle Eye height of 1.65 m ¹⁷	
	Top of vehicle	Headlights/ Taillights	Top of Vehicle	Headlights/ Taillights
North Side of No 2 Side Road				
Looking East	Visible	Not constantly visible	Visible	Visible
Looking West	Visible	Not constantly visible	Visible	Visible
South Side of No 2 Side Road				
Looking East	Visible	Not constantly visible	Visible	Visible
Looking West	Visible	Not constantly visible	Visible	Visible

The observed available sight distances, taken from the edge of the pavement on the north and south sides of No 2 Side Road, were below the recommended sight distances for an eye height of 1.08 m due to the nature of the vertical curve, but were greater than the recommended sight distances for an eye height of 1.65 m.

The crossing will be primarily used by CAT 775 70-tonnes trucks, which have a driver eye height estimated to be approximately 3 m, which is well above the 1.65 m eye position

¹⁴ Nelson Aggregate Company Burlington Quarry Extension Traffic Report, Paradigm Transportation Solutions Limited, February 2020.

¹⁵ Nelson Aggregate Company Burlington Quarry Extension Traffic Report, Paradigm Transportation Solutions Limited, February 2020.

¹⁶ Geometric Design Guide for Canadian Roads, Transportation Association of Canada, 2017.

¹⁷ Eye height of TNS employee who completed the site visit.

applied in the field assessment. Drivers in these trucks would have available sight distances of oncoming traffic along No 2 Side Road greater than the recommended 220 m.

Some passenger vehicles associated with the quarry may also occasionally use the proposed crossing. Using a conservative eye height of 1.08 m, these drivers would have the following visibility:

- ▶ Oncoming vehicles along No 2 Side Road would be fully visible while at a distance greater than recommended sight distances.
- ▶ As the oncoming vehicles approach the vertical curve, a driver on the proposed crossing would continue to have visibility of the top of the oncoming vehicles but would not have constant visibility of the headlights of the oncoming vehicles due to a localized dip in the vertical alignment.
- ▶ As the oncoming vehicles continue to approach the crest of the vertical curve, their headlights would become visible again to a driver on the proposed crossing. For eastbound vehicles, this would occur as they are approximately 125 m from the proposed access road. For westbound vehicles, this would occur as they are approximately 100 m from the proposed access road.¹⁸

In these cases, the passenger vehicle on the proposed crossing would be visible to drivers along No 2 Side Road for a distance greater than the required stopping and decision sight distances, requiring a moderate speed reduction to allow the occasional left or right turn passenger vehicle to attain free flow speeds. The probability of these instances occurring will be very low and will require the main road vehicle to temporarily adjust its speed below the design speed, as opposed to representing a collision risk.

It should be noted that berms will be installed parallel to No 2 Side Road to the west of the crossing and perpendicular to No 2 Side Road to the east of the crossing, as shown on Figure 11, above. Based on their proposed locations, the presence of these berms is not expected to hinder the departure sight distances at the crossing.

¹⁸ These distances will vary slightly based on the exact location of the proposed crossing.

3.0 CONCLUSIONS

This report addresses the existing truck and administrative accesses and a proposed crossing of No 2 Side Road located between the existing driveways to properties located at #2316 and #2330 No 2 Side Road, as shown on Figure 5.1 of the Paradigm Report¹⁹.

Our assessment indicates that the existing truck and administrative accesses should continue to operate efficiently and safely with the proposed quarry extensions. A review of collisions history has shown no reported access-related collisions in the recent past. Our assessment also indicates that the proposed crossing should operate efficiently and safely once constructed. All quarry accesses are also expected to operate with an acceptable level of service, allowing for ample gaps for vehicles crossing or turning onto No 2 Side Road.

The following remedial actions should be considered to ensure ongoing safety:

- ▶ The proposed crossing location should be constructed and maintained to provide the appropriate approach sight triangles and departure sight distances for a 70 km/h design speed. Vegetation should be trimmed or removed as necessary during construction to provide the recommended approach sight triangles and departure sight distances in all four quadrants.
- ▶ TRUCK ENTRANCE warning signs should be installed on the approaches to the proposed crossing to warn drivers along No 2 Side Road of the possible presence of slow-moving trucks crossing the intersection.
- ▶ Regulatory or information signs should be installed prohibiting the general public from using the proposed crossing.
- ▶ Vegetation should be maintained to ensure the approach sight distances at all accesses are provided.
- ▶ Based on the existing conditions, the municipality may wish to revisit the frequency of maintenance for pavement markings, shoulder grading and pavement condition along No 2 Side Road.

¹⁹ Nelson Aggregate Company Burlington Quarry Extension Traffic Report, Paradigm Transportation Solutions Limited, February 2020.

APPENDIX A

Five-Year Collision History for No 2 Side Road



Collision Details Report

From:

To:

Location NO 2 SDRD btwn CEDAR SPRINGS RD & GUELPH LINE

Municipality..... Burlington

Traffic Control.... No control

Total Collisions.... 1

Collision ID	Date/Day/Time	Environment	Impact Type	Classification	Direction	Surface Cond'n	Vehicle Manoeuver	Vehicle type	First Event	Driver Action	Light
17-275496	2017-Aug-13, Sun,04:27	Clear	SMV other	P.D. only	West	Dry Dry	Going ahead	Pick-up truck	Ran off road	Lost control	Dark

Comments: