Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Transportation

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Reference	Source of Comment	Applicant Response (June 2021)	JART Response
Report/Date: Transportation / Haul Route Study, February 2020				**Author: Paradigm Transportation Solutions Limited**	
1.	In addition to the provided comments, the Transportation Planning Department provided the following background studies, with corresponding links, for the TIS to consider in its growth rate assumptions and overall background traffic characterization: • Dundas Corridor Study - Brant St to Bronte Rd - MCEA Study: (2015) https://www.halton.ca/For-Residents/Roads-Construction/Municipal-Class-Environmental-Assessment-Studies/Dundas-Corridor-Study-Brant-St-to-Bronte-Rd-(1) • Hamilton - Waterdown/Aldershot Transportation Master Plan – East-West Corridor Study – (2012) https://www.hamilton.ca/city-planning/master-plans-class-eas/waterdownaldershot-transportation-master-plan	General	Halton Region	The growth rates used in the Dundas Corridor Study and the Hamilton - Waterdown/Aldershot Transportation Master Plan are consistent with the growth rate used in the February 2020 traffic report prepared for the proposed Burlington Quarry Extension. The generalized background traffic growth assumes an annual growth rate of 2% per annum. This growth rate is considered conservative (i.e., high) for the study area. In general terms, peak hour traffic growth is driven by urban development trends and in this area, the new urban development for the next few years is the Waterdown urban expansion, urban Burlington intensification and north Oakville urban expansion. These urban development trends would indicate that traffic growth is most likely to increase in the eastbound and westbound directions along Dundas Street with limited growth along the north/south arterial roadways of Guelph Line and Cedar Springs Road, south of Dundas Street.	
2.	Perform safety analysis for the future crossing of No. 2 Side Road. This is where the access to the proposed southern expansion will align with the existing access and large trucks will be crossing city road.	General	City of Burlington	**True North Safety (TNS)** has prepared a safety analysis for the crossing of No. 2 Sideroad. This report has been provided to JART under separate cover.	
3.	Provide information that the applicant's traffic consultant used to come up with the traffic generated by the quarry. It is needed to confirm the number of vehicles, where these vehicles are coming from and travelling to.	General	City of Burlington	**Appendix A** in the February 2020 Traffic Study contains confidential data provided by Nelson Aggregate Co. This data was provided to the JART peer reviewer (CIMA Canada Inc.) in November 2020 subject to a Non Disclosure Agreement (NDA) with Nelson Aggregate Co. We understand the City of Burlington is relying upon the peer reviewer to conduct the review on behalf of the City of Burlington.	
4.	With regard to deemed right of way widths and widening requirements, under the current official plan, the following information is provided, please be advised however that through the application process, through review of the traffic studies, etc., by vested departments/agencies, it may be necessary for additional lands to be dedicated for additional lanes, turning lanes, daylight and visibility triangles etc., Site Engineering defers to the expertise of the City's Transportation department and the Region's Transportation department to confirm requirements.	General	City of Burlington	See MHBC cover letter for response to Comments #4-#14	

5.	No. 2 side Road is a City of Burlington owned road, the deemed right of way is 30.0 metres, the actual width varies from +/- 20.0 metres to 25.0 metres. In order to meet the deemed width a variable widening of up to +/- 5.0 metres would be required. The widening would be dedicated (free of charge and all legal and survey costs would be the responsibility of the applicant) through the planning application process. Only an Ontario Land Surveyor (OLS) would be able to accurately determine the actual dimensions and prepare a drawing which accurately shows the deemed right of way/widening.	General	City of Burlington	Refer to Comment Response #4.	
6.	Colling Road is a City of Burlington owned road, the deemed right of way is 20.0 metres, the actual width meets deemed, no widening required.	General	City of Burlington	Refer to Comment Response #4.	
7.	Cedar Springs Road is a City of Burlington owned road, the deemed right of way is 30.0 metres, the actual width varies from +/- 20.0 metres to 30.0 metres. In order to meet the deemed width a variable widening of up to +/- 5.0 metres would be required. The widening would be dedicated (free of charge and all legal and survey costs would be the responsibility of the applicant) through the planning application process. Only an Ontario Land Surveyor (OLS) would be able to accurately determine the actual dimensions and prepare a drawing which accurately shows the deemed right of way/widening.	General	City of Burlington	Refer to Comment Response #4.	
8.	Guelph Line is a Region of Halton owned road, please contact the Region for deemed width and any widening and daylight triangle requirements.	General	City of Burlington	Refer to Comment Response #4.	
9.	Official Plan/Transportation Master Plan Right-of-Way Requirements: Any lands within 17.5 metres (57.4 feet) of the centre line of the original right-of-way of Guelph Line (Regional Road 1) that are part of the subject property shall be dedicated to the Regional Municipality of Halton for the purpose of road right-of-way widening and future road improvements.	General	Halton Region	Refer to Comment Response #4.	
10.	Municipal Class Environmental Assessment Study/Environmental Study Report (Transportation Planning) Right-of-Way Requirements Guelph Line (Regional Road 1): Any additional lands that are part of the subject property and have been identified as required for the future widening of Guelph Line (Regional Road 1), as identified in a future Municipal Class Environmental Assessment Study/Environmental Study Report, shall be dedicated to the Regional Municipality of Halton for the purpose of road right-of-way widening and future road improvements.	General	Halton Region	Refer to Comment Response #4.	

	Currently, a Municipal Class Environmental Assessment has not been completed.				
11.	Detail Design Project (Engineering & Construction) Right-of-Way Requirements - Guelph Line (Regional Road 1): Any additional lands that are part of the subject property and have been identified as required for the future widening of Guelph Line (Regional Road 1), as identified in a future Detailed Design Project, shall be dedicated to the Regional Municipality of Halton for the purpose of road right-of-way widening and future road improvements. Currently, a Detail Design has not been completed.	General	Halton Region	Refer to Comment Response #4.	
12.	A daylight triangle measuring 15.0 metres along Guelph Line (Regional Road 1) and 15.0 metres along Colling Road shall be dedicated to the Regional Municipality of Halton for the purpose of road right-of-way widening and future road improvements.	General	Halton Region	Refer to Comment Response #4.	
13.	All lands to be dedicated to Halton Region shall be dedicated with clear title (free and clear of encumbrances) and a Certificate of title shall be provided, in a form satisfactory to the Director of Legal Services or his/her designate.	General	Halton Region	Refer to Comment Response #4.	
14.	Please provide a draft reference plan detailing all of the proposed widening (and daylight triangle) dedications. The quarry lands (both the expansion and existing quarry) north of No. 2 Side Road, are, or will be one property, therefore the widening dedications would be taken on both the expansion and existing quarry lands, as well as for the frontage of the south expansion lands.	General	City of Burlington	Refer to Comment Response #4.	
15.	Mitigation Measures – Future Operational Analysis Various movements at intersections within the study area were identified as operating at or above capacity during Total Traffic Conditions. The report does not specifically identify how critical movements operating over capacity attributable to the proposed development can be improved. For example, eastbound and northbound through movements during the AM peak hour at Guelph Line and Dundas Street, are expected to operate above capacity. The eastbound through movement is expected to be addressed by the Dundas Street road widening outlined in the Region's Transportation Master Plan (TMP). However, no specific improvements are recommended for northbound movements on Guelph Line by the report or the Region's TMP. Further information is required regarding proposed improvements for alleviating movements that are	General	CIMA Canada Inc.	The following critical movements, per the Halton Region TIS guidelines, are forecast to occur under Total Traffic conditions. Dundas Street and Guelph Line • Eastbound left-turn (capacity issue) • Eastbound through (capacity issue) • Westbound left-turn (capacity & queueing issue) • Westbound through (capacity issue) • Northbound left-turn (capacity & queueing issue) • Northbound through (capacity issue) Dundas Street & Cedar Springs Road/Brant Street • Eastbound through (capacity issue) • Westbound left-turn (capacity & queueing issue) • Northbound left-turn (capacity & queueing issue) Guelph Line and 2 Side Road • Eastbound Left-Turn Lane (capacity issue) • Westbound approach (capacity issue)	

	expected to operate at or above capacity attributable to the traffic generated by the proposed development.			Site generated traffic is not creating any new critical movements at the above noted intersections. Site generated traffic is expected to contribute volumes to only the following critical movements: Dundas Street and Guelph Line • Eastbound left-turn – AM peak hour = 4 PCE, PM = zero • Northbound through – AM peak hour = 7 PCE, PM = zero Dundas Street & Cedar Springs Road/Brant Street • Eastbound through – AM peak hour = 4 PCE, PM = zero Guelph Line and 2 Side Road • Eastbound Left-Turn Lane – AM peak hour = 21 PCE, PM = 4. Of the four critical movements identified as being a concern under the total traffic horizon where site traffic contributes volumes, the following movements are also considered critical under the background traffic horizon (i.e. no site traffic): Dundas Street and Guelph Line • Eastbound left-turn – (capacity issue) • Northbound through – (capacity issue) Dundas Street & Cedar Springs Road/Brant Street • Eastbound through – (capacity issue) Guelph Line and 2 Side Road • Eastbound Left-Turn Lane (capacity issue) Site traffic related to a 2.0 million tonnes per annum extraction limit has negligible impact on traffic operations. Of the four critical movements identified to occur under total traffic operations, site traffic is expected to have very little impact on intersection operations beyond the 2 Side Road intersection with Guelph Line. **Table 1** below summaries the change in delay per vehicle, v/c ratio and queue length between total traffic operations and background traffic operations. The generalized increase in background traffic growth (2% per annum) is expected to have a greater impact on intersection operations than site traffic generated by the site. **TABLE 1: OPERATION SUMMARY – CRITICAL MOVEMENTS IMPACTED BY SITE TRAFFIC**	

Intersection/ Movement		Horizon Year	Intersection Operations								Change					
			AM Peak Hour				PM Peak Hour				AM Peak Hour			PM Peak Hour		
			LOS	Delay	v/c	Q	LOS	Delay	v/c	Q	Delay	v/c	Q	Delay	v/c	Q
Dundas Street & Guelph Line	EBL	Existing	C	25	0.44	51	F	125	0.89	41						
		Background	C	28	0.53	60	F	176	1.02	47	3	0.09	9	51	0.13	6
		Total	C	28	0.54	62	F	176	1.02	47	0	0.01	2	0	0.00	0
	NBT	Existing	B	14	0.31	58	C	27	0.88	289						
		Background	F	182	1.32	208	E	62	0.84	115	168	1.01	150	35	-0.04	-174
		Total	F	187	1.32	210	E	62	0.84	115	5	0.00	2	0	0.00	0
Dundas Street & Brant Street	EBT	Existing	C	33	0.94	195	C	25	0.41	63						
		Background	E	57	1.04	288	C	26	0.44	70	24	0.10	93	1	0.03	7
		Total	E	58	1.04	229	C	25	0.24	10	1	0.00	-59	-1	-0.20	-60
Guelph Line & 2 Side Road	EBL	Existing	D	29	0.53	24	F	53	0.57	24						
		Background	E	41	0.70	40	F	93	0.80	38	12	0.17	16	40	0.23	14
		Total	F	121	1.08	94	F	100	0.83	41	80	0.38	54	7	0.03	3

16.	Mitigation Measures – Queue Lengths Some of the 95th percentile queues reported are expected to exceed the available storage length (e.g., 2024 PM peak hour northbound and westbound left turning movements at Guelph Line & Dundas Street are expected to exceed available storage by 106.0 and 214.0 metres, respectively). The eastbound through movement is expected to be addressed by the Dundas Street road widening outlined in the Region's Transportation Master Plan (TMP) as previously mentioned; however, no mitigation measures are recommended to address the excessive northbound left queues. Assess and provide mitigation measure to address the excessive 95th percentile queues that are expected to exceed available storage at Guelph Line & Dundas Street.	General	CIMA Canada Inc.	The following queue lengths are forecast to exceed the available existing storage at the signalized intersection of Dundas Street and Guelph Line under total traffic conditions. • Westbound left-turn • Northbound left-turn Site generated traffic is not expected to contribute volumes to these two movements. Both turning movements are identified as critical movements under existing conditions and are expected to remain critical with or without the approval of the quarry extension. It is anticipated that the storage requirements for the westbound left-turn movement from Dundas Street to Guelph Line will be addressed by the Dundas Street road widening outlined in the Region's Transportation Master Plan (TMP). The existing storage lane length for this movement is approximately 115 m. The forecast queue length is approximately 400 m. The forecast volume for this movement is approximately 715 PCE during the PM peak hour. The forecast volume suggests the need for dual westbound left-turn lanes. The existing storage lane length for the northbound left-turn lane is 50 m. Guelph Line between Dundas Street and Driftwood Drive/Coventry Way is currently designed as a 5 lane cross-section with a painted centre median measuring approximately 5 m in width. The Carncastle Gate intersection with Guelph Line operates as a right-in/right-out connection with left-turns restricted by a raised centre median. There are no private driveways or intersections along Guelph Line between Dundas Street and Driftwood Drive/Coventry Way. This would allow the road authority to repaint the existing center median to provide additional storage for the northbound left-turn movement. The analysis contained in the February 2020 report suggests a storage lane length of approximately 190 m is needed for this movement. The additional storage can be accommodated by repainting the existing center median to provide the additional storage. **Table 2** below summarizes the operational conditions for the Dundas Street and Guelph Line intersection under total traffic conditions with the implementation of a dual westbound left-turn lane with 115 m of storage (existing storage) and northbound left-turn lane with 190 m of storage. The additional storage for the northbound left-turn lane and dual westbound left-turn lanes would address the forecast queueing issues expected to occur under the five-year horizon (year 2024). Site generated traffic is not expected to contribute volumes to these two movements.	

TABLE 2: TOTAL TRAFFIC OPERATIONS – WITH REMEDIAL MEASURES (DUNDAS STREET & GUELPH LINE)

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	OVERALL
AM Peak Hour	Guelph Line & Dundas Street	TCS	LOS	C	F	C	**F**	E	B	>	**C**	D	F	>	**F**	D	D	D	**D**	**F**
			Delay	28	118	23	**100**	79	14	>	**31**	37	202	>	**184**	46	48	43	**47**	**99**
			V/C	0.54	1.16	0.31		0.83	0.35	>		0.39	1.38	>		0.69	0.45	0.05		**1.10**
			95th	62	402	53		63	67	>		43	218	>		54	64	5		
			Storage	100	-	70		115	-	>		190	-	>		70	-	70		
			Avail.	38	-	17		52	-	>		147	-	>		16	-	65		
PM Peak Hour	Guelph Line & Dundas Street	TCS	LOS	F	C	C	**D**	C	D	>	**D**	F	E	>	**F**	D	E	D	**D**	**D**
			Delay	171	34	27	**39**	23	42	>	**37**	168	62	>	**96**	44	58	49	**53**	**50**
			V/C	1.02	0.58	0.14		0.77	0.98	>		1.22	0.84	>		0.62	0.77	0.37		**1.00**
			95th	50	134	24		75	380	>		156	115	>		48	98	50		
			Storage	100	-	70		115	-	>		190	-	>		70	-	70		
			Avail.	50	-	46		40	-	>		34	-	>		23	-	21		

MOE - Measure of Effectiveness
TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
V/C - Volume to Capacity Ratio
95th - 95th Percentile Queue Length
LOS - Level of Service
> - Shared Right-Turn Lane
< - Shared Left-Turn Lane

17.	Safety Analysis It is suggested for the terms of reference that a 'Safety Analysis' section will be included in the report to discuss potential safety or operational issues (per Region's TIS Guidelines, Section 3.6.2) in the study area. Even if there are no safety issues, a review should be completed and documented in the TIS report. Include a Safety Analysis section in the report to discuss potential safety or operational issues.	General	CIMA Canada Inc.	True North Safety prepared a safety analysis for No. 2 Sideroad which has been provided to JART under separate cover. Guelph Line is a Regional Road that has been designed to accommodate truck traffic and is the existing haul route and the only haul route available for the proposed Burlington Quarry Extension. Refer to Comment Response #18.	
18.	Haul Route Study Although the Report states that there are no changes to the proposed haul route and no new impacts to the road network are anticipated, the Report does not mention the preparation of a Haul Route Study. It should be noted that the request for a Haul Route Study was identified by the Region's report LPS08-20 – Proposed Expansion to the Burlington Quarry (Nelson), Pre-Consultation Meeting. Complete a Haul Route Study following the requirements identified by the Region's Aggregate Resources Reference Manual for the preparation of a Transportation/Haul Route Study.	General	CIMA Canada Inc.	The Burlington Quarry has been producing aggregate since 1953. The proposed quarry extensions will allow the Burlington Quarry to continue to produce aggregate at its existing location. The haul route used to ship material to market will remain unchanged. All material shipped to market, except local deliveries, will travel east to/from Guelph Line (Regional Road 1). The Regional Road network will support the movement of goods to market including the resources produced at the Burlington Quarry. All Regional roads are classified and designed to accommodate truck traffic[1]. All trucks hauling material to market are expected to follow and adhere to the existing, and future, truck route network. Local deliveries may require a deviation from identified truck routes. To the west of the subject site there is an existing truck prohibition which limits truck traffic on No 2 Sideroad. No changes to the truck prohibition are proposed. The existing prohibition was established by Council Resolution CC-83-05. The existing truck prohibition requires all quarry truck traffic to travel to/from Guelph Line. No other haul route options are available to the subject site. The site driveway for heavy vehicles is located approximately 350 metres from the Regional road network. The existing haul route provides the shortest most direct route to the Regional road network while limiting impacts to local roadways. The rock trucks shipping material across No 2 Sideroad from the South Extension lands will be contained to the driveway intersection. The South Extension driveway is located approximately 485 m west of Guelph Line. Rock trucks will not travel along No 2 Sideroad. Rock trucks will only cross No 2 Sideroad until the South Extension is exhausted.	

[1] Halton Region Transportation Master Plan September 2011 - Appendix F4 - Goods Movement Technical Reference

19.	Travel Demand Figure 2.1 shows that the highest traffic volumes during the PM peak occurs between 2:00 PM and 3:00 PM. This is confirmed by the statement in Section 2.2.3 that says: “Shipping actively begins to taper off around 3PM”. However, the TMCs provided in Appendix B for the driveway site show that the highest PM peak hour occurs between 4:30 and 5:30 PM. Please confirm and update the report as necessary to be consistent. Please update Sections 2.2.1 and 2.2.3 to a consistent PM peak hour with the TMCs. If the PM peak hour at the site is the same as the Guelph Line peak hour, no changes in the traffic analysis are necessary. However, if the PM peak hour at the site occurs between 2:00 and 3:00 PM, it is recommended to conduct an additional PM peak operational analysis.	Section 2.2.1, Section 2.2.3, Figure 2.1, and Appendix B	CIMA Canada Inc.	Although the site traffic tapers off around 3PM the AM and PM hour of the adjacent street was used to provide a conservative analysis of intersection capacity. At Guelph Line & No 2 Side Road the entering volume during the PM peak hour is 1,156 vehicles. During the 3:00 PM hour the entering volumes are 356 vehicles per hour lower at 800 vehicles per hour. **Table 3** below summarizes the two-way traffic volumes on Guelph Line at No 2 Side Road and the two-way volumes using the site driveway for the AM and PM count periods. High lighted cells indicate the peak hour for Guelph Line and the site driveway. The two-way volumes using both Guelph Line and the site driveway peak at the same time during the AM count period. During the PM count period, two-way volumes using the site driveway peak prior to Guelph Line. The peak hour for the network is the adjacent street PM peak hour. Off peak analysis is not expected to result in the identification of any new capacity issues vs. the findings of the February 2020 Traffic Report.	

TABLE 3: TWO-WAY VOLUME SUMMARY

Period	Time Ending	Guelph Line Two-Way	Driveway Two-Way	SUM
AM	08:00	781	79	860
	08:15	839	84	923
	08:30	**850**	**88**	**938**
	08:45	846	80	926
	09:00	821	83	904
PM	16:00	732	**41**	773
	16:15	784	33	817
	16:30	884	28	912
	16:45	977	28	1,005
	17:00	1,037	27	1,064
	17:15	**1,090**	23	**1,113**
	17:30	1,078	19	1,097
	17:45	1,067	17	1,084
	18:00	1,022	10	1,032

20.	Trip Generation In Section 2.2.3 the report provides details of heavy vehicle generation in recent years at the existing site. It is noted that the Nelson Quarry does not own or operate any trucks for the transportation of materials from the point of origin to the quarry or to an end use location; rather, it is the customer and their contractors, that transports material. Given the report examines the customers’ truck fleet, outlines are given for typical truck sizes, trailer configurations and average net load per outgoing trip. However, to determine the estimated truck trips generated by the proposed site expansion, the proponent’s consultant conducted a review of detailed shipping records from 2014 to 2018. The report indicates that	Section 2.2.3 and Appendix A	CIMA Canada Inc.	**Appendix A** in the February 2020 Traffic Study contains confidential data provided by Nelson Aggregate Co. This data was provided to the JART peer reviewer (CIMA Canada Inc.) in November 2020 subject to a Non Disclosure Agreement (NDA) with Nelson Aggregate Co. We understand the Region of Halton is relying upon the peer reviewer to conduct the review on behalf of the Region of Halton.	

<table>
<tr><td></td><td>records used for the review are confidential and only available upon request.

The details provided in Section 2.2.3 of the report are satisfactory; however, a review of the detailed shipping records would be beneficial to provide more details on truck types and material loads to verify the typical truck sizes and load volumes to be expected as part of the Quarry's operations. As such, it is recommended that the Region should request the detailed shipping records from Appendix A.</td><td></td><td></td><td></td><td></td></tr>
<tr><td>21.</td><td>Trip Distribution
Future quarry activity estimates are based on the turning movement count done in October 2019 and factored to the maximum quarry production of 2.0 million tonnes per annum. The TMC data indicates 84 AM peak hour trips with 28 (98 passenger car equivalents (PCE)) two-way additional heavy vehicle trips and 15 PM peak hour trips with 1 (4 PCE) two-way additional heavy vehicle trip. No justification is provided for the number of estimated additional two-way trips.

Additionally, the trip distributions shown in Figures 4.2A and 4.2B require further explanation or adjustments. For example, Figures 4.2A indicates 28 additional inbound trips are making southbound right-turns from Guelph Line but there are only 21 outbound trips making an eastbound left-turn onto Guelph Line.

Please provide further justification for the number of additional trips estimated in Table 4.1. Additionally, update Figure 4.2A and 4.2B to reflect outbound trips returning on the same path as the inbound trips or provide justification for the different origin/destination points. Any changes to the future operations should be reflected in the future improvement scenario.</td><td>Table 4.1 and Figures 4.2A and 4.2B</td><td>CIMA Canada Inc.</td><td>Nelson does not own or operate any trucks for the shipping of material to market; rather, customers and their contractors transport the material from the quarry by truck.

The site's trip generation for 2 million tonnes has been estimated by prorating the existing extraction rate 1.5 million tonnes.

"the estimated total future truck levels shown in Table 4.1 of the subject TIS are appropriate estimates for the future peak hour truck volumes." - Refer to comment #23

As Nelson does not own or operate any of the trucks shipping material to market, vehicles may not return to the site on the same path. The estimated trip distribution pattern reflects existing travel patterns as documented under existing conditions. Table 4 below, summarizes the estimated trip distribution.

TABLE 4: ESTIMATED TRIP DISTRIBUTION<table><tr><th rowspan="2">Origin/Destination</th><th colspan="2">AM Peak Hour</th><th colspan="2">PM Peak Hour</th></tr><tr><th>In</th><th>Out</th><th>In</th><th>Out</th></tr><tr><td>North via Guelph Line</td><td>60%</td><td>40%</td><td>60%</td><td>75%</td></tr><tr><td>South via Guelph Line</td><td>15%</td><td>30%</td><td>20%</td><td>15%</td></tr><tr><td>South via Brant Street</td><td>0%</td><td>5%</td><td>0%</td><td>0%</td></tr><tr><td>East via Dundas Street</td><td>20%</td><td>15%</td><td>20%</td><td>10%</td></tr><tr><td>West via Dundas Street</td><td>5%</td><td>10%</td><td>0%</td><td>0%</td></tr><tr><td>Total</td><td>100%</td><td>100%</td><td>100%</td><td>100%</td></tr></table>No update to the site traffic assignment or the site trip generation for a 2.0 million tonne licence limit is recommended at this time.

The haul route used to ship material to market will remain unchanged from existing. All material shipped to market, except local deliveries, will travel east to/from Guelph Line (Regional Road 1). The Regional Road network will support the movement of goods to market including the resources produced at the Burlington Quarry. All Regional roads are classified and designed to accommodate truck traffic[2].</td><td></td></tr>
<tr><td>22.</td><td>Paradigm Methodology
Paradigm reviewed the detailed shipping records, provided in Appendix A, that contain shipping details from 2014 to 2018. Based on the shipping details, they estimated trucking levels for a 2.0 tonnes per annum scenario. This scenario includes three distinct types of truck trips entering</td><td>Table 4.1 and Appendix A</td><td>CIMA Canada Inc.</td><td>Acknowledged.</td><td></td></tr>
</table>

[2] Halton Region Transportation Master Plan September 2011 - Appendix F4 - Goods Movement Technical Reference

	and exiting the quarry. The first distinct type, which accounts for all the outbound trips, is aggregate material that is mined and processed in the quarry. The second and third distinct types, which are incoming trips to the quarry, are clean fill and recycling materials. Estimates of approximately 50.0% to 58.0% of the incoming trucks with clean fill and recycling material between 2014 and 2017 also left with a load of aggregate. In 2018, the proportion these incoming trucks leaving with aggregate increased by about 23.0%. The estimates were used to calculate the annual inbound and outbound truck trips from 2014 to 2018. Additionally, estimates of the future increase to truck volumes were calculated based on the details shipping records. The estimates were developed by adding the truck volumes from the October 2019 site driveway turning movement count to the volumes estimated from the average daily trucks served in 2018. The volumes from the TMC as well as the estimated volumes are shown in Table 4.1 of the TIS report.				
23.	Peer Review Findings Based on the review of the detailed data provided in Appendix A, CIMA verified that the estimated 50.0% of the clean fill and recycling trips that left with aggregate, was used to calculate annual inbound and outbound truck trips from 2014 to 2017, while 77.0% was used for 2018. Based on the review of the detailed 2018 data provide in Appendix A, the estimated total future truck levels shown in Table 4.1 of the subject TIS are appropriate estimates for the future peak hour truck volumes. From Table 4.1, the future estimated truck volume is 29, which is added to the existing TMC volumes. To verify the estimated volumes CIMA examined the 2018 month-by-month total (aggregate, clean fills and recycling trips) average daily trucks served in 2018. The total average daily trucks served averaged for the year was 31 trucks (rounded up). The value is fairly close to the 29 total trucks estimated by Paradigm. However, CIMA was unable to verify the distribution of the estimated 29 total trucks between the AM and PM peak hours. The subject TIS distributes 28 trucks (evenly distributed between inbound and outbound) to the AM peak	Table 4.1 and Appendices A and B	CIMA Canada Inc.	Appendix B of the February 2020 TIS contains the existing turning movement counts. The TMC data provides a break down of vehicle classification.	

	hour and 1 outbound truck to the PM peak hour. Based on the TMC volumes shown in Table 4.1, 15.0% of the estimated 29 added trucks, or 4 trucks, should be allocated to the PM peak hour. The TMC provided in Appendix B, does not include a detailed breakdown of the vehicles in the PM peak hour. A detailed breakdown of the vehicle types entering and exiting the site, such as the one for the AM peak hour, is needed to verify the added truck volumes in PM peak hour of the subject TIS. In summary, the process used to estimate the added future truck volumes for both peak hours was verified; however, the distribution of the added truck volumes could not be verified. It is recommended that a detailed breakdown of PM peak hour TMC data be provided, similar to the data provided for the AM peak hour.				
24.	Future Traffic Operations Tables 4.2 and 4.3 show future traffic operations at all study area intersections. Signalized and unsignalized intersections are together in the same table. Signalized and unsignalized intersections should not be in the same table as the level of service for a stop-controlled intersection differs from a signalized intersection. Please provide separate tables for signalized and unsignalized intersections for all traffic operational analyses.	Tables 4.2 and 4.3	CIMA Canada Inc.	Acknowledged. Separate tables are not required to summarize operational conditions. The tables contained in the February 2020 TIS reflects the different LOS thresholds for unsignalized and signalized intersections. **Attachment 1** contains the requested separate operational tables for ease of review.	
25.	Mitigation Measures – Traffic Signal Warrant A traffic signal warrant analysis was undertaken for the intersection of Guelph Line & No. 2 Sideroad. The report mentions that the traffic signal was not warranted. However, the volumes used for the traffic signal warrant did not match those in Figures 4.3A/B (Total Traffic Conditions). It is recommended to review the volumes used for the traffic signal warrant and update the analysis as necessary.	Figures 4.3A and 4.3B	CIMA Canada Inc.	OTM warrants utilize total count volume forecast for the intersection with no PCE factor applied. **Attachment 2** contains supplementary OTM Warrant analysis with a PCE factor applied. Traffic control signals at the intersection of Guelph Line & No. 2 Sideroad are not warranted using OTM Book 12 Justification 7.	
26.	Access Road In Section 5.2.1 the second bullet point for site operational assumptions indicates the expected number of working days per year will be 208. However, in Table 5.1 the number of operating days used for calculating average tonnage per year is 250.	Section 5.2.1 and Table 5.1	CIMA Canada Inc.	The difference between Section 5.2.1 and Table 5.1 accounts for the theoretical maximum tonnage of 2.0 tonnes per annum. The table assumes the 2.0 million tonne per annum limit is comprised of only new material extracted from the South Extension. The traffic impact assessment has been completed based on the proposed limit of 2.0 million tonnes per annum and considers asphalt production, aggregate recycling and clean fill imported for rehabilitation. With the existing 208 working days per year the tonnage would be approximately 1.75M tonnes where 250 working days per year equates to approximately 2.1M tonnes.	

	Additionally, Table 5.1 shows the number of two-way truck trips is 24 per hour (84 PCE). However, the number of PCE vehicles per hour increase form 85 PCEs in the AM peak to 90 PCEs in the PM peak without any further background. Finally, Section 5.2.1 mentions that the South Extension Access Road will be designed to accommodate the heavy truck design vehicle (CAT 775 70-tonne rock truck) and will be stop-controlled, however no reference to the requirements of Halton Region's "Access Management Guidelines" is presented as part of the report. Update Table 5.1 with the proper estimate for the working days per year and update the affected calculations. Please provide clarification for the change in two-way truck traffic crossing Number 2 Side Road from the AM peak hour to PM peak hour. Please refer to Region's Access Management Guidelines for the South Extension's Access Road design considerations.			Although this adjustment was made, the number of working days per year has no effect on the truck trip generation as the generation based on the number of trucks, trips per hour and hours of operation. **Table 5** below provides an updated table with 208 working days. **TABLE 5: ESTIMATED SOUTH QUARRY EXTENSION CROSSING TRAFFIC** | Measure	Units	Input	Calculation | |---|---|---|---| | CAT 772 Trucks | Trucks | 4 | | | One Way Trips per Hour | Trips/Hour | 3 | | | Operating Hours per Day | Hours/Day | 10 | | | One way Truck Trips | Truck Trips/Day | | 120 | | Operating Days per Year | Days/Year | 208 | | | One way Truck Trips | Truck Trips/Year | | 24,960 | | Average Load per Truck | Tonnes/Truck | 70 | | | Average Tonnes per Year | Tonnes/Year* | | 1,747,200 | | Loaded Inbound Trips | Trucks/Hour | | 12 | | Empty Outbound Trips | Trucks/Hour | | 12 | | **Total Two-Way Truck Trips** | **Trucks/Hour** | | **24** | **Extraction limited by license amount.* The No. 2 Side Road driveway is proposed approximately 485 m west of Guelph Line. No. 2 Side Road is under the City of Burlington jurisdiction and is classified as a collector roadway[3]. Halton Region Access Management Guidelines do not apply to this City roadway. But the proposed spacing between the site driveway and Guelph Line exceeds the minimum spacing guideline outlined in the Regional document. "The general spacing guidelines for a full movements access is 300 metres to 400 metres[4]." For additional information regarding the No. 2 Sideroad crossing, please see the True North Safety study provided to JART under separate cover. It is expected that the South Extension Access Road will be designed to accommodate the heavy truck design vehicle and that the northbound and southbound approaches will operate under stop control. Additional signage and/or gates to restrict the Access Road to authorized vehicles only should be considered.	
27.	Provision of Confidential Truck Counts In Appendix A, an NDA has been requested for release of Confidential Truck Count Data by Nelson Aggregated to the Region. The Region would like to pursue this request to allow for confirmation of TIS analysis and results, including peer review consultant permissions to view the data. Without the held data the Trip Generation assumptions about the typical truck sizes and load volumes to be expected as part of the Quarry's operations based on truck types and material loads cannot be verified.	Appendix A	Halton Region	**Appendix A** in the February 2020 Traffic Study contains confidential data provided by Nelson Aggregate Co. This data was provided to the JART peer reviewer (CIMA Canada Inc.) in November 2020 subject to a Non Disclosure Agreement (NDA) with Nelson Aggregate Co. We understand the Region of Halton is relying upon the peer reviewer to conduct the review on behalf of the Region of Halton.	

[3] Burlington Official Plan – Schedule L Classification Of Transportation Facilities No. 1 Side Road To Derry Road
[4] Halton Region Access Management Guideline Section 3.2

	(Note: Planning's direction/assistance on how to proceed with the NDA process will be required.)				
28.	Peak Hour Factor The intersection of No. 2 Side Road and the Quarry driveway was the sole TMC to provide a 15-minute volume breakdown. CIMA was not able to verify the peak hour factor (PHF) for the other study area intersections due to the provided TMCs not having 15-minutes volume breakdowns. Please provide the full TMC for all study area intersections in Appendix B.	Appendix B	CIMA Canada Inc.	The PHF was established using existing traffic data as per the Region of Halton TIS guidelines. Full 15-minute volume breakdown TMC's for all locations are provided in **Attachment 3**.	

Attachment **1**

Base Operations
Signalized Intersections

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Guelph Line & Dundas Street	TCS	LOS	C	E	C	**E**	F	B	>	**C**	D	F	>	**F**	D	D	D	**D**	**E**
			Delay	25	73	23	**64**	85	14	>	**32**	36	121	>	**111**	42	47	43	**45**	**66**
			V/C	0.44	1.05	0.27		0.93	0.31	>		0.33	1.17	>		0.61	0.39	0.04		**0.99**
			95th	51	345	45		106	58	>		39	174	>		46	56	6		
			Storage	100	-	70		115	-	>		50	-	>		70	-	70		
			Avail.	49	-	25		9	-	>		11	-	>		24	-	64		
	Cedar Springs Rd/Brant Street & Dundas Street	TCS	LOS	B	C	B	**C**	D	A	A	**C**	C	C	C	**C**	C	D	>	**C**	**C**
			Delay	13	33	15	**29**	43	8	8	**20**	26	22	26	**25**	32	36	>	**35**	**27**
			V/C	0.02	0.94	0.29		0.84	0.18	0.03		0.56	0.16	0.53		0.36	0.60	>		**0.80**
			95th	4	195	20		63	24	0		40	23	59		27	56	>		
			Storage	75	-	75		75	-	75		100	-	-		75	-	>		
			Avail.	71	-	55		12	-	75		60	-	-		48	-	>		
PM Peak Hour	Guelph Line & Dundas Street	TCS	LOS	F	D	C	**D**	F	C	>	**D**	F	E	>	**E**	D	E	D	**D**	**D**
			Delay	125	40	32	**43**	114	27	>	**50**	105	57	>	**72**	41	56	48	**52**	**53**
			V/C	0.89	0.63	0.12		1.14	0.88	>		1.04	0.77	>		0.56	0.72	0.32		**0.98**
			95th	41	119	19		268	289	>		126	96	>		43	89	43		
			Storage	100	-	70		115	-	>		50	-	>		70	-	70		
			Avail.	59	-	52		-153	-	>		-76	-	>		27	-	27		
	Cedar Springs Rd/Brant Street & Dundas Street	TCS	LOS	C	C	C	**C**	C	B	A	**B**	D	C	C	**C**	D	D	>	**D**	**C**
			Delay	23	25	23	**24**	32	16	9	**20**	45	26	25	**34**	40	43	>	**42**	**25**
			V/C	0.16	0.41	0.17		0.90	0.68	0.04		0.85	0.31	0.16		0.23	0.52	>		**0.74**
			95th	9	63	18		132	142	5		99	49	17		17	48	>		
			Storage	75	-	75		75	-	75		100	-	-		75	-	>		
			Avail.	66	-	57		-57	-	70		1	-	-		58	-	>		

MOE - Measure of Effectiveness *V/C - Volume to Capacity Ratio* *> - Shared Right-Turn Lane*
TCS - Traffic Control Signal *95th - 95th Percentile Queue Length* *< - Shared Left-Turn Lane*
TWSC - Two-Way Stop Control *LOS - Level of Service*

Base Operations
Unsignalized Intersections

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Guelph Line & 2 Side Road	TWSC	LOS	<	D		**D**	<	E	>	**E**	A	A	>	**A**	A	A	>	**A**	
			Delay	<	29		**29**	<	37	>	**37**	9	0	>	**1**	9	0	>	**0**	
			V/C	<	0.53			<	0.30	>		0.05	0.31	>		0.01	0.32	>		
			95th	<	24			<	10	>		1	0	>		0	0	>		
			Storage	<	-			<	-	>		50	-	>		40	-	>		
			Avail.	<	-			<	-	>		49	-	>		40	-	>		
	Cedar Springs Rd & 2 Side Road	TWSC	LOS	<	B	>	**B**	<	B	>	**B**	<	A	>	**A**	<	A	>	**A**	
			Delay	<	10	>	**10**	<	12	>	**12**	<	0	>	**0**	<	1	>	**1**	
			V/C	<	0.04	>		<	0.04	>		<	0.00	>		<	0.02	>		
			95th	<	1	>		<	1	>		<	0	>		<	0	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	2 Side Road & Site Driveway	TWSC	LOS	<	A		**A**		A	>	**A**					B		>	**A**	
			Delay	<	0		**0**		0	>	**0**					11		>		
			V/C	<	0.00				0.12	>						0.20		>		
			95th	<	0				0	>						6		>		
PM Peak Hour	Guelph Line & 2 Side Road	TWSC	LOS	<	F		**F**	<	E	>	**E**	A	A	>	**A**	A	A	>	**A**	
			Delay	<	53		**53**	<	46	>	**46**	9	0	>	**1**	9	0	>	**0**	
			V/C	<	0.57			<	0.21	>		0.07	0.34	>		0.01	0.42	>		
			95th	<	24			<	6	>		2	0	>		0	0	>		
			Storage	<	-			<	-	>		50	-	>		40	-	>		
			Avail.	<	-			<	-	>		48	-	>		40	-	>		
	Cedar Springs Rd & 2 Side Road	TWSC	LOS	<	B	>	**B**	<	B	>	**B**	<	A	>	**A**	<	A	>	**A**	
			Delay	<	10	>	**10**	<	11	>	**11**	<	1	>	**1**	<	0	>	**0**	
			V/C	<	0.02	>		<	0.09	>		<	0.01	>		<	0.00	>		
			95th	<	1	>		<	3	>		<	0	>		<	0	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	2 Side Road & Site Driveway	TWSC	LOS	<	A		**A**		A	>	**A**					A		>	**A**	
			Delay	<	0		**0**		0	>	**0**					10		>		
			V/C	<	0.00				0.08	>						0.03		>		
			95th	<	0				0	>						1		>		

MOE - Measure of Effectiveness *V/C - Volume to Capacity Ratio* *> - Shared Right-Turn Lane*
TCS - Traffic Control Signal *95th - 95th Percentile Queue Length* *< - Shared Left-Turn Lane*
TWSC - Two-Way Stop Control *LOS - Level of Service*

Background Operations
Signalized Intersections

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Guelph Line & Dundas Street	TCS	LOS	C	F	C	**F**	F	B	>	**D**	D	F	>	**F**	D	D	D	**D**	**F**
			Delay	28	117	23	**99**	114	14	>	**40**	37	182	>	**165**	45	48	43	**46**	**97**
			V/C	0.53	1.16	0.31		1.04	0.34	>		0.38	1.31	>		0.66	0.43	0.05		**1.10**
			95th	60	402	53		123	66	>		43	208	>		52	62	8		
			Storage	100	-	70		115	-	>		50	-	>		70	-	70		
			Avail.	40	-	17		-8	-	>		7	-	>		18	-	62		
	Cedar Springs Rd/Brant Street & Dundas Street	TCS	LOS	B	E	B	**D**	E	A	A	**C**	C	C	C	**C**	C	D	>	**D**	**D**
			Delay	13	57	16	**48**	62	9	8	**27**	28	22	28	**27**	33	37	>	**36**	**40**
			V/C	0.03	1.04	0.35		0.93	0.20	0.03		0.63	0.17	0.61		0.39	0.65	>		**0.89**
			95th	4	228	29		74	26	1		44	25	71		29	62	>		
			Storage	75	-	75		75	-	75		100	-	-		75	-	>		
			Avail.	71	-	46		1	-	74		56	-	-		46	-	>		
PM Peak Hour	Guelph Line & Dundas Street	TCS	LOS	F	D	C	**D**	F	D	>	**F**	F	E	>	**F**	D	E	D	**D**	**E**
			Delay	176	42	33	**47**	198	42	>	**82**	168	62	>	**96**	44	58	49	**53**	**74**
			V/C	1.02	0.69	0.15		1.33	0.98	>		1.22	0.84	>		0.62	0.77	0.37		**1.10**
			95th	47	134	24		329	380	>		156	115	>		48	98	50		
			Storage	100	-	70		115	-	>		50	-	>		70	-	70		
			Avail.	53	-	46		-214	-	>		-106	-	>		23	-	21		
	Cedar Springs Rd/Brant Street & Dundas Street	TCS	LOS	C	C	C	**C**	E	B	A	**C**	E	C	C	**D**	D	D	>	**D**	**C**
			Delay	25	26	23	**25**	64	18	9	**30**	70	27	26	**46**	41	45	>	**44**	**33**
			V/C	0.24	0.44	0.19		1.04	0.74	0.04		0.98	0.34	0.18		0.25	0.57	>		**0.83**
			95th	10	70	17		177	165	6		163	61	19		21	58	>		
			Storage	75	-	75		75	-	75		100	-	-		75	-	>		
			Avail.	65	-	58		-102	-	70		-63	-	-		54	-	>		

MOE - Measure of Effectiveness *V/C - Volume to Capacity Ratio* *> - Shared Right-Turn Lane*
TCS - Traffic Control Signal *95th - 95th Percentile Queue Length* *< - Shared Left-Turn Lane*
TWSC - Two-Way Stop Control *LOS - Level of Service*

Background Operations
Signalized Intersections

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Guelph Line & 2 Side Road	TWSC	LOS	<	E		**E**	<	F	>	**F**	A	A	>	**A**	A	A	>	**A**	
			Delay	<	41		**41**	<	51	>	**51**	9	0	>	**1**	9	0	>	**0**	
			V/C	<	0.70			<	0.40	>		0.06	0.34	>		0.01	0.35	>		
			95th	<	40			<	13	>		2	0	>		0	0	>		
			Storage	<	-			<	-	>		50	-	>		40	-	>		
			Avail.	<	-			<	-	>		49	-	>		40	-	>		
	Cedar Springs Rd & 2 Side Road	TWSC	LOS	<	B	>	**B**	<	B	>	**B**	<	A	>	**A**	<	A	>	**A**	
			Delay	<	10	>	**10**	<	13	>	**13**	<	0	>	**0**	<	1	>	**1**	
			V/C	<	0.04	>		<	0.05	>		<	0.00	>		<	0.02	>		
			95th	<	1	>		<	1	>		<	0	>		<	1	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	2 Side Road & Site Driveway	TWSC	LOS	<	A		**A**		A	>	**A**					B		>	**A**	
			Delay	<	0		**0**		0	>	**0**					11		>		
			V/C	<	0.00				0.12	>						0.21		>		
			95th	<	0				0	>						6		>		
PM Peak Hour	Guelph Line & 2 Side Road	TWSC	LOS	<	F		**F**	<	F	>	**F**	A	A	>	**A**	A	A	>	**A**	
			Delay	<	93		**93**	<	63	>	**63**	10	0	>	**1**	9	0	>	**0**	
			V/C	<	0.80			<	0.29	>		0.08	0.38	>		0.01	0.47	>		
			95th	<	38			<	9	>		2	0	>		0	0	>		
			Storage	<	-			<	-	>		50	-	>		40	-	>		
			Avail.	<	-			<	-	>		48	-	>		40	-	>		
	Cedar Springs Rd & 2 Side Road	TWSC	LOS	<	B	>	**B**	<	B	>	**B**	<	A	>	**A**	<	A	>	**A**	
			Delay	<	10	>	**10**	<	11	>	**11**	<	1	>	**1**	<	0	>	**0**	
			V/C	<	0.02	>		<	0.11	>		<	0.01	>		<	0.00	>		
			95th	<	1	>		<	3	>		<	0	>		<	0	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	2 Side Road & Site Driveway	TWSC	LOS	<	A		**A**		A	>	**A**					A		>	**A**	
			Delay	<	0		**0**		0	>	**0**					10		>		
			V/C	<	0.00				0.09	>						0.03		>		
			95th	<	0				0	>						1		>		

MOE - Measure of Effectiveness *V/C - Volume to Capacity Ratio* *> - Shared Right-Turn Lane*
TCS - Traffic Control Signal *95th - 95th Percentile Queue Length* *< - Shared Left-Turn Lane*
TWSC - Two-Way Stop Control *LOS - Level of Service*

Total Operations
Signalized Intersections

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Guelph Line & Dundas Street	TCS	LOS	C	F	C	**F**	F	B	>	**D**	D	F	>	**F**	D	D	D	**D**	**F**
			Delay	28	118	23	**100**	114	14	>	**40**	37	187	>	**170**	46	48	43	**47**	**98**
			V/C	0.54	1.16	0.31		1.04	0.35	>		0.39	1.32	>		0.69	0.45	0.05		**1.11**
			95th	62	402	53		123	67	>		43	210	>		54	64	11		
			Storage	100	-	70		115	-	>		50	-	>		70	-	70		
			Avail.	38	-	17		-8	-	>		7	-	>		16	-	59		
	Cedar Springs Rd/Brant Street & Dundas Street	TCS	LOS	B	E	B	**D**	E	A	A	**C**	C	C	C	**C**	C	D	>	**D**	**D**
			Delay	13	58	16	**49**	66	9	8	**28**	28	22	28	**27**	33	37	>	**36**	**40**
			V/C	0.03	1.04	0.35		0.95	0.20	0.03		0.63	0.17	0.61		0.39	0.65	>		**0.90**
			95th	4	229	29		76	26	1		44	25	71		29	62	>		
			Storage	75	-	75		75	-	75		100	-	-		75	-	>		
			Avail.	71	-	46		-1	-	74		56	-	-		46	-	>		
PM Peak Hour	Guelph Line & Dundas Street	TCS	LOS	F	D	C	**D**	F	D	>	**F**	F	E	>	**F**	D	E	D	**D**	**E**
			Delay	176	42	33	**47**	198	42	>	**82**	168	62	>	**96**	44	58	49	**53**	**74**
			V/C	1.02	0.69	0.15		1.33	0.98	>		1.22	0.84	>		0.62	0.77	0.37		**1.10**
			95th	47	134	24		329	380	>		156	115	>		48	98	50		
			Storage	100	-	70		115	-	>		50	-	>		70	-	70		
			Avail.	53	-	46		-214	-	>		-106	-	>		23	-	21		
	Cedar Springs Rd/Brant Street & Dundas Street	TCS	LOS	C	C	C	**C**	E	B	A	**C**	E	C	C	**D**	D	D	>	**D**	**C**
			Delay	25	26	23	**25**	64	18	9	**30**	70	27	26	**46**	41	45	>	**44**	**33**
			V/C	0.24	0.44	0.19		1.04	0.74	0.04		0.98	0.34	0.18		0.25	0.57	>		**0.83**
			95th	10	70	17		177	165	6		163	61	19		21	58	>		
			Storage	75	-	75		75	-	75		100	-	-		75	-	>		
			Avail.	65	-	58		-102	-	70		-63	-	-		54	-	>		

MOE - Measure of Effectiveness *V/C - Volume to Capacity Ratio* *> - Shared Right-Turn Lane*
TCS - Traffic Control Signal *95th - 95th Percentile Queue Length* *< - Shared Left-Turn Lane*
TWSC - Two-Way Stop Control *LOS - Level of Service*

Total Operations
Signalized Intersections

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																OVERALL
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Guelph Line & 2 Side Road	TWSC	LOS	<	F		**F**	<	F	>	**F**	A	A	>	**A**	A	A	>	**A**	
			Delay	<	121		**121**	<	66	>	**66**	9	0	>	**1**	9	0	>	**0**	
			V/C	<	1.08			<	0.47	>		0.08	0.34	>		0.01	0.37	>		
			95th	<	94			<	17	>		2	0	>		0	0	>		
			Storage	<	-			<	-	>		50	-	>		40	-	>		
			Avail.	<	-			<	-	>		48	-	>		40	-	>		
	Cedar Springs Rd & 2 Side Road	TWSC	LOS	<	B	>	**B**	<	B	>	**B**	<	A	>	**A**	<	A	>	**A**	
			Delay	<	10	>	**10**	<	13	>	**13**	<	0	>	**0**	<	1	>	**1**	
			V/C	<	0.04	>		<	0.05	>		<	0.00	>		<	0.02	>		
			95th	<	1	>		<	1	>		<	0	>		<	1	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	2 Side Road & Site Driveway	TWSC	LOS	<	A		**A**		A	>	**A**					B		>	**A**	
			Delay	<	0		**0**		0	>	**0**					12		>		
			V/C	<	0.00				0.16	>						0.29		>		
			95th	<	0				0	>						10		>		
PM Peak Hour	Guelph Line & 2 Side Road	TWSC	LOS	<	F		**F**	<	F	>	**F**	A	A	>	**A**	A	A	>	**A**	
			Delay	<	100		**100**	<	63	>	**63**	10	0	>	**1**	9	0	>	**0**	
			V/C	<	0.83			<	0.29	>		0.08	0.38	>		0.01	0.47	>		
			95th	<	41			<	9	>		2	0	>		0	0	>		
			Storage	<	-			<	-	>		50	-	>		40	-	>		
			Avail.	<	-			<	-	>		48	-	>		40	-	>		
	Cedar Springs Rd & 2 Side Road	TWSC	LOS	<	B	>	**B**	<	B	>	**B**	<	A	>	**A**	<	A	>	**A**	
			Delay	<	10	>	**10**	<	11	>	**11**	<	1	>	**1**	<	0	>	**0**	
			V/C	<	0.02	>		<	0.11	>		<	0.01	>		<	0.00	>		
			95th	<	1	>		<	3	>		<	0	>		<	0	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	2 Side Road & Site Driveway	TWSC	LOS	<	A		**A**		A	>	**A**					A		>	**A**	
			Delay	<	0		**0**		0	>	**0**					10		>		
			V/C	<	0.00				0.09	>						0.03		>		
			95th	<	0				0	>						1		>		

MOE - Measure of Effectiveness *V/C - Volume to Capacity Ratio* *> - Shared Right-Turn Lane*
TCS - Traffic Control Signal *95th - 95th Percentile Queue Length* *< - Shared Left-Turn Lane*
TWSC - Two-Way Stop Control *LOS - Level of Service*

Attachment **2**

Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)

Horizon Year: Base Traffic
Region/City/Township: City of Burlington

Major Street: Guelph Line North/South: Y
Minor Street: No. 2 Side Road

Number of Approach Lanes: 1
Tee Intersection? N
Flow Conditions: Free

PM Forecast Only? N

Warrant Results		
150% Satisfied	**No**	Justification for new intersections with forecast traffic
120% Satisfied	**No**	Justification for existing intersections with forecast traffic

Time Period	Major Street: Guelph Line						Minor Street: No. 2 Side Road						Peds Crossing Main Road
	Northbound			Southbound			Eastbound			Westbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	49	463	18	10	433	64	75	3	Free Flow	31	6	6	0
PM Peak Hour	57	501	9	6	580	53	51	3	Free Flow	15	5	0	0
verage Hourly Volur	**27**	**241**	**7**	**4**	**253**	**29**	**32**	**2**	**0**	**12**	**3**	**2**	**0**

Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	610
1B - Minor	49
2A - Major	561
2B - Cross	46

	Approach Lanes	1		2 or more		Average Hourly Volume
1A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	All Approaches	480	720	600	900	610
					% Fulfilled	**127.0%**

	Approach Lanes	1		2 or more		Average Hourly Volume
1B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Minor Street Approaches	120	170	120	170	49
					% Fulfilled	**40.6%**

Warrant 2 - Delay To Cross Traffic

	Approach Lanes	1		2 or more		Average Hourly Volume
2A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Major Street Approaches	480	720	600	900	561
					% Fulfilled	**116.8%**

	Approach Lanes	1		2 or more		Average Hourly Volume
2B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Traffic Crossing Major Street	50	75	50	75	46
					% Fulfilled	**91.5%**

Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)

Horizon Year: Background Traffic
Region/City/Township: City of Burlington

Major Street: Guelph Line
Minor Street: No. 2 Side Road
North/South: Y

Number of Approach Lanes: 1
Tee Intersection? N
Flow Conditions: Free

PM Forecast Only? N

Warrant Results		
150% Satisfied	**No**	Justification for new intersections with forecast traffic
120% Satisfied	**No**	Justification for existing intersections with forecast traffic

Time Period	Major Street: Guelph Line						Minor Street: No. 2 Side Road						Peds Crossing Main Road
	Northbound			Southbound			Eastbound			Westbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	53	510	19	10	477	72	82	3	Free Flow	33	6	6	0
PM Peak Hour	62	552	10	6	639	57	57	3	Free Flow	17	5	0	0
verage Hourly Volur	**29**	**266**	**7**	**4**	**279**	**32**	**35**	**2**	**0**	**13**	**3**	**2**	**0**

Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	670
1B - Minor	53
2A - Major	617
2B - Cross	50

	Approach Lanes	1		2 or more		Average Hourly Volume
1A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	All Approaches	480	720	600	900	670
					% Fulfilled	**139.5%**

	Approach Lanes	1		2 or more		Average Hourly Volume
1B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Minor Street Approaches	120	170	120	170	53
					% Fulfilled	**44.2%**

Warrant 2 - Delay To Cross Traffic

	Approach Lanes	1		2 or more		Average Hourly Volume
2A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Major Street Approaches	480	720	600	900	617
					% Fulfilled	**128.5%**

	Approach Lanes	1		2 or more		Average Hourly Volume
2B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Traffic Crossing Major Street	50	75	50	75	50
					% Fulfilled	**100.0%**

Signal Justification Calculation for Forecasted Volumes (OTM Book 12 - Justification 7)

Horizon Year: Total Traffic
Region/City/Township: City of Burlington

Major Street: Guelph Line
Minor Street: No. 2 Side Road
North/South: Y

Number of Approach Lanes: 1
Tee Intersection? N
Flow Conditions: Free

PM Forecast Only? N

Warrant Results		
150% Satisfied	**No**	Justification for new intersections with forecast traffic
120% Satisfied	**No**	Justification for existing intersections with forecast traffic

Time Period	Major Street: Guelph Line						Minor Street: No. 2 Side Road						Peds Crossing Main Road
	Northbound			Southbound			Eastbound			Westbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	74	510	19	10	477	100	103	3	Free Flow	33	6	6	0
PM Peak Hour	62	552	10	6	639	57	60	3	Free Flow	17	5	0	0
verage Hourly Volur	**34**	**266**	**7**	**4**	**279**	**39**	**41**	**2**	**0**	**13**	**3**	**2**	**0**

Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	688
1B - Minor	59
2A - Major	629
2B - Cross	56

	Approach Lanes	1		2 or more		Average Hourly Volume
1A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	All Approaches	480	720	600	900	688
					% Fulfilled	**143.3%**

	Approach Lanes	1		2 or more		Average Hourly Volume
1B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Minor Street Approaches	120	170	120	170	59
					% Fulfilled	**49.2%**

Warrant 2 - Delay To Cross Traffic

	Approach Lanes	1		2 or more		Average Hourly Volume
2A	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Major Street Approaches	480	720	600	900	629
					% Fulfilled	**131.0%**

	Approach Lanes	1		2 or more		Average Hourly Volume
2B	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Traffic Crossing Major Street	50	75	50	75	56
					% Fulfilled	**112.0%**

Attachment **3**

Cedar Springs Rd @ No. 2 Side Road

Municipality: Burlington
Major Road: Cedar Springs Rd
Minor Road: No. 2 Side Road

Date: Apr 2, 2013

Major Road Runs: North/South
Weather Conditions: Partly Cloudy/Dry
Person No. 1 Rick W
Person No. 2

Period	North Approach							East Approach							South Approach							West Approach							Veh. Summary	
	Cars			Trucks			Ped.	Cars			Trucks			Ped.	Cars			Trucks			Ped.	Cars			Trucks			Ped.		
Ending	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	15	60
07:15	4	15	0	0	0	0	0	2	0	0	0	0	0	0	0	4	3	0	1	0	0	0	1	0	0	0	0	0	30	
07:30	9	22	0	0	0	0	0	3	0	0	0	0	0	0	0	10	10	0	0	1	0	0	3	3	0	0	0	0	61	
07:45	6	22	0	0	0	0	0	1	0	0	0	0	0	0	0	24	6	0	0	0	0	0	2	4	0	0	1	0	66	
08:00	4	26	0	0	1	0	0	4	0	0	1	0	0	0	0	17	5	0	0	0	0	0	0	2	0	0	1	0	61	218
08:15	3	37	0	0	0	0	0	4	0	0	0	0	0	0	0	21	4	0	0	0	0	0	2	3	0	0	1	0	75	263
08:30	6	41	0	0	0	0	0	1	0	0	1	0	0	0	2	21	11	0	2	1	0	0	2	2	0	0	0	0	90	292
08:45	6	39	0	0	0	0	0	1	0	1	0	0	0	0	1	21	2	0	1	1	0	0	1	3	0	0	0	0	77	303
09:00	5	26	0	0	2	0	0	1	0	1	0	0	0	0	0	9	4	1	1	0	0	0	0	2	0	0	1	0	53	295
11:15	3	15	1	0	1	0	0	3	0	1	0	0	0	0	2	14	1	0	0	0	0	0	0	1	0	0	0	2	42	
11:30	2	18	0	0	0	0	0	0	1	0	0	0	0	0	0	12	1	0	0	0	0	1	0	2	0	0	0	0	37	
11:45	2	24	0	0	0	0	0	2	0	3	0	0	0	0	2	20	1	0	0	0	0	0	0	0	0	0	0	0	54	
12:00	1	16	0	0	1	0	0	6	0	1	0	0	0	0	0	15	2	0	1	0	0	0	1	0	0	0	0	0	44	177
12:15	1	14	0	2	1	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	36	171
12:30	0	15	0	0	0	0	0	2	0	3	0	0	0	0	0	24	2	0	0	0	0	1	0	1	0	0	0	0	48	182
12:45	3	22	0	0	0	0	0	3	0	1	0	0	0	0	1	19	3	0	1	0	0	0	0	2	0	0	0	0	55	183
13:00	4	16	0	0	0	0	0	2	0	0	0	0	0	0	1	12	2	0	0	1	0	0	1	0	0	0	0	0	39	178
13:15	0	21	0	0	0	0	0	4	1	1	0	0	0	0	1	22	2	0	1	0	0	0	0	2	0	0	0	0	55	197
13:30	1	21	0	0	0	0	0	2	0	4	0	0	0	0	0	18	6	0	0	0	0	0	0	2	0	0	0	0	54	203
13:45	0	25	1	0	0	0	0	2	1	2	0	0	0	0	0	24	1	0	0	0	0	0	0	0	0	0	0	0	56	204
14:00	1	15	0	0	0	0	0	1	2	2	0	0	0	0	2	25	2	0	0	0	0	1	1	0	0	0	1	0	53	218
15:15	0	15	0	0	0	0	0	5	1	1	0	0	0	0	0	5	1	1	0	0	0	0	0	1	0	0	0	0	30	
15:30	1	17	0	0	1	0	0	2	0	2	0	0	0	0	3	22	4	1	1	0	0	0	1	2	0	0	0	0	57	
15:45	0	23	0	0	0	0	0	6	1	0	0	0	0	0	0	15	2	0	1	0	0	0	1	1	0	0	0	0	50	
16:00	3	27	0	0	0	0	0	6	0	6	0	0	1	0	3	23	2	0	1	1	0	0	0	1	0	0	0	0	74	211
16:15	2	24	0	0	1	0	0	13	0	6	0	0	0	0	3	33	2	0	0	0	0	0	0	0	0	0	0	0	84	265
16:30	4	34	0	0	1	0	0	10	1	6	0	0	0	0	0	36	3	0	2	2	0	0	0	1	0	1	0	0	101	309
16:45	0	35	0	0	1	0	0	7	0	7	0	0	0	0	2	33	0	0	0	0	0	0	0	3	0	0	0	0	88	347
17:00	1	26	0	0	1	0	0	3	1	11	0	0	0	0	1	39	6	0	0	0	0	0	0	1	0	1	0	0	91	364
17:15	1	37	0	0	0	0	0	7	1	5	0	0	0	0	5	37	7	0	0	0	0	0	0	0	0	0	0	0	100	380
17:30	0	34	1	0	0	0	0	6	0	5	0	0	0	0	2	46	3	0	1	0	0	1	0	3	0	0	0	0	102	381
17:45	4	24	0	0	0	0	0	1	0	3	0	0	0	0	1	39	1	0	2	0	0	1	1	2	0	0	0	0	79	372
18:00	1	32	0	0	0	0	0	0	0	1	0	0	0	0	3	40	4	0	2	0	0	0	2	0	0	0	0	1	85	366

Dundas St @ Brant St

Municipality: Halton Region
Major Road: Dundas St
Minor Road: Brant St

Date: Apr 5, 2018

Major Road Runs: East/West
Weather Conditions: Cloudy/Dry
Person No. 1 Cam
Person No. 2

Period	North Approach							East Approach							South Approach							West Approach							Veh. Summary	
	Cars			Trucks			Ped.	Cars			Trucks			Ped.	Cars			Trucks			Ped.	Cars			Trucks			Ped.		
Ending	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	15	60
07:15	13	21	0	0	0	0	0	24	41	1	2	1	0	0	22	19	66	0	0	1	0	0	303	49	0	8	1	0	572	
07:30	14	28	0	0	1	0	0	23	35	4	3	3	1	0	32	23	82	0	1	3	0	1	350	71	0	10	0	0	685	
07:45	7	39	0	0	1	0	0	42	63	0	0	7	3	0	30	14	72	3	0	3	0	4	372	92	0	9	1	0	762	
08:00	17	42	1	2	5	0	0	33	84	5	3	2	2	0	27	26	102	2	0	0	0	3	320	109	0	6	3	0	794	2813
08:15	18	45	2	0	1	0	0	42	66	5	5	3	0	0	24	18	79	4	1	4	0	3	358	77	0	9	2	0	766	3007
08:30	24	38	1	2	0	1	0	55	81	9	3	8	1	0	46	21	80	4	1	1	0	0	338	96	0	4	2	0	816	3138
08:45	8	31	2	1	0	0	0	76	91	4	1	4	1	0	29	13	65	0	0	2	0	1	274	78	0	11	1	0	693	3069
09:00	10	39	1	2	0	0	0	66	96	3	3	6	0	0	46	17	75	1	0	1	0	2	245	80	0	2	1	0	696	2971
11:15	2	13	1	0	1	0	0	38	68	7	1	2	0	0	45	15	49	3	0	3	0	3	97	44	0	5	3	0	400	
11:30	7	29	0	0	1	0	0	42	73	5	1	6	1	0	47	17	44	0	1	3	0	2	107	55	0	3	2	0	446	
11:45	13	32	1	0	0	0	0	44	83	9	3	5	0	0	41	18	42	0	1	1	0	1	94	53	0	4	1	0	446	
12:00	9	16	0	0	0	0	0	49	104	4	2	5	0	0	53	22	40	1	0	1	0	2	110	49	0	2	0	0	469	1761
12:15	8	19	2	0	0	0	0	58	84	7	1	3	1	0	28	20	37	1	1	4	0	3	91	53	0	4	1	0	426	1787
12:30	5	31	4	0	0	0	0	43	98	10	1	1	0	0	42	21	46	1	0	0	0	1	95	44	0	7	3	0	453	1794
12:45	8	23	3	0	0	1	0	34	88	12	4	6	2	0	46	19	46	2	0	3	0	2	95	45	0	7	0	0	446	1794
13:00	9	22	2	1	0	0	0	47	82	7	1	5	0	0	42	30	40	1	0	1	0	0	96	50	0	6	2	0	444	1769
13:15	9	18	2	0	0	0	0	35	77	9	1	8	1	0	46	22	42	0	0	1	0	3	94	52	0	8	0	0	428	1771
13:30	6	18	1	0	0	0	0	48	77	4	3	3	0	0	34	19	45	1	0	3	0	4	105	46	0	7	2	0	426	1744
13:45	4	14	1	0	0	0	0	48	108	9	3	5	0	0	39	16	36	0	0	2	0	4	85	39	0	7	1	0	421	1719
14:00	7	18	0	1	2	0	0	42	105	11	4	2	0	0	51	21	35	1	2	4	0	1	77	47	0	3	0	0	434	1709
15:15	7	21	3	0	0	0	0	72	157	12	1	4	1	0	57	21	37	1	1	2	0	2	104	62	0	5	1	0	571	
15:30	9	20	1	0	0	0	0	84	200	9	4	4	3	0	69	36	39	1	0	0	0	2	101	42	0	3	1	0	628	
15:45	3	31	3	0	0	1	0	97	207	14	1	8	0	0	49	28	41	2	1	0	0	1	101	54	0	5	2	0	649	
16:00	7	29	1	0	1	0	0	91	254	10	1	8	1	1	70	39	56	3	0	0	0	2	113	40	0	1	0	0	727	2575
16:15	4	23	0	0	0	2	0	117	318	16	2	7	0	0	60	35	76	2	0	0	0	9	98	60	0	3	1	0	833	2837
16:30	8	36	1	1	1	0	0	113	287	9	2	7	2	0	85	34	51	1	1	0	0	6	131	61	0	4	0	0	841	3050
16:45	6	33	1	0	1	0	0	122	322	15	2	11	0	0	80	34	44	2	0	1	0	3	116	66	0	1	3	0	863	3264
17:00	11	30	2	0	0	0	0	125	297	10	0	3	0	0	92	47	57	0	0	2	0	4	123	59	0	5	3	0	870	3407
17:15	6	34	1	0	0	0	0	152	325	16	1	3	0	0	76	42	68	1	0	2	0	5	121	57	0	1	1	0	912	3486
17:30	11	33	4	0	0	0	0	120	337	18	1	3	0	0	105	55	51	3	0	1	0	5	112	57	0	1	3	0	920	3565
17:45	10	35	2	0	0	0	0	107	368	14	2	5	0	0	68	43	54	0	0	0	0	4	134	59	0	0	1	0	906	3608
18:00	7	31	3	0	1	0	0	96	294	15	5	6	1	0	95	47	57	0	0	0	0	4	108	60	0	0	0	0	830	3568

Dundas St @ Guelph Line

Municipality: Halton Region
Major Road: Dundas St
Minor Road: Guelph Line

Date: Apr 5, 2017

Major Road Runs: East/West
Weather Conditions: Cloudy/Dry
Person No. 1 Cam
Person No. 2

Period	North Approach							East Approach							South Approach							West Approach							Veh. Summary	
	Cars			Trucks			Ped.	Cars			Trucks			Ped.	Cars			Trucks			Ped.	Cars			Trucks			Ped.		
Ending	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	15	60
06:15	2	5	2	1	2	0	0	8	16	12	1	1	0	0	7	28	38	0	0	3	0	10	136	10	0	0	0	0	282	
06:30	11	25	1	0	2	0	0	4	27	6	1	0	0	0	5	46	63	0	0	1	0	16	176	12	0	2	0	0	398	
06:45	13	20	2	0	1	0	0	10	40	9	2	2	1	0	8	34	77	1	2	4	0	14	263	28	0	3	0	0	534	
07:00	16	25	3	2	1	0	0	9	36	12	4	2	3	0	14	44	88	2	0	8	0	10	276	28	6	6	1	0	596	1810
07:15	11	31	9	0	1	0	0	14	60	16	3	6	0	0	8	68	89	0	1	3	0	26	335	23	1	11	0	0	716	2244
07:30	11	36	8	4	0	4	0	18	69	21	2	8	3	0	11	66	118	1	2	5	0	32	406	36	0	10	2	0	873	2719
07:45	20	54	6	1	2	1	0	24	95	13	4	9	4	0	23	89	146	3	1	5	0	30	379	58	0	10	1	0	978	3163
08:00	31	63	8	0	6	0	0	54	91	17	2	5	1	1	24	59	119	1	2	4	0	34	431	60	1	9	1	0	1023	3590
08:15	29	74	17	3	2	4	0	45	117	18	5	3	4	0	21	59	117	1	5	4	0	32	378	62	1	5	2	0	1008	3882
08:30	33	59	12	2	1	0	0	43	118	20	5	11	3	0	19	58	107	2	4	7	0	29	387	69	3	6	0	0	998	4007
08:45	31	66	18	2	4	3	0	54	154	11	2	13	1	0	28	46	113	0	3	3	0	17	310	59	2	9	0	0	949	3978
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09:15	17	45	13	4	3	1	0	49	91	22	3	11	6	0	25	40	81	1	3	3	0	17	222	47	0	9	0	0	713	3447
09:30	16	47	11	3	2	1	0	48	112	19	1	12	0	0	21	31	65	4	1	1	0	7	175	30	4	9	0	0	620	3069
09:45	11	43	11	6	3	0	0	37	124	8	0	10	6	0	16	44	62	2	5	4	0	6	139	37	5	10	2	0	591	2711
10:00	16	32	13	5	2	3	0	46	116	7	1	7	1	0	24	28	50	3	1	4	0	7	137	41	0	3	1	0	548	2472
12:15	14	38	9	0	4	3	0	44	102	11	3	8	2	0	41	49	46	1	7	1	0	11	115	38	0	8	0	0	555	
12:30	10	43	12	3	2	2	0	42	104	12	1	10	2	0	33	44	47	1	3	1	0	12	107	38	1	5	2	0	537	
12:45	11	30	8	4	4	0	0	27	126	18	6	10	6	0	32	33	44	0	2	0	0	7	106	35	2	5	0	0	516	
13:00	15	47	10	3	6	3	0	44	116	11	0	7	5	1	22	42	55	1	2	0	0	10	102	20	1	7	2	0	531	2139
13:15	22	26	9	2	2	2	0	54	87	17	2	10	2	0	31	38	48	4	4	0	0	6	133	43	1	7	2	0	552	2136
13:30	19	35	8	3	6	1	0	63	132	17	0	10	1	0	37	42	50	1	0	3	0	11	112	32	3	10	3	0	599	2198
13:45	15	47	9	3	5	1	0	51	107	13	2	4	6	1	33	45	49	1	3	4	1	10	118	28	2	6	0	0	562	2244
14:00	12	41	8	4	2	2	0	48	117	22	1	7	5	0	39	47	40	2	2	1	0	9	107	32	2	7	1	0	558	2271
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15:30	23	84	25	3	5	0	0	101	265	15	7	9	8	0	55	47	60	1	0	0	1	5	104	27	1	6	3	0	854	
15:45	13	74	19	4	4	1	0	140	316	21	4	6	1	0	60	50	50	1	0	1	0	7	142	35	1	3	2	0	955	
16:00	20	94	22	6	7	0	0	125	311	23	1	8	1	0	53	62	61	1	1	1	0	6	135	52	2	7	2	0	1001	3619
16:15	15	73	33	1	0	0	0	133	389	17	8	12	4	0	59	70	59	0	2	3	0	6	126	41	0	7	1	0	1059	3869
16:30	17	93	32	3	3	1	0	124	348	17	6	10	5	0	54	51	59	1	5	3	0	17	148	36	0	6	1	0	1040	4055
16:45	23	108	61	0	2	1	0	121	364	24	6	2	0	0	51	91	63	1	4	4	0	12	142	27	2	3	0	0	1112	4212
17:00	23	101	53	2	1	0	0	140	410	21	5	12	1	0	64	52	65	3	3	3	0	9	178	33	0	4	1	0	1184	4395
17:15	34	130	50	2	1	0	0	126	339	23	6	6	0	0	64	80	66	1	0	0	0	16	164	39	0	1	0	0	1148	4484
17:30	20	93	28	0	4	1	0	153	409	36	3	4	2	1	61	78	61	1	1	4	0	11	184	54	0	1	0	0	1209	4653
17:45	29	100	26	1	2	0	0	135	423	24	5	5	1	1	70	80	62	0	0	4	0	9	136	28	0	2	0	0	1142	4683
18:00	22	75	31	0	1	0	0	136	371	22	6	7	0	0	45	60	75	0	0	3	0	12	132	31	0	1	0	0	1030	4529
18:15	23	52	23	2	0	1	0	113	268	12	3	5	0	0	47	48	50	1	0	2	0	9	120	38	0	1	0	0	818	4199
18:30	18	65	22	0	3	0	0	102	225	14	2	0	0	0	47	43	47	0	0	1	0	11	138	32	0	1	0	0	771	3761
18:45	14	43	10	0	0	0	0	78	209	9	1	0	0	0	48	30	49	0	1	3	0	9	125	38	0	1	0	0	668	3287
19:00	16	51	13	1	0	0	0	74	157	11	1	1	0	0	50	36	48	0	2	2	0	9	116	36	0	1	0	0	625	2882
19:15	10	41	10	0	2	0	0	77	151	10	2	1	0	0	28	17	44	0	0	1	0	8	122	27	0	3	0	0	554	2618
19:30	16	38	10	0	0	0	0	43	139	13	2	3	0	0	34	38	50	0	0	0	0	6	113	31	0	2	0	0	538	2385
19:45	12	27	10	0	1	0	0	48	109	6	0	1	0	0	29	27	40	0	0	1	0	2	83	13	0	0	0	0	409	2126
20:00	12	25	10	0	0	0	0	34	117	11	0	2	1	0	33	25	35	0	1	0	0	3	65	30	0	0	0	0	404	1905
20:15	6	21	5	0	0	0	0	40	101	11	0	0	0	0	30	25	37	0	0	1	0	4	99	27	0	0	0	0	407	1758
20:30	7	19	10	1	0	0	0	43	95	4	0	1	0	0	10	26	24	0	0	0	0	6	90	25	0	0	0	0	361	1581
20:45	9	22	7	0	0	0	0	38	71	4	0	0	0	0	20	21	38	0	0	0	0	5	70	10	0	2	0	0	317	1489
21:00	6	21	7	0	0	1	0	31	72	1	0	0	0	0	29	13	32	0	0	0	0	3	69	15	0	0	0	0	300	1385
21:15	5	15	4	0	0	0	0	19	68	3	0	1	0	0	23	24	25	0	0	0	0	7	87	15	0	0	0	0	296	1274
21:30	1	23	4	0	0	0	0	19	59	3	0	0	0	0	11	15	26	0	0	0	0	6	68	11	0	0	0	0	246	1159
21:45	3	17	4	0	0	0	0	26	65	6	1	0	0	0	21	22	21	0	1	0	0	2	65	11	0	0	0	0	265	1107
22:00	6	11	3	0	0	0	0	19	41	7	0	0	0	1	15	14	16	0	0	0	0	1	37	9	0	0	0	0	179	986

Guelph Line @ 2 Side Rd

Municipality: Halton Region
Major Road: Guelph Line
Minor Road: 2 Side Rd

Date: Sep 21, 2017

Major Road Runs: North/South
Weather Conditions: Sunny/Dry
Person No. 1 Armando
Person No. 2

Period	North Approach							East Approach							South Approach							West Approach							Veh. Summary	
	Cars			Trucks			Ped.	Cars			Trucks			Ped.	Cars			Trucks			Ped.	Cars			Trucks			Ped.		
Ending	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	Left	Thru	Right	Left	Thru	Right	Cross.	15	60
07:15	0	44	0	0	1	0	0	1	1	2	0	0	0	0	0	81	1	4	3	0	0	5	2	5	7	1	5	0	163	
07:30	1	65	0	0	2	2	0	2	1	1	0	0	0	0	6	92	2	7	7	1	0	5	0	6	1	0	6	0	207	
07:45	0	101	2	0	4	2	0	7	1	1	1	0	0	0	2	105	1	2	6	1	0	11	1	19	1	0	6	0	274	
08:00	1	98	3	0	2	5	0	6	0	1	1	0	0	0	5	109	4	4	5	0	0	9	0	8	2	0	5	0	268	912
08:15	2	92	2	1	4	3	0	3	0	0	0	0	0	0	2	75	7	3	1	0	0	3	2	11	5	0	2	0	218	967
08:30	0	82	1	1	4	6	0	7	0	0	0	1	1	0	1	89	2	2	8	0	0	9	0	16	4	0	3	0	237	997
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09:00	0	112	5	0	5	5	0	0	1	0	1	0	0	0	5	64	2	8	5	0	0	9	1	15	6	0	3	0	247	952
11:15	0	62	4	0	3	0	0	0	0	0	0	0	0	0	4	44	3	2	0	0	0	3	3	12	2	0	2	0	144	
11:30	1	50	1	0	7	5	0	1	0	0	0	1	0	0	6	66	2	9	1	1	0	1	0	3	2	0	4	0	161	
11:45	1	38	2	0	2	7	0	2	1	0	0	0	1	1	4	32	2	6	2	0	0	2	1	4	3	0	3	0	113	
12:00	0	72	4	0	2	5	0	1	0	1	0	0	0	0	9	65	4	3	2	0	0	1	0	5	6	1	6	0	187	605
12:15	0	62	4	0	5	2	0	3	1	0	0	0	0	0	3	53	1	6	0	0	0	1	2	3	5	0	3	0	154	615
12:30	0	57	2	0	3	2	0	3	0	0	0	0	0	0	4	69	4	4	2	1	0	1	0	2	5	0	5	0	164	618
12:45	0	62	1	0	2	4	0	3	0	1	0	0	0	0	4	58	3	4	5	0	0	0	0	3	5	0	1	0	156	661
13:00	0	69	1	0	4	7	0	3	0	1	0	0	0	0	3	46	4	4	8	0	0	1	1	4	3	0	3	0	162	636
13:15	0	55	2	0	5	4	0	2	0	1	0	0	0	0	8	46	4	8	5	0	0	2	1	5	5	0	8	0	161	643
13:30	0	24	0	0	4	3	0	3	0	1	0	1	0	0	1	29	1	2	2	0	0	1	0	12	5	0	3	0	92	571
13:45	0	46	1	0	1	2	0	2	0	0	0	0	0	0	8	21	2	4	0	0	0	4	0	4	1	0	4	0	100	515
14:00	0	67	8	0	9	4	0	1	0	0	0	0	0	0	7	63	5	3	2	0	0	9	0	1	3	0	4	0	186	539
15:15	0	60	4	0	3	1	0	3	1	0	2	0	0	0	10	50	5	5	1	0	0	3	0	2	5	0	5	0	160	
15:30	0	73	6	0	2	0	0	2	0	0	0	0	0	0	13	55	7	3	5	1	0	2	0	3	3	1	2	0	178	
15:45	0	109	4	0	9	2	0	3	2	0	0	0	0	0	7	79	2	2	2	0	0	0	2	3	7	0	1	0	234	
16:00	1	107	4	0	5	2	0	2	0	2	0	0	0	0	13	71	3	1	5	0	0	1	0	4	6	1	0	0	228	800
16:15	1	100	5	0	5	1	0	2	0	0	0	0	0	0	7	67	1	2	2	0	0	5	0	3	5	0	1	0	207	847
16:30	0	133	9	1	6	3	0	4	0	0	0	0	0	0	12	96	2	1	2	0	0	3	0	4	2	0	2	0	280	949
16:45	0	148	7	0	5	0	0	1	0	0	0	0	0	0	12	127	4	0	6	0	0	7	2	6	4	0	0	0	329	1044
17:00	0	116	13	0	3	0	0	2	0	0	0	0	0	0	17	119	0	1	3	0	0	3	1	5	1	0	1	0	285	1101
17:15	2	119	12	0	0	0	0	8	1	0	0	1	0	0	8	97	3	0	3	0	0	3	0	2	3	0	0	0	262	1156
17:30	1	119	5	0	1	0	0	6	1	3	0	0	0	0	9	111	7	0	0	0	0	7	1	4	0	0	0	0	275	1151
17:45	1	124	8	0	5	0	0	4	0	0	0	0	0	0	20	131	4	0	5	0	0	1	1	4	0	0	0	0	308	1130
18:00	1	116	2	0	0	0	0	2	4	0	0	0	0	0	14	90	1	0	3	0	0	4	1	3	0	0	1	0	242	1087

TNS Safety Study

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:

Nelson Aggregates Co.
c/o Ms. Tecia White
tecia@white-water.ca

June, 2021

Josée Dumont,
M.A.Sc., RSP2I, P.Eng.

TABLE OF CONTENTS

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 or 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).

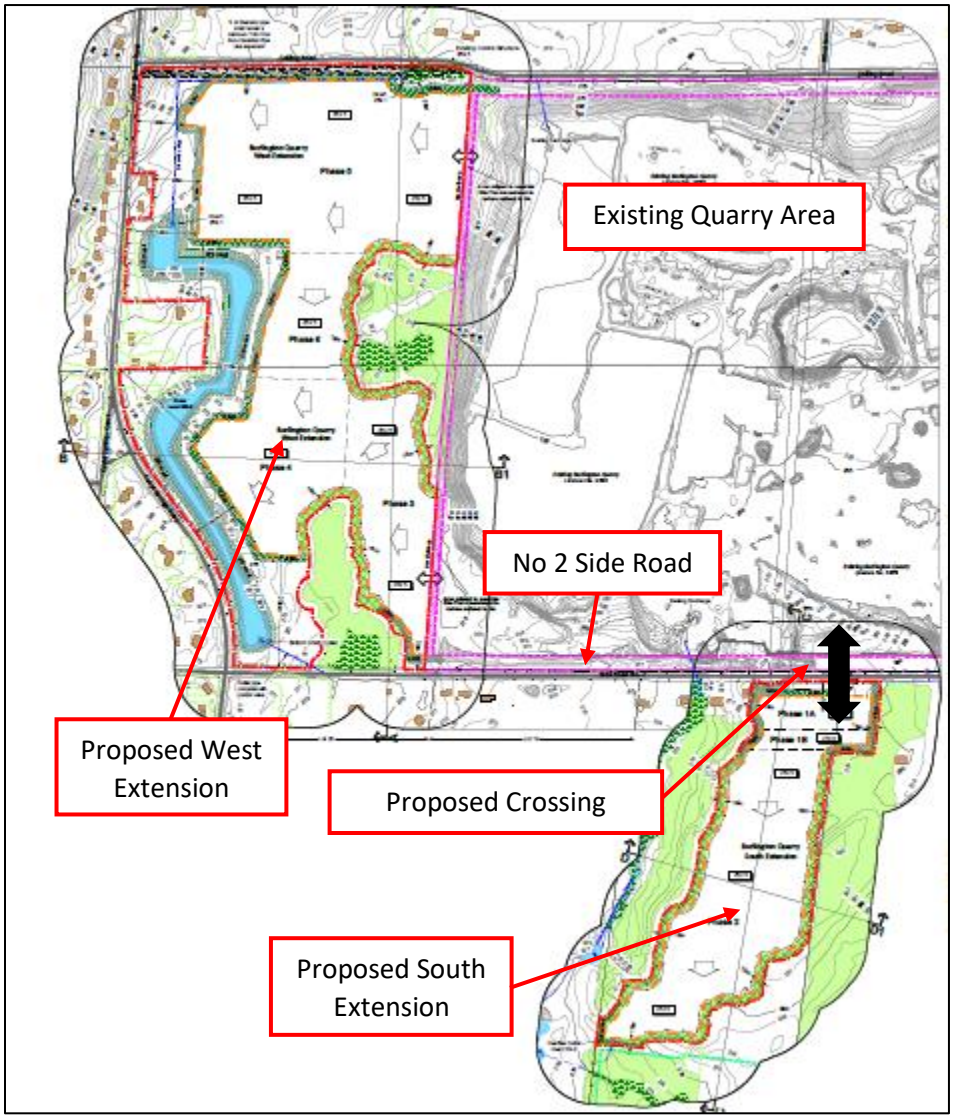

Figure 2: Site plan showing the existing quarry and proposed extensions and crossing (MHBC)[2].

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.

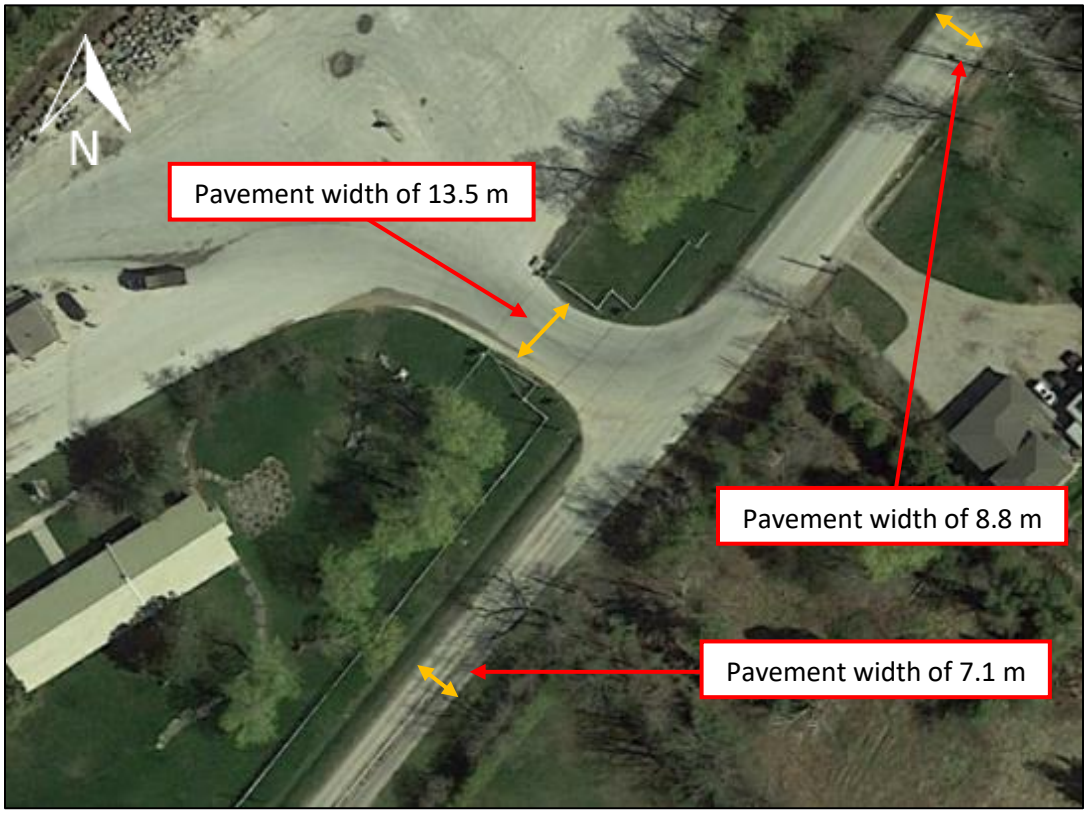

Figure 5: Pavement widths around the existing truck entrance (© Google, 2018)

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 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.

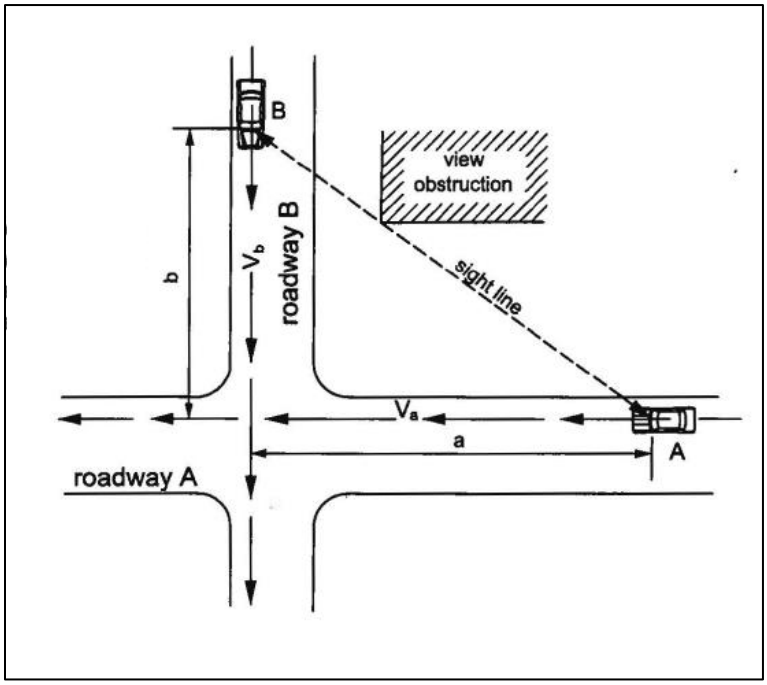

Figure 8: Illustration of an approach sight triangle at a stop-controlled intersection (Figure 2.3.3.1, TAC,[5] 1999).

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 Guide [6] 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.

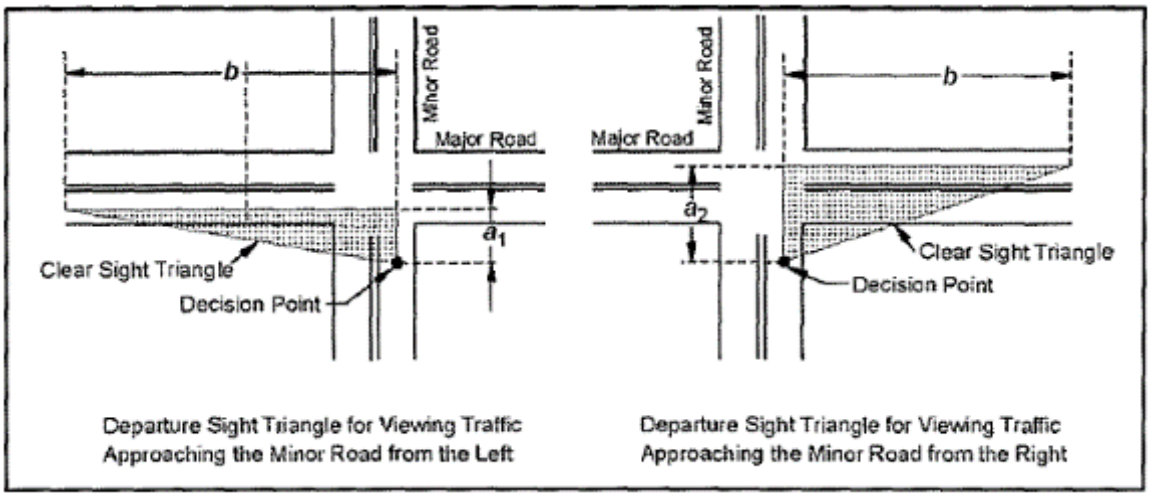

Figure 9: Illustration of departure sight distances (Figure 9.9.2, TAC,[7] 2017)

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 Report[10].

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 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 Guide[12] 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.

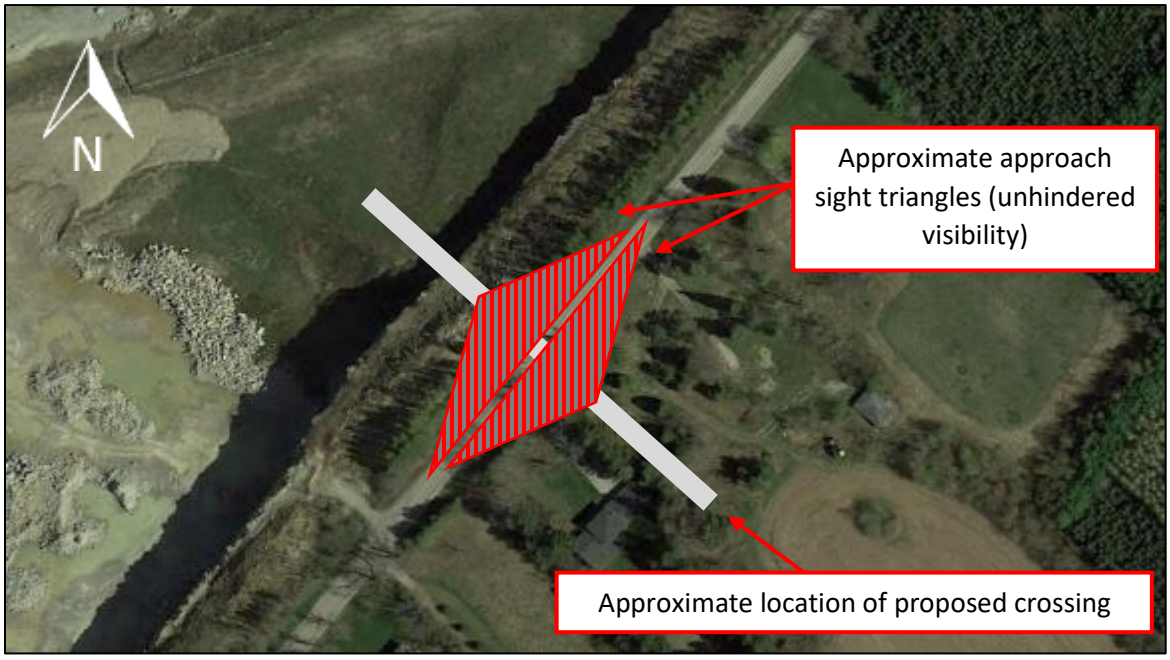

Figure 10: Approximate location of crossing and approach sight triangles (© Google, 2018)

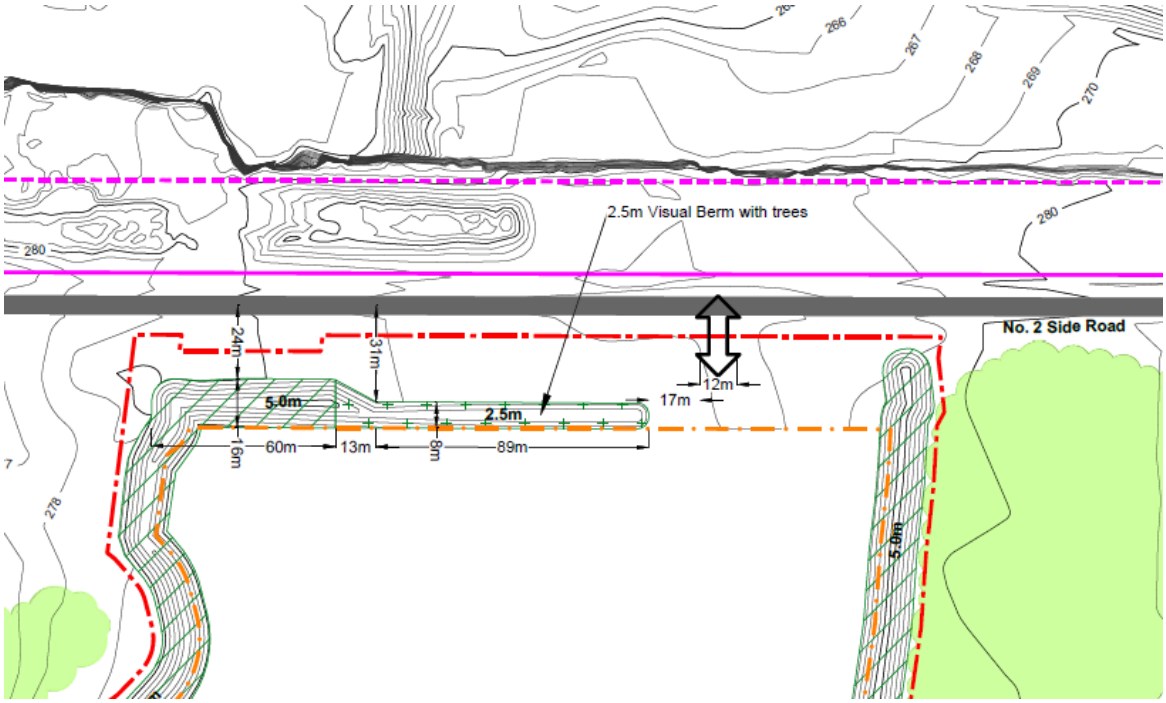

Figure 11: Location of proposed berms and crossing (MHBC)[13].

[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 Report[19].

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	Going ahead	Pick-up truck	Ran off road	Lost control	Dark
Comments:						Dry					