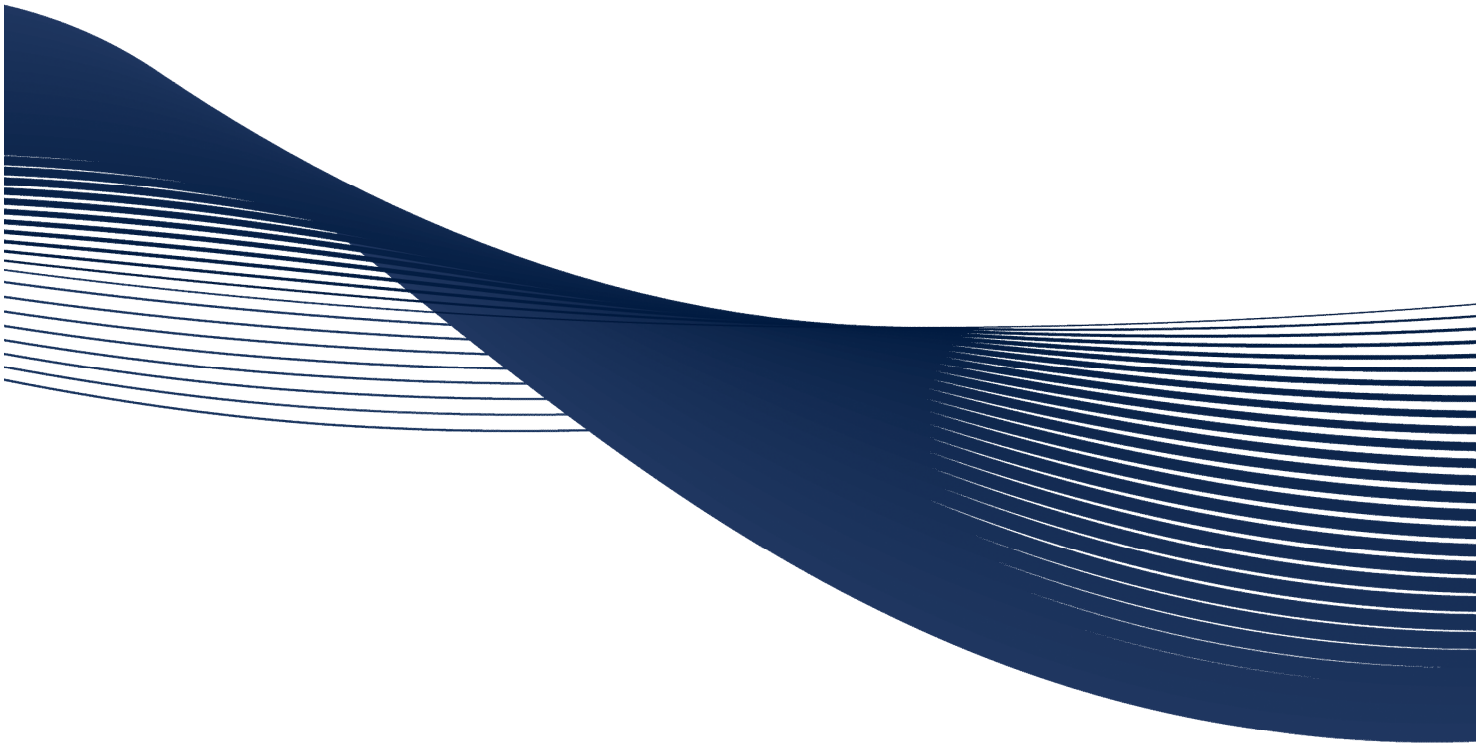
JAMES DICK CONSTRUCTION LIMITED

REVISED HAUL ROUTE STUDY

Eramosa Quarry, Township of Guelph-Eramosa

Project No.: TR12-0013



AUGUST 2015

COLE ENGINEERING GROUP LTD.

HEAD OFFICE
70 Valleywood Drive
Markham, ON CANADA L3R 4T5
T. 905.940.6161 | 416.987.6161
F. 905.940.2064 | www.ColeEngineering.ca

GTA WEST OFFICE
150 Courtneypark Drive West, Unit C100
Mississauga, ON CANADA L5W 1Y6
T. 905.364.6161
F. 905.364.6162

COLE ENGINEERING

Experience Enhancing Excellence

August 20, 2015
Our Ref: TR12-0013

James Dick Construction Ltd.
P.O. Box 470
Bolton, ON L7E 5T4

Attention: Mr. Greg Sweetnam, B.Sc.
Vice President, Resources

Dear Mr. Sweetnam:

Re: Revised Haul Route Study
Eramosa Quarry (Hidden Quarry)
Township of Guelph-Eramosa

Cole Engineering Group Ltd. is pleased to submit this Haul Route Study for the proposed Eramosa Quarry in the Township of Guelph-Eramosa.

Our study finds that the proposed quarry will have minimal impact on the surrounding road network with an average of 14 truck trips during the a.m. peak period dispersed over several haul routes. This study has also reviewed the existing traffic and collision history along Regional Road 25, the expected major route of the Eramosa Quarry and finds that Steps 5 through 8 of the *Haul Route Study – Terms of Reference* are not required.

Should you have any questions regarding the study, please do not hesitate to contact the undersigned.

Yours truly,

COLE ENGINEERING GROUP LTD.

Joseph E. Gowrie, P.Eng.
Project Manager, Traffic

JG:

S:\2012 Projects\TR\TR12-0013 JamesDick_Hwy7-6Conc_Eramosa\300-Design-Engineering\312-Deliverables\Project Deliverables\007_Updated Studies\HRS\TR12-0013 Haul Route 08 2015.doc

COLE ENGINEERING GROUP LTD.

HEAD OFFICE
70 Valleywood Drive
Markham, ON CANADA
L3R 4T5

T. 905.940.6161 | 416.987.6161
F. 905.940.2064
www.ColeEngineering.ca

Statement of Conditions

This Report / Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner / Client, and its affiliates (the "Intended User"). No one other than the Intended User has the right to use and rely on the Work without first obtaining the written authorization of Cole Engineering Group Ltd. and its Owner. Cole Engineering expressly excludes liability to any party except the intended User for any use of, and/or reliance upon, the work.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1.0 Introduction

Cole Engineering Group Ltd. (Cole Engineering) has prepared this Haul Route study on behalf of James Dick Construction Ltd. (the "Owner") for the proposed Hidden Quarry (Eramosa Quarry). The subject lands are approximately 39.4 hectares (97 acres) in area and are located on the northeast quadrant of the Highway 7 and 6th Line intersection (west half of Lot 1, Concession 6) in the Township of Guelph/Eramosa. The site location is identified in **Figure 1-1**.

The study has been requested by the Region of Halton, Town of Milton and Town of Halton Hills and its purpose is to identify the operating characteristics of the facility and the expected haul routes to and from the proposed quarry. The *Haul Route Study – Terms of Reference Proposed "Hidden Quarry" – James Dick Construction Ltd. (Terms of Reference)* which is provided in **Appendix A**.

2.0 Operating Characteristics

2.1. Fleet Size

The number of trips forecasted in the analysis was derived using the James Dick Construction Ltd.'s fleet size. The information related to James Dick Construction Ltd.'s fleet if provided in **Table 2-1**.

Table 2-1 Fleet Size

Vehicle Type	Payload	Number of Units
Tri-Axle Straight Truck	22.7 Tonnes	21
Tri-Axle Tractor Trailer	35.1 Tonnes	18
Quad-Axle Tractor Trailer	39.1 Tonnes	16
Tri-Axel Pony Pup Combination	41.4 Tonnes	30
Total	**35.0 Tonnes**	**85**

There is a fleet size of 85 vehicles with an average haul size of 35 tonnes. To be conservative, a load size of 33 tonnes per truck was assumed in calculations.

2.2. Truck Traffic

The proposed quarry is applying for a license of 700,000 tonnes of aggregate and has a life expectancy of 20 years. Based on the fleet operated by James Dick Construction, each load will be approximately 33 tonnes resulting in a total of 21,213 truck loads per year. The quarry will only be operated from 6:00 a.m. to 6:00 p.m. Monday to Saturday, excluding public holidays, and have an average of 69 truck loads per day. It is important to note that the distribution of truck traffic varies throughout the year based on construction projects.

Operation of the Hidden Quarry is expected to be similar to the Erin Pit which has a license for 723,000 tonnes per annum. The Erin Pit data is provided in **Appendix B**. This is a good comparison due to its proximity as well as the similar license size to the Hidden Quarry. Using the data provided by James Dick Construction Ltd., the annual distribution of truck traffic for the Hidden Quarry is provided in **Figure 2-1**.

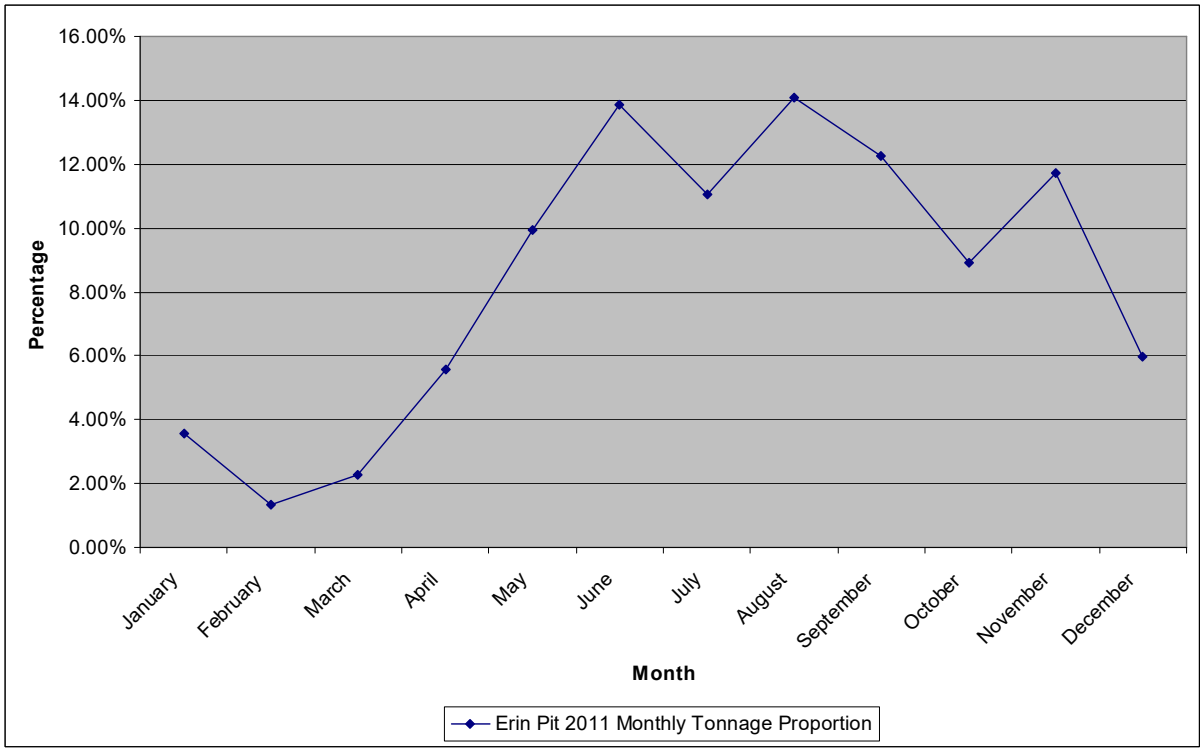


Figure 2-1 2011 Erin Pit Monthly Distribution

Based on the monthly variation of traffic, the quarry is expected to have an approximate total of 12 truck loads (24 trips) in the month of February to an approximate total of 115 truck loads in the month of August. The expected number of truck loads per day by month is provided in **Table 2-2**.

Table 2-2 Expected Monthly Distribution of Trucks

Month	Monthly Proportion of Truck Traffic	Trucks Per Month	Working Days Per Month	Truck Loads Per Day
January	3.50%	742	25	30
February	1.33%	282	23	12
March	2.20%	467	27	17
April	5.50%	1167	25	47
May	9.90%	2100	25	84
June	13.86%	2940	26	113
July	11.00%	2333	25	93
August	14.09%	2989	26	115
September	12.27%	2603	25	104
October	8.80%	1867	25	75
November	11.70%	2482	25	99
December	5.85%	1241	26	48

In reviewing the trucking information, the expected proportion of truck traffic by day of the week is provided in **Figure 2-2**.

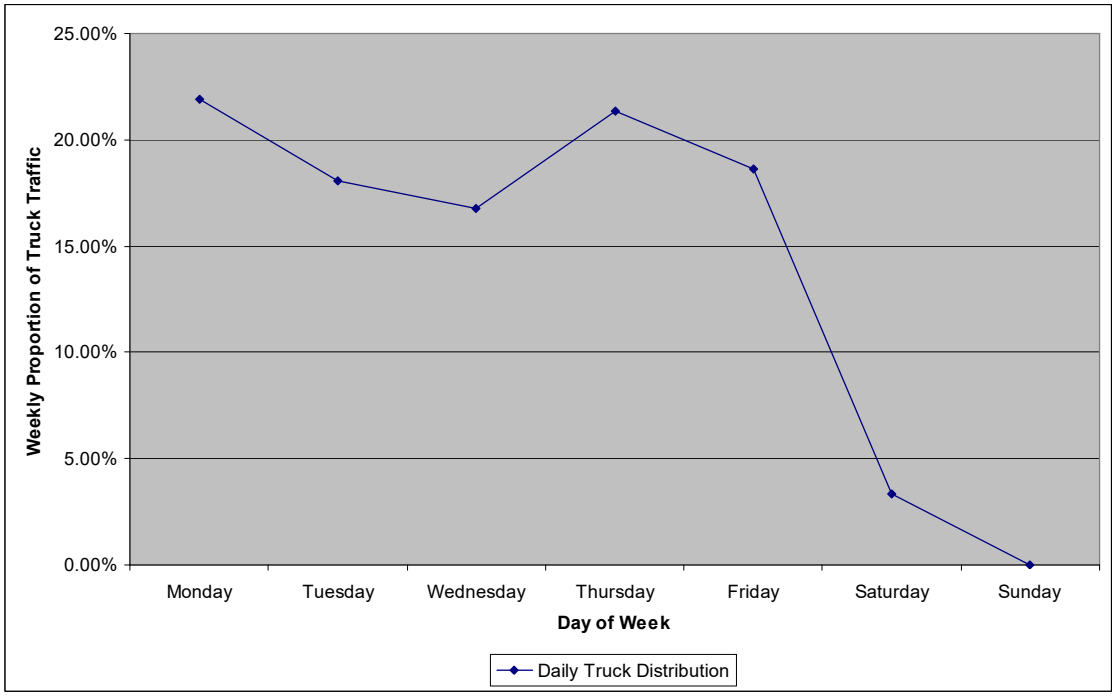


Figure 2-2 Weekly Truck Distribution

This is further refined based on historical truck arrivals at the Erin Pit to derive an hourly breakdown of expected traffic. The hourly distribution of truck traffic is provided in **Figure 2-3**.

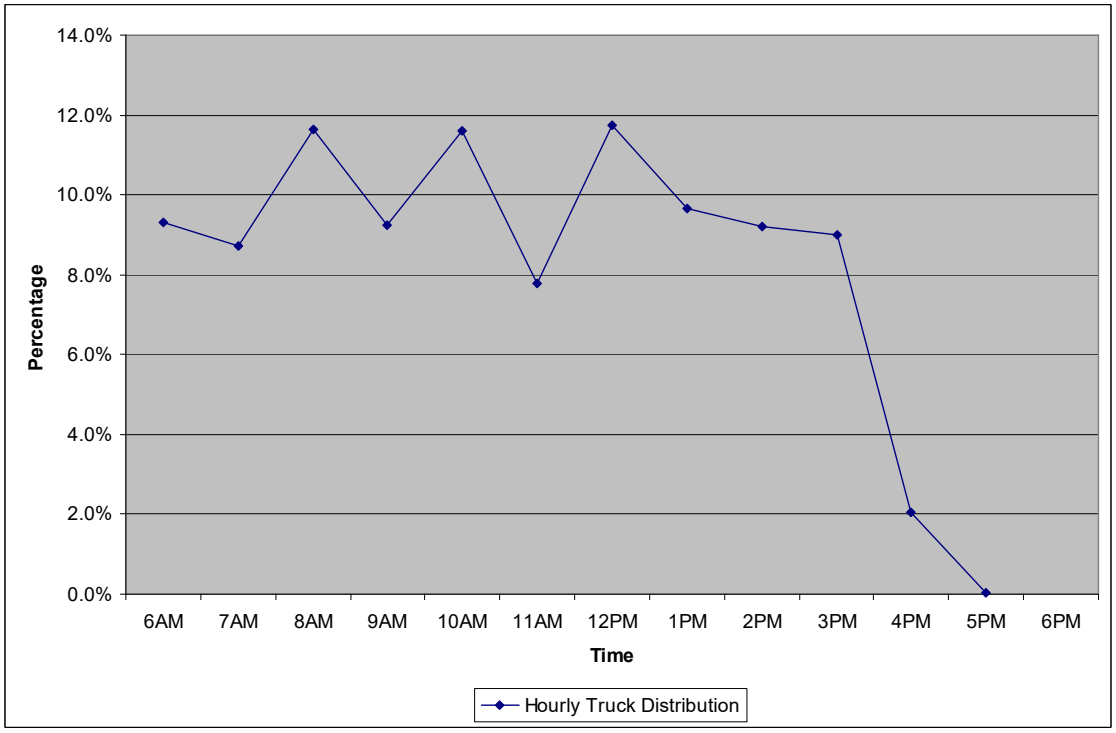


Figure 2-3 Hourly Distribution of Trucks

Based on this distribution, the expected number of truck trips (two-way) per hour is estimated in **Table 2-3**.

Table 2-3 Expected Hourly Distribution of Truck Trips by Month

Month	6AM	7AM	8AM	9AM	10AM	11AM	12PM	1PM	2PM	3PM	4PM	5PM
January	6	6	6	6	6	4	8	6	6	6	2	0
February	2	2	2	2	2	2	2	2	2	2	0	0
March	4	2	4	4	4	2	4	4	4	4	0	0
April	8	8	10	8	10	8	12	10	8	8	2	0
May	16	14	20	16	20	14	20	16	16	16	4	0
June	22	20	26	20	26	18	26	22	20	20	4	0
July	18	16	22	18	22	14	22	18	18	16	4	0
August	22	20	26	22	26	18	26	22	22	20	4	0
September	20	18	24	20	24	16	24	20	20	18	4	0
October	14	14	18	14	18	12	18	14	14	14	4	0
November	18	18	24	18	22	16	24	20	18	18	4	0
December	8	8	12	8	12	8	12	10	8	8	2	0
Average	**13.17**	**12.17**	**16.17**	**13.0**	**16.0**	**11.0**	**16.5**	**13.67**	**13.0**	**12.5**	**2.83**	**0.0**

During the roadway peak hours (between 7:15 and 8:15 and 16:45 and 17:45), we anticipate the Hidden Quarry will have approximately 14 two-way trips (7 truck loads rounded) during the morning roadway peak period and less than 2 two-way trips (1 truck load) during the afternoon roadway peak period.

Operation of the pit is expected to remain consistent from year to year until shutdown of the quarry when the material is exhausted.

2.3. Fleet Origin, Loading and Queueing

James Dick currently has a fleet stationed at the Bolton Yard which will be maintained. There is the potential to move the fleet serving the Eramosa Quarry if a business case presents itself. Other users will most likely originate from the within the GTA and will most likely arrive from the east as identified in the *Revised Traffic Impact Study Eramosa Quarry, Township of Guelph-Eramosa*.

Trucks are encouraged to arrive after the quarry starts operating at 6:00 a.m., however, if a driver arrives earlier, the gates are typically opened 30 minutes in advance, and the driver allowed to park on-site in designated waiting/queuing areas.

Trucks arriving early will be strictly disciplined, including refusal to load. In the rare event where a truck arrives before the gates are opened, the entrance is designed to allow at least one truck length between the shoulder and the gate to allow an offending truck to get off the road. In practical terms there would actually be room for two or three trucks to line up abreast. Company policy is to refuse to load a truck that arrives early a second time.

3.0 Haul Route

3.1. Material Destination

3.1.1. Market Distribution

As the proposed quarry is going to replace an existing quarry, the catchment area is already known. Based on the existing market for James Dick Construction, the material is expected to go to the following locations as identified in **Table 3-1**.

Table 3-1 Aggregate Destination Areas

Location	Proportion
Local Industry	5%
Local Delivery / Halton Region	5%
Wellington / Caledon	25%
Acton / Georgetown / Brampton	10%
Milton / Mississauga / Brampton /Toronto	55%
Total	100%

Although Halton Region does not have specific Haul Routes, any road which is designated as a King's Highway can be used for trucking purposes. Since the site is located adjacent to Highway 7, a significant portion of traffic will use that roadway. However, the majority of the traffic will travel through the Town of Halton Hills. **Appendix C** illustrates the trucking restrictions within the Town and shows how traffic will be forced to use the King's Highway and Regional roads.

Based on this distribution of material, and the trucking restrictions within the Town of Halton Hills, the anticipated truck routes for traffic associated with the Eramosa Quarry are provided in **Appendix D** for reference. James Dick Construction discourages drivers from using 'shortcuts' and trucks that deviate from these designated haul routes can be ticketed by local authorities and will be subject to an internal disciplinary policy. In addition, James Dick is prepared to accept phone calls from residents to report drivers that do not use designated haul routes.

Once operation of the quarry begins, the Eramosa Quarry will generally serve markets to the east while the Guelph Quarry will serve markets to the west. As a result, existing James Dick truck traffic from the Guelph Quarry currently using Highway 7 to travel to markets to the east will be removed along Highway 7 between Guelph and the new Eramosa Quarry, including Rockwood.

3.1.2. Travel Distance

A calculation was undertaken to estimate the driving kilometres saved by operation of the Eramosa Quarry. As the currently operating Bolton Ready Mix plant is within the expected epicentre of the market to be serviced by the Eramosa Quarry, it was used a the destination of material. This calculation is undertaken using the three (3) closest amabel limestone quarries outside the Greater Toronto Area (GTA) and three (3) located within the west Greater Toronto Area (GTA). **Table 3-2** provides information relating to these quarries.

Table 3-2 Locations of Quarries Serving Bolton Ready Mix Plant

Quarry	Location	Distance to Bolton Ready Mix Plant	Difference from Eramosa Quarry	Two-Way Distance Difference
Eramosa Quarry	Township of Guelph-Eramosa	54.4 km	0 km	0 km
*Dufferin Acton	Town of Halton Hills	42.5 km	-11.9 km	-23.8 km
*Dufferin Milton	Town of Milton	43.5 km	-10.9 km	-21.8 km
*Nelson Burlington	City of Burlington	76.2 km	+21.8 km	+43.6 km
**Lafarge Dundas	City of Hamilton	94.2 km	+39.8 km	+79.6 km
**Georgian Duntroon	Township of Clearview	90.1 km	+35.7 km	+71.4 km
**MAQ Osprey	Township of Clearview	91.0 km	+36.6 km	+73.2 km

Note: *Quarry located within GTA; **Quarry located outside GTA

Assuming that the materials currently arrive to the Bolton Ready Mix Plant at a ratio of 95% from quarries outside of the GTA and the remaining 5% are from quarries within the GTA (based on information provided by James Dick Construction), are replaced by material from the Eramosa Quarry there will be a total savings of approximately 1,505, 282 km of truck trips within the Province of Ontario. The calculation is provided in **Appendix E** for reference.

3.2. Quarry Traffic Volumes

The following section analyses the volume of traffic predicted to be generated by the Eramosa Quarry.

3.2.1. Peak Hour Traffic Volume

Based on the *Revised Traffic Impact Study, Eramosa Quarry, Township of Guelph-Eramosa August 2015* prepared by Cole Engineering, estimates of the future (2023) total traffic around the site is presented in **Figure 3-1**.

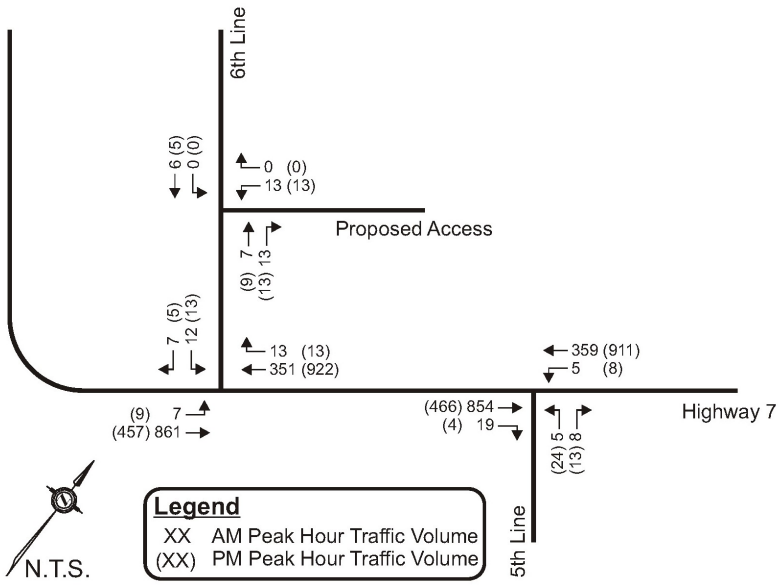


Figure 3-1 Peak Hour Future (2023) Total Traffic Volumes

Based on the projected traffic volumes, the new quarry is expected to generate a conservative maximum of 13 truck loads per peak hour at peak operation during the peak season. This represents a two-way total of approximately 2% of the peak hour traffic volume along Highway 7 and is not significant in the context of total traffic volumes and is well within the normal daily variation of traffic observed on a roadway.

3.2.2. Daily Traffic Volumes

The trips associated with the Eramosa Quarry will vary between the time of day as well as the month of the year. Based on the distribution of truck traffic identified in **Table 3-1**, the minimum and maximum daily traffic expected by route is provided in **Table 3-3**.

Table 3-3 Daily Truck Traffic Volumes from Eramosa Quarry

Direction	Via	Proportion	Maximum Daily Truck Traffic			Minimum Daily Truck Traffic		
			In	Out	Total	In	Out	Total
Local	Local	5%	6	6	12	1	1	2
North	Regional Road 25	25%	29	29	58	2	2	4
South	Regional Road 25	55%	63	63	126	5	5	10
	Guelph Line	5%	6	6	12	1	1	2
East	Highway 7	10%	10	10	20	1	1	2
West	Highway 7	0%	0	0	0	0	0	0
Total		100%	114	114	228	10	10	20

The traffic using Regional Road 25 south of Acton makes up the largest proportion of the quarry generated trips with an expected maximum of 63 truck loads (126 two-way trips) in a peak day.

3.3. Constraints

Generally, the routes expected to be utilized are regional and provincial roadways and are designed to accommodate truck traffic. However, Highway 7 travels through the Town of Acton, and directs all traffic through the downtown area. James Dick Construction recognizes that the turn on Highway 7 (at the Main Street / Mill Street intersection) is constrained and expects that minimal quarry traffic would utilize this route to service most local customers located along Highway 7. This movement is only expected to occur with 10% of the trucks associated with the Eramosa Quarry where due to the current haul routes, cannot use any roadways as a suitable by-pass due to truck restrictions. Although it is recognized as a route to be avoided if possible, there are currently no alternate truck routes that can be used to serve these local businesses. The customers located along Highway 7 are currently serviced by James Dick Construction's Guelph Quarry utilizing the same route that will be used by traffic from the Eramosa Quarry. Thus, traffic from the Eramosa Quarry will, in large part, supplant existing traffic from the Guelph Quarry.

3.3.1. Main Street / Mill Street Intersection

The Main Street / Mill Street intersection was evaluated using turning templates for the James Dick Construction Limited's fleet vehicle.

The westbound approach is the leg of concern with the potential of a truck, turning from the curb lane making a westbound right turn mounting the curb. This is due to two (2) substandard westbound lanes of 2.4 meters and 2.7 meters. Although each lane is not specifically designated as a right turn or through-left lane, based on their alignment within the intersection is assumed.

Using the existing lane configuration the truck turning movement from the curb lane is demonstrated in **Figure 3-2** and shows the vehicle mounting the curb. However, based on observations, although several trucks are observed to mount the curb while making the turning movement, many trucks also avoid mounting the curb by turning while straddling the two (2) westbound lanes. Turning while straddling the two (2) lanes, results in trucks avoiding the curb and still permitting southbound left turns concurrently. This is demonstrated in **Figure 3-3**.

A traffic analysis was undertaken for the Main Street / Mill Street intersection using Synchro 9 software with the results summarized in **Table 3-4** and detailed calculations provided in **Appendix F**.

Table 3-4 Main Street / Mill Street Intersection Existing Configuration – Level of Service

Key Movement	Lane Width	AM Peak LOS (v/c)	Midday Peak LOS (v/c)	PM Peak LOS (v/c)
EB left-through-right	4.3 m	C (0.27)	C (0.24)	C (0.29)
WB left-through	2.7 m	D (0.68)	D (0.62)	C (0.81)
WB right	2.4 m	B (0.16)	C (0.18)	B (0.50)
NB left-through	3.5 m	C (0.75)	B (0.23)	C (0.67)
NB right	3.0 m	B (<0.01)	B (0.08)	B (0.19)
SB left	3.4 m	A (0.61)	A (0.34)	B (0.27)
SB through-right	3.6 m	A (0.34)	A (0.19)	A (0.27)

In the existing configuration, the Main Street / Mill Street intersection operates at good levels of service and volume to capacity ratios. However, in an attempt to widen the westbound approach to allow trucks to make a turn from further away from the curb, the Synchro analysis was repeated with a shared

westbound left-through-right turn lane. The results are summarized in **Table 3-5** and detailed calculations provided in **Appendix G**.

Table 3-5 Main Street / Mill Street Intersection Modified Configuration – Level of Service

Key Movement	Lane Width	AM Peak LOS (v/c)	Midday Peak LOS (v/c)	PM Peak LOS (v/c)
EB left-through-right	4.3 m	C (0.23)	C (0.19)	B (0.23)
WB left-through-right	4.8 m	D (0.76)	D (0.76)	D (0.95)
NB left-through NB right	3.5 m 3.0 m	D (0.82) B (<0.01)	B (0.27) B (0.08)	D (0.86) C (0.22)
SB left SB through-right	3.4 m 3.6 m	B (0.66) A (0.36)	A (0.37) A (0.21)	C (0.73) B (0.32)

By combining the westbound right turn and through-left lanes (i.e. removing the line painting between the lanes), the westbound leg is expected to operate with level of service D and volume to capacity ratios ranging from 0.76 to 0.95. Additional capacity can be gained for the westbound leg by assigning more green time to the east-west phases.

3.4. Regional Road 25

The traffic impact on Regional Road 25 has been evaluated below.

3.4.1. Annual Average Daily Traffic Volumes

A comparison of the expected truck traffic in comparison to the Annual Average Daily Traffic (AADT) volumes is provided in **Table 3-6**. The AADT data was obtained from Halton Region.

Table 3-6 Daily Traffic Comparison

Roadway	AADT	Heavy Vehicles	Existing Heavy Vehicle Percentage	Eramosa Quarry Traffic	Future Heavy Vehicle Percentage
Regional Road 25	10461	732	7.0%	126	8.0%

During peak operation, the Eramosa Quarry will increase the heavy vehicle proportion of traffic along Regional Road 25 by approximately 15% or 1.0% of the overall roadway traffic. This is a very conservative assessment, as existing trips currently utilizing the haul routes were not removed from the analysis, and the analysis is undertaken for an average day of the peak month representing a 96th percentile analysis.

3.4.2. Collisions

The collisions along Regional Road 25 were also investigated and are summarized in **Table 3-7**.

Table 3-7 Regional 25 Road Collision Data

Year	Severity of Collision				Total
	Non-Reportable	Property Damage Only	Non-Fatal Injury	Fatality	
2010	0	1	1	0	**2**
2011	0	5	0	0	**5**
2012	1	2	0	0	**3**
2013	0	2	0	0	**2**
2014	0	1	1	0	**2**
Total	**1**	**11**	**2**	**0**	**14**
Proportion	**7%**	**79%**	**14%**	**0%**	**100%**

Regional Road 25 in the vicinity of the Town of Acton, have had a total of 14 collisions since 2010, averaging 2.8 collisions per year with the majority of collisions resulting only in property damage. Assuming a linear correlation between traffic volumes and collisions, the increase in traffic may result in the number of collisions increasing from 2.8 collisions per year to 2.86 collisions per year. This is an increase of significantly less than 1 collision per year and is annual variation in collisions in the area which range from two (2) to five (5) collisions per year. As a result, the increased traffic will not significantly impact roadway conditions.

4.0 Results and Conclusions

Based on our review of the expected operation of the proposed quarry and the expected haul routes, the Eramosa Quarry will not have significant impact on the haul routes it is expected to utilize. The findings and conclusions of the study are as follows:

- The Eramosa Quarry will provide on-site queuing space for trucks arriving to the site so they do not park within municipal right-of-ways with gates opening 30 minutes before the quarry opens;
- The Eramosa Quarry will utilize existing truck haul routes to move its product;
- The location of the Eramosa Quarry will reduce truck traffic from the Guelph Quarry to 0 in the Town of Rockwood and Town of Acton;
- Queuing for trucks will be accommodated on-site and off the street. Should drivers arrive before the gates open for the day, there is space for trucks to queue within the driveway throat, and off of 6th Line;
- Drivers arriving early multiple times will be disciplined as per James Dick Construction Limited's disciplinary policy;
- Based on the proposed license, the Eramosa Quarry is expected to produce a maximum total of 115 truck loads (230 two-way trips) a day during the peak operating season;

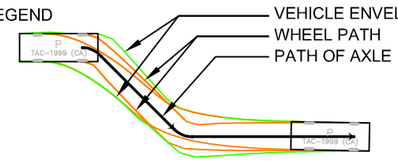
- During the off-peak season, the Eramosa Quarry is expected to produce approximately 20 two-way trips per day;
- The most significantly impacted roadway will be Regional Road 25, which will experience an increase in truck traffic of up to 1% of overall traffic per day, during the peak operating season;
- Generally Regional Road 25 experiences an average of 2.8 collisions per year. Taking into account the traffic associated with the Eramosa Quarry, this rate could increase to 2.86 collisions per year, or approximately one (1) additional collision during the life of the quarry;
- The westbound leg of the Main Street / Mill Street intersection can be modified to minimize trucks turning mounting the northeastern curb by combining the right turn and through-left turn lanes;
- The traffic introduced by the Eramosa Quarry is not permanent and will cease once the reserves of material have been exhausted; and,
- As the Eramosa Quarry is located close to the target market, there will be an annual reduction of approximately 1,585,282 kilometers of truck travel within the Province of Ontario, thereby increasing road safety in an overall sense.

In review of the *Haul Route Study - Terms of Reference*, we believe that there is sufficient justification to demonstrate that the additional truck traffic on the haul routes would be very low throughout the entire life of the Eramosa Quarry. As such, there will not be any appreciable negative effects on the expected haul routes and Sections 5 to 8 of the *Haul Route Study – Terms of Reference* need not be undertaken.

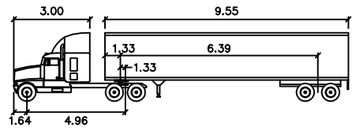
COLE ENGINEERING

70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LEGEND



DESIGN VEHICLE

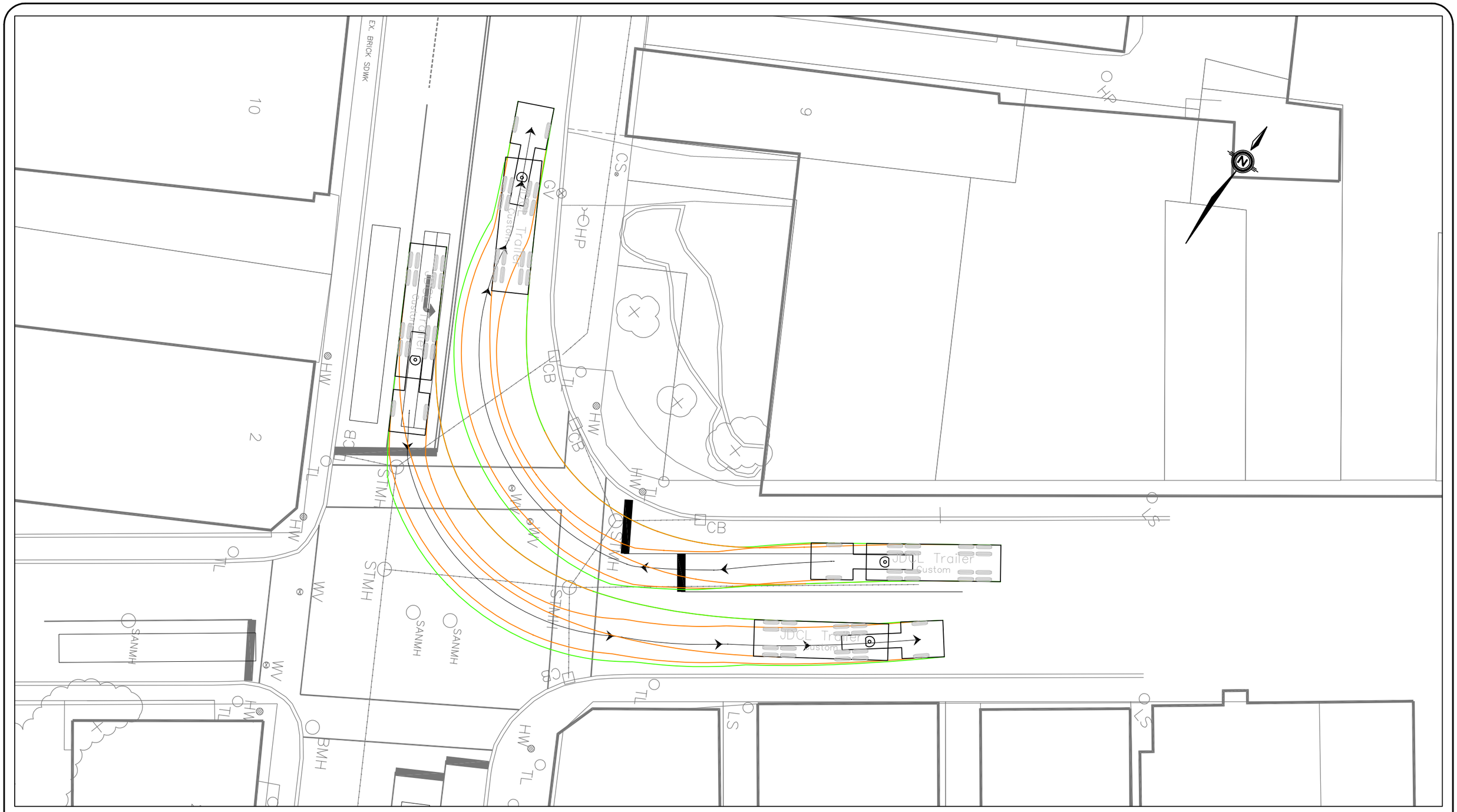


JDCL Trailer	meters
Tractor Width	: 2.60
Trailer Width	: 2.60
Tractor Track	: 2.60
Trailer Track	: 2.60
Lock to Lock Time	: 6.0
Steering Angle	: 18.0
Articulating Angle	: 70.0

AUTOTURN ASSESSMENT - TURN FROM CURB LANE
MAIN STREET / MILL STREET INTERSECTION

ERAMOSA (HIDDEN) QUARRY
TOWNSHIP OF GUELPH-ERAMOSA
WELLINGTON COUNTY

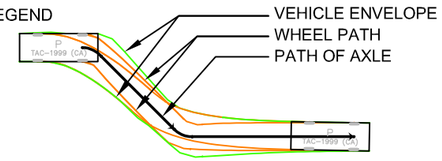
DATE:	AUGUST, 2015	PROJECT No.:	TR12-0013
SCALE:	1:250	FIGURE No.:	3-2



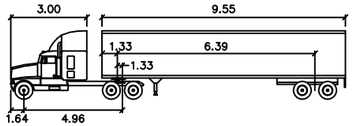
COLE ENGINEERING

70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LEGEND



DESIGN VEHICLE



JDCL Trailer	meters
Tractor Width	: 2.60
Trailer Width	: 2.60
Tractor Track	: 2.60
Trailer Track	: 2.60
Lock to Lock Time	: 6.0
Steering Angle	: 18.0
Articulating Angle	: 70.0

AUTOTURN ASSESSMENT - CONCURRENT TURNS
MAIN STREET / MILL STREET INTERSECTION

ERAMOSA (HIDDEN) QUARRY
TOWNSHIP OF GUELPH-ERAMOSA
WELLINGTON COUNTY

DATE:	AUGUST, 2015	PROJECT No.:	TR12-0013
SCALE:	1:250	FIGURE No.:	3-3

APPENDIX A
Haul Route Study Terms Of Reference

R.J. Burnside & Associates Limited 3 Ronell Crescent Collingwood ON L9Y 4J6 CANADA
telephone (705) 446-0515 **fax** (705) 446-2399 **web** www.rjburnside.com

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

October 10, 2014

Via: Email (kwingrove@get.on.ca)

Ms. Kim Wingrove
Chief Administrative Officer
Township of Guelph/Eramosa
8348 Wellington Road 124
P.O. Box 700
Rockwood ON N0B 2K0

Dear Ms. Wingrove:

Re: Haul Route Study - Terms of Reference
Proposed "Hidden Quarry" - James Dick Construction Ltd.
Project No.: 300032475.0000

This letter provides a Terms of Reference (TOR) for the above noted project, located on the west half of Lot 1, Concession 6 in the Township of Eramosa. This TOR is in response to comments received from staff at the Region of Halton, the Town of Milton and the Town of Halton Hills, requesting that a Haul Route Study be prepared by the applicant as part of the proposed Zoning By-Law Amendment application. A draft of this TOR was reviewed with representatives of the Township and the adjacent municipalities, at a meeting on September 9, 2014. This TOR has been revised in response to those discussions.

We acknowledge that the following TOR has been based on a TOR that has been used in previous haul route studies in the Region of Halton, as originally developed by Dillon Consulting Limited.

1.0 Introduction

James Dick Construction Ltd is proposing to develop a quarry on a site approximately 39.4 hectares (97.4 acres) in size, located in the northeast quadrant of Highway 7 and 6th Line. Approximately 24.8 hectares (61.3 acres) of the site is proposed to be used for extraction of aggregate material. The proposed quarry would extract up to 700,000 tonnes of aggregate material annually. The material will be shipped off-site via 6th Line and Highway 7, with an estimated 95 percent of the product travelling east on Highway 7 (according to the applicant's Traffic Impact Study).

The purpose of this TOR is to outline the requirements for a Haul Route Study for the subject development, to be reviewed by the Township of Guelph/Eramosa, the Region of Halton, the Town of Halton Hills and the Town of Milton. The Ministry of Transportation (MTO) has not requested this study; however, it would be expected that they will also be circulated for comment, considering the potential for impacts to Highway 7.

Figure 1 shows the location of the proposed quarry and the recommended study area for the haul route evaluation.

The primary concern associated with the project is the potential for significant heavy truck traffic beyond that already on any identified haul route(s) that would be generated by the quarry and the impact of that additional traffic movement on road operational concerns and traffic safety, and social features along the haul route(s).

2.0 Define Study Parameter Assumptions

Key assumptions regarding the project that are to be defined based on available information include:

- Assumed in-service data;
- Sizes of the trucks to be used;
- Volume of truck traffic to be generated;
- Location of truck queuing area(s);
- The distribution of truck traffic volumes among the potential haul routes (if more than 1 haul route is to be utilized);
- A description as to how truck volumes and truck tonnages might vary over the life of the project and by hours of the day, days of the week, and time of the year;
- Destinations of the material;
- Trucking base origins;
- Hours of facility operations, etc.;
- How the use of routes would be regulated/enforced; and
- Horizon year and intervals required for analysis (20 years in 10 year intervals).

3.0 Identification of a Haul Route(s) With The Study Area

The intention is to establish a haul route or routes which minimize travel through Acton and Georgetown. A reasonable route or routes to be considered are to be identified and described by the applicant based on input from the Town of Halton Hills, Town of Milton and Region of Halton, as well as the Township of Guelph/Eramosa.

4.0 Assessment of Truck Traffic Volumes

An assessment of the volumes of additional truck traffic on the route or routes will be carried out and reviewed by the Township in consultation with the Region of Halton, Town of Halton Hills, and Town of Milton. If the additional truck traffic on the route or routes would be so low throughout the entire life of the facility so as to not result in any appreciable negative effects, as determined by the Township, then the route or routes or portions of the route or routes in those directions would not need to be further assessed and the work identified in Sections 5 to 8 would not need to be carried out. Should that occur, the study would conclude with the preparation of the draft and final reports and their review as set out in Sections 10 and 11.

5.0 Describe Baseline Conditions

If the truck volumes are deemed by the Township to be sufficient to require further assessment, a description of baseline conditions for the route or routes is to be provided, including:

- Existing and proposed land uses;
- Identification of the locations of other existing, or proposed quarries, pits or other large truck generating land uses;
- Land use plans and designations including municipal official plans, the Greenbelt Plan; the Niagara Escarpment Plan; the Region of Halton Official Plan Amendment 38 and the Aggregate Resources Reference Manual (Halton Region);
- Relevant planning studies (Transportation Master Plans, Active Transportation Plans, Capital Planning studies);
- Social environment (residences, community features, recreational facilities, community function and character, schools and school bus routes, emergency vehicle access, etc.);
- Available information regarding air quality conditions;
- Available information about noise levels;
- Economic environment (location and type of business enterprises);
- General nature of Agriculture;
- Recreation uses (trail crossings, cycling uses, walking etc.);
- Cultural resources (built heritage, cultural landscape, archaeology);
- Road characterization (road classification, right-of-way widths, level of service (current and projected), weight restrictions, number of lanes, pavement structure, intersection configuration, road alignment (vertical and horizontal), reduced load designations, posted speed, truck route designation, watercourse crossings, culvert types, rail crossings, steep grades, visibility, etc.);
- Traffic volumes; and
- Five year vehicle collision history by link/intersection including wildlife.

The description of the baseline conditions will be used as the basis from which to assess the potential for change as a result of the use and possible improvement to the route or alternative routes where being considered.

6.0 Develop the Evaluation Approach

A Technical Advisory Committee (TAC) will be set up with representatives of Town of Halton Hills, Town of Milton, and Region of Halton, as well as the Township of Guelph/Eramosa to provide input on the evaluation approach. The County of Wellington will also be invited to attend.

If alternative routes are to be considered, the evaluation of the identified alternative routes is to be conducted in a systematic, comprehensive and traceable manner, based on a set of evaluation criteria and indicators. Similarly, if only one route is being evaluated with respect to impacts, it should also be evaluated in a systematic, comprehensive and traceable manner based on a set of evaluation criteria and indicators.

Typical criteria, where applicable, may include:

- Potential for disruption to sensitive land uses;
- Conformity with applicable plans and policies;
- Potential for impacts to residents;
- Potential for disruption to users of recreation facilities, community features and institutions;
- Potential property impacts;
- Potential for impact to business enterprises;
- Potential for impact to agricultural operations;
- Potential for impact to property values;
- Potential for disturbance to built heritage features or archaeological resources; and
- Potential for impact to transportation facilities (i.e., change in service level, change in road safety, impact on alternative transportation modes).

The monetary costs for mitigation work, to address haul route impacts, will be estimated for the alternative routes considered.

Both quantitative and qualitative data should be collected for the criteria noted where available. The criteria, and their relative importance, are to be confirmed through agency consultation prior to their application. It is expected that a meeting will be held with the TAC to achieve this confirmation and to generally confirm the results of the identification of baseline conditions.

The assessment of effects is to consider the potential increase in truck volumes, as a result of the quarry activity, over the anticipated future background traffic volume. This is to be considered for a proposed route or for each alternative route where applicable. As well, the assessment of the routes is to consider any needed improvements to the routes to support the increase in truck volumes (see next section).

7.0 Assess Road Improvements

Road improvements, if required, are to be identified for each route, to support the forecast traffic (existing plus growth due to other development and due to the quarry development). Improvement requirements, where required, may include road widenings, resurfacing, turning lanes, new crossings/grade separations, paved shoulders, signals, etc. and will be considered in the analysis completed to determine improvements to a proposed route or to compare the route options and impacts where applicable.

The route assessment is to be presented in a matrix format, describing the potential for effect for each indicator/alternative.

8.0 Comparatively Evaluate and Recommend the Preferred Route(s)

Where alternative routes are under consideration, on the basis of the collected data/assessment of effects for each of the alternative routes, the alternatives are to be comparatively evaluated. The preference would be to use a qualitative evaluation method, to be supported by a quantitative evaluation method, if the data type support one. In comparing the alternatives, the relative importance of the criteria is to be considered. The advantages and disadvantages of the alternative routes are to be compared and considered in the rationalization of the preferred route(s).

9.0 Describe Effects and Mitigation for the Preferred Route(s)

For the preferred haul route(s), provide a description of the potential effects that are expected to occur from the anticipated truck traffic volumes. This description of effects is to be based on the evaluation criteria, plus other more detailed criteria, if appropriate. Assess the overall acceptability of the route and the effects of increased truck traffic on the quality of life for the affected individuals/communities. The proponent is to demonstrate that the effects of the preferred alternative (with the proposed truck volumes) can be considered as being "reasonable" and "acceptable".

Any property requirements to support the preferred haul route(s) are to be described.

Mitigation measures to avoid or minimize effects shall be described. The method, to regulate/enforce the use of the prescribed route(s) by all trucks associated with the quarry, is to be described.

It is expected that a meeting will be held with the TAC to confirm the results of the haul route evaluation, identification of mitigation works and preliminary preferred route(s).

10.0 Prepare Draft and Final Evaluation Reports

A table of contents of the report is to be prepared and circulated to the Township of Guelph/Eramosa, Town of Milton, Town of Halton Hills, and the Region of Halton, prior to its completion. It will also be provided to Ministry of Transportation for their information.

A draft report is to be prepared, that describes the evaluation process, and circulated to the agencies noted above for comment.

The report is to be finalized, considering the comments received on the draft report.

The number of copies of the report will be set through the consultation process. Sufficient copies of the draft report and final report shall be provided to satisfy the circulation requirements of the agencies. Reports will be required in both hard copy and digital formats.

11.0 Public and Agency Consultation

The haul route study is being prepared as a support document to the rezoning process for the subject lands. It is expected that this document will be presented, and considered, as part of the ongoing public consultations and agency consultation that are part of the rezoning process.

The Township of Guelph/Eramosa, as the municipality leading this process, will direct the proponent as to the need for, and timing, for any additional formal public and/or agency consultations/meetings that may be required as this study is completed. It is requested that written acknowledgement be obtained from these agencies regarding their interest and/or concerns with this project and provided to the Township to the attention of Ms. Kelsey Lang, Planning Associate. All consultation related materials, including meeting minutes and comments received and responses are to be provided throughout the study process.

Closing Comments

This letter has provided a draft TOR for the completion of a haul route study by the proponent for the "Hidden Quarry" development. If there are any questions pertaining to this assignment please give us a call.

Yours truly,

R.J. Burnside & Associates Limited

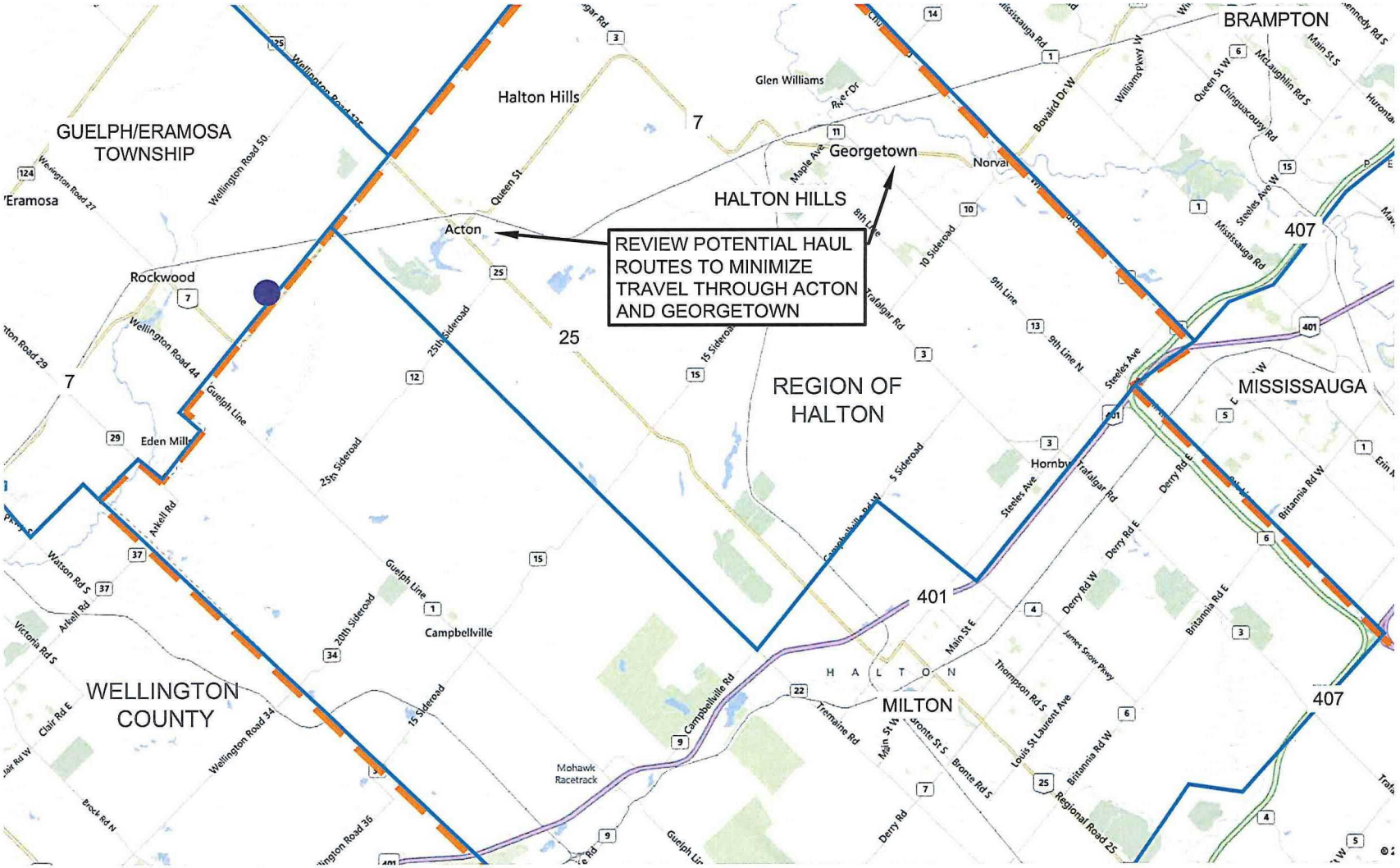
Henry Centen, P.Eng.
Senior Transportation Engineer
HC/DMcN:sj

Don McNalty, P.Eng.
Vice President, Public Sector

Enclosure(s) Figure 1 – Study Area

cc: Elizabeth Howson, Macaulay Shiomi Howson Ltd. (Via: Email - howson@mshplan.ca)
Kelsey Lane, Township of Guelph/Eramosa, (Via: Email - klang@get.on.ca)

141010_TOR_Haul_Route_Study_300032475
11/02/2015 10:56 AM



LEGEND

- SITE LOCATION
- REGION BOUNDARY
- MUNICIPAL BOUNDARY

BURNSIDE

Figure Title

HAUL ROUTE EVALUATION TERMS OF REFERENCE

STUDY AREA

Client

GUELPH/ERAMOSA TOWNSHIP

Drawn	Checked	Date	Figure No.
JBL	HC	14/09/05	1
Scale		Project No.	
NTS		300032475	

File: W:\032475_Haul_Route_Study_Area.dwg Date Plotted: September 5, 2014 - 1:41 PM

APPENDIX B
Erin Gravel Pit Truck Trip Generation

James Dick Erin Pit August 2011 Busiest Month Shipping by Hour of the Day

DATE	6AM	7AM	8AM	9AM	10AM	11AM	12PM	1PM	2PM	3PM	4PM	5PM	6PM	TOTAL
02-Aug	13	20	19	11	19	15	15	19	8	16	2			158
03-Aug	9	4	7	5	5	4	7	5	9	6	1			62
04-Aug	11	13	11	15	15	11	18	15	21	13	2			145
05-Aug	9	11	12	16	12	8	16	11	9	10	0			114
08-Aug	11	8	11	9	15	5	21	11	16	12	1			123
09-Aug	8	13	12	9	5	4	7	5	5	1	1			71
10-Aug	6	12	12	7	16	7	12	8	10	10	0			100
11-Aug	5	14	7	17	13	9	11	10	5	3	2			96
12-Aug	12	14	13	12	19	7	16	8	11	8	2			122
13-Aug	6	2	5	4	2	3	0	0	0	0	0			22
15-Aug	12	7	23	16	20	13	21	13	17	18	1			162
16-Aug	10	8	10	8	23	6	14	16	10	13	1			119
17-Aug	16	13	18	12	21	15	15	16	14	17	5			162
18-Aug	20	15	22	17	11	16	18	19	15	19	2			174
19-Aug	11	13	16	14	10	5	18	11	12	15	2			122
22-Aug	12	12	21	12	21	8	22	17	19	16	4	1		170
23-Aug	9	9	11	9	10	4	15	5	11	5	6			94
24-Aug	8	11	14	9	7	16	10	21	12	12	8			128
25-Aug	18	11	19	13	23	14	20	10	14	9	1			152
26-Aug	12	9	18	11	14	8	17	11	12	12	7			131
29-Aug	15	11	12	13	14	13	13	12	14	11	7			135
30-Aug	15	11	19	12	21	17	15	18	9	20	2			159
31-Aug	15	5	16	10	11	11	10	11	7	8	1			105
TOTAL	263	246	328	261	327	219	331	272	260	254	58	1		2826
%	9.3%	8.7%	11.6%	9.2%	11.6%	7.7%	11.7%	9.6%	9.2%	9.0%	2.1%	0.0%		100%

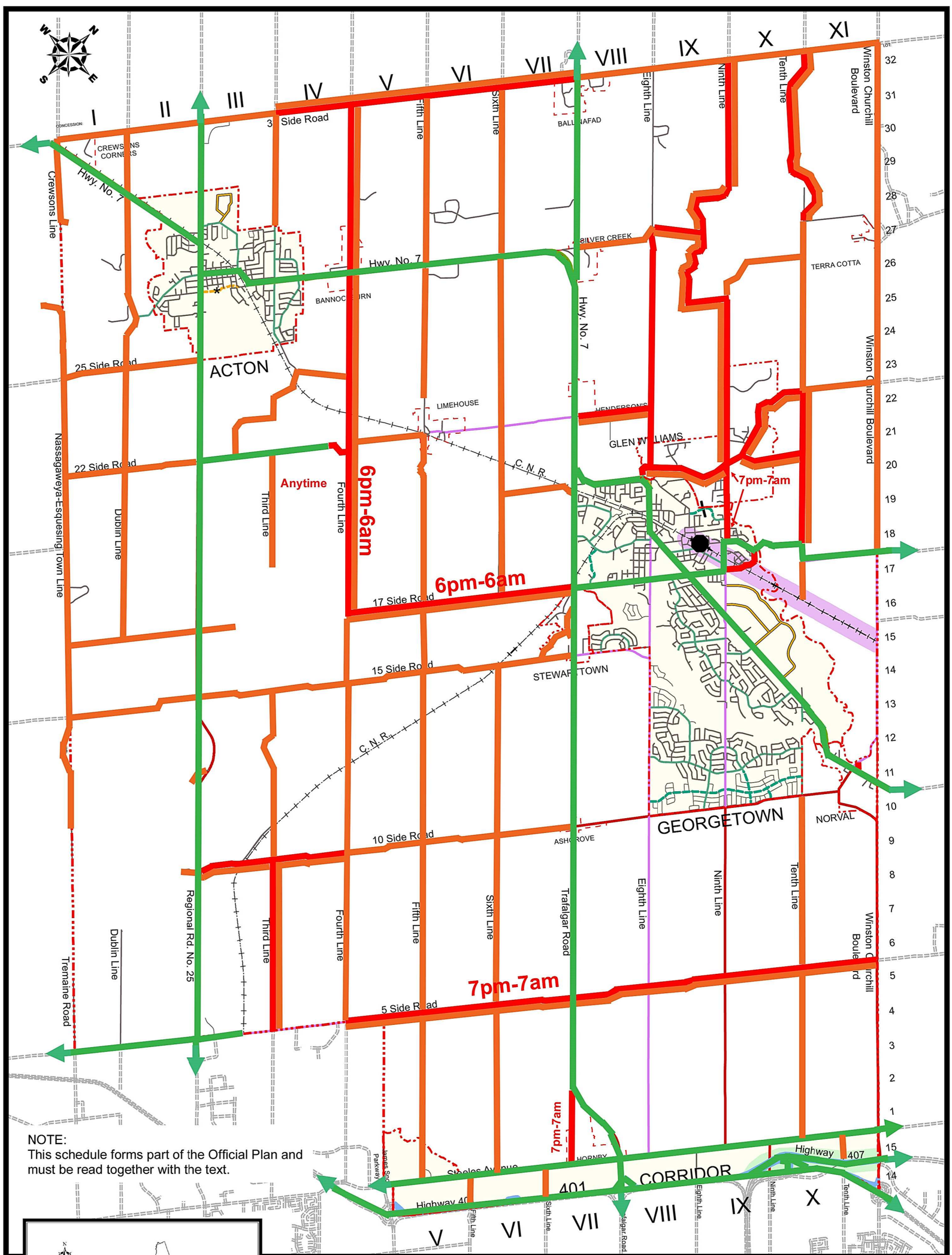
Busiest Hour 23 Trucks Shipped in one hour
% of Monthly Shipping 23/2826 0.814%

Total Monthly Tonnage Percentage for Erin Pit 2011

Jan-11	3.55%	
Feb-11	1.34%	
Mar-11	2.29%	
Apr-11	5.56%	
May-11	9.44%	
Jun-11	13.86%	
Jul-11	11.05%	
Aug-11	14.09%	Busiest Month
Sep-11	12.27%	
11-Oct	8.90%	
Nov-11	11.70%	
Dec-11	5.95%	
Total		

APPENDIX C
Town Of Halton Hills Trucking Restrictions

FUNCTIONAL PLAN OF MAJOR TRANSPORTATION FACILITIES



NOTE:
This schedule forms part of the Official Plan and must be read together with the text.

Truck Restrictions in the Town of Halton Hills

Based on Bylaw 84-1 Schedules 24 and 26

- **Heavy Traffic Prohibited (Anytime unless noted)**
- **Reduced Loads**
- **Commonly Used Unrestricted Haul Routes**

Kilometres
0 1 2 4 6 8

* Note: The exact alignment of Queen Street is conceptual and is to be determined through a Class Environmental Assessment in accordance with the policies of Section F6.4.1.10 of this Plan.

TOWN OF HALTON HILLS
Working Together Working for You!

Produced by:
TOWN OF HALTON HILLS
September 2006

APPENDIX D
Hidden Quarry Haul Route Analysis

Wellington/Caledon

25%

GUELPH/ERAMOSA TOWNSHIP

Local Industry

5%

HIDDEN QUARRY

Acton/Georgetown/Brampton

10%

7

Halton Hills

Glen Williams

Georgetown

HALTON HILLS

EVALUATE HAUL ROUTES
TO MINIMIZE HAULAGE
IN HALTON HILLS
EAST OF CTY. RD. 125

BRAMPTON

407

Rockwood

25

REGION OF HALTON

MISSISSAUGA

5%

Local Delivery/ Halton Region

Milton/Mississauga/Brampton/Toronto

55%

401

MILTON

WELLINGTON COUNTY

Campbellville

Mohawk Racetrack

Hidden Quarry Haul Route Analysis

Approximate Percentage of Traffic 5%

Concrete Plant / Depot Location

APPENDIX E
Eramosa Quarry Distance Comparison Calculations

Transportation Savings at Hidden Quarry

	Quarry	Distance to JDCL Bolton Ready Mix*	Difference from Test Case km	2-ways km	Average Additional km
Closest Amabel Quarries Outside GTA West	Georgian Duntroon	90.1	35.7	71.4	
	MAQ	91.0	36.6	73.2	74.7
	Lafarge Dundas	94.2	39.8	79.6	
Remaining Quarries in GTA West	Nelson Burlington	76.2	21.8	43.6	
	Dufferin Milton	43.5	-10.9	-21.8	-0.7
	Dufferin Acton	42.5	-11.9	-23.8	
Test Case	JDCL Hidden Quarry	54.4	0	0	

Bolton Ready Mix Plant was used because it is a real operation in the epicentre of the market that **Hidden** will serve (Halton, York and Peel) with close proximity to North Brampton, Caledon Whitebelt, Vaughan and the new GTA West Corridor.
All distances calculated with Google Maps door to door
Given the fact that average GTA west consumption is running on average at approximately 17 MT/Yr (Clayton Page 8)
Given that GTA current production (8MT/Yr) and licensed supplies are inadequate to meet demand
Therefore **Hidden Quarry** production will displace only Outside GTA production

Displaced Source	Weighting	Av. Additional km	Saved km per load	
Quarries Outside GTA	0.95	74.7	71.0	
Quarries in GTA	0.05	-0.7	0.0	
			71.0	Total Km saved per truck load

Hidden Production Level	Trucks/Annum	Km saved per truckload	Total Annual km saved
700000	21212	71.0	1,505,282.83

Hidden Quarry GHG Savings Calculation

Tonnes	**T/Truck**	**Trucks/Annum**	**Km/Yr**	**L/Km**	**L/Year**	**CO2 Equiv**	**Greenhouse Gas Savings**	
700,000.00	33.00	21,212.12	1,585,252.53	0.51	808,478.79	2.73	2,207,147.09	kg
							2,207.15	tonnes

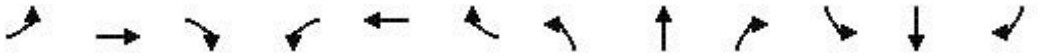
APPENDIX F

Existing Main Street / Mill Street Configuration

Level Of Service Calculations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	14	73	21	117	38	194	137	174	5	370	355	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	4.3	3.7	3.7	2.7	2.4	3.7	3.5	3.0	3.4	3.6	3.7
Total Lost time (s)		6.0			6.0	4.0		6.0	6.0	4.0	6.0	
Lane Util. Factor		1.00			1.00	1.00		1.00	1.00	1.00	1.00	
Frt		0.97			1.00	0.85		1.00	0.85	1.00	1.00	
Flt Protected		0.99			0.96	1.00		0.98	1.00	0.95	1.00	
Satd. Flow (prot)		1867			1494	1320		1546	1383	1634	1755	
Flt Permitted		0.95			0.73	1.00		0.68	1.00	0.43	1.00	
Satd. Flow (perm)		1780			1129	1320		1077	1383	734	1755	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	15	78	22	124	40	206	146	185	5	394	378	11
RTOR Reduction (vph)	0	13	0	0	0	123	0	0	3	0	1	0
Lane Group Flow (vph)	0	102	0	0	164	83	0	331	2	394	388	0
Heavy Vehicles (%)	8%	7%	2%	12%	5%	6%	20%	18%	9%	8%	8%	2%
Turn Type	Perm	NA		Perm	NA	pm+ov	Perm	NA	Perm	pm+pt	NA	
Protected Phases		4			8	1		2		1	6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)		18.5			18.5	35.2		35.8	35.8	56.5	56.5	
Effective Green, g (s)		18.5			18.5	35.2		35.8	35.8	56.5	56.5	
Actuated g/C Ratio		0.21			0.21	0.40		0.41	0.41	0.65	0.65	
Clearance Time (s)		6.0			6.0	4.0		6.0	6.0	4.0	6.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		378			240	534		443	569	649	1139	
v/s Ratio Prot						0.03				c0.12	0.22	
v/s Ratio Perm		0.06			c0.15	0.03		c0.31	0.00	0.28		
v/c Ratio		0.27			0.68	0.16		0.75	0.00	0.61	0.34	
Uniform Delay, d1		28.6			31.6	16.5		21.8	15.1	7.9	6.9	
Progression Factor		1.00			1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.4			7.8	0.1		11.0	0.0	1.6	0.8	
Delay (s)		29.0			39.3	16.6		32.7	15.1	9.5	7.7	
Level of Service		C			D	B		C	B	A	A	
Approach Delay (s)		29.0			26.7			32.4			8.6	
Approach LOS		C			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	71	10	90	67	233	4	176	107	242	181	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	4.3	3.7	3.7	2.7	2.4	3.7	3.5	3.0	3.4	3.6	3.7
Total Lost time (s)		6.0			6.0	4.0		6.0	6.0	4.0	6.0	
Lane Util. Factor		1.00			1.00	1.00		1.00	1.00	1.00	1.00	
Frt		0.99			1.00	0.85		1.00	0.85	1.00	0.98	
Flt Protected		1.00			0.97	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1874			1621	1320		1595	1396	1604	1629	
Flt Permitted		0.96			0.81	1.00		1.00	1.00	0.59	1.00	
Satd. Flow (perm)		1813			1347	1320		1589	1396	991	1629	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	9	73	10	93	69	240	4	181	110	249	187	21
RTOR Reduction (vph)	0	6	0	0	0	163	0	0	55	0	3	0
Lane Group Flow (vph)	0	86	0	0	162	77	0	185	55	249	205	0
Heavy Vehicles (%)	22%	6%	2%	3%	2%	6%	2%	18%	8%	10%	16%	5%
Turn Type	Perm	NA		Perm	NA	pm+ov	Perm	NA	Perm	pm+pt	NA	
Protected Phases		4			8	1		2		1	6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)		16.8			16.8	27.8		43.2	43.2	58.2	58.2	
Effective Green, g (s)		16.8			16.8	27.8		43.2	43.2	58.2	58.2	
Actuated g/C Ratio		0.19			0.19	0.32		0.50	0.50	0.67	0.67	
Clearance Time (s)		6.0			6.0	4.0		6.0	6.0	4.0	6.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		350			260	421		789	693	740	1089	
v/s Ratio Prot						0.02				c0.04	0.13	
v/s Ratio Perm		0.05			c0.12	0.04		0.12	0.04	c0.18		
v/c Ratio		0.24			0.62	0.18		0.23	0.08	0.34	0.19	
Uniform Delay, d1		29.7			32.2	21.4		12.5	11.5	5.8	5.5	
Progression Factor		1.00			1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.4			4.6	0.2		0.7	0.2	0.3	0.4	
Delay (s)		30.1			36.8	21.6		13.2	11.7	6.0	5.8	
Level of Service		C			D	C		B	B	A	A	
Approach Delay (s)		30.1			27.7			12.6			5.9	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	23	117	10	166	108	354	14	441	157	265	257	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	4.3	3.7	3.7	2.7	2.4	3.7	3.5	3.0	3.4	3.6	3.7
Total Lost time (s)		6.0			6.0	4.0		6.0	6.0	4.0	6.0	
Lane Util. Factor		1.00			1.00	1.00		1.00	1.00	1.00	1.00	
Frt		0.99			1.00	0.85		1.00	0.85	1.00	0.99	
Flt Protected		0.99			0.97	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1945			1608	1346		1788	1449	1713	1761	
Flt Permitted		0.92			0.73	1.00		0.99	1.00	0.29	1.00	
Satd. Flow (perm)		1806			1210	1346		1767	1449	517	1761	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	23	118	10	168	109	358	14	445	159	268	260	22
RTOR Reduction (vph)	0	4	0	0	0	74	0	0	54	0	3	0
Lane Group Flow (vph)	0	147	0	0	277	284	0	459	105	268	279	0
Heavy Vehicles (%)	2%	4%	2%	4%	2%	4%	2%	5%	4%	3%	7%	2%
Turn Type	Perm	NA		Perm	NA	pm+ov	Perm	NA	Perm	pm+pt	NA	
Protected Phases		4			8	1		2		1	6	
Permitted Phases	4			8		8	2		2	6		
Actuated Green, G (s)		24.6			24.6	37.0		34.0	34.0	50.4	50.4	
Effective Green, g (s)		24.6			24.6	37.0		34.0	34.0	50.4	50.4	
Actuated g/C Ratio		0.28			0.28	0.43		0.39	0.39	0.58	0.58	
Clearance Time (s)		6.0			6.0	4.0		6.0	6.0	4.0	6.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		510			342	572		690	566	469	1020	
v/s Ratio Prot						0.07				c0.08	0.16	
v/s Ratio Perm		0.08			c0.23	0.14		c0.26	0.07	0.25		
v/c Ratio		0.29			0.81	0.50		0.67	0.19	0.57	0.27	
Uniform Delay, d1		24.4			29.0	18.2		21.8	17.4	11.3	9.1	
Progression Factor		1.00			1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3			13.2	0.7		5.0	0.7	1.7	0.7	
Delay (s)		24.7			42.2	18.9		26.8	18.1	12.9	9.8	
Level of Service		C			D	B		C	B	B	A	
Approach Delay (s)		24.7			29.1			24.6			11.3	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX G

Modified Main Street / Mill Street Configuration

Level Of Service Calculations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	14	73	21	117	38	194	137	174	5	370	355	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	4.3	3.7	3.7	4.8	2.4	3.7	3.5	3.0	3.4	3.6	3.7
Total Lost time (s)		6.0			6.0			6.0	6.0	4.0	6.0	
Lane Util. Factor		1.00			1.00			1.00	1.00	1.00	1.00	
Frt		0.97			0.92			1.00	0.85	1.00	1.00	
Flt Protected		0.99			0.98			0.98	1.00	0.95	1.00	
Satd. Flow (prot)		1867			1815			1546	1383	1634	1755	
Flt Permitted		0.93			0.86			0.68	1.00	0.40	1.00	
Satd. Flow (perm)		1743			1584			1077	1383	693	1755	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	15	78	22	124	40	206	146	185	5	394	378	11
RTOR Reduction (vph)	0	12	0	0	63	0	0	0	3	0	1	0
Lane Group Flow (vph)	0	103	0	0	307	0	0	331	2	394	388	0
Heavy Vehicles (%)	8%	7%	2%	12%	5%	6%	20%	18%	9%	8%	8%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		22.2			22.2			32.5	32.5	52.8	52.8	
Effective Green, g (s)		22.2			22.2			32.5	32.5	52.8	52.8	
Actuated g/C Ratio		0.26			0.26			0.37	0.37	0.61	0.61	
Clearance Time (s)		6.0			6.0			6.0	6.0	4.0	6.0	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		444			404			402	516	596	1065	
v/s Ratio Prot										c0.12	0.22	
v/s Ratio Perm		0.06			c0.19			c0.31	0.00	0.28		
v/c Ratio		0.23			0.76			0.82	0.00	0.66	0.36	
Uniform Delay, d1		25.7			29.9			24.7	17.1	9.9	8.6	
Progression Factor		1.00			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.3			8.2			17.2	0.0	2.8	1.0	
Delay (s)		25.9			38.2			41.8	17.1	12.6	9.6	
Level of Service		C			D			D	B	B	A	
Approach Delay (s)		25.9			38.2			41.5			11.1	
Approach LOS		C			D			D			B	

Intersection Summary			
HCM 2000 Control Delay	24.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	71	10	90	67	233	4	176	107	242	181	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	4.3	3.7	3.7	4.8	2.4	3.7	3.5	3.0	3.4	3.6	3.7
Total Lost time (s)		6.0			6.0			6.0	6.0	4.0	6.0	
Lane Util. Factor		1.00			1.00			1.00	1.00	1.00	1.00	
Frt		0.99			0.92			1.00	0.85	1.00	0.98	
Flt Protected		1.00			0.99			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1874			1871			1595	1396	1604	1629	
Flt Permitted		0.95			0.90			0.99	1.00	0.58	1.00	
Satd. Flow (perm)		1786			1707			1589	1396	978	1629	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	9	73	10	93	69	240	4	181	110	249	187	21
RTOR Reduction (vph)	0	6	0	0	74	0	0	0	63	0	4	0
Lane Group Flow (vph)	0	86	0	0	328	0	0	185	47	249	204	0
Heavy Vehicles (%)	22%	6%	2%	3%	2%	6%	2%	18%	8%	10%	16%	5%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		22.0			22.0			37.5	37.5	53.0	53.0	
Effective Green, g (s)		22.0			22.0			37.5	37.5	53.0	53.0	
Actuated g/C Ratio		0.25			0.25			0.43	0.43	0.61	0.61	
Clearance Time (s)		6.0			6.0			6.0	6.0	4.0	6.0	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		451			431			684	601	678	992	
v/s Ratio Prot										c0.05	0.13	
v/s Ratio Perm		0.05			c0.19			0.12	0.03	c0.18		
v/c Ratio		0.19			0.76			0.27	0.08	0.37	0.21	
Uniform Delay, d1		25.5			30.1			15.9	14.6	8.0	7.6	
Progression Factor		1.00			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.2			7.7			1.0	0.3	0.3	0.5	
Delay (s)		25.7			37.8			16.9	14.8	8.3	8.1	
Level of Service		C			D			B	B	A	A	
Approach Delay (s)		25.7			37.8			16.1			8.2	
Approach LOS		C			D			B			A	

Intersection Summary			
HCM 2000 Control Delay	20.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	23	117	10	166	108	354	14	441	157	265	257	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	4.3	3.7	3.7	4.8	2.4	3.7	3.5	3.0	3.4	3.6	3.7
Total Lost time (s)		6.0			6.0			6.0	6.0	4.0	6.0	
Lane Util. Factor		1.00			1.00			1.00	1.00	1.00	1.00	
Frt		0.99			0.92			1.00	0.85	1.00	0.99	
Flt Protected		0.99			0.99			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1945			1894			1788	1449	1713	1761	
Flt Permitted		0.88			0.87			0.99	1.00	0.19	1.00	
Satd. Flow (perm)		1721			1667			1765	1449	345	1761	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	23	118	10	168	109	358	14	445	159	268	260	22
RTOR Reduction (vph)	0	3	0	0	54	0	0	0	61	0	4	0
Lane Group Flow (vph)	0	148	0	0	581	0	0	459	98	268	278	0
Heavy Vehicles (%)	2%	4%	2%	4%	2%	4%	2%	5%	4%	3%	7%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		32.0			32.0			26.4	26.4	43.0	43.0	
Effective Green, g (s)		32.0			32.0			26.4	26.4	43.0	43.0	
Actuated g/C Ratio		0.37			0.37			0.30	0.30	0.49	0.49	
Clearance Time (s)		6.0			6.0			6.0	6.0	4.0	6.0	
Vehicle Extension (s)		3.0			3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		633			613			535	439	368	870	
v/s Ratio Prot										c0.11	0.16	
v/s Ratio Perm		0.09			c0.35			c0.26	0.07	0.25		
v/c Ratio		0.23			0.95			0.86	0.22	0.73	0.32	
Uniform Delay, d1		19.0			26.7			28.5	22.6	16.1	13.2	
Progression Factor		1.00			1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.2			23.8			16.2	1.2	7.0	1.0	
Delay (s)		19.2			50.5			44.7	23.8	23.1	14.2	
Level of Service		B			D			D	C	C	B	
Approach Delay (s)		19.2			50.5			39.4			18.5	
Approach LOS		B			D			D			B	

Intersection Summary			
HCM 2000 Control Delay	35.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	110.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			