Tri City Lands Ltd.

Traffic Impact Assessment

Proposed Spencer Pit - Town of Guelph/Eramosa

April 2014

April 4, 2014

Tri City Lands Ltd.
c/o Mr. Glenn Harrington
Snyders Road, P.O. Box 209
Petersburg, ON N0B 2M0

Dear Sir

RE: Proposed Spencer Pit
Traffic Impact Assessment
Wellington Road 124 / Kossuth Road
Township of Guelph/Eramosa, County of Wellington
Our Project No. 2821569 / 13268

We are pleased to present the enclosed Traffic Impact Assessment analysing the traffic impacts of the proposed Spencer Pit located on the south side of Wellington Road 124 in the vicinity of Kossuth Road in the Township of Guelph/Eramosa, County of Wellington. The proposed Spencer Pit license proposes an annual maximum material extraction of 650,000 tonnes.

This study concludes that the trips associated with the proposed Spencer Pit can be accommodated by the existing roadway system with the implementation of the proposed Pit Access lane configurations at the intersection of Wellington Road 124 / Kossuth Road.

We trust the enclosed is sufficient for your needs, but please do not hesitate to contact the undersigned should you require any additional assistance.

Sincerely
GHD Inc.

J.A. (Jim) Bacchus, B.A., MITE
Service Group Manager, Transport Planning
D 406 752 4345

William Maria, P.Eng.
Transportation Engineer
D 905 814 4397

.../hs

Executive summary

- The proposed Spencer Pit license proposes an annual maximum material extraction of 650,000 tonnes. This translates into an hourly truck traffic generation of up to 6 inbound and 9 outbound trucks during the am peak hour and 9 inbound and 6 outbound trips during the pm peak hour during peak summertime operations.
- Vehicular access for the new pit will be directly to Wellington Road 124 opposite Kossuth Road at its intersection with Wellington Road 124. The site access driveway will create a new four-legged intersection at this location.
- The primary haul route will be east and west respectively along Wellington Road 124 and Hespeler Road (Waterloo Regional Road 24), as well as west on Kossuth Road (Waterloo Regional Road 31). All routes satisfy the Wellington County and Waterloo Region's Official Plan requirements with respect to heavy vehicle goods movement.
- Two future horizon years have been adopted for the future conditions analysis to coincide with the projected opening year of the Pit in 2015, as well as a 2020 scenario (five years beyond the initial operating year) to provide a longer-term Pit-impact assessment in context with predicted non-Pit generated future traffic growth along the haul routes.
- An annual growth rate of 5% was (conservatively) applied to the baseline 2013 traffic flows to predict future non-pit related traffic volumes along the haul routes under both 2015 and 2020 scenarios.
- The existing peak directional volumes on Wellington Road 124 just east of the Kossuth Road intersection (am peak hour northbound and pm peak hour southbound) range between 1020 and 1135 vehicles per hour respectively. This volume of traffic exceeds typical regional arterial roadway planning capacities (generally in the range of 800 to 1,000 vehicles per hour per lane).
- Considering future background traffic growth, the estimated 2020 background (without Pit traffic) peak direction volumes on Wellington Road 124 just east of the Kossuth Road are expected to increase to approximately 1600 vehicles per hour in the peak direction, which is in excess of this road's theoretical capacity as a two-lane arterial road. Therefore, the widening of Wellington Road 124 (and Hespeler Road into Waterloo Region) to four lanes should be considered by the road authorities in the medium term to accommodate existing and future background traffic growth.
- The results of our analysis indicates that the 2015 background traffic growth, plus trips associated with the proposed Spencer Pit can be accommodated by the existing roadway system with the implementation of exclusive turn lane configurations at the intersection of Wellington Road 124 / Kossuth Road as recommended herein. The intersection is expected to operate at 'good' levels of service (LOS 'C') and within design capacity.
- By 2020, with the implementation of the recommended pit site access improvements, in conjunction with the recommended widening to four lanes of Wellington Road 124/Hespeler Road through the Kossuth Road intersection, future total traffic flows to the 2020 horizon can be accommodated at the study intersection with overall 'good' levels of service (LOS 'C').
- Spencer Pit truck traffic, even at its peak generation levels, only contributes about 1% to the future traffic flows along the haul route roadways examined herein. This indicates it is predicted growth in background traffic flows (in combination with existing traffic volumes) that compels the recommended widening of Wellington Road 124 and that the truck trips introduced by the Spencer Pit do not trigger any adjacent roadway improvements beyond those required to facilitate access into and out of the Pit.

Recommended Site Access Features

- By 2015, the following improvements are recommended at the Wellington Road 124/Kossuth Road intersection to accommodate Spencer Pit-related traffic:
  - A southbound exclusive left turn lane to serve inbound truck trips from the northeast and to separate these turns from the heavy southbound through movement flows;
  - Northbound right turn taper to provide a deceleration facility for inbound trucks to the Pit, and to separate these movements from the heavy northbound traffic flow;
  - A new site access opposite from, and aligned with, Kossuth Road;
  - Associated signalized intersection infrastructure (poles, heads, etc.) to accommodate above;
  - The recommended pit access lane configurations shall be incorporated into the site plans upon acceptance by the road authority.

Recommended Adjacent Roadway Improvements

- By 2020, based on the predicted background traffic growth (and unrelated to the Spencer Pit impacts), the widening of Wellington Road 124 and Hespeler Road to four lanes through the Kossuth Road intersection is recommended.

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1. Introduction and study background

GHD was retained by Tri City Lands Ltd.to conduct a Traffic Impact Study to assess the extent of traffic-related impacts on the abutting roadway system generated by the proposed Spencer Pit. The proposed Spencer Pit is located on the south side of Wellington Road 124 in the vicinity of Kossuth Road in the Township of Guelph/Eramosa, County of Wellington as illustrated on **Figure 1**. The proposed Operations Plan dated February 2014 for the Pit is shown on **Figure 2**.

GHD has reviewed the Wellington County and Waterloo Region's Official Plans, to confirm the abutting roadways are appropriate to be used as haul routes to transport material from the proposed pit to key market areas. These roadways include:

- Wellington Road 124 – to serve the local Guelph area
- Kossuth Road (Waterloo Regional Road 31) – to serve the local Kitchener market
- Hespeler Road (Waterloo Regional Road 24) – to provide a route south to Highway 401 and markets further out to the east and west

The Wellington County Official Plan indicates that all county roads are expected to provide and serve high volumes of traffic including truck traffic. The Waterloo Region Official Plan also identifies all regional roads will be classified as appropriate for trucks unless prohibitions or time restrictions are imposed on particular sections. The excerpts of the Wellington County and Waterloo Region Official Plans are included in **Appendix A**.

In this regard, all three routes are appropriate to carry forward as 'haul routes' for material shipped from the proposed Spencer Pit. Therefore, we have assumed the transport of material from the Spencer Pit will occur equally along each of the abutting roadways to serve local and broader markets. It is likely that there will be periods of time that a higher proportion of truck trips will utilize one or the other haul roads, but such fluctuations in market demand for product would not dictate or necessitate substantive changes in the predicted impacts from the proposed pit, as will be discussed and presented herein.

1.1 Statement of qualifications

Our Service Group Manager and Transportation Engineer have a reputation for delivering traffic engineering solutions that are practical and innovative. Below we describe the qualifications and experience each brings to this project.

William Maria | Transportation Engineer, Project Manager

Qualifications	Bachelor of Engineering (civil), 1998
Experience	Will provides services to clients that enable them to optimize their transportation systems and to plan (and budget) effectively for growth. These services include: transportation planning; traffic engineering and parking; site traffic analysis; urban transit operations and project management. He has over 14 years' experience in these fields in Ontario. As Project Manager on this project, Will was responsible for the successful planning, execution, monitoring and control of the project
Professional Designations	Member of the Professional Engineers of Ontario (PEO)

Jim Bacchus | Service Group Manager, Transport Planning

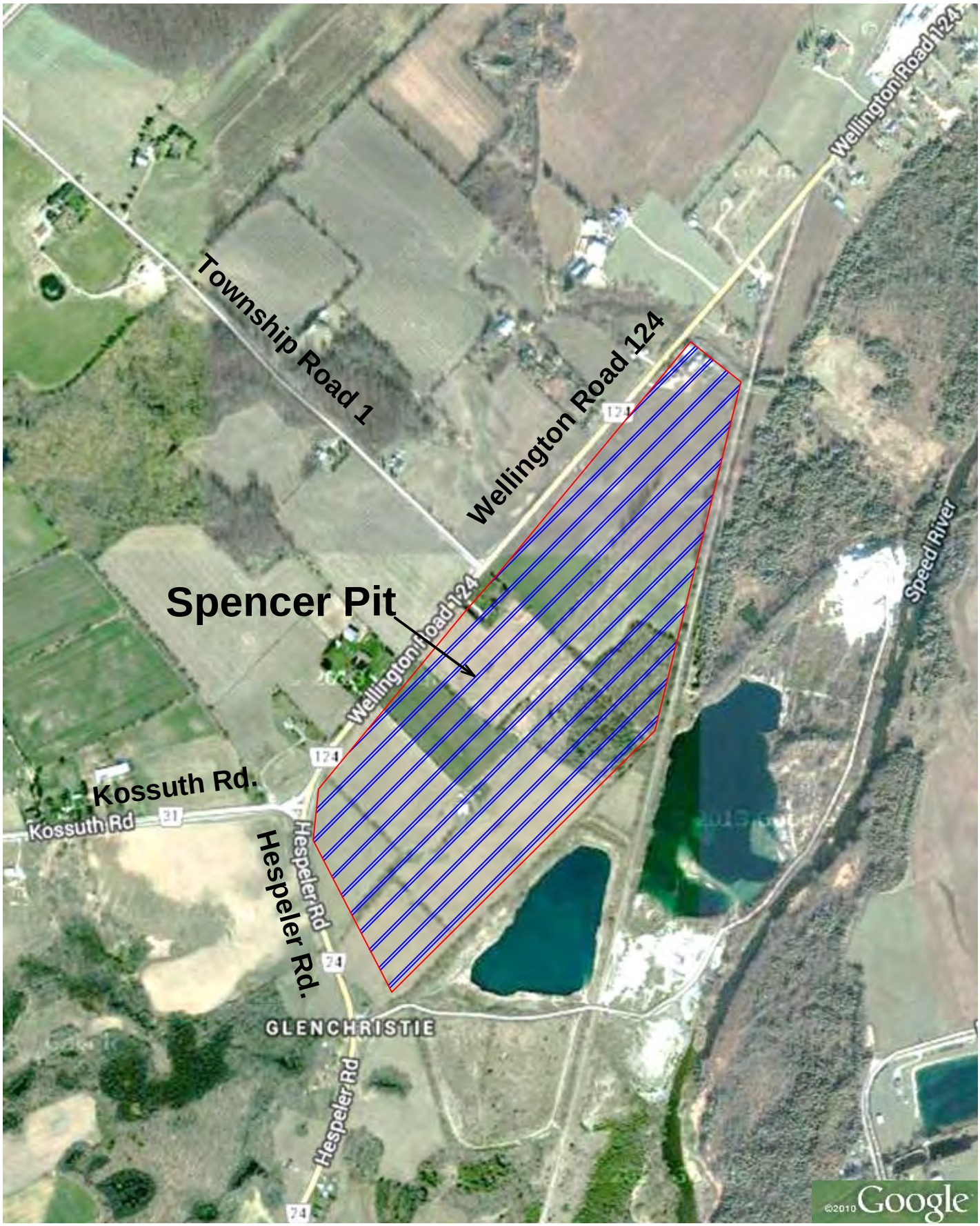
Qualifications	B.A.
Experience	Jim provides services to clients in transportation planning, traffic engineering, expert testimony, and project management based on 20 years of local and international experience in his field. In addition, Jim manages GHD's Transport Planning team in Canada. Jim was technical advisor for the project and provided quality control and assurance (QA/QC).
Professional Designations	Member, Institute of Transportation Engineers

1.2 Project team

The GHD team involved in the preparation of this study are:

- Mr J.A. (Jim) Bacchus, B.A., MITE, Service Group Manager, Transport Planning
- Mr William Maria, P.Eng., Transportation Engineer
- Mr Hong Shen, M.Eng., P.Eng., Transportation Engineer
- Mr Michael Dowdall, Dipl.T., Transportation Analyst

Their CVs are in **Appendix G**.



NOT TO SCALE

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GHD

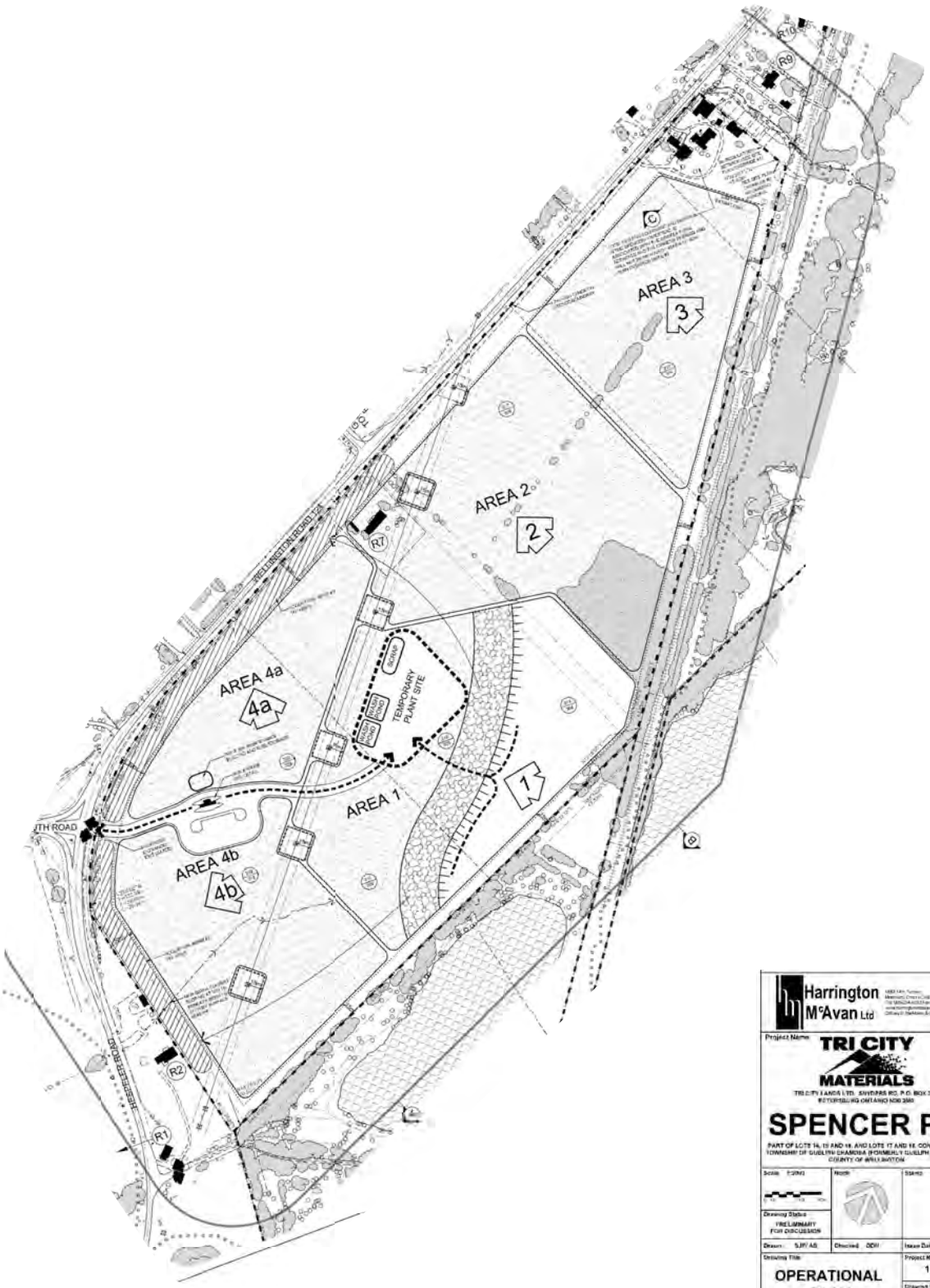
Tri City Materials
Traffic Impact Assessment
Proposed Spencer Pit
Site Location

Job Number	2821569
Revision	A
Date	Apr 2014

Figure 1

6705 Millcreek Drive, Unit 1, Mississauga Ontario L5N 5M4 **T** 1 416 213 7121 **F** 1 416 890 8499 **E** info@ghdcanada.com **W** www.ghd.com

Plot Date: 4 April 2014 - 10:29 AM Plotted by: Michael Dowdall Cad File No: X:\SernasTransTech\Projects\2013\13268 SPENCER PIT\Analysis\April 2014 Update\13268 Spencer Pit Figures - Apr 4-2014.dwg



Harrington McAvan Ltd

Project Name: TRI CITY MATERIALS

SPENCER PIT

PART OF LOTS 14, 15 AND 16, AND LOTS 17 AND 18, CONCESSION 9
TOWNSHIP OF GUELPH CHARDON (FORMERLY GUELPH TOWNSHIP)
COUNTY OF WELLINGTON

Drawing Status: PRELIMINARY FOR DISCUSSION

OPERATIONAL PLAN PHASE A

Project Number: 10-47

Drawing Number: 2 OF 5

Source from Harrington McAvan Ltd.

NOT TO SCALE

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GHD

Tri City Materials
Traffic Impact Assessment
Proposed Spencer Pit
Site Operational Plan

Job Number 2821569
Revision A
Date Apr 2014

Figure 2

6705 Millcreek Drive, Unit 1, Mississauga Ontario L5N 5M4 **T** 1 416 213 7121 **F** 1 416 890 8499 **E** info@ghdcanada.com **W** www.ghd.com

Plot Date: 4 April 2014 - 10:28 AM Plotted by: Michael Dowdall Cad File No: X:\SernasTransTech\Projects\2013\13268 SPENCER PIT\Analysis\April 2014 Update\13268 Spencer Pit Figures - Apr 4-2014.dwg

2. Baseline traffic conditions

This section summarizes the proposed haul routes and surrounding road network, summarizes the data collection program, presents the existing traffic volume conditions on the proximate study area roadways and assesses the current operating conditions at the intersection examined in this study (Wellington Road 124 / Kossuth Road). These 'baseline conditions' form the foundation for future background traffic projections and the incremental site-impact analyses investigated later herein.

2.1 Haul route roadways

Wellington Road 124 is a rural, two-lane roadway generally oriented in a north-south direction, with a posted speed limit of 70 km/h in the study area, and under the jurisdiction of the County of Wellington.

Hespeler Road (Regional Road 24) is generally oriented in a north-south direction and has a two-lane rural cross section with a posted speed limit of 80 km/h. It is under the jurisdiction of the Region of Waterloo.

Kossuth Road (Regional Road 31) also under the jurisdiction of the Region of Waterloo, is generally oriented in an east-west direction and has a two-lane rural cross section with a statutory speed limit of 80km/h.

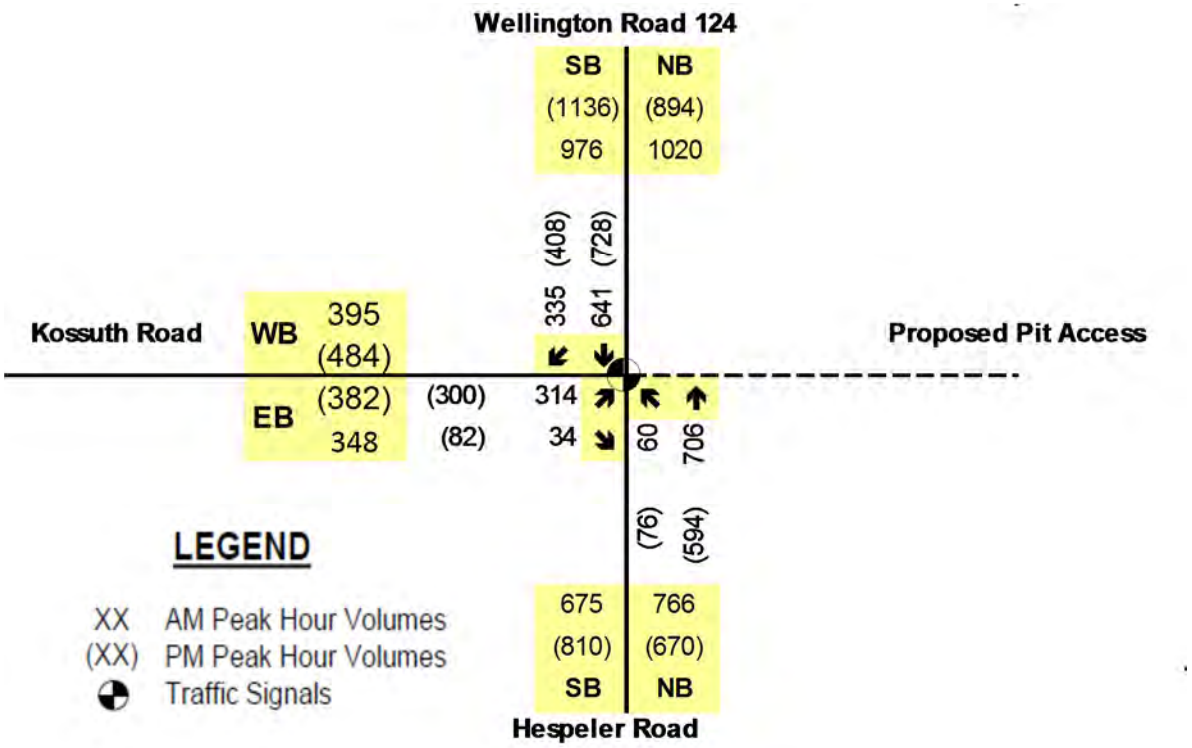
The Wellington Road 124 / Hespeler Road intersection at Kossuth Road is currently signalized with a northbound left turning lane, eastbound and southbound channelized right turn lanes.

2.2 2013 baseline traffic volumes

A weekday turning movement survey was conducted by GHD in October 2013 (attached in **Appendix A**) at the intersection of Wellington Road 124 (Hespeler Road) and Kossuth Road. The am and pm peak hour volumes from this count are shown in **Figure 3**.

To consider seasonal traffic variations, we have reviewed the MTO 2010 Seasonal Variation Factors for a suburban commuter route, which is the current designation of Highway 7 in the vicinity of the site. The seasonal variation from October to the peak annual traffic condition indicated in the MTO data (May) indicates similar levels of traffic volume. Therefore, we have not applied a seasonal adjustment to the October 2013 turning movements. A copy of the MTO Seasonal Adjustment Factors for 2010 is attached in **Appendix A**.

Figure 3 Baseline (2013) traffic Volumes



2.3 Intersection operations

The 2013 baseline traffic volumes were subjected to intersection capacity analyses to identify how the study intersections are operating. The analysis contained within this report utilizes the Highway Capacity Manual (HCM) 2000 techniques applying Synchro Version 8 Software package and following the Region of Waterloo's guidelines for intersection analyses. The existing signal timings for the intersection of Wellington Road 124/Hespeler Road and Kossuth Road were obtained from the County of Wellington and are provided in **Appendix A**.

The reported intersection volume-to-capacity ratios (v/c) are a measure of the saturation volume for each turning movement, while the levels-of-service (LOS) are a measure of the average delay for each turning movement. Queuing characteristics are reported as the predicted 95th percentile queue for each turning movement.

For analysis purpose, 'critical' intersection movements are defined as traffic movements where:

- Volume to capacity (V/C) ratio of through movement or shared through/turning movement exceeds 0.85; or
- Volume to capacity (V/C) ratio of an exclusive turning movement exceeds 1.0.

Table 1 summarizes the results of the intersection capacity analyses, while **Appendix B** contains the detailed 2013 baseline intersection capacity/summaries

Table 1 2013 Baseline traffic conditions

Intersection	AM Peak Hour			PM Peak Hour		
	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)
Hespeler Road (RR24) /Wellington Road 124 & Kossuth Road (RR31)	0.76 (B) 17	EBL = 0.62 (C) 21 EBR = 0.03 (A) 0 NBL = 0.36 (B) 12 NBT = 0.86 (C) 23 SBT = 0.78 (B) 18 SBR = 0.27 (A) 0	EBL = 65 m EBR = 0 m NBL = 20 m NBT = 185 m SBT = 160 m SBR = 0 m	0.76 (B) 15	EBL = 0.6 (C) 21 EBR = 0.06 (A) 0 NBL = 0.64 (C) 25 NBT = 0.72 (B) 15 SBT = 0.86 (C) 22 SBR = 0.32 (A) 1	EBL = 60 m EBR = 0 m NBL = 35 m NBT = 145 m SBT = 190 m SBR = 0 m

Under 2013 baseline traffic conditions, this signalized intersection is operating at LOS 'B' during both the weekday am and pm peak hours with overall delays of 17 and 15 seconds, respectively. The overall v/c ratios during the weekday am and pm peak hours are 0.76.

During the weekday am peak hour, the northbound through movement is identified as a critical movement (albeit only marginally, with a v/c ratio of 0.86); the northbound through vehicle queues occasionally reach 185 metres. During the weekday pm peak hour, the southbound through movement is identified as a critical movement (again, only marginally with a v/c ratio of 0.86); the southbound through vehicle queues occasionally reach 190 metres.

There is queuing evident in the northbound and southbound through movements due to the high volumes along Wellington Road 124/Hespeler Road.

It should be noted that the existing peak directional volumes on Wellington Road 124 just east of Kossuth Road range from between 1020 to 1135 vehicles per hour (am northbound and pm southbound respectively). This demand volume exceeds typical theoretical capacity of this type of roadway (i.e., regional arterial), which is generally in the range of 800 to 1,000 vehicles per hour per lane. However, it is important to state that by virtue of the current volume of traffic being successfully 'processed' by this facility (in excess of this theoretical capacity range), the road's 'real' capacity is at least as high as the observed volume of 1135 vehicles per hour. Nevertheless, prioritizing the widening Wellington Road 124 / Hespeler Road from two-lanes to four lanes in the near term should be considered by the road authorities (at least a localized widening through the Kossuth Road intersection).

3. Future background traffic conditions

This section presents the future background traffic conditions for the adopted time horizons of 2015 and 2020. These horizon years were selected to coincide with the projected initial year of operations (estimated for 2015) and to provide a longer-term planning horizon five years beyond the Pit opening (2020). This is a typical analysis approach used in the preparation of traffic impact studies.

3.1 Roadway improvements

According to Region of Waterloo Transportation Master Plan (January 2011), the widening of Kossuth Road is identified, but beyond a 20 year time horizon. Based on consultation with Wellington County staff, Wellington Road 124 is scheduled to be resurfaced from Kossuth to the City of Guelph limits in the next five years (within the study horizon year of 2020). There are no road widening improvements programmed by Wellington County and Waterloo Region for any identified haul route roadways within the time horizons selected for this study. Therefore, the existing lane configurations are carried forward into the future analyses as a base condition.

3.2 Future traffic growth

A new crossing of the Grand River in Waterloo, The Fairway Road Bridge, opened in December 2012. As a result of this new crossing, and in evidence from a review of traffic data collected by the Region of Waterloo and the County of Wellington obtained for this study before and after the bridge opening, some traffic patterns have changed on Kossuth Road, Hespeler Road and Wellington Road 124, making it difficult to credibly apply a blanket growth rate to account for future background traffic increases.

However, based on a review of pre-bridge growth in these corridors and a comparison of post-bridge traffic trends during two data points collected in 2013 (both post-bridge opening), an annual growth rate of 5% was applied to the baseline 2013 traffic flows to predict future non-pit related traffic volumes along the haul routes under both 2015 and 2020 scenarios.

3.3 Future background operating conditions

3.3.1 2015 Future background conditions

The traffic volumes for the near-term 2015 horizon are shown in **Figure 4a**. These am and pm 2015 future background scenarios were then subject to intersection capacity analyses based on the same methodologies utilized for 2013 baseline conditions, (HCM 2000 procedures and Synchro 8 software). Traffic signal timings were optimized using Synchro 8 software.

Table 2 summarizes the future 2015 future background traffic operations for the study intersections. Detailed 2015 future background intersection capacity analysis reports are in **Appendix C**.

Figure 4a Fugure (2015) background traffic volumes

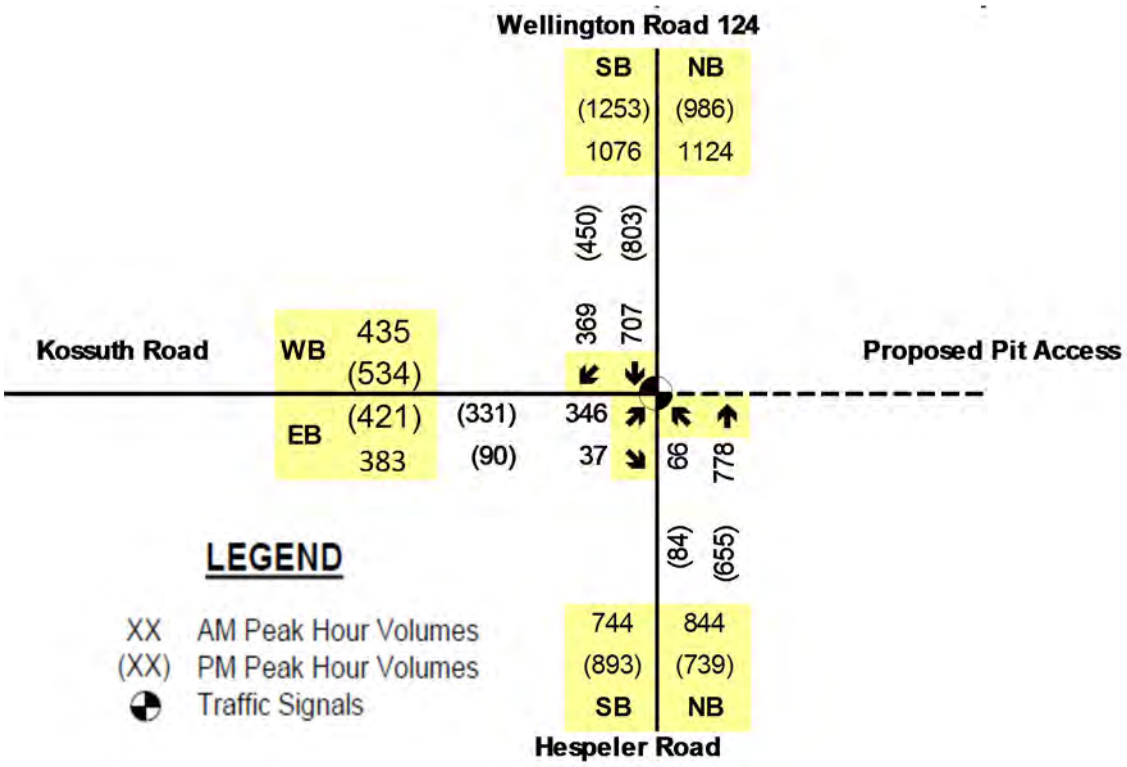


Table 2 2015 Fugure background traffic conditions (without Pit traffic)

Intersection	AM Peak Hour			PM Peak Hour		
	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)
Hespeler Road (RR24) /Wellington Road 124 & Kossuth Road (RR31)	0.83 (C) 20	EBL = 0.71 (C) 27 EBR = 0.03 (A) 0 NBL = 0.46 (B) 15 NBT = 0.9 (C) 28 SBT = 0.82 (C) 20 SBR = 0.29 (A) 0	EBL = 85 m EBR = 0 m NBL = 25 m NBT = 205 m SBT = 175 m SBR = 0 m	0.82 (B) 19	EBL = 0.7 (C) 29 EBR = 0.07 (A) 0 NBL = 0.82 (D) 52 NBT = 0.74 (B) 16 SBT = 0.89 (C) 25 SBR = 0.35 (A) 1	EBL = 85 m EBR = 0 m NBL = 45 m NBT = 135 m SBT = 215 m SBR = 0 m

Under 2015 background conditions, this signalized intersection is expected to operate at LOS 'C' and 'B' during the weekday am and pm peak hours with overall delays of 20 and 19 seconds, respectively. The overall v/c ratios during the weekday am and pm peak hours are 0.83 and 0.82, respectively.

During the weekday am peak hour, the northbound through movement is predicted to be 'critical' (>0.85) with a v/c ratio of 0.90 and occasionally significant queuing. During the weekday pm peak hour, the 'returning commuter trip' southbound through the intersection is likewise identified as critical with a v/c ratio of 0.89 and occasionally significant queuing.

The projected 2015 background peak directional volumes on Wellington Road 124 (their highest level predicted just east of Kossuth Road) are expected to grow to between 1125 to 1250 vehicles per hour (am northbound and pm southbound respectively). As mentioned under the existing conditions, this future demand volume exceeds the typical theoretical capacity of a regional arterial

roadway. This reinforces the recommendation that the road authorities should investigate (indeed prioritize) improvements in this corridor in the short term (at least a localized widening through the Wellington Road 124 / Hespeler Road intersection).

3.3.2 2020 Future background conditions

The estimated 5% per annum growth rate was then applied to simulate the 2020 horizon with the results shown in **Figure 4b**.

The 2020 future background scenario was then subject to intersection capacity analyses based on the same methodologies utilized previously.

Table 3a summarizes the future 2020 future background traffic operations for the study intersections. Detailed 2020 future background intersection capacity analysis reports are in **Appendix D**.

Figure 4b Fugure (2020) background traffic volumes

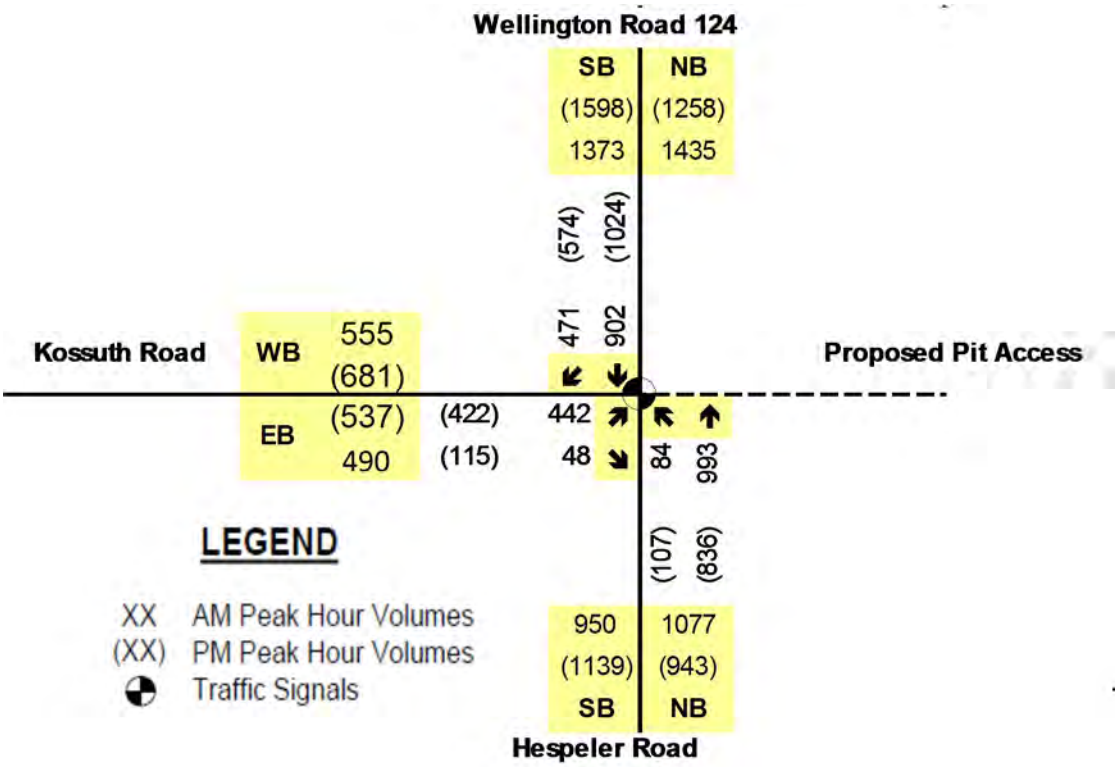


Table 3a 2020 Fugure background traffic conditions (without Pit traffic)

Intersection	AM Peak Hour			PM Peak Hour		
	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)
Hespeler Road (RR24) /Wellington Road 124 & Kossuth Road (RR31)	1.05 (D) 52	EBL = 1.04 (F) 95 EBR = 0.04 (A) 0 NBL = 0.75 (D) 54 NBT = 1.00 (D) 49 SBT = 1.03 (E) 64 SBR = 0.37 (A) 1	EBL = 200 m EBR = 0 m NBL = 35 m NBT = 370 m SBT = 350 m SBR = 0 m	1.09 (D) 53	EBL = 1.1 (F) 117 EBR = 0.09 (A) 0 NBL = 0.97 (F) 106 NBT = 0.82 (B) 20 SBT = 1.1 (F) 83 SBR = 0.45 (A) 1	EBL = 200 m EBR = 0 m NBL = 55 m NBT = 225 m SBT = 405 m SBR = 0 m

Under 2020 background conditions, this signalized intersection is expected to operate at LOS 'D' during both the weekday am and pm peak hours with overall delays of 52 and 53 seconds, respectively. The overall v/c ratios during the weekday am and pm peak hours are 1.05 and 1.09, respectively, indicating the intersection will reach its design capacity (likely sometime before 2020).

During the weekday am peak hour, the eastbound left turn, northbound and southbound through movements will reach saturation with v/c ratios of 1.04, 1.00 and 1.03, respectively. During the weekday pm peak hour, the eastbound and northbound left turn, and southbound through movements will likewise reach design capacity with v/c ratios of 1.10, 0.97 and 1.10, respectively.

The projected 2020 Background peak directional volumes on Wellington Road 124 just east of Kossuth Road range from between 1435 to 1600 vehicles per hour (am northbound and pm southbound respectively). This demand volume exceeds typical theoretical capacity of this type of roadway (i.e., regional arterial). Therefore, the widening of Wellington Road 124 / Hespeler Road to four lanes (at least through this intersection) is recommended within the study horizon year of 2020 to accommodate the future predicted traffic demand.

To provide an operational analysis of the long-term horizon with the recommended intersection widening in place, we have re-run the Synchro analyses with two through lanes along Wellington Road 124.

Table 3b summarizes the future 2020 future background traffic operations with the widening of Wellington Road 124 /Hespeler Road to four lanes. Detailed 2020 future background intersection capacity analysis reports are in **Appendix D**.

Table 3b Future background traffic conditions (with Wellington Road 124 / Hespeler Road widening)

Intersection	AM Peak Hour			PM Peak Hour		
	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)
Hespeler Road (RR24) /Wellington Road 124 & Kossuth Road (RR31)	0.78 (B) 17	EBL = 0.85 (C) 35 EBR = 0.04 (A) 0 NBL = 0.52 (B) 18 NBT = 0.63 (B) 14 SBT = 0.71 (C) 20 SBR = 0.37 (A) 1	EBL = 125 m EBR = 0 m NBL = 15 m NBT = 85 m SBT = 95 m SBR = 0 m	0.8 (B) 16	EBL = 0.83 (C) 33 EBR = 0.09 (A) 0 NBL = 0.72 (C) 32 NBT = 0.53 (B) 12 SBT = 0.77 (C) 21 SBR = 0.45 (A) 1	EBL = 120 m EBR = 0 m NBL = 25 m NBT = 65 m SBT = 110 m SBR = 0 m

Under 2020 future background traffic conditions, with the implementation of a localized widening of Wellington Road 124 / Hespeler Road to four lanes through the Kossuth Road intersection, this signalized intersection is expected to operate at an improved overall LOS 'B' during both weekday am and pm peak hours with overall delays of 17 and 16 seconds, respectively. The overall v/c ratios during the weekday am and pm peak hours are 0.78 and 0.80, respectively. Further, all individual movements are likewise expected to operate at 'good' levels of service (LOS 'B') with no critical movements to report.

4. Site Generated Traffic

4.1 Traffic generation

In order to generate the estimated truck traffic associated with the application, the following assumptions and base data have been adopted based on the proposed Operations Plan dated April 2014:

- Annual Extraction Limit (License application) = 650,000 tonnes
- Pit operations proposed as follows:
  - Weekday shipping hours of 6:00 am to 7:00 pm (13 hours)
  - Saturday shipping hours of 6:00 am to 6:00 pm (12 hours)
  - Total of 77 shipping hours a week or an average of 334 hours a month
  - Average truck capacity = 35 tonnes

The Pit is proposed to operate year round from January to December with variable amounts of material extraction and shipping depending on the month. Based on estimates from our experience on previous pit applications, peak shipping generally occurs during the 'construction season' between the months of June and October. Based on our expectations, it is likely that a maximum of up to 65,000 tonnes of material shipped per month during this busy construction period. **Table 4** below summarizes the monthly breakdown of material extraction based on this activity presumption.

Table 4 Monthly material shipping estimates

Month	Material Volume/Month (tonnes)
January	37000
February	37000
March	37000
April	57000
May	57000
June	65000
July	65000
August	65000
September	65000
October	65000
November	57000
December	43000

To account for the occasional periods of higher-volume trucking that is likely to occur during high-construction activity (typically between June and October) the trip generation used in the analysis of Pit-generated traffic impacts is based on the peak level of shipping / trucking activity during these busy summertime periods. During this peak season, a total of 65,000 tonnes of material is proposed to be extracted per month. This equates to 195 tonnes of material per hour based on an average of 334 shipping hours per month. With a capacity of approximately 35 tonnes per truck, 195 tonnes of material extraction generates 6 outbound loaded truck trips per hour (plus the same number of returning trucks).

It has been our experience that additional peaking occurs during early morning shipping activity, as it is common for trucks to be loaded and waiting to leave the Pit before 6:00 am when the scales begin operation and shipping commences. As a result, a surge of outbound loaded trucks could occasionally occur creating a short-lived 'peak within a peak' condition (generally occurring prior to the adjacent street peak). Similarly, in the afternoon as closing time approaches, a spike in empty inbound trucks might also occur as operators attempt to deliver a late-in-the-day shipment to construction sites.

To account for this peaking, the am peak hour outbound and pm peak hour inbound truck volume was increased by an additional 50%, equating to 9 loaded truck trips per hour. We have adopted this peak trip generation as the design-hour vehicle volume for our site-impact analysis that follows. As alluded to above, these 'peak within a peak' activities are predicted to occur largely outside of the adjacent street peak hours, so in this respect we are predicting an unlikely (and conservative) scenario of the Pit and adjacent street peaks coinciding.

It is acknowledged that there may also be on-site recycling of asphalt and concrete at this pit, but this is not planned to be a regular occurrence. Furthermore, it is likely that most of this incoming recyclable material is already accounted for by the estimated inbound trucks for material pick-up and outbound shipping. Therefore, the traffic flows associated with this potential occasional activity have not been considered separately in the analysis, their effects largely captured by the estimated volume of returning 'inbound' trucks.

With adoption of the various peaking factors described above and employed in the regular aggregate shipping activity estimates, we have portrayed a conservative (high) trucking activity level of site-related traffic flows, and therefore impacts on the abutting street system.

4.2 Traffic distribution and assignment

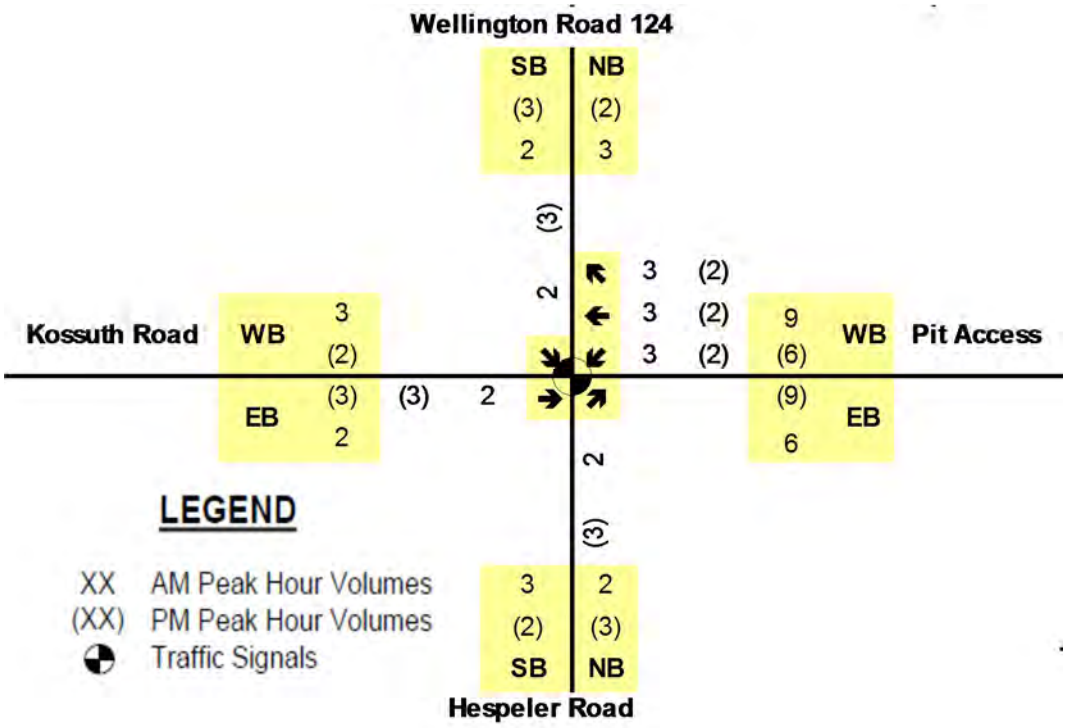
Consultations with the applicant have indicated that about one-third of the material will be destined to the Guelph area; one-third to the Kitchener area; and one-third south to Highway 401 (to markets further away to the east and west). Therefore, we have assigned the predicted Pit-generated trucks onto the prescribed haul route in equal measure to the following routes:

- Right turns out to go northbound along Wellington Road 124 to Guelph;
- Through moves out to go westbound along Kossuth Road to Kitchener; and
- Left turns out to go southbound along Hespeler Road to Highway 401.

All these roadways have been deemed acceptable and appropriate for use as aggregate haul routes as per Wellington County and Waterloo Region Official Plans.

The above-noted traffic distribution has been applied to the calculated estimates of the peak hourly truck trips as described in **Section 4.1** and the resultant truck traffic volume assignments are shown in **Figure 5**.

Figure 5 Total site traffic volumes



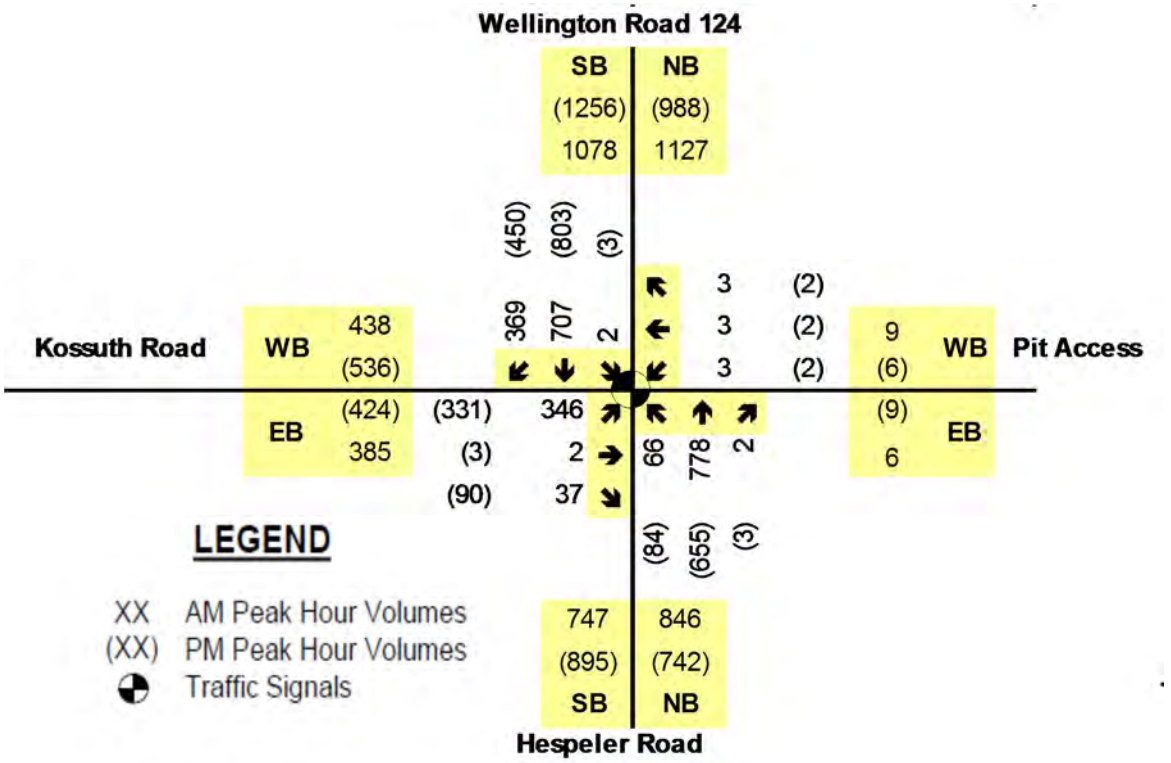
5. Total future traffic impact analysis

For the purpose of the site impact analyses, we have employed Passenger Car Equivalent (PCE) factors to account for the additional time it takes a heavy vehicle (in this case, different PCE's for each the loaded and empty gravel trucks) to travel through an intersection. Based on our experience, we have adopted a PCE of 3.5 for outbound loaded trucks and a PCE of 2.0 for inbound empty trucks. The truck traffic volumes expressed as PCEs are shown in a figure contained in **Appendix E**. Traffic signal timings were optimized using Synchro 8 software.

5.1 2015 Total future operations

The estimated truck trip assignments (**Figure 5**) have been combined with the 2015 future background traffic (**Figure 4a**) to produce the estimated 2015 Total Future Traffic shown in **Figure 6a**.

Figure 6a Total (2015) future traffic volumes



The total volumes were then subject to intersection capacity analyses based on the same methodologies utilized previously herein, plus the PCE flows for Spencer truck traffic. **Table 5** summarizes the 2015 total future traffic operations. Detailed 2015 total future intersection capacity analysis reports are included in **Appendix E**.

Table 5 2015 Total future traffic conditions (with Pit traffic included)

Intersection	AM Peak Hour			PM Peak Hour		
	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)
Hespeler Road (RR24) /Wellington Road 124 & Kossuth Road (RR31)	0.95 (C) 30	EBTL = 0.97 (E) 62 EBR = 0.03 (A) 0 WBTLR = 0.12 (B) 17 NBL = 0.57 (C) 22 NBT = 0.95 (D) 37 NBR = 0.01 (A) 10 SBL = 0.09 (B) 12 SBT = 0.86 (C) 26 SBR = 0.29 (A) 1	EBTL = 120 m EBR = 0 m WBTLR = 10 m NBL = 30 m NBT = 210 m NBR = 0 m SBL = 5 m SBT = 180 m SBR = 0 m	0.92 (C) 28	EBTL = 0.99 (E) 75 EBR = 0.07 (A) 1 WBTLR = 0.08 (C) 23 NBL = 0.85 (E) 65 NBT = 0.74 (B) 20 NBR = 0.01 (A) 10 SBL = 0.06 (A) 10 SBT = 0.89 (C) 29 SBR = 0.35 (A) 1	EBTL = 150 m EBR = 0 m WBTLR = 10 m NBL = 50 m NBT = 150 m NBR = 0 m SBL = 5 m SBT = 220 m SBR = 0 m

The following lane configurations are recommended at the Wellington Road 124/Kossuth Road intersection to accommodate Spencer Pit-related traffic:

- A southbound exclusive left turn lane to serve inbound truck trips from the northeast and to separate these turns from the heavy southbound through movement flows
- Northbound right turn taper to provide a deceleration facility for inbound trucks to the Pit, and to separate these movements from the heavy northbound traffic flow
- A new site access opposite from, and aligned with, Kossuth Road

Figure 7 is a concept design illustrating the above recommended lane configurations for the Wellington Road 124/Kossuth Road (Pit Access) intersection to accommodate Pit-related traffic.

Based on the above lane configuration, under 2015 future total traffic conditions, this signalized intersection is expected to operate at LOS 'C' during both the weekday am and pm peak hours with overall delays of 30 and 28 seconds, respectively. The overall v/c ratios during the weekday am and pm peak hours are 0.95 and 0.92, respectively, indicating that the intersection is expected to operate within its theoretical design capacity under the existing two-lane Wellington Road 124 configuration. While it is acknowledged that the intersection is expected to operate with high v/c ratios, these metrics are balanced by the 'good' LOS and short delays expected.

During the weekday am peak hour, the eastbound shared left-through, northbound and southbound through movements are identified as critical movements with v/c ratios of 0.97, 0.95 and 0.86, respectively. During the weekday pm peak hour, the eastbound shared left-through and southbound through movement are identified as critical movements with v/c ratios of 0.99 and 0.89, respectively.

It should be noted that the Spencer Pit traffic does not contribute volumes to previously identified critical movements, nor does predicted site traffic make those operations significantly worse than during the future background condition. This suggests that with construction of the recommended turn lanes at the Pit access, Spencer Pit traffic can be accommodated by the existing two-lane Wellington Road 124 facility with acceptable impacts on the pre-existing (background) intersection operations.

Furthermore, even under the projected seasonal / daily peak truck trip generation scenario, traffic generated by the Spencer Pit represents less than 1% of the expected 2015 total future flows along

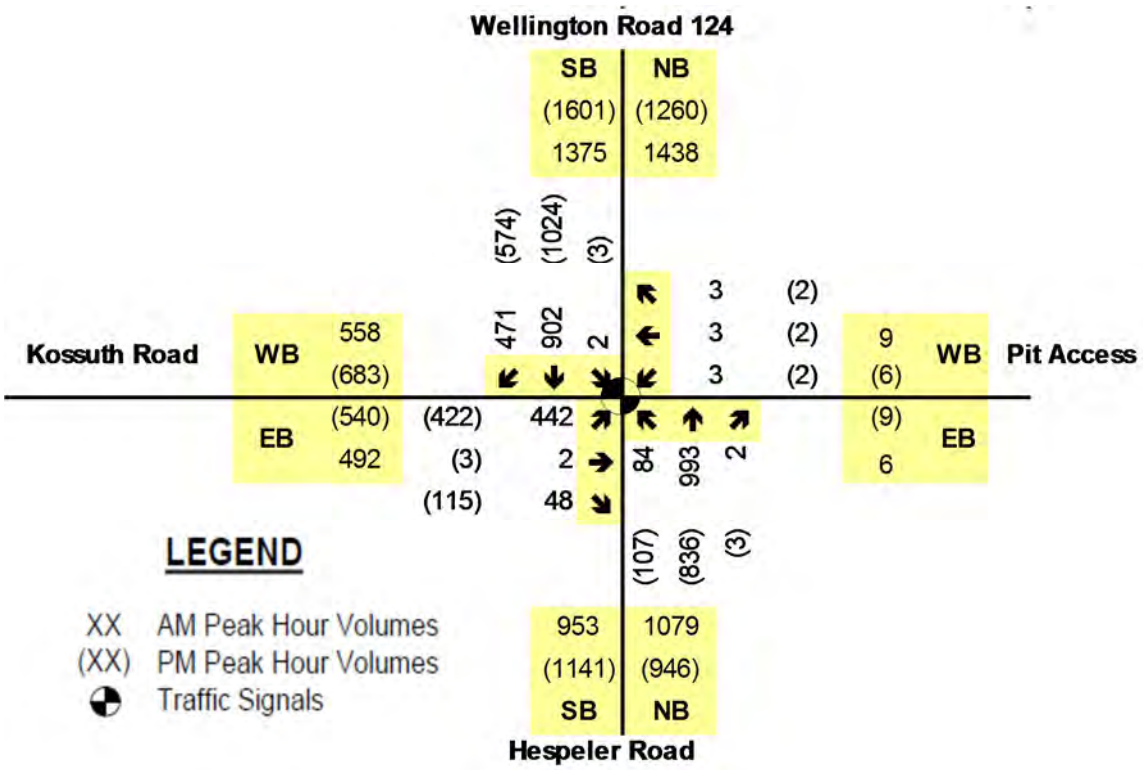
Wellington Road 124. This represents an imperceptible change in traffic flow and is well within what would be expected in daily traffic volume variation.

5.2 2020 Total future operations

The estimated truck trip assignments (**Figure 5**) w combined with the 2020 future background traffic (**Figure 4b**) to produce the estimated 2020 Total Future Traffic shown in **Figure 6b**.

The total 2020 volumes were then subject to intersection capacity analyses based on the same methodologies utilized previously herein, again using the PCE flows for Spencer truck traffic. The intersection upgrades and site access recommended for the 2015 condition (see **Figure 7**) have been dutifully incorporated into the 2020 horizon analysis.

Figure 6b Total (2020) future traffic volumes



For comparison purposes, total 2020 capacity analyses includes two scenarios; Wellington Road 124 as one lane in each direction, and the widening of Wellington Road 124 (and Hespeler Road) to four lanes through the intersection at Kossuth Road.

Table 6a summarizes the 2020 total future traffic operations with existing Wellington Road 124 one lane in each direction. Detailed 2020 total future intersection capacity analysis reports are included in **Appendix F**.

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

N

GHD
6705 Millcreek Drive, Unit 1
Mississauga Ontario L5N 5M4
T 1 416 213 7121 F 1 416 890 8499
E ytomail@ghd.com W www.ghd.com

Drawn	M.D.	Designer	M.D.
Drafting Check	J.B.	Design Check	J.B.
Approved (Project Director)	W.M.		
Date	November 13, 2013		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client **Tri City Lnads Ltd.**
Project **Spencer Pit**
Title **Wellington Road 124 / Kossuth Road (Site Access) Concept Design**

Original Size Arch D **Drawing No: Figure 7** **Rev: A**

Plot Date: 21 November 2013 - 6:22 PM Plotted by: Hong Shen

Cad File No: X:\Transtech\Project Files\2013\13268 SPENCER PIT\Analysis\Functional Design\Fig 7 - FD-1 Sketch (UPDATED) - Nov 21, 2013.dwg

Table 6a 2020 Total future traffic conditions (without Wellington Road 124 widening)

Intersection	AM Peak Hour			PM Peak Hour		
	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)
Hespeler Road (RR24) /Wellington Road 124 & Kossuth Road (RR31)	1.22 (F) 99	EBTL = 1.26 (F) 174 EBR = 0.04 (C) 25 WBTLR = 0.13 (C) 26 NBL = 0.75 (D) 53 NBT = 1.12 (F) 94 NBR = 0.01 (B) 12 SBL = 0.14 (C) 22 SBT = 1.17 (F) 121 SBR = 0.40 (C) 20	EBTL = 225 m EBR = 10 m WBTLR = 15 m NBL = 40 m NBT = 400 m NBR = 0 m SBL = 10 m SBT = 380 m SBR = 30 m	1.26 (F) 93	EBTL = 1.27 (F) 179 EBR = 0.14 (C) 28 WBTLR = 0.09 (C) 28 NBL = 0.98 (F) 105 NBT = 0.92 (D) 36 NBR = 0.01 (B) 11 SBL = 0.13 (B) 18 SBT = 1.25 (F) 153 SBR = 0.50 (C) 20	EBTL = 220 m EBR = 25 m WBTLR = 10 m NBL = 55 m NBT = 300 m NBR = 0 m SBL = 5 m SBT = 440 m SBR = 45 m

With the lane configurations discussed in 2015 future total scenario, under 2020 future total traffic conditions, this signalized intersection is expected to experience congestion and long delays with overall delays of 99 and 93 seconds, respectively during the weekday am and pm peak hours. The overall v/c ratios during the weekday am and pm peak hours are 1.22 and 1.26, respectively, indicating the intersection is expected to exceed its design capacity.

During the weekday am peak hour, the eastbound shared left-through, northbound and southbound through movements are identified as critical movements with v/c ratios of 1.26, 1.12 and 1.17, respectively. During the weekday pm peak hour, the eastbound shared left-through, northbound left turn, northbound through, and southbound through movements are identified as critical movements with v/c ratios of 1.27, 0.98, 0.92 and 1.25, respectively.

As discussed in **Section 3.3.2**, considering future background traffic growth, the estimated 2020 background (without Pit traffic) peak direction volumes on Wellington Road 124 just east of the Kossuth Road are expected to increase to approximately 1600 vehicles per hour in the peak direction, far in excess of this road's theoretical capacity as a two-lane arterial road. This indicates that it is predicted growth in background traffic flows (in combination with existing traffic volumes) that compels the widening of Wellington Road 124 and that the truck trips introduced by the Spencer Pit do not trigger the widening of the facility.

Table 6b summarizes the 2020 total future traffic operations with the widening of Wellington Road 124 (and Hespeler Road) to four lanes. Detailed 2020 total future intersection capacity analysis reports are included in **Appendix F**.

Table 6b 2020 Total fugure traffic conditions (with Wellington Road 124 widening)

Intersection	AM Peak Hour			PM Peak Hour		
	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)	Overall v/c (LOS) Delay in Seconds	Critical/ Key Movements v/c (LOS) Delay in Seconds	95th %ile Queues (m)
Hespeler Road (RR24) /Wellington Road 124 & Kossuth Road (RR31)	0.93 (C) 29	EBTL = 0.96 (D) 55 EBR = 0.04 (A) 1 WBTLR = 0.10 (B) 14 NBL = 0.67 (D) 37 NBT = 0.77 (C) 26 NBR = 0.01 (B) 15 SBL = 0.09 (C) 22 SBT = 0.86 (D) 36 SBR = 0.37 (A) 1	EBTL = 160 m EBR = 0 m WBTLR = 10 m NBL = 25 m NBT = 120 m NBR = 0 m SBL = 5 m SBT = 135 m SBR = 0 m	0.93 (C) 29	EBTL = 0.96 (D) 55 EBR = 0.09 (A) 1 WBTLR = 0.03 (B) 15 NBL = 0.77 (D) 46 NBT = 0.62 (C) 21 NBR = 0.01 (B) 14 SBL = 0.09 (C) 21 SBT = 0.93 (D) 42 SBR = 0.45 (A) 1	EBTL = 155 m EBR = 0 m WBTLR = 10 m NBL = 35 m NBT = 90 m NBR = 0 m SBL = 5 m SBT = 155 m SBR = 0 m

Under 2020 future total traffic conditions, with the implementation of a widening of Wellington Road 124/Hespeler Road to four lanes through the Kossuth Road intersection, this signalized intersection is expected to operate at a LOS 'C' during both the weekday am and pm peak hours with overall delays of 29 and 29 seconds, respectively. The overall v/c ratios during the weekday am and pm peak hours are 0.93 and 0.93, respectively indicating that the intersection is expected to operate within its theoretical design capacity.

During the weekday am peak hour, the eastbound shared left-through and southbound through movements are identified as critical movements (v/c ratios of 0.96 and 0.86) with delays of 55 and 36 seconds, respectively. During the weekday pm peak hour, the eastbound shared left-through and southbound through movements are identified as critical movements (v/c ratios of 0.96 and 0.93) with delays of 55 and 42 seconds, respectively. All other individual movements are expected to operate at acceptable levels of service within their theoretical design capacity.

As is evident from a review of the above, with the implementation of the recommended intersection and pit site access improvements, in conjunction with the widening of Wellington Road 124 and Hespeler Road to four lanes through the Kossuth Road intersection, future total traffic flows to the 2020 horizon can be accommodated at the study intersection with acceptable levels of service. This indicates that it is predicted growth in background traffic flows (in combination with existing traffic volumes) that compels the widening of Wellington Road 124 and that the very few additional truck trips introduced by the Spencer Pit do not trigger the widening of the facility.

Furthermore, as mentioned in the 2015 total future scenario, even under the projected seasonal / daily peak truck trip generation scenario, traffic generated by the Spencer Pit represents less than 1% of the expected 2015 total future flows along Wellington Road 124. This represents an imperceptible change in traffic flow and is well within what would be expected in daily traffic volume variation.

6. Findings and recommendations

The following are key findings with regard to the proposed Spencer Pit application:

- The haul route is proposed as;
  - Wellington Road 124 - to serve the local Guelph area
  - Kossuth Road (Waterloo Regional Road 31) - to serve the local Kitchener market
  - Hespeler Road (Waterloo Regional Road 24) - to provide a route south to Highway 401 and markets further out to the east and west
- The existing operation of the intersection of Wellington Road 124/Hespeler Road and Kossuth Road has good operating characteristics with no 'critical' movements. There is queuing evident in the northbound and southbound through movements due to the high volumes along Wellington Road 124/Hespeler Road.
  - The existing peak directional volumes on Wellington Road 124 just east of Kossuth Road range from between 1020 to 1135 vehicles per hour (AM northbound and PM southbound respectively). This demand volume exceeds typical theoretical capacity of this type of roadway (generally in the range of 800 to 1,000 vehicles per hour per lane), although it must be stated that this volume of traffic was observed processed through the facility, so the 'actual' capacity of Wellington Road 124 / Hespeler Road is at least 1135 vphpl.
- Future background growth is estimated to be 5% per annum and two horizon years were selected for study; 2015 and 2020
- The proposed Pit operation is expected to generate a seasonal / daily peak of 15 (6 inbound and 9 outbound) trips during the morning peak hour and 15 (9 inbound and 6 outbound) trips during the afternoon peak hour. This represents about 1% of the future traffic flows along the abutting haul route roadways.
  - Considering future background traffic growth, the estimated 2020 background (without Pit traffic) peak direction volumes on Wellington Road 124 just east of the Kossuth Road are expected to increase to approximately 1600 vehicles per hour in the peak direction, far in excess of this road's theoretical capacity as a two-lane arterial road. Therefore, the widening of Wellington Road 124 (and Hespeler Road into Waterloo Region) to four lanes should be considered by the road authorities in the medium term (by 2020) to accommodate existing and future background traffic growth.
  - The results of our analysis indicates that the 2015 background traffic growth, plus the trips associated with the proposed Spencer Pit can be accommodated by the existing roadway system with the implementation of exclusive turn lane configurations at the intersection of Wellington Road 124/Kossuth Road as recommended herein. The intersection is expected to operate at 'good' levels of service (LOS 'C') and within its capacity assuming Wellington Road 124 is still only one lane in each direction.
  - By 2020, with the implementation of the recommended intersection and pit site access improvements, in conjunction with a recommended widening to four lanes of Wellington Road 124/Hespeler Road through the Kossuth Road intersection, future total traffic flows to the 2020 horizon can be accommodated at the study intersection with 'good' levels of service (LOS 'C') in the overall intersection. It is however the predicted growth in background traffic flows (in combination with existing traffic volumes) that compels the

widening of Wellington Road 124 and the truck trips introduced by the Spencer Pit do not trigger the widening of the facility.

Based on our study findings, we recommend the following improvements:

- By 2015, the following improvements are recommended at the Wellington Road 124 / Kossuth Road intersection to accommodate Spencer Pit-related traffic:
  - a southbound exclusive left turn lane to serve inbound truck trips from the northeast and to separate these turns from the heavy southbound through movement flows;
  - Northbound right turn taper to provide a deceleration facility for inbound trucks to the Pit, and to separate these movements from the heavy northbound traffic flow;
  - A new site access opposite from, and aligned with, Kossuth Road;
  - Associated signalized intersection infrastructure (poles, heads, etc.) to accommodate above;
  - The recommended pit access lane configurations shall be incorporated into the site plans upon acceptance by the road authority.
- By 2020, based on the predicted background traffic growth (and unrelated to the Spencer Pit impacts), the widening of Wellington Road 124 and Hespeler Road to four lanes through the Kossuth Road intersection is recommended.

Appendix A
Traffic Data

AMENDMENTS MADE APRIL 26, 2010 TO:

OFFICIAL PLAN AMENDMENTS 19, 21,44, 43, 68, 69, 28

AMENDMENTS MADE JULY 6/10

OPA #71, 72, 56

AMENDMENTS MADE FEBRUARY 12/13

OPA # 7, # 73, #74, #76, #79, #82,

12.4 PUBLIC TRANSIT

The County of Wellington has not reached the point where public transit is a viable transportation option. Wellington will continue to focus its planning efforts on supporting urban centres and downtowns so that public transit may become a viable option.

12.5 ROADWAYS

12.5.1 General

Roadways are far and away the most important means of transportation in Wellington. The County of Wellington accepts the heavy reliance on automobiles and trucks in small towns and rural areas and will make its best efforts at encouraging safe, efficient and convenient community design practices which facilitate people's desires to use automobiles.

12.5.2 Provincial Highways

This classification applies to roadways under the jurisdiction of the Ontario Ministry of Transportation. These highways include Nos. 6, 7, 9, 89 and 401. Provincial highways generally function as major roadways or arterials but are regulated under the Public Transportation and Highway Improvement Act. Provincial highways carry large volumes of traffic at relatively high speed, therefore access to provincial highways is limited. Ministry of Transportation approvals (permits) are required for all entrances (new or altered), buildings/structures and signs located adjacent to the highway prior to any construction being undertaken. Access will only be considered to those properties abutting a provincial highway that meet the minimum safety and geometric requirements of the Ministry of Transportation.

12.5.3 Major Roadways

The provincial highway system and the county road system provide the major roadways in Wellington and they are shown on Schedule A. The following policies apply to provincial and county roads:

a) major roadways are expected to provide and serve high volumes of traffic including truck traffic;

b) major roadways are designed for safety, efficiency and convenience to move people and goods at reasonably high speeds;

c) major roadways within urban centres should be served by sidewalks;

d) access to major roadways should be restricted through the following means:

   i) prohibition, where necessary;

   ii) requiring access from lower volume roads, where possible;

e) where access to major roadways is necessary, the following facilities may be required;

   i) traffic signals
   ii) turning lanes and tapers
   iii) road widenings;

f) roadway authorities may acquire land for road widening through acquisition programs or land dedication when planning approvals are sought;

g) New major roadways require an amendment to this Plan and appropriate provincial environmental approvals. Changes in jurisdiction and minor realignment, widening or improvements do not require an amendment;

Transportation may identify the need for other information and materials through the pre-submission consultation meeting with the Region and/or applicable Area Municipality.

5.A.27 Where a proposed *development application* may compromise the Environmental Assessment Act requirements for a Proposed Regional Road Corridor as shown on Map 5b, a future Proposed Transit Corridor, Proposed *Provincial Highway,* or Proposed Provincial Transit Corridor not shown on Map 5b, the Region and/or Area Municipalities may, in consultation with the *Province,* whenever appropriate, consider the proposed *development application* to be premature until transportation planning and Environmental Assessment studies are completed.

5.A.28 Where a proposed *development application* is affected by road improvements that are subject to a Municipal Class Environmental Assessment, the Environmental Assessment will be completed to the extent required before approval of the *development application* by the Region or Area Municipality.

5.A.29 The following changes to the designations of roads as shown on Map 5b may be made without amendment to this Plan:

(a) to recognize the construction of a Planned Regional Road or *Provincial Highway*; and

(b) to implement the alignment of a Proposed Regional Road consistent with the corridor as shown on Map 5b.

5.A.30 All Regional Roads will be classified as truck routes unless prohibitions or time restrictions are imposed on particular sections based on the following:

(a) the section of roadway is not designed or constructed for heavy truck traffic or long vehicles;

(b) there are critical height or weight restrictions on the section of roadway;

(c) the land uses adjacent to the roadway are primarily front-lotted urban residential and a suitable alternate route is available; or

(d) other considerations as determined by Regional Council.

Regional Road Design, Construction and Operation

5.A.31 The design, construction and operation of Regional Roads, and *development applications* or *site plans* that affect Regional Roads, will be in accordance with

Ontario Traffic Inc.

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 7:30:00
To: 8:30:00

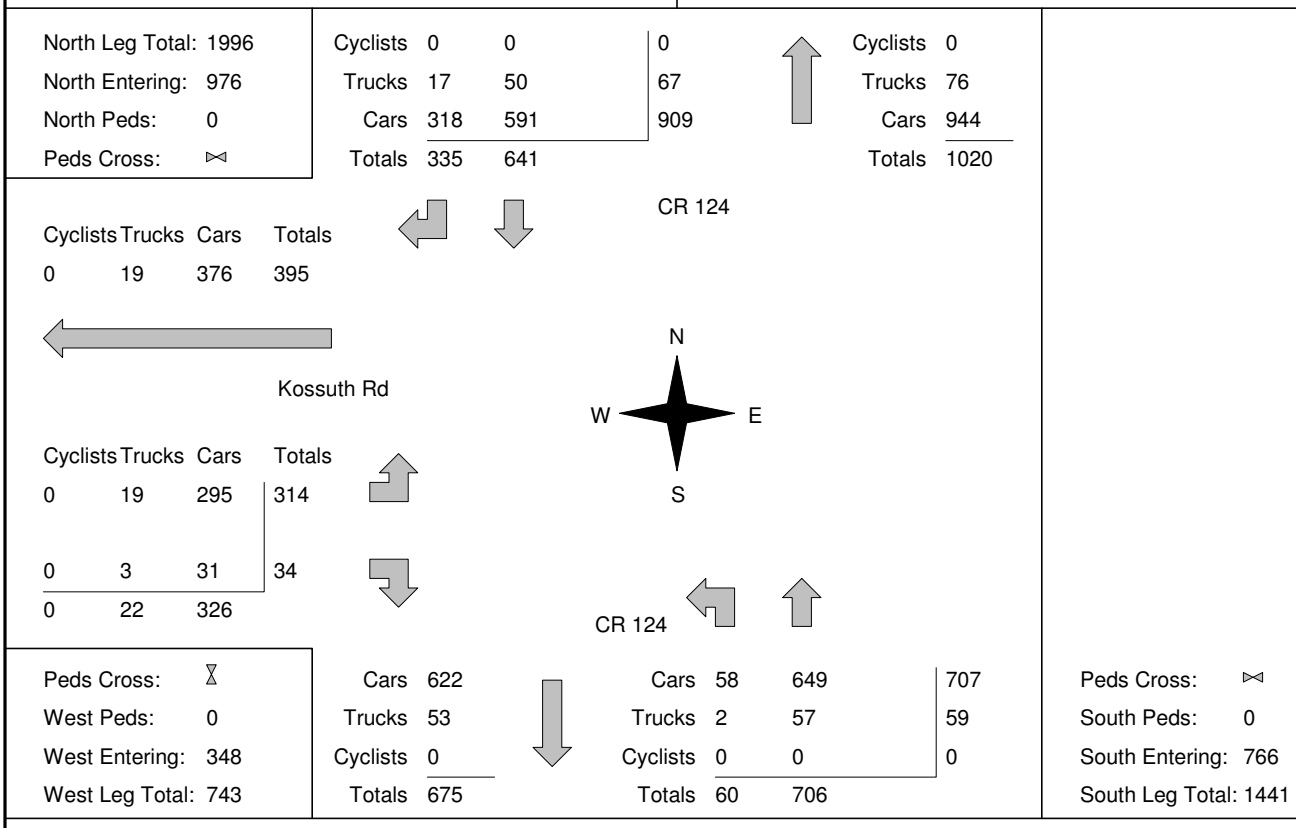
Municipality: Wellington
Site #: 1318200002
Intersection: CR 124 & Kossuth Rd
TFR File #: 1
Count date: 1-Oct-13

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: CR 124 runs N/S



Comments

Ontario Traffic Inc.

Mid-day Peak Diagram

Specified Period
From: 7:00:00
To: 19:00:00

One Hour Peak
From: 16:30:00
To: 17:30:00

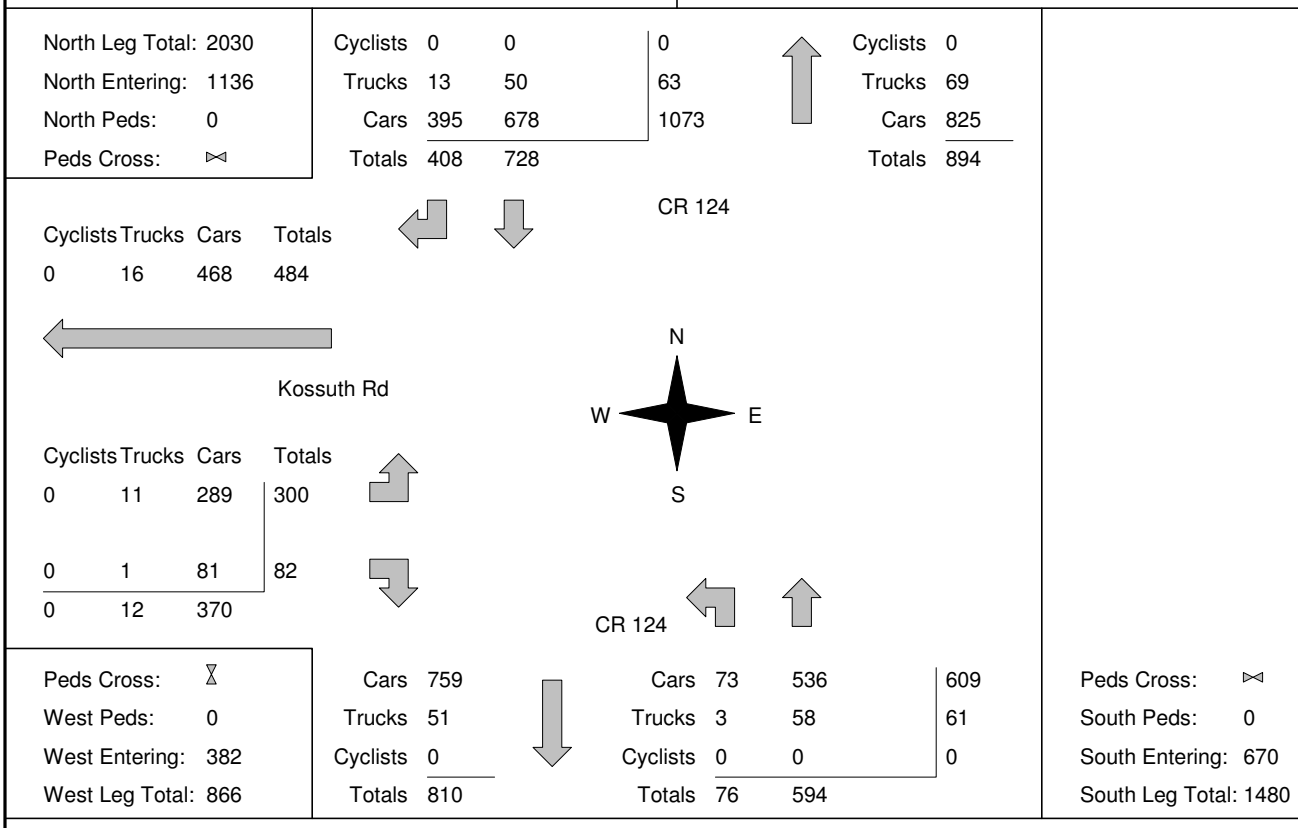
Municipality: Wellington
Site #: 1318200002
Intersection: CR 124 & Kossuth Rd
TFR File #: 1
Count date: 1-Oct-13

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: CR 124 runs N/S



Comments

Ontario Traffic Inc.

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 19:00:00

One Hour Peak
From: 16:30:00
To: 17:30:00

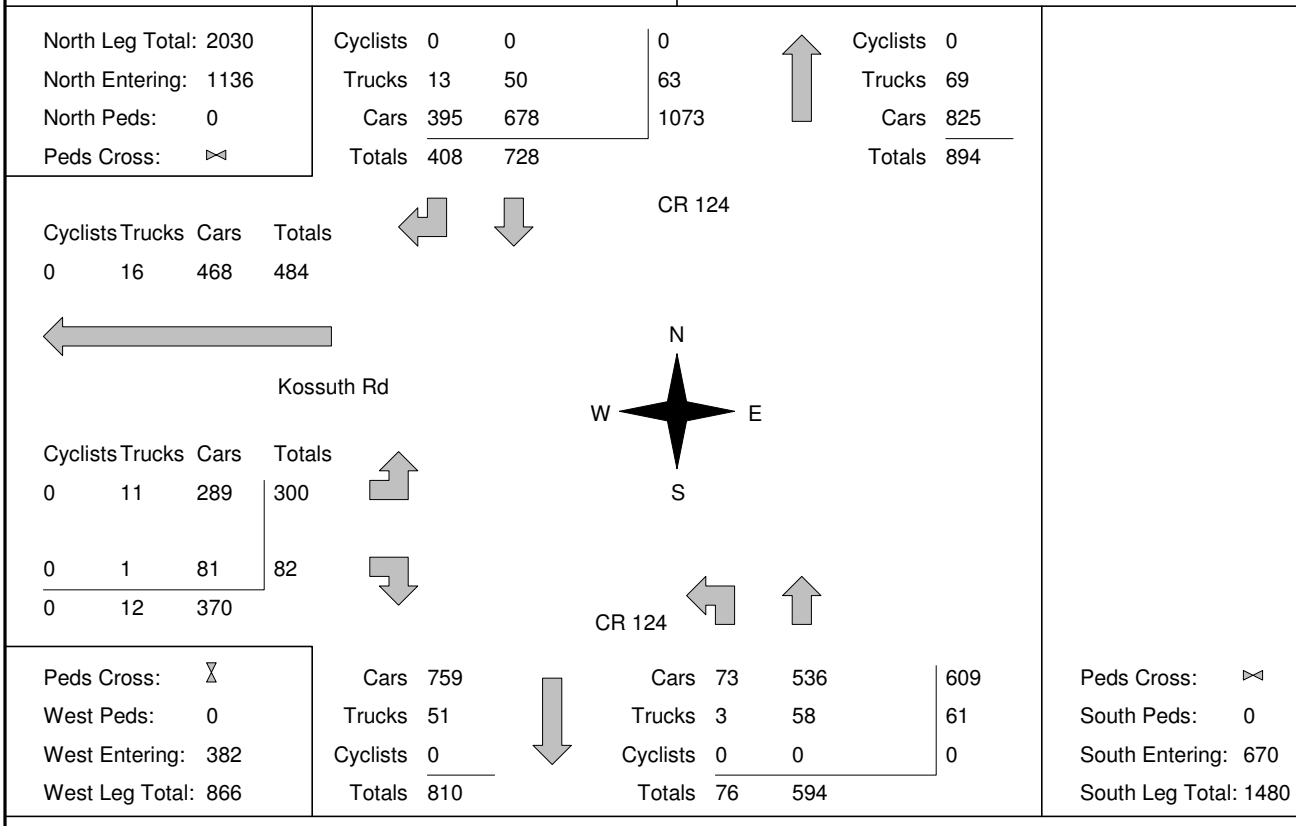
Municipality: Wellington
Site #: 1318200002
Intersection: CR 124 & Kossuth Rd
TFR File #: 1
Count date: 1-Oct-13

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: CR 124 runs N/S



Comments

Ontario Traffic Inc.

Eight Hour Peak Diagram

Eight Hour Peak
From: 11:00:00
To: 19:00:00

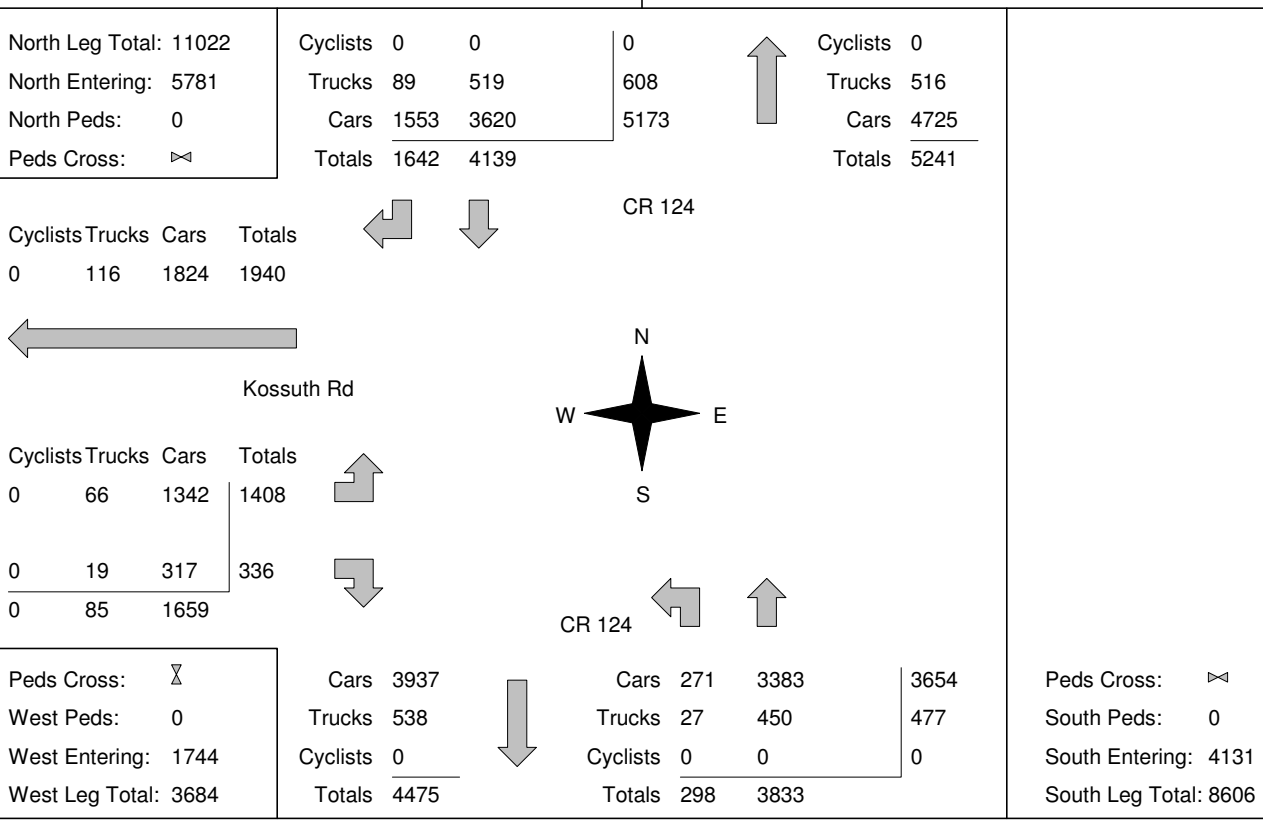
Municipality: Wellington
Site #: 1318200002
Intersection: CR 124 & Kossuth Rd
TFR File #: 1
Count date: 1-Oct-13

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: CR 124 runs N/S



Comments

Ontario Traffic Inc.

Total Count Diagram

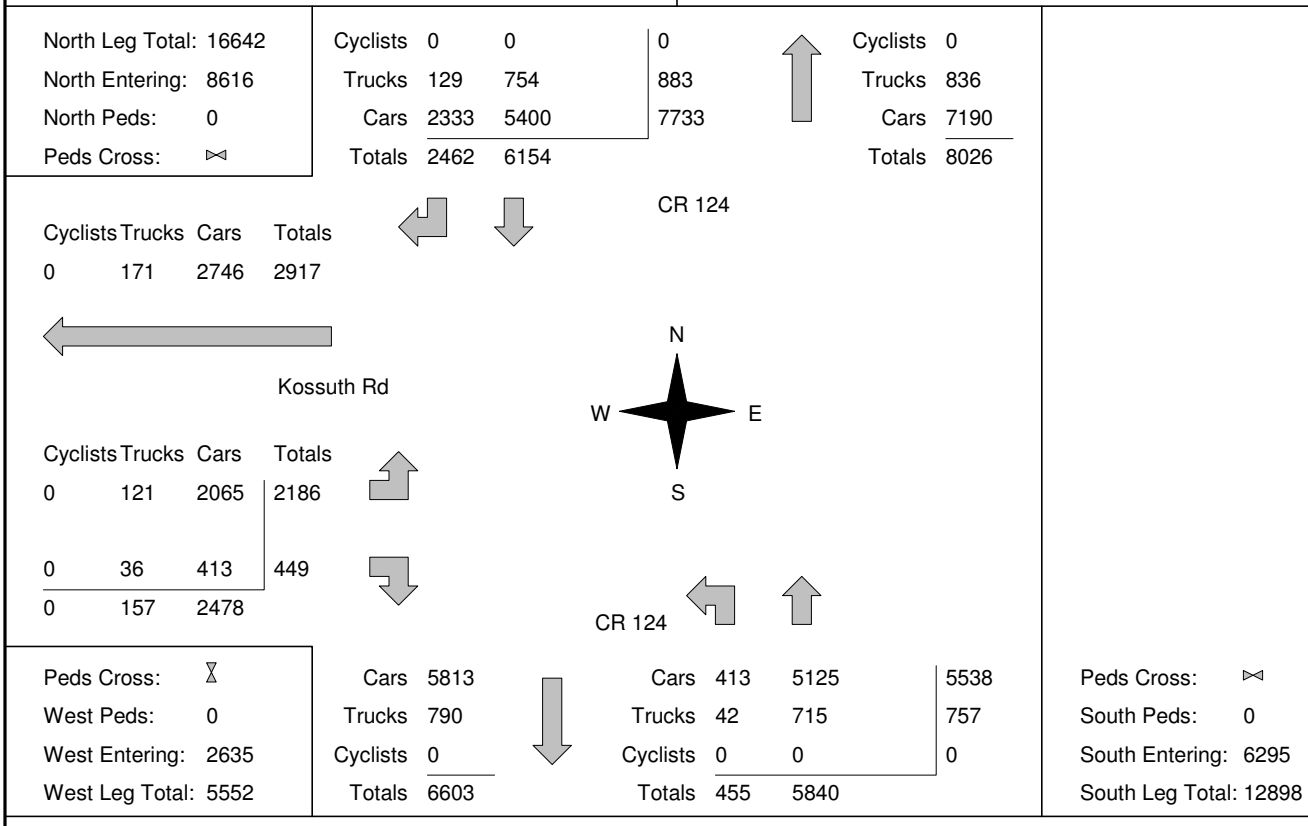
Municipality: Wellington
Site #: 1318200002
Intersection: CR 124 & Kossuth Rd
TFR File #: 1
Count date: 1-Oct-13

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: CR 124 runs N/S



Comments

Ontario Traffic Inc.
Traffic Count Summary

Intersection: CR 124 & Kossuth Rd | **Count Date:** 1-Oct-13 | **Municipality:** Wellington

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	1	0	1	0	3
8:00:00	0	657	280	937	0	1640
9:00:00	0	545	283	828	0	1444
10:00:00	0	441	146	587	0	1048
11:00:00	0	371	111	482	0	864
12:00:00	0	409	141	550	0	946
13:00:00	0	418	106	524	0	1010
14:00:00	0	414	96	510	0	947
15:00:00	0	423	157	580	0	1130
16:00:00	0	611	248	859	0	1410
17:00:00	0	682	353	1035	0	1666
18:00:00	0	704	367	1071	0	1690
19:00:00	0	478	174	652	0	1113
Totals:	0	6154	2462	8616	0	14911

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	2	0	2	0
8:00:00	45	658	0	703	0
9:00:00	53	563	0	616	0
10:00:00	26	435	0	461	0
11:00:00	33	349	0	382	0
12:00:00	22	374	0	396	0
13:00:00	30	456	0	486	0
14:00:00	23	414	0	437	0
15:00:00	22	528	0	550	0
16:00:00	36	515	0	551	0
17:00:00	50	581	0	631	0
18:00:00	82	537	0	619	0
19:00:00	33	428	0	461	0
Totals:	455	5840	0	6295	0

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	0	0	0	0	0	0
8:00:00	0	0	0	0	0	292
9:00:00	0	0	0	0	0	298
10:00:00	0	0	0	0	0	166
11:00:00	0	0	0	0	0	135
12:00:00	0	0	0	0	0	117
13:00:00	0	0	0	0	0	132
14:00:00	0	0	0	0	0	161
15:00:00	0	0	0	0	0	191
16:00:00	0	0	0	0	0	229
17:00:00	0	0	0	0	0	361
18:00:00	0	0	0	0	0	337
19:00:00	0	0	0	0	0	216
Totals:	0	0	0	0	0	2635

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0
8:00:00	273	0	19	292	0
9:00:00	260	0	38	298	0
10:00:00	141	0	25	166	0
11:00:00	104	0	31	135	0
12:00:00	103	0	14	117	0
13:00:00	115	0	17	132	0
14:00:00	130	0	31	161	0
15:00:00	160	0	31	191	0
16:00:00	193	0	36	229	0
17:00:00	294	0	67	361	0
18:00:00	252	0	85	337	0
19:00:00	161	0	55	216	0
Totals:	2186	0	449	2635	0

Calculated Values for Traffic Crossing Major Street

Hours Ending:	8:00	9:00	10:00	15:00	16:00	17:00	18:00	19:00
Crossing Values:	273	260	141	160	193	294	252	161

Ontario Traffic Inc.

Count Date: 1-Oct-13 **Site #: 1318200002**

Interval Time	Passenger Cars - North Approach						Trucks - North Approach						Cyclists - North Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		North Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	0	0	99	98	45	45	0	0	5	5	1	1	0	0	0	0	0	0	0	0
7:30:00	0	0	273	174	97	52	0	0	13	8	3	2	0	0	0	0	0	0	0	0
7:45:00	0	0	444	171	175	78	0	0	19	6	7	4	0	0	0	0	0	0	0	0
8:00:00	0	0	625	181	264	89	0	0	33	14	16	9	0	0	0	0	0	0	0	0
8:15:00	0	0	736	111	344	80	0	0	42	9	19	3	0	0	0	0	0	0	0	0
8:30:00	0	0	864	128	415	71	0	0	63	21	20	1	0	0	0	0	0	0	0	0
8:45:00	0	0	1006	142	487	72	0	0	77	14	23	3	0	0	0	0	0	0	0	0
9:00:00	0	0	1104	98	540	53	0	0	99	22	23	0	0	0	0	0	0	0	0	0
9:15:00	0	0	1203	99	574	34	0	0	117	18	25	2	0	0	0	0	0	0	0	0
9:30:00	0	0	1307	104	612	38	0	0	125	8	27	2	0	0	0	0	0	0	0	0
9:45:00	0	0	1410	103	645	33	0	0	142	17	32	5	0	0	0	0	0	0	0	0
10:00:00	0	0	1483	73	675	30	0	0	161	19	34	2	0	0	0	0	0	0	0	0
10:15:00	0	0	1541	58	707	32	0	0	181	20	35	1	0	0	0	0	0	0	0	0
10:30:00	0	0	1624	83	734	27	0	0	201	20	35	0	0	0	0	0	0	0	0	0
10:45:00	0	0	1701	77	757	23	0	0	214	13	38	3	0	0	0	0	0	0	0	0
11:00:00	0	0	1780	79	780	23	0	0	235	21	40	2	0	0	0	0	0	0	0	0
11:15:00	0	0	1861	81	812	32	0	0	258	23	44	4	0	0	0	0	0	0	0	0
11:30:00	0	0	1937	76	852	40	0	0	285	27	46	2	0	0	0	0	0	0	0	0
11:45:00	0	0	2026	89	890	38	0	0	308	23	49	3	0	0	0	0	0	0	0	0
12:00:00	0	0	2104	78	912	22	0	0	320	12	49	0	0	0	0	0	0	0	0	0
12:15:00	0	0	2199	95	935	23	0	0	337	17	50	1	0	0	0	0	0	0	0	0
12:30:00	0	0	2290	91	956	21	0	0	353	16	51	1	0	0	0	0	0	0	0	0
12:45:00	0	0	2373	83	985	29	0	0	369	16	54	3	0	0	0	0	0	0	0	0
13:00:00	0	0	2455	82	1012	27	0	0	387	18	55	1	0	0	0	0	0	0	0	0
13:15:00	0	0	2540	85	1027	15	0	0	409	22	57	2	0	0	0	0	0	0	0	0
13:30:00	0	0	2624	84	1048	21	0	0	433	24	58	1	0	0	0	0	0	0	0	0
13:45:00	0	0	2705	81	1073	25	0	0	453	20	61	3	0	0	0	0	0	0	0	0
14:00:00	0	0	2789	84	1099	26	0	0	467	14	64	3	0	0	0	0	0	0	0	0
14:15:00	0	0	2844	55	1130	31	0	0	487	20	65	1	0	0	0	0	0	0	0	0
14:30:00	0	0	2932	88	1166	36	0	0	510	23	68	3	0	0	0	0	0	0	0	0
14:45:00	0	0	3018	86	1206	40	0	0	529	19	71	3	0	0	0	0	0	0	0	0
15:00:00	0	0	3130	112	1246	40	0	0	549	20	74	3	0	0	0	0	0	0	0	0
15:15:00	0	0	3230	100	1293	47	0	0	570	21	80	6	0	0	0	0	0	0	0	0
15:30:00	0	0	3390	160	1351	58	0	0	581	11	82	2	0	0	0	0	0	0	0	0
15:45:00	0	0	3529	139	1413	62	0	0	597	16	87	5	0	0	0	0	0	0	0	0
16:00:00	0	0	3679	150	1478	65	0	0	611	14	90	3	0	0	0	0	0	0	0	0
16:15:00	0	0	3814	135	1548	70	0	0	631	20	100	10	0	0	0	0	0	0	0	0
16:30:00	0	0	3980	166	1625	77	0	0	640	9	102	2	0	0	0	0	0	0	0	0
16:45:00	0	0	4135	155	1696	71	0	0	659	19	104	2	0	0	0	0	0	0	0	0

Ontario Traffic Inc.

Count Date: 1-Oct-13 **Site #: 1318200002**

Interval Time	Passenger Cars - North Approach						Trucks - North Approach						Cyclists - North Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		North Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
17:00:00	0	0	4302	167	1816	120	0	0	670	11	105	1	0	0	0	0	0	0	0	0
17:15:00	0	0	4470	168	1933	117	0	0	682	12	111	6	0	0	0	0	0	0	0	0
17:30:00	0	0	4658	188	2020	87	0	0	690	8	115	4	0	0	0	0	0	0	0	0
17:45:00	0	0	4842	184	2092	72	0	0	702	12	120	5	0	0	0	0	0	0	0	0
18:00:00	0	0	4957	115	2166	74	0	0	719	17	122	2	0	0	0	0	0	0	0	0
18:15:00	0	0	5092	135	2220	54	0	0	728	9	125	3	0	0	0	0	0	0	0	0
18:30:00	0	0	5198	106	2273	53	0	0	738	10	126	1	0	0	0	0	0	0	0	0
18:45:00	0	0	5312	114	2305	32	0	0	746	8	128	2	0	0	0	0	0	0	0	0
19:00:00	0	0	5400	88	2333	28	0	0	754	8	129	1	0	0	0	0	0	0	0	0
19:00:03	0	0	5400	0	2333	0	0	0	754	0	129	0	0	0	0	0	0	0	0	0

Ontario Traffic Inc.

Count Date: 1-Oct-13 **Site #: 1318200002**

Interval Time	Passenger Cars - East Approach						Trucks - East Approach						Cyclists - East Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		East Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ontario Traffic Inc.

Count Date: 1-Oct-13 **Site #: 1318200002**

Interval Time	Passenger Cars - East Approach						Trucks - East Approach						Cyclists - East Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		East Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
17:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00:03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ontario Traffic Inc.

Count Date: 1-Oct-13 **Site #: 1318200002**

Interval Time	Passenger Cars - South Approach						Trucks - South Approach						Cyclists - South Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		South Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
7:15:00	7	7	101	100	0	0	0	0	12	11	0	0	0	0	0	0	0	0	0	0
7:30:00	10	3	250	149	0	0	3	3	25	13	0	0	0	0	0	0	0	0	0	0
7:45:00	22	12	444	194	0	0	5	2	40	15	0	0	0	0	0	0	0	0	0	0
8:00:00	40	18	609	165	0	0	5	0	51	11	0	0	0	0	0	0	0	0	0	0
8:15:00	55	15	757	148	0	0	5	0	62	11	0	0	0	0	0	0	0	0	0	0
8:30:00	68	13	899	142	0	0	5	0	82	20	0	0	0	0	0	0	0	0	0	0
8:45:00	82	14	1005	106	0	0	6	1	96	14	0	0	0	0	0	0	0	0	0	0
9:00:00	92	10	1111	106	0	0	6	0	112	16	0	0	0	0	0	0	0	0	0	0
9:15:00	101	9	1200	89	0	0	6	0	133	21	0	0	0	0	0	0	0	0	0	0
9:30:00	106	5	1288	88	0	0	7	1	152	19	0	0	0	0	0	0	0	0	0	0
9:45:00	109	3	1381	93	0	0	8	1	173	21	0	0	0	0	0	0	0	0	0	0
10:00:00	115	6	1464	83	0	0	9	1	194	21	0	0	0	0	0	0	0	0	0	0
10:15:00	124	9	1538	74	0	0	10	1	211	17	0	0	0	0	0	0	0	0	0	0
10:30:00	131	7	1593	55	0	0	13	3	223	12	0	0	0	0	0	0	0	0	0	0
10:45:00	134	3	1665	72	0	0	15	2	247	24	0	0	0	0	0	0	0	0	0	0
11:00:00	142	8	1742	77	0	0	15	0	265	18	0	0	0	0	0	0	0	0	0	0
11:15:00	146	4	1830	88	0	0	16	1	280	15	0	0	0	0	0	0	0	0	0	0
11:30:00	147	1	1899	69	0	0	17	1	291	11	0	0	0	0	0	0	0	0	0	0
11:45:00	153	6	1974	75	0	0	17	0	304	13	0	0	0	0	0	0	0	0	0	0
12:00:00	160	7	2055	81	0	0	19	2	326	22	0	0	0	0	0	0	0	0	0	0
12:15:00	165	5	2162	107	0	0	19	0	342	16	0	0	0	0	0	0	0	0	0	0
12:30:00	174	9	2263	101	0	0	21	2	360	18	0	0	0	0	0	0	0	0	0	0
12:45:00	182	8	2341	78	0	0	22	1	375	15	0	0	0	0	0	0	0	0	0	0
13:00:00	186	4	2447	106	0	0	23	1	390	15	0	0	0	0	0	0	0	0	0	0
13:15:00	191	5	2514	67	0	0	23	0	406	16	0	0	0	0	0	0	0	0	0	0
13:30:00	193	2	2605	91	0	0	25	2	423	17	0	0	0	0	0	0	0	0	0	0
13:45:00	198	5	2691	86	0	0	26	1	443	20	0	0	0	0	0	0	0	0	0	0
14:00:00	204	6	2788	97	0	0	28	2	463	20	0	0	0	0	0	0	0	0	0	0
14:15:00	211	7	2900	112	0	0	28	0	475	12	0	0	0	0	0	0	0	0	0	0
14:30:00	213	2	3033	133	0	0	28	0	492	17	0	0	0	0	0	0	0	0	0	0
14:45:00	217	4	3157	124	0	0	29	1	509	17	0	0	0	0	0	0	0	0	0	0
15:00:00	224	7	3251	94	0	0	30	1	528	19	0	0	0	0	0	0	0	0	0	0
15:15:00	229	5	3362	111	0	0	31	1	542	14	0	0	0	0	0	0	0	0	0	0
15:30:00	237	8	3491	129	0	0	34	3	559	17	0	0	0	0	0	0	0	0	0	0
15:45:00	250	13	3610	119	0	0	34	0	576	17	0	0	0	0	0	0	0	0	0	0
16:00:00	256	6	3710	100	0	0	34	0	584	8	0	0	0	0	0	0	0	0	0	0
16:15:00	261	5	3837	127	0	0	34	0	599	15	0	0	0	0	0	0	0	0	0	0
16:30:00	272	11	3958	121	0	0	35	1	610	11	0	0	0	0	0	0	0	0	0	0
16:45:00	289	17	4094	136	0	0	35	0	624	14	0	0	0	0	0	0	0	0	0	0

Ontario Traffic Inc.

Count Date: 1-Oct-13 **Site #: 1318200002**

Interval Time	Passenger Cars - South Approach						Trucks - South Approach						Cyclists - South Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		South Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
17:00:00	305	16	4238	144	0	0	35	0	637	13	0	0	0	0	0	0	0	0	0	0
17:15:00	325	20	4360	122	0	0	36	1	653	16	0	0	0	0	0	0	0	0	0	0
17:30:00	345	20	4494	134	0	0	38	2	668	15	0	0	0	0	0	0	0	0	0	0
17:45:00	361	16	4611	117	0	0	40	2	674	6	0	0	0	0	0	0	0	0	0	0
18:00:00	381	20	4725	114	0	0	41	1	687	13	0	0	0	0	0	0	0	0	0	0
18:15:00	390	9	4839	114	0	0	41	0	695	8	0	0	0	0	0	0	0	0	0	0
18:30:00	398	8	4947	108	0	0	42	1	702	7	0	0	0	0	0	0	0	0	0	0
18:45:00	404	6	5038	91	0	0	42	0	711	9	0	0	0	0	0	0	0	0	0	0
19:00:00	413	9	5125	87	0	0	42	0	715	4	0	0	0	0	0	0	0	0	0	0
19:00:03	413	0	5125	0	0	0	42	0	715	0	0	0	0	0	0	0	0	0	0	0

Ontario Traffic Inc.

Count Date: 1-Oct-13 **Site #: 1318200002**

Interval Time	Passenger Cars - West Approach						Trucks - West Approach						Cyclists - West Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		West Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	38	38	0	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0
7:30:00	94	56	0	0	2	2	8	4	0	0	1	1	0	0	0	0	0	0	0	0
7:45:00	172	78	0	0	8	6	16	8	0	0	2	1	0	0	0	0	0	0	0	0
8:00:00	252	80	0	0	16	8	21	5	0	0	3	1	0	0	0	0	0	0	0	0
8:15:00	322	70	0	0	27	11	25	4	0	0	4	1	0	0	0	0	0	0	0	0
8:30:00	389	67	0	0	33	6	27	2	0	0	4	0	0	0	0	0	0	0	0	0
8:45:00	458	69	0	0	40	7	29	2	0	0	7	3	0	0	0	0	0	0	0	0
9:00:00	502	44	0	0	48	8	31	2	0	0	9	2	0	0	0	0	0	0	0	0
9:15:00	543	41	0	0	54	6	35	4	0	0	10	1	0	0	0	0	0	0	0	0
9:30:00	570	27	0	0	61	7	36	1	0	0	10	0	0	0	0	0	0	0	0	0
9:45:00	603	33	0	0	63	2	36	0	0	0	10	0	0	0	0	0	0	0	0	0
10:00:00	628	25	0	0	72	9	46	10	0	0	10	0	0	0	0	0	0	0	0	0
10:15:00	654	26	0	0	80	8	46	0	0	0	11	1	0	0	0	0	0	0	0	0
10:30:00	684	30	0	0	86	6	48	2	0	0	12	1	0	0	0	0	0	0	0	0
10:45:00	696	12	0	0	93	7	51	3	0	0	15	3	0	0	0	0	0	0	0	0
11:00:00	723	27	0	0	96	3	55	4	0	0	17	2	0	0	0	0	0	0	0	0
11:15:00	747	24	0	0	97	1	57	2	0	0	17	0	0	0	0	0	0	0	0	0
11:30:00	774	27	0	0	103	6	60	3	0	0	17	0	0	0	0	0	0	0	0	0
11:45:00	794	20	0	0	105	2	64	4	0	0	17	0	0	0	0	0	0	0	0	0
12:00:00	814	20	0	0	109	4	67	3	0	0	18	1	0	0	0	0	0	0	0	0
12:15:00	838	24	0	0	113	4	68	1	0	0	19	1	0	0	0	0	0	0	0	0
12:30:00	869	31	0	0	115	2	72	4	0	0	19	0	0	0	0	0	0	0	0	0
12:45:00	894	25	0	0	120	5	73	1	0	0	19	0	0	0	0	0	0	0	0	0
13:00:00	922	28	0	0	125	5	74	1	0	0	19	0	0	0	0	0	0	0	0	0
13:15:00	951	29	0	0	131	6	77	3	0	0	19	0	0	0	0	0	0	0	0	0
13:30:00	990	39	0	0	139	8	79	2	0	0	21	2	0	0	0	0	0	0	0	0
13:45:00	1014	24	0	0	145	6	82	3	0	0	23	2	0	0	0	0	0	0	0	0
14:00:00	1041	27	0	0	151	6	85	3	0	0	24	1	0	0	0	0	0	0	0	0
14:15:00	1075	34	0	0	158	7	86	1	0	0	24	0	0	0	0	0	0	0	0	0
14:30:00	1100	25	0	0	166	8	86	0	0	0	24	0	0	0	0	0	0	0	0	0
14:45:00	1137	37	0	0	176	10	88	2	0	0	24	0	0	0	0	0	0	0	0	0
15:00:00	1188	51	0	0	181	5	98	10	0	0	25	1	0	0	0	0	0	0	0	0
15:15:00	1222	34	0	0	186	5	98	0	0	0	25	0	0	0	0	0	0	0	0	0
15:30:00	1274	52	0	0	193	7	101	3	0	0	25	0	0	0	0	0	0	0	0	0
15:45:00	1332	58	0	0	203	10	101	0	0	0	26	1	0	0	0	0	0	0	0	0
16:00:00	1376	44	0	0	215	12	103	2	0	0	27	1	0	0	0	0	0	0	0	0
16:15:00	1429	53	0	0	229	14	104	1	0	0	29	2	0	0	0	0	0	0	0	0
16:30:00	1496	67	0	0	243	14	106	2	0	0	29	0	0	0	0	0	0	0	0	0
16:45:00	1570	74	0	0	262	19	111	5	0	0	29	0	0	0	0	0	0	0	0	0

Ontario Traffic Inc.

Count Date: 1-Oct-13 **Site #: 1318200002**

Interval Time	Passenger Cars - West Approach						Trucks - West Approach						Cyclists - West Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		West Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
17:00:00	1661	91	0	0	280	18	112	1	0	0	29	0	0	0	0	0	0	0	0	0
17:15:00	1725	64	0	0	301	21	115	3	0	0	29	0	0	0	0	0	0	0	0	0
17:30:00	1785	60	0	0	324	23	117	2	0	0	30	1	0	0	0	0	0	0	0	0
17:45:00	1843	58	0	0	347	23	117	0	0	0	31	1	0	0	0	0	0	0	0	0
18:00:00	1905	62	0	0	361	14	120	3	0	0	33	2	0	0	0	0	0	0	0	0
18:15:00	1947	42	0	0	376	15	120	0	0	0	35	2	0	0	0	0	0	0	0	0
18:30:00	1990	43	0	0	389	13	120	0	0	0	35	0	0	0	0	0	0	0	0	0
18:45:00	2030	40	0	0	403	14	120	0	0	0	36	1	0	0	0	0	0	0	0	0
19:00:00	2065	35	0	0	413	10	121	1	0	0	36	0	0	0	0	0	0	0	0	0
19:00:03	2065	0	0	0	413	0	121	0	0	0	36	0	0	0	0	0	0	0	0	0

Ontario

Ministry of Transportation | Highway Standards Branch | Traffic Office

Provincial Highways — Traffic Volumes 1988-2010

King's Highways / Secondary Highways / Tertiary Roads

Ministry Contact:
Traffic Office (905)-704-2960

Abstract:
This annual publication contains averaged traffic volume information and accident rate information for each of the sections of highway under MTO jurisdiction.

Key Words:
Annual Average Daily Traffic volume (AADT), Summer Average Daily Traffic volume (SADT), Summer Average Weekday Traffic volume (SAWDT), Winter Average Daily Traffic volume (WADT), Accident Rate (AR)

Distance (KM)

The length of the section in kilometres reported to one decimal place.

Pattern Type

One of 14 pattern types that represent the seasonal variation of the traffic flow on the section indicated. A graphical presentation of these pattern types has been included on the following page.

The 14 pattern types represent the traffic flow variation on the whole network. They include:

Variation Types

	UC	urban commuter
LOW	**SC**	suburban commuter
	C	commuter
	IC	intermediate commuter
	CR	commuter recreation
INTER	**IR**	intermediate recreation
	CTR	commuter tourist recreation
	IT	intermediate tourist
	LT	low tourist
	T	tourist
HIGH	**HT**	high tourist
	LR	low recreation
	R	recreation
	HR	high recreation
	UNC	unclassified
	NEW	new volume section

The first three are generally referred to as Low Variation Curves (or commuter travel); the next five as Intermediate Variation Curves (a blend of all types of traffic); and the last six as High Variation Curves. For the last group, the first three represent tourist travel and the second three, recreational travel; this sub-grouping is distinguished by the relationship of weekend to weekday traffic.

There are two additional codes in the pattern type column. "UNC" indicates that the AADT was calculated using adjustment factors from an unclassified (i.e. new) permanent counting station. "NEW" indicates that this is a new volume section and there is insufficient data to assign a pattern type.

AADT

Annual Average Daily Traffic; defined as the average twenty four hour, two way traffic for the period January 1st to December 31st.

SADT

Summer Average Daily Traffic; defined as the average twenty four hour, two way traffic for the period July 1st to August 31st including weekends.

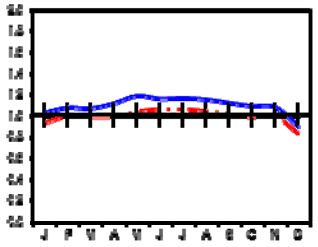
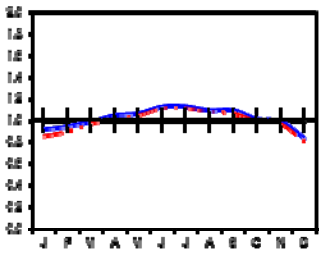
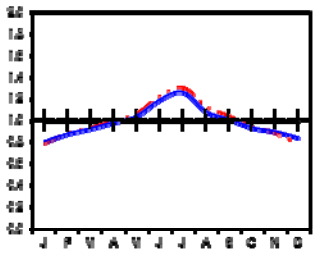
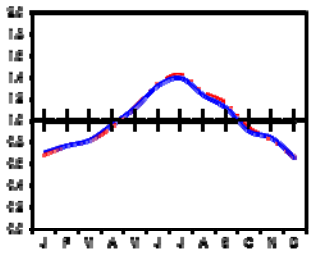
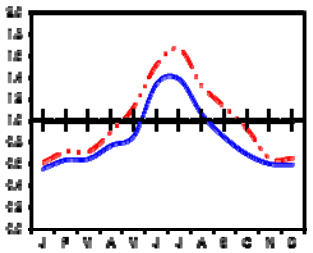
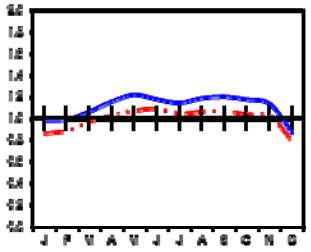
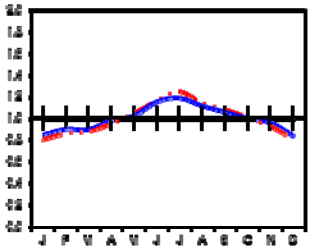
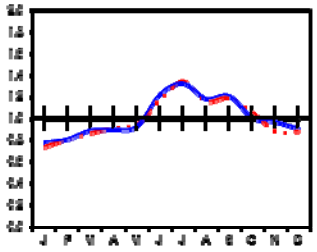
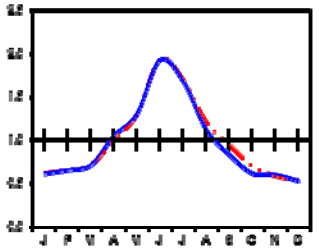
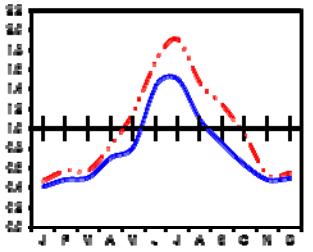
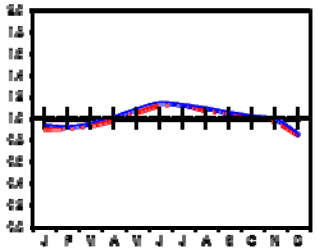
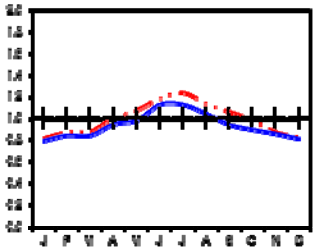
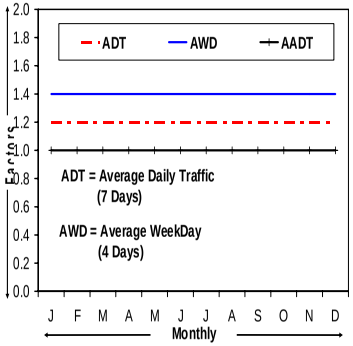
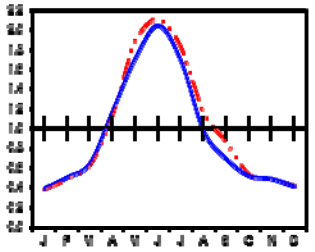
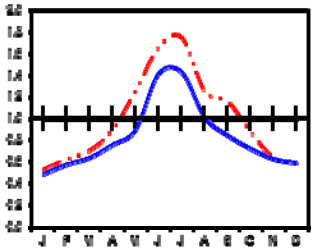
SAWDT

Summer Average Weekday Traffic; defined as the average twenty four hour, two way traffic for the period July 1st to August 31st, excluding weekends.

WADT

Winter Average Daily Traffic; defined as the average twenty four hour, two way traffic for the period January 1st to March 31st, plus December 1st to December 31st, including weekends.

2010 Seasonal Variation Graphs

Urban Commuter D.H.V. % = 10.2	Intermediate Commuter D.H.V. % = 10.0	Commuter Tourist Recreation D.H.V. % = 9.8	Low Tourist D.H.V. % = 12.7	Low Recreation D.H.V. % = 20.9
				
Suburban Commuter D.H.V. % = 10.6	Commuter Recreation D.H.V. % = 10.1	Intermediate Tourist D.H.V. % = 14.2	Tourist D.H.V. % = 21.2	Recreation D.H.V. % = 22.5
				
Commuter D.H.V. % = 9.4	Intermediate Recreation D.H.V. % = 12.0	Legend	High Tourist D.H.V. % = 17.2	High Recreation D.H.V. % = 25.2
				

Highway	Location Description	Dist	Year	Patt Type	AADT	SADT	SAWDT	WADT	AR
7	71 WOOLWICH GUELPH TOWNLINE	6.0	1988	SC	15,250	16,400	17,900	13,700	1.0
			1989	C	15,700	17,400	17,500	14,100	0.9
			1990	C	16,400	18,200	18,200	14,700	1.1
			1991	C	17,050	18,700	18,900	15,500	0.7
			1992	SC	15,700	16,400	18,300	14,400	0.8
			1993	SC	15,850	17,500	19,300	14,100	1.0
			1994	SC	17,000	17,700	19,600	15,600	0.8
			1995	UC	17,900	18,600	20,400	16,600	0.8
			1996	UC	18,900	20,100	22,100	18,000	0.8
			1997	SC	19,800	21,000	23,200	17,600	0.9
			1998	SC	20,900	22,200	24,500	18,600	0.7
			1999	SC	22,000	23,400	25,800	19,600	1.0
			2000	SC	21,800	23,200	25,500	19,200	1.1
			2001	SC	21,900	23,400	25,600	19,300	1.1
			2002	SC	21,900	23,200	25,600	19,300	0.7
			2003	SC	21,500	22,600	25,200	18,900	1.2
			2004	SC	21,300	22,500	24,900	18,800	0.7
			2005	SC	21,600	22,900	25,200	19,000	0.9
			2006	SC	21,900	23,200	25,600	19,300	0.9
			2007	SC	22,200	23,500	25,700	19,500	1.0
			2008	SC	22,500	23,600	22,300	19,800	0.7
			2009	SC	22,500	23,800	26,300	19,800	0.6
			2010	SC	23,300	24,600	27,300	20,500	0.7
7	WOOLWICH ST E JCT -START OF NA KITCHENER/WATERLOO	5.5							
7	HWY 85 OP-CONESTOGA PKWY-END OF NA	1.5	1988	UC	61,000	64,000	68,900	57,300	1.6
			1989	UC	62,000	65,000	70,000	58,800	1.6
			1990	UC	66,250	70,800	76,800	62,900	1.1
			1991	UC	68,900	73,000	79,200	66,800	0.9
			1992	SC	66,900	70,200	78,200	61,500	1.1
			1993	SC	67,550	74,900	82,400	60,100	0.9
			1994	SC	73,700	76,600	84,800	67,800	0.9
			1995	SC	76,300	80,100	88,500	67,400	1.0
			1996	SC	78,800	83,800	92,400	70,900	0.7
			1997	SC	81,300	86,400	95,300	72,400	0.9
			1998	SC	83,800	89,100	98,200	74,600	0.4
			1999	SC	86,300	91,700	101,100	76,800	0.5
			2000	SC	88,800	94,400	104,100	78,400	0.4
			2001	SC	91,300	97,700	106,800	80,300	0.5
			2002	SC	93,800	99,500	109,800	82,700	0.8
			2003	SC	95,800	100,600	112,100	84,300	0.6
			2004	SC	97,400	102,800	113,600	86,200	0.6
			2005	SC	99,000	104,800	115,600	87,100	0.3
			2006	SC	100,600	106,400	117,600	88,700	0.5
			2007	SC	102,200	108,000	118,200	89,900	0.4

Configuration

Controller Sequence Priority

	1	2	3	4	5	6	7	8	9	10	11	12
Ring 1 Phases	1	2	3	4	9	10	0	0	0	0	0	0
Ring 2 Phases	5	6	7	8	11	12	0	0	0	0	0	0

Phase	1	2	3	4	5	6	7	8	9	10	11	12
In Use		X		X		X						
Exclusive Ped												
Direction												

Overlap	A	B	C	D
Direction				

Load Switch Channel/Driver Group Assign (Info Only):

Load Switch (MMU) Channel	Signal Driver Phase/ Ovlap	Group Ped
1	1	.
2	2	.
3	3	.
4	4	.
5	5	.
6	6	.
7	7	.
8	8	.
9	2	X
10	4	X
11	6	X
12	8	X
13	A	.
14	B	.
15	C	.
16	D	.

Configuration Continued

Enable BIU:	1	2	3	4	5	6	7	8
Terminal/Facilities.	.	.	.	.	.	.	.	.
Detector Rack.	.	.	.	.	.	.	.	.

Type 2 Runs as Type 1. . .	.
MMU Disable.	X
Diagnostic Enable.	.
Peer-Peer Comm Enable. . .	.

	1	2	3	4	5	6	7	8	9	10
Peer To Peer Addresses . .	255	255	255	255	255	255	255	255	255	255

Port 2:

Port 2 Protocol	Terminal
Port 2 Enable	YES
AB3418 Address.	0
AB3418 Group Address.	0
AB3418 Response Delay	0
AB3418 Single Flag Enable . . .	NO
AB3418 Drop-Out Time.	0
AB3418 TOD SF Select.	0
Data Rate	1200 bps
Data, Parity, Stop.	8, 0, 1

Port 3:

Port 3 Protocol	Telemetry
Port 3 Enable	NO
Telemetry Address	3
System Detector 9-16 Address. .	0
Telemetry Response Delay. . . .	7800
AB3418 Address.	0
AB3418 Group Address.	0
AB3418 Response Delay	0
AB3418 Single Flag Enable . . .	NO
AB3418 Drop-Out Time.	0
AB3418 TOD SF Select.	0
Duplex.	Full
Data Rate	1200 bps
Data, Parity, Stop.	8, 0, 1

Wellington County 1-12 124 & Kossuth 11/4/2013 15:34

By-Phase Timing Data

	Phase											
Direction	1	2	3	4	5	6	7	8	9	10	11	12
Minimum Green	5	30	5	12	5	30	5	5	5	5	5	5
Bike Min Green	0	0	0	0	0	0	0	0	0	0	0	0
Cond Serv Min Grn	0	0	0	0	0	0	0	0	0	0	0	0
Walk	0	5	0	5	0	5	0	5	0	10	0	10
Ped Clearance	0	7	0	7	0	7	0	7	0	16	0	16
Veh Extension	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Alt Veh Exten	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Extension	0	0	0	0	0	0	0	0	0	0	0	0
Max 1	35	40	35	35	35	40	35	35	35	35	35	35
Max 2	40	60	40	40	40	60	40	40	40	40	40	40
Max 3	0	0	0	0	0	0	0	0	0	0	0	0
Det. Fail Max	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Change	3.0	5.0	3.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Red Clearance	1.0	2.0	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Red Revert	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Act. B4 Init	0	0	0	0	0	0	0	0	0	0	0	0
Sec/Actuation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Initial	30	30	30	30	30	30	30	30	30	30	30	30
Time B4 Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Cars Waiting	0	0	0	0	0	0	0	0	0	0	0	0
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Power Start, Remote Flash

	Phase 1	2	3	4	5	6	7	8	9	10	11	12	Overlap A	B	C	D
Power Start	.	X	.	.	.	X	.	.	.	.	.	.				
External Start	.	X	.	.	.	X	.	.	.	.	.	.				
Into Remote Flash	.	X	.	.	.	X	.	.	.	.	.	.				
Exit Remote Flash	.	X	.	.	.	X	.	.	.	.	.	.				
Remote Flash Yellow	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	X
Flash Together	.	X	.	X	.	X	.	X	.	X	.	X	.	X	.	X

Initialization Interval:

Power Start	Yellow
External Start	Yellow

Power Start All Red Time	0
Power Start Flash Time	0

Remote Flash Options:

Out of Flash Yellow	YES
Out of Flash All Red	NO
Minimum Recall	NO
Alternate Flash	NO
Flash Thru Load Switches	NO
Cycle Through Phases	NO

Option Data

	Phase											
	1	2	3	4	5	6	7	8	9	10	11	12
Guaranteed Passage												
Call To NonActuated 1		X				X						
Call To NonActuated 2				X				X				
Dual Entry		X				X						
Conditional Service	X		X		X		X		X		X	
Conditional Reservice												
Actuated Rest in Walk												
Flashing Walk												

Enable Programmable Options

Dual Entry	ON	Backup Protection Group 1	OFF
Conditional Service	OFF	Backup Protection Group 2	OFF
Ped Clearance Protection	OFF	Backup Protection Group 3	OFF
Special Preempt Overlap Flash	OFF	Simultaneous Gap Group 1	OFF
Cond Service Det Cross Switch	OFF	Simultaneous Gap Group 2	OFF
Lock Detectors in Red Only	OFF	Simultaneous Gap Group 3	OFF

Five Section Left Turn Control

Phases:	5-2	7-4	1-6	3-8	11-10	9-12
Left Turn Head						

Recall Data, Dimming

	Phase											
	1	2	3	4	5	6	7	8	9	10	11	12
Locking Detector. . . .	.	.	.	.	.	.	.	.	.	.	.	.
Vehicle Recall.	.	X	.	.	.	X	.	.	.	.	.	.
Pedestrian Recall . . .	.	.	.	.	.	.	.	.	.	.	.	.
Recall To Max	.	.	.	.	.	.	.	.	.	.	.	.
Soft Recall	.	.	.	.	.	.	.	.	.	.	.	.
Don't Rest Here	.	.	.	.	.	.	.	.	.	.	.	.
Ped Dark if No Call . .	.	.	.	.	.	.	.	.	.	.	.	.

Dimming:

	Load Switch															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Green/Walk. . . .	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Yellow/Ped Clear.	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Red/Don't Walk. .	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

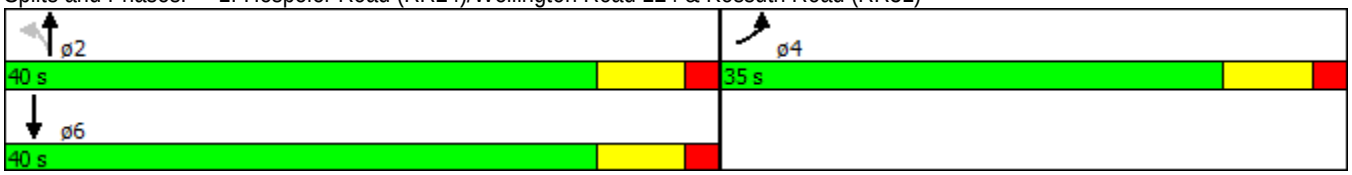
Appendix B

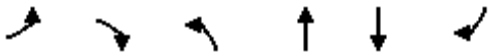
Baseline (2013) Traffic Synchro Capacity Analysis

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	314	34	60	706	641	335
Turn Type	NA	Free	Perm	NA	NA	Free
Protected Phases	4			2	6	
Permitted Phases		Free	2			Free
Detector Phase	4		2	2	6	
Switch Phase						
Minimum Initial (s)	12.0		30.0	30.0	30.0	
Minimum Split (s)	33.0		37.0	37.0	37.0	
Total Split (s)	35.0		40.0	40.0	40.0	
Total Split (%)	46.7%		53.3%	53.3%	53.3%	
Yellow Time (s)	5.0		5.0	5.0	5.0	
All-Red Time (s)	2.0		2.0	2.0	2.0	
Lost Time Adjust (s)	-3.0		-3.0	-3.0	-3.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None		Min	Min	Min	
Act Effct Green (s)	24.2	67.8	35.6	35.6	35.6	67.8
Actuated g/C Ratio	0.36	1.00	0.53	0.53	0.53	1.00
v/c Ratio	0.62	0.03	0.36	0.86	0.78	0.27
Control Delay	23.4	0.0	18.7	27.6	22.3	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.4	0.0	18.7	27.6	22.3	0.5
LOS	C	A	B	C	C	A
Approach Delay	21.1			26.9	14.8	
Approach LOS	C			C	B	

Intersection Summary	
Cycle Length: 75	
Actuated Cycle Length: 67.8	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 20.3	Intersection LOS: C
Intersection Capacity Utilization 78.7%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)

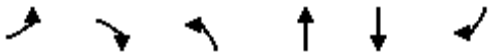




Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	349	38	67	784	712	372
v/c Ratio	0.62	0.03	0.36	0.86	0.78	0.27
Control Delay	23.4	0.0	18.7	27.6	22.3	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.4	0.0	18.7	27.6	22.3	0.5
Queue Length 50th (m)	37.9	0.0	4.9	84.4	71.3	0.0
Queue Length 95th (m)	63.0	0.0	18.0	#181.7	#156.8	0.0
Internal Link Dist (m)	704.1			173.7	579.0	
Turn Bay Length (m)		30.0	90.0			120.0
Base Capacity (vph)	724	1350	187	931	931	1401
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.03	0.36	0.84	0.76	0.27

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	314	34	60	706	641	335
Ideal Flow (vphpl)	1775	1750	1775	1900	1900	1750
Total Lost time (s)	4.0	1.0	4.0	4.0	4.0	1.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1573	1350	1619	1740	1740	1401
Flt Permitted	0.95	1.00	0.21	1.00	1.00	1.00
Satd. Flow (perm)	1573	1350	351	1740	1740	1401
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	349	38	67	784	712	372
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	349	38	67	784	712	372
Heavy Vehicles (%)	6%	9%	3%	8%	8%	5%
Turn Type	NA	Free	Perm	NA	NA	Free
Protected Phases	4			2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	21.1	67.7	32.6	32.6	32.6	67.7
Effective Green, g (s)	24.1	67.7	35.6	35.6	35.6	67.7
Actuated g/C Ratio	0.36	1.00	0.53	0.53	0.53	1.00
Clearance Time (s)	7.0		7.0	7.0	7.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	559	1350	184	914	914	1401
v/s Ratio Prot	c0.22			c0.45	0.41	
v/s Ratio Perm		0.03	0.19			0.27
v/c Ratio	0.62	0.03	0.36	0.86	0.78	0.27
Uniform Delay, d1	18.1	0.0	9.4	13.9	12.9	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.1	0.0	2.6	8.8	5.0	0.5
Delay (s)	21.1	0.0	12.0	22.6	17.8	0.5
Level of Service	C	A	B	C	B	A
Approach Delay (s)	19.1			21.8	11.9	
Approach LOS	B			C	B	

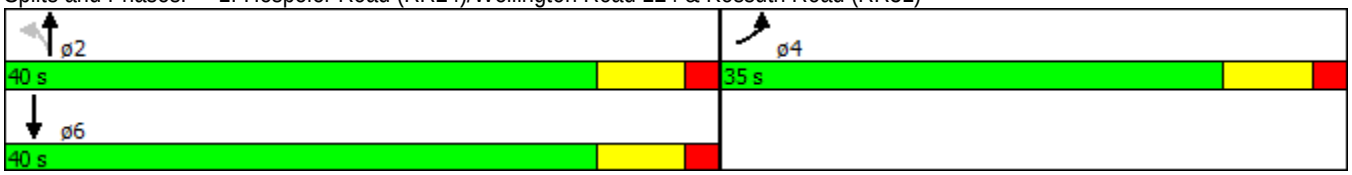
Intersection Summary			
HCM 2000 Control Delay	16.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	67.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		

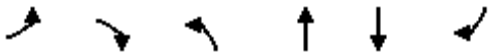
c Critical Lane Group

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	300	82	76	594	728	408
Turn Type	NA	Free	Perm	NA	NA	Free
Protected Phases	4			2	6	
Permitted Phases		Free	2			Free
Detector Phase	4		2	2	6	
Switch Phase						
Minimum Initial (s)	12.0		30.0	30.0	30.0	
Minimum Split (s)	33.0		37.0	37.0	37.0	
Total Split (s)	35.0		40.0	40.0	40.0	
Total Split (%)	46.7%		53.3%	53.3%	53.3%	
Yellow Time (s)	5.0		5.0	5.0	5.0	
All-Red Time (s)	2.0		2.0	2.0	2.0	
Lost Time Adjust (s)	-3.0		-3.0	-3.0	-3.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None		Min	Min	Min	
Act Effct Green (s)	23.4	67.6	36.2	36.2	36.2	67.6
Actuated g/C Ratio	0.35	1.00	0.54	0.54	0.54	1.00
v/c Ratio	0.60	0.06	0.64	0.72	0.86	0.32
Control Delay	23.0	0.1	42.1	19.4	27.3	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.0	0.1	42.1	19.4	27.3	0.6
LOS	C	A	D	B	C	A
Approach Delay	18.1			22.0	17.7	
Approach LOS	B			C	B	

Intersection Summary	
Cycle Length: 75	
Actuated Cycle Length: 67.6	
Natural Cycle: 75	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 19.1	Intersection LOS: B
Intersection Capacity Utilization 91.1%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)

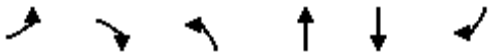




Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	333	91	84	660	809	453
v/c Ratio	0.60	0.06	0.64	0.72	0.86	0.32
Control Delay	23.0	0.1	42.1	19.4	27.3	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.0	0.1	42.1	19.4	27.3	0.6
Queue Length 50th (m)	35.5	0.0	7.2	60.8	84.8	0.0
Queue Length 95th (m)	59.2	0.0	#34.8	#141.5	#189.0	0.0
Internal Link Dist (m)	704.1			173.7	579.0	
Turn Bay Length (m)		30.0	90.0			120.0
Base Capacity (vph)	739	1456	131	915	941	1428
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.06	0.64	0.72	0.86	0.32

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	300	82	76	594	728	408
Ideal Flow (vphpl)	1775	1750	1775	1900	1900	1750
Total Lost time (s)	4.0	1.0	4.0	4.0	4.0	1.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1603	1456	1603	1708	1756	1428
Flt Permitted	0.95	1.00	0.15	1.00	1.00	1.00
Satd. Flow (perm)	1603	1456	245	1708	1756	1428
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	333	91	84	660	809	453
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	333	91	84	660	809	453
Heavy Vehicles (%)	4%	1%	4%	10%	7%	3%
Turn Type	NA	Free	Perm	NA	NA	Free
Protected Phases	4			2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	20.3	67.4	33.1	33.1	33.1	67.4
Effective Green, g (s)	23.3	67.4	36.1	36.1	36.1	67.4
Actuated g/C Ratio	0.35	1.00	0.54	0.54	0.54	1.00
Clearance Time (s)	7.0		7.0	7.0	7.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	554	1456	131	914	940	1428
v/s Ratio Prot	c0.21			0.39	c0.46	
v/s Ratio Perm		0.06	0.34			0.32
v/c Ratio	0.60	0.06	0.64	0.72	0.86	0.32
Uniform Delay, d1	18.2	0.0	11.1	11.9	13.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.7	0.1	13.8	3.5	8.8	0.6
Delay (s)	20.9	0.1	24.8	15.3	22.3	0.6
Level of Service	C	A	C	B	C	A
Approach Delay (s)	16.4			16.4	14.5	
Approach LOS	B			B	B	

Intersection Summary			
HCM 2000 Control Delay	15.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	67.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

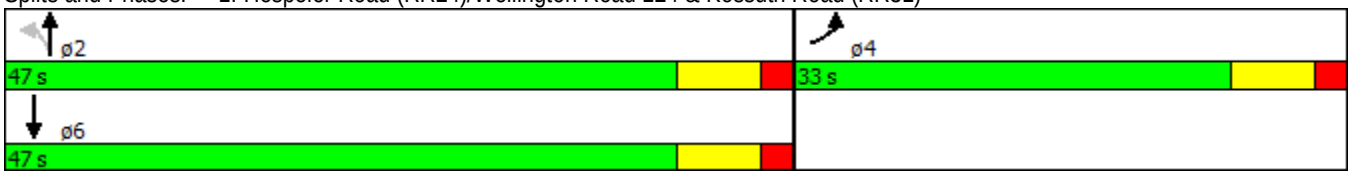
Appendix C

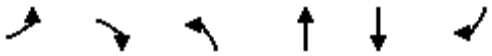
Future (2015) Background Traffic Synchro Capacity Analysis

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	346	37	66	778	707	369
Turn Type	NA	Free	Perm	NA	NA	Free
Protected Phases	4			2	6	
Permitted Phases		Free	2			Free
Detector Phase	4		2	2	6	
Switch Phase						
Minimum Initial (s)	12.0		30.0	30.0	30.0	
Minimum Split (s)	33.0		37.0	37.0	37.0	
Total Split (s)	33.0		47.0	47.0	47.0	
Total Split (%)	41.3%		58.8%	58.8%	58.8%	
Yellow Time (s)	5.0		5.0	5.0	5.0	
All-Red Time (s)	2.0		2.0	2.0	2.0	
Lost Time Adjust (s)	-3.0		-3.0	-3.0	-3.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None		Min	Min	Min	
Act Effct Green (s)	25.9	75.3	41.3	41.3	41.3	75.3
Actuated g/C Ratio	0.34	1.00	0.55	0.55	0.55	1.00
v/c Ratio	0.71	0.03	0.46	0.90	0.82	0.29
Control Delay	30.1	0.1	23.2	31.5	24.0	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.1	0.1	23.2	31.5	24.0	0.5
LOS	C	A	C	C	C	A
Approach Delay	27.2			30.8	16.0	
Approach LOS	C			C	B	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 75.3	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.90	
Intersection Signal Delay: 23.3	Intersection LOS: C
Intersection Capacity Utilization 85.9%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)

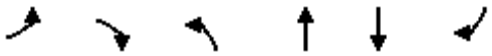




Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	384	41	73	864	786	410
v/c Ratio	0.71	0.03	0.46	0.90	0.82	0.29
Control Delay	30.1	0.1	23.2	31.5	24.0	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.1	0.1	23.2	31.5	24.0	0.5
Queue Length 50th (m)	50.8	0.0	6.7	117.0	97.9	0.0
Queue Length 95th (m)	82.3	0.0	21.4	#203.3	#175.2	0.0
Internal Link Dist (m)	704.1			173.7	579.0	
Turn Bay Length (m)		30.0	90.0			120.0
Base Capacity (vph)	612	1350	167	1003	1003	1401
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.03	0.44	0.86	0.78	0.29

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	346	37	66	778	707	369
Ideal Flow (vphpl)	1775	1750	1775	1900	1900	1750
Total Lost time (s)	4.0	1.0	4.0	4.0	4.0	1.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1573	1350	1619	1740	1740	1401
Flt Permitted	0.95	1.00	0.17	1.00	1.00	1.00
Satd. Flow (perm)	1573	1350	289	1740	1740	1401
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	384	41	73	864	786	410
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	384	41	73	864	786	410
Heavy Vehicles (%)	6%	9%	3%	8%	8%	5%
Turn Type	NA	Free	Perm	NA	NA	Free
Protected Phases	4			2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	22.9	75.2	38.3	38.3	38.3	75.2
Effective Green, g (s)	25.9	75.2	41.3	41.3	41.3	75.2
Actuated g/C Ratio	0.34	1.00	0.55	0.55	0.55	1.00
Clearance Time (s)	7.0		7.0	7.0	7.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	541	1350	158	955	955	1401
v/s Ratio Prot	c0.24			c0.50	0.45	
v/s Ratio Perm		0.03	0.25			0.29
v/c Ratio	0.71	0.03	0.46	0.90	0.82	0.29
Uniform Delay, d1	21.4	0.0	10.2	15.2	13.9	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.3	0.0	4.4	12.5	6.5	0.5
Delay (s)	26.7	0.0	14.7	27.7	20.5	0.5
Level of Service	C	A	B	C	C	A
Approach Delay (s)	24.1			26.6	13.6	
Approach LOS	C			C	B	

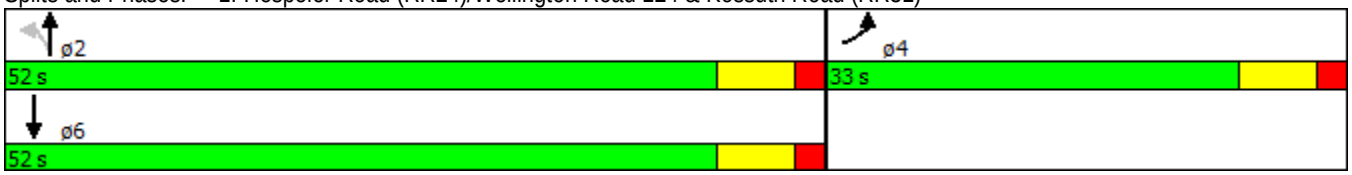
Intersection Summary			
HCM 2000 Control Delay	20.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	75.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		

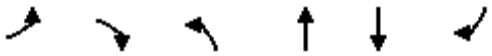
c Critical Lane Group

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	331	90	84	655	803	450
Turn Type	NA	Free	Perm	NA	NA	Free
Protected Phases	4			2	6	
Permitted Phases		Free	2			Free
Detector Phase	4		2	2	6	
Switch Phase						
Minimum Initial (s)	12.0		30.0	30.0	30.0	
Minimum Split (s)	33.0		37.0	37.0	37.0	
Total Split (s)	33.0		52.0	52.0	52.0	
Total Split (%)	38.8%		61.2%	61.2%	61.2%	
Yellow Time (s)	5.0		5.0	5.0	5.0	
All-Red Time (s)	2.0		2.0	2.0	2.0	
Lost Time Adjust (s)	-3.0		-3.0	-3.0	-3.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None		Min	Min	Min	
Act Effct Green (s)	25.8	79.3	45.3	45.3	45.3	79.3
Actuated g/C Ratio	0.33	1.00	0.57	0.57	0.57	1.00
v/c Ratio	0.70	0.07	0.82	0.75	0.89	0.35
Control Delay	32.4	0.1	69.8	19.2	28.7	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.4	0.1	69.8	19.2	28.7	0.7
LOS	C	A	E	B	C	A
Approach Delay	25.5			25.0	18.6	
Approach LOS	C			C	B	

Intersection Summary	
Cycle Length: 85	
Actuated Cycle Length: 79.3	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.89	
Intersection Signal Delay: 21.7	Intersection LOS: C
Intersection Capacity Utilization 96.9%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)

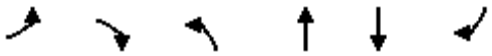




Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	368	100	93	728	892	500
v/c Ratio	0.70	0.07	0.82	0.75	0.89	0.35
Control Delay	32.4	0.1	69.8	19.2	28.7	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.4	0.1	69.8	19.2	28.7	0.7
Queue Length 50th (m)	53.0	0.0	12.0	87.0	124.2	0.0
Queue Length 95th (m)	84.6	0.0	#43.2	135.9	#214.4	0.0
Internal Link Dist (m)	704.1			173.7	579.0	
Turn Bay Length (m)		30.0	90.0			120.0
Base Capacity (vph)	596	1456	122	1051	1080	1428
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.62	0.07	0.76	0.69	0.83	0.35

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	331	90	84	655	803	450
Ideal Flow (vphpl)	1775	1750	1775	1900	1900	1750
Total Lost time (s)	4.0	1.0	4.0	4.0	4.0	1.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1603	1456	1603	1708	1756	1428
Flt Permitted	0.95	1.00	0.12	1.00	1.00	1.00
Satd. Flow (perm)	1603	1456	200	1708	1756	1428
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	368	100	93	728	892	500
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	368	100	93	728	892	500
Heavy Vehicles (%)	4%	1%	4%	10%	7%	3%
Turn Type	NA	Free	Perm	NA	NA	Free
Protected Phases	4			2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	22.8	79.1	42.3	42.3	42.3	79.1
Effective Green, g (s)	25.8	79.1	45.3	45.3	45.3	79.1
Actuated g/C Ratio	0.33	1.00	0.57	0.57	0.57	1.00
Clearance Time (s)	7.0		7.0	7.0	7.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	522	1456	114	978	1005	1428
v/s Ratio Prot	c0.23			0.43	c0.51	
v/s Ratio Perm		0.07	0.47			0.35
v/c Ratio	0.70	0.07	0.82	0.74	0.89	0.35
Uniform Delay, d1	23.3	0.0	13.6	12.6	14.7	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.4	0.1	38.0	3.7	10.3	0.7
Delay (s)	28.7	0.1	51.5	16.3	25.0	0.7
Level of Service	C	A	D	B	C	A
Approach Delay (s)	22.6			20.3	16.2	
Approach LOS	C			C	B	

Intersection Summary			
HCM 2000 Control Delay	18.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	79.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

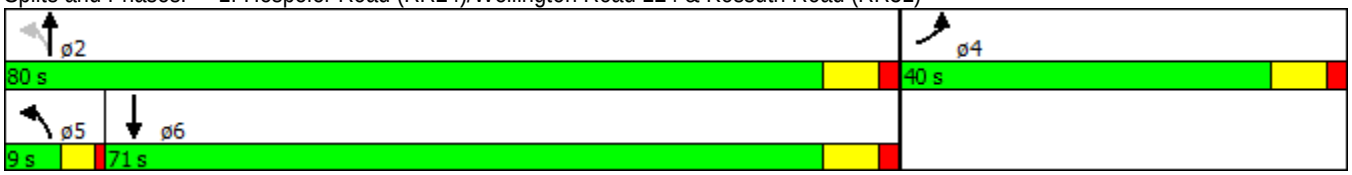
Appendix D

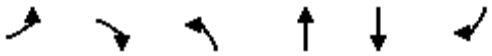
Future (2020) Background Traffic Synchro Capacity Analysis

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	442	48	84	993	902	471
Turn Type	NA	Free	pm+pt	NA	NA	Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Detector Phase	4		5	2	6	
Switch Phase						
Minimum Initial (s)	12.0		5.0	30.0	30.0	
Minimum Split (s)	33.0		9.0	37.0	37.0	
Total Split (s)	40.0		9.0	80.0	71.0	
Total Split (%)	33.3%		7.5%	66.7%	59.2%	
Yellow Time (s)	5.0		3.0	5.0	5.0	
All-Red Time (s)	2.0		1.0	2.0	2.0	
Lost Time Adjust (s)	-3.0		0.0	-3.0	-3.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?						
Recall Mode	None		None	Min	Min	
Act Effct Green (s)	36.0	120.0	76.0	76.0	67.0	120.0
Actuated g/C Ratio	0.30	1.00	0.63	0.63	0.56	1.00
v/c Ratio	1.04	0.04	0.73	1.00	1.03	0.37
Control Delay	94.3	0.1	48.1	50.1	64.5	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	94.3	0.1	48.1	50.1	64.5	0.8
LOS	F	A	D	D	E	A
Approach Delay	85.1			50.0	42.7	
Approach LOS	F			D	D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Natural Cycle: 110	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.04	
Intersection Signal Delay: 52.4	Intersection LOS: D
Intersection Capacity Utilization 88.7%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)



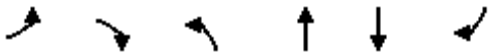


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	491	53	93	1103	1002	523
v/c Ratio	1.04	0.04	0.73	1.00	1.03	0.37
Control Delay	94.3	0.1	48.1	50.1	64.5	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	94.3	0.1	48.1	50.1	64.5	0.8
Queue Length 50th (m)	~131.6	0.0	8.3	~255.3	~266.3	0.0
Queue Length 95th (m)	#199.1	0.0	#35.1	#366.7	#346.7	0.0
Internal Link Dist (m)	704.1			173.7	579.0	
Turn Bay Length (m)		30.0	90.0			120.0
Base Capacity (vph)	471	1350	127	1102	971	1401
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.04	0.04	0.73	1.00	1.03	0.37

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	442	48	84	993	902	471
Ideal Flow (vphpl)	1775	1750	1775	1900	1900	1750
Total Lost time (s)	4.0	1.0	4.0	4.0	4.0	1.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1573	1350	1619	1740	1740	1401
Flt Permitted	0.95	1.00	0.06	1.00	1.00	1.00
Satd. Flow (perm)	1573	1350	100	1740	1740	1401
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	491	53	93	1103	1002	523
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	491	53	93	1103	1002	523
Heavy Vehicles (%)	6%	9%	3%	8%	8%	5%
Turn Type	NA	Free	pm+pt	NA	NA	Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	33.0	120.0	73.0	73.0	64.0	120.0
Effective Green, g (s)	36.0	120.0	73.0	76.0	67.0	120.0
Actuated g/C Ratio	0.30	1.00	0.61	0.63	0.56	1.00
Clearance Time (s)	7.0		4.0	7.0	7.0	
Vehicle Extension (s)	5.0		5.0	5.0	8.0	
Lane Grp Cap (vph)	471	1350	124	1102	971	1401
v/s Ratio Prot	c0.31		0.03	c0.63	0.58	
v/s Ratio Perm		0.04	0.42			0.37
v/c Ratio	1.04	0.04	0.75	1.00	1.03	0.37
Uniform Delay, d1	42.0	0.0	27.8	22.0	26.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	53.0	0.1	25.9	27.3	37.4	0.8
Delay (s)	95.0	0.1	53.7	49.3	63.9	0.8
Level of Service	F	A	D	D	E	A
Approach Delay (s)	85.7			49.7	42.2	
Approach LOS	F			D	D	

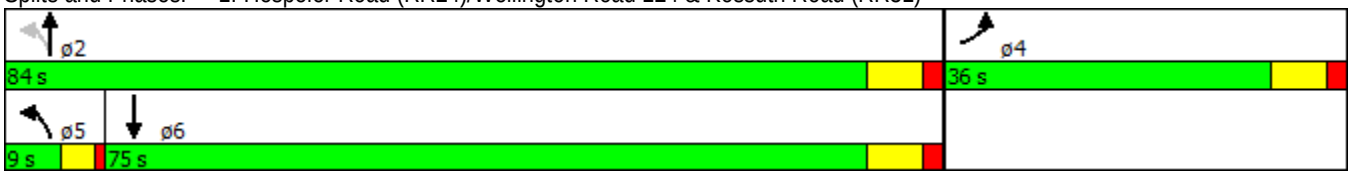
Intersection Summary			
HCM 2000 Control Delay	52.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

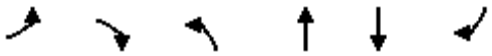
c Critical Lane Group

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	422	115	107	836	1024	574
Turn Type	NA	Free	pm+pt	NA	NA	Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Detector Phase	4		5	2	6	
Switch Phase						
Minimum Initial (s)	12.0		5.0	30.0	30.0	
Minimum Split (s)	33.0		9.0	37.0	37.0	
Total Split (s)	36.0		9.0	84.0	75.0	
Total Split (%)	30.0%		7.5%	70.0%	62.5%	
Yellow Time (s)	5.0		3.0	5.0	5.0	
All-Red Time (s)	2.0		1.0	2.0	2.0	
Lost Time Adjust (s)	-3.0		0.0	-3.0	-3.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?						
Recall Mode	None		None	Min	Min	
Act Effct Green (s)	32.0	120.0	80.0	80.0	71.0	120.0
Actuated g/C Ratio	0.27	1.00	0.67	0.67	0.59	1.00
v/c Ratio	1.10	0.09	0.94	0.82	1.10	0.45
Control Delay	114.4	0.1	89.3	22.1	83.5	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	114.4	0.1	89.3	22.1	83.5	1.0
LOS	F	A	F	C	F	A
Approach Delay	89.9			29.8	53.8	
Approach LOS	F			C	D	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Natural Cycle: 120	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.10	
Intersection Signal Delay: 52.8	Intersection LOS: D
Intersection Capacity Utilization 95.3%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)



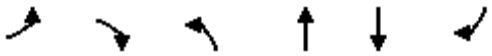


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	469	128	119	929	1138	638
v/c Ratio	1.10	0.09	0.94	0.82	1.10	0.45
Control Delay	114.4	0.1	89.3	22.1	83.5	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	114.4	0.1	89.3	22.1	83.5	1.0
Queue Length 50th (m)	~131.7	0.0	14.1	154.1	~319.0	0.0
Queue Length 95th (m)	#198.2	0.0	#52.8	224.4	#401.5	0.0
Internal Link Dist (m)	704.1			173.7	579.0	
Turn Bay Length (m)		30.0	90.0			120.0
Base Capacity (vph)	427	1456	126	1138	1038	1428
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.10	0.09	0.94	0.82	1.10	0.45

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	422	115	107	836	1024	574
Ideal Flow (vphpl)	1775	1750	1775	1900	1900	1750
Total Lost time (s)	4.0	1.0	4.0	4.0	4.0	1.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1603	1456	1603	1708	1756	1428
Flt Permitted	0.95	1.00	0.06	1.00	1.00	1.00
Satd. Flow (perm)	1603	1456	94	1708	1756	1428
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	469	128	119	929	1138	638
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	469	128	119	929	1138	638
Heavy Vehicles (%)	4%	1%	4%	10%	7%	3%
Turn Type	NA	Free	pm+pt	NA	NA	Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	29.0	120.0	77.0	77.0	68.0	120.0
Effective Green, g (s)	32.0	120.0	77.0	80.0	71.0	120.0
Actuated g/C Ratio	0.27	1.00	0.64	0.67	0.59	1.00
Clearance Time (s)	7.0		4.0	7.0	7.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	427	1456	123	1138	1038	1428
v/s Ratio Prot	c0.29		0.04	c0.54	c0.65	
v/s Ratio Perm		0.09	0.58			0.45
v/c Ratio	1.10	0.09	0.97	0.82	1.10	0.45
Uniform Delay, d1	44.0	0.0	35.0	14.6	24.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	72.9	0.1	71.2	5.2	58.1	1.0
Delay (s)	116.9	0.1	106.2	19.9	82.6	1.0
Level of Service	F	A	F	B	F	A
Approach Delay (s)	91.8			29.7	53.3	
Approach LOS	F			C	D	

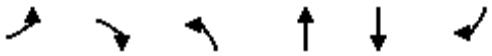
Intersection Summary			
HCM 2000 Control Delay	52.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	442	48	84	993	902	471
Turn Type	NA	Free	pm+pt	NA	NA	Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Detector Phase	4		5	2	6	
Switch Phase						
Minimum Initial (s)	12.0		5.0	30.0	30.0	
Minimum Split (s)	33.0		9.0	37.0	37.0	
Total Split (s)	34.0		9.0	46.0	37.0	
Total Split (%)	42.5%		11.3%	57.5%	46.3%	
Yellow Time (s)	5.0		3.0	5.0	5.0	
All-Red Time (s)	2.0		1.0	2.0	2.0	
Lost Time Adjust (s)	-3.0		0.0	-3.0	-3.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?						
Recall Mode	None		None	Min	Min	
Act Effct Green (s)	28.5	76.8	40.2	40.2	33.3	76.8
Actuated g/C Ratio	0.37	1.00	0.52	0.52	0.43	1.00
v/c Ratio	0.84	0.04	0.44	0.64	0.70	0.37
Control Delay	37.8	0.1	16.5	15.4	22.0	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.8	0.1	16.5	15.4	22.0	0.8
LOS	D	A	B	B	C	A
Approach Delay	34.1			15.5	14.7	
Approach LOS	C			B	B	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 76.8	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.84	
Intersection Signal Delay: 18.2	Intersection LOS: B
Intersection Capacity Utilization 66.2%	ICU Level of Service C
Analysis Period (min) 15	

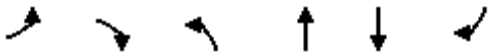
Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	491	53	93	1103	1002	523
v/c Ratio	0.84	0.04	0.44	0.64	0.70	0.37
Control Delay	37.8	0.1	16.5	15.4	22.0	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.8	0.1	16.5	15.4	22.0	0.8
Queue Length 50th (m)	69.8	0.0	7.0	62.0	69.0	0.0
Queue Length 95th (m)	#124.1	0.0	14.3	82.6	92.3	0.0
Internal Link Dist (m)	704.1			173.7	579.0	
Turn Bay Length (m)		30.0	90.0			120.0
Base Capacity (vph)	619	1350	209	1822	1432	1401
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.04	0.44	0.61	0.70	0.37

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	442	48	84	993	902	471
Ideal Flow (vphpl)	1775	1750	1775	1900	1900	1750
Total Lost time (s)	4.0	1.0	4.0	4.0	4.0	1.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1573	1350	1619	3305	3305	1401
Flt Permitted	0.95	1.00	0.13	1.00	1.00	1.00
Satd. Flow (perm)	1573	1350	226	3305	3305	1401
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	491	53	93	1103	1002	523
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	491	53	93	1103	1002	523
Heavy Vehicles (%)	6%	9%	3%	8%	8%	5%
Turn Type	NA	Free	pm+pt	NA	NA	Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	25.5	77.5	38.0	38.0	30.2	77.5
Effective Green, g (s)	28.5	77.5	38.0	41.0	33.2	77.5
Actuated g/C Ratio	0.37	1.00	0.49	0.53	0.43	1.00
Clearance Time (s)	7.0		4.0	7.0	7.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	578	1350	179	1748	1415	1401
v/s Ratio Prot	c0.31		0.03	c0.33	c0.30	
v/s Ratio Perm		0.04	0.23			0.37
v/c Ratio	0.85	0.04	0.52	0.63	0.71	0.37
Uniform Delay, d1	22.5	0.0	13.4	12.9	18.2	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.3	0.1	5.0	1.0	2.1	0.8
Delay (s)	34.8	0.1	18.4	13.9	20.2	0.8
Level of Service	C	A	B	B	C	A
Approach Delay (s)	31.5			14.3	13.6	
Approach LOS	C			B	B	

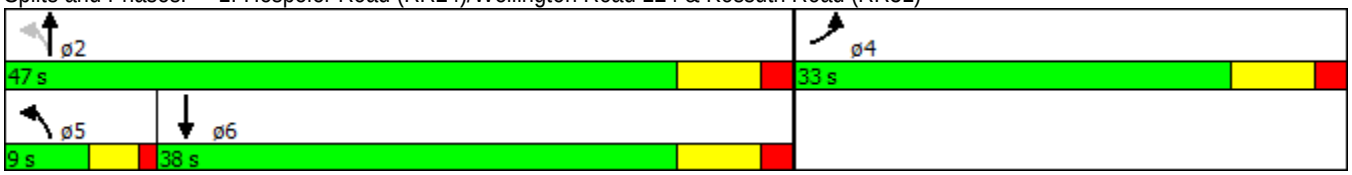
Intersection Summary			
HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	77.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		

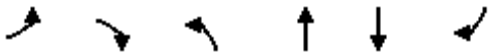
c Critical Lane Group

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	422	115	107	836	1024	574
Turn Type	NA	Free	pm+pt	NA	NA	Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Detector Phase	4		5	2	6	
Switch Phase						
Minimum Initial (s)	12.0		5.0	30.0	30.0	
Minimum Split (s)	33.0		9.0	37.0	37.0	
Total Split (s)	33.0		9.0	47.0	38.0	
Total Split (%)	41.3%		11.3%	58.8%	47.5%	
Yellow Time (s)	5.0		3.0	5.0	5.0	
All-Red Time (s)	2.0		1.0	2.0	2.0	
Lost Time Adjust (s)	-3.0		0.0	-3.0	-3.0	
Total Lost Time (s)	4.0		4.0	4.0	4.0	
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?						
Recall Mode	None		None	Min	Min	
Act Effct Green (s)	27.4	76.5	41.0	41.0	34.1	76.5
Actuated g/C Ratio	0.36	1.00	0.54	0.54	0.45	1.00
v/c Ratio	0.82	0.09	0.61	0.53	0.77	0.45
Control Delay	36.2	0.1	24.6	13.1	23.2	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.2	0.1	24.6	13.1	23.2	1.0
LOS	D	A	C	B	C	A
Approach Delay	28.5			14.4	15.2	
Approach LOS	C			B	B	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 76.5	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 17.3	Intersection LOS: B
Intersection Capacity Utilization 69.7%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)

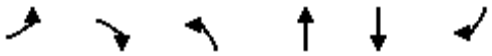




Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	469	128	119	929	1138	638
v/c Ratio	0.82	0.09	0.61	0.53	0.77	0.45
Control Delay	36.2	0.1	24.6	13.1	23.2	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.2	0.1	24.6	13.1	23.2	1.0
Queue Length 50th (m)	66.2	0.0	8.9	47.2	80.8	0.0
Queue Length 95th (m)	#117.1	0.0	#21.2	63.7	107.3	0.0
Internal Link Dist (m)	704.1			173.7	579.0	
Turn Bay Length (m)		30.0	90.0			120.0
Base Capacity (vph)	613	1456	196	1842	1496	1428
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.09	0.61	0.50	0.76	0.45

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	422	115	107	836	1024	574
Ideal Flow (vphpl)	1775	1750	1775	1900	1900	1750
Total Lost time (s)	4.0	1.0	4.0	4.0	4.0	1.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1603	1456	1603	3245	3336	1428
Flt Permitted	0.95	1.00	0.11	1.00	1.00	1.00
Satd. Flow (perm)	1603	1456	192	3245	3336	1428
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	469	128	119	929	1138	638
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	469	128	119	929	1138	638
Heavy Vehicles (%)	4%	1%	4%	10%	7%	3%
Turn Type	NA	Free	pm+pt	NA	NA	Free
Protected Phases	4		5	2	6	
Permitted Phases		Free	2			Free
Actuated Green, G (s)	24.4	77.3	38.9	38.9	31.1	77.3
Effective Green, g (s)	27.4	77.3	38.9	41.9	34.1	77.3
Actuated g/C Ratio	0.35	1.00	0.50	0.54	0.44	1.00
Clearance Time (s)	7.0		4.0	7.0	7.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	568	1456	165	1758	1471	1428
v/s Ratio Prot	c0.29		0.04	0.29	c0.34	
v/s Ratio Perm		0.09	0.32			c0.45
v/c Ratio	0.83	0.09	0.72	0.53	0.77	0.45
Uniform Delay, d1	22.8	0.0	14.2	11.4	18.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.6	0.1	17.4	0.5	3.0	1.0
Delay (s)	33.4	0.1	31.6	11.9	21.4	1.0
Level of Service	C	A	C	B	C	A
Approach Delay (s)	26.3			14.1	14.1	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	16.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	77.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

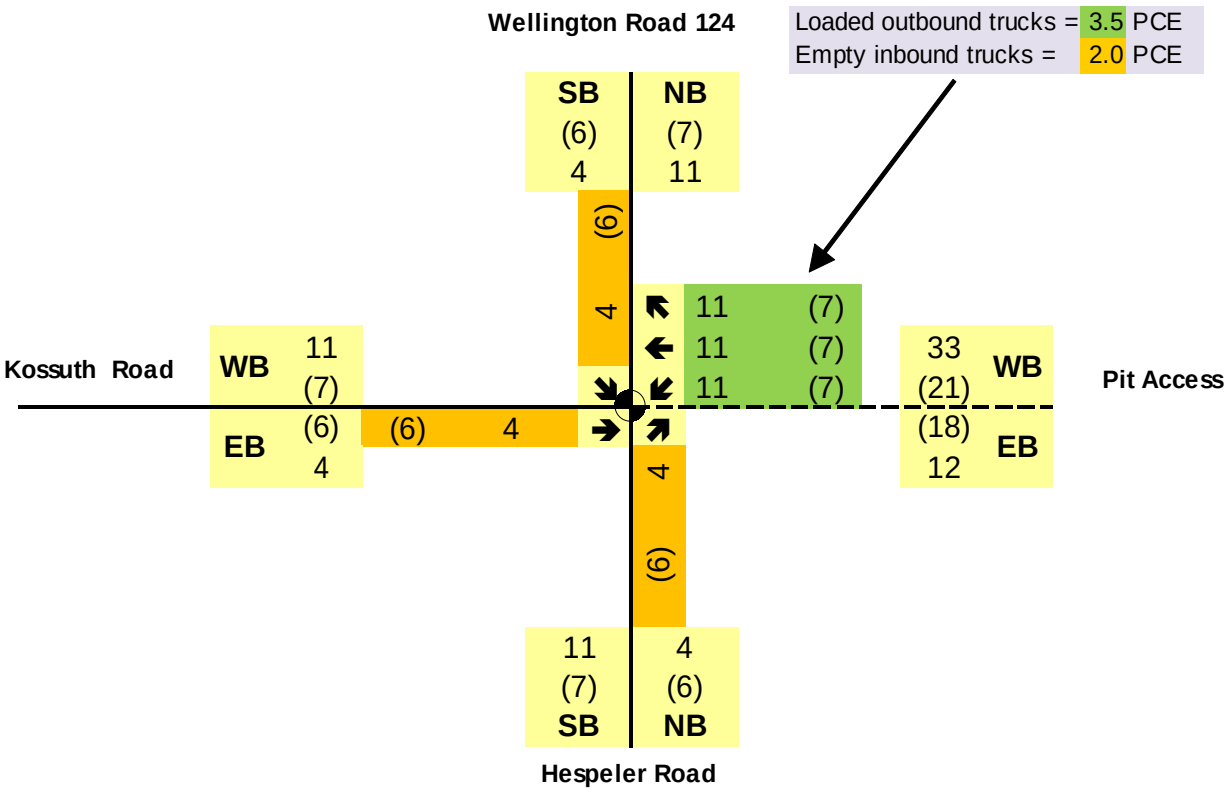
c Critical Lane Group

Appendix E

Future (2015) Total Traffic Synchro Capacity Analysis & Passenger Car Equivalent (PCE) Figure

* Note: Site volumes from Spencer Pit TIS, which were then multiplied by the following PCE value:

Loaded outbound trucks = 3.5 PCE
Empty inbound trucks = 2.0 PCE



Legend

XX	AM Peak Hour Volumes
(XX)	PM Peak Hour Volumes
	Signalized Intersection
	Proposed Access

Tri City Materials
Traffic Impact Assessment
Proposed Spencer Pit
Passenger Car Equivalent
Truck (Site) Volumes

Job Number 2821569
Revision A
Date Apr 2014

Figure E1

6705 Millcreek Drive, Unit 1, Mississauga Ontario L5N 5M4 T 1 416 213 7121 F 1 416 890 8499 E info@ghdcanada.com W www.ghd.com

Plot Date: 4 April 2014 - 10:29 AM Plotted by: Michael Dowdall Cad File No: X:\SernasTransTech\Projects\2013\13268 SPENCER PIT\Analysis\April 2014 Update\13268 Spencer Pit Figures - Apr 4-2014.dwg

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	346	4	37	11	11	66	778	4	4	707	369
Turn Type	Perm	NA	Free	Perm	NA	Perm	NA	Perm	Perm	NA	Free
Protected Phases		4			8		2			6	
Permitted Phases	4		Free	8		2		2	6		Free
Detector Phase	4	4		8	8	2	2	2	6	6	
Switch Phase											
Minimum Initial (s)	12.0	12.0		8.0	8.0	30.0	30.0	30.0	30.0	30.0	
Minimum Split (s)	33.0	33.0		33.0	33.0	37.0	37.0	37.0	37.0	37.0	
Total Split (s)	34.0	34.0		34.0	34.0	46.0	46.0	46.0	46.0	46.0	
Total Split (%)	42.5%	42.5%		42.5%	42.5%	57.5%	57.5%	57.5%	57.5%	57.5%	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-3.0			-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag											
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	Min	Min	Min	Min	Min	
Act Effct Green (s)		30.0	80.0		22.4	42.0	42.0	42.0	42.0	42.0	80.0
Actuated g/C Ratio		0.38	1.00		0.28	0.52	0.52	0.52	0.52	0.52	1.00
v/c Ratio		0.97	0.03		0.19	0.57	0.95	0.01	0.09	0.86	0.29
Control Delay		65.2	0.1		15.5	34.4	39.3	0.0	15.5	28.5	0.5
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		65.2	0.1		15.5	34.4	39.3	0.0	15.5	28.5	0.5
LOS		E	A		B	C	D	A	B	C	A
Approach Delay		58.9			15.5		38.8			18.9	
Approach LOS		E			B		D			B	

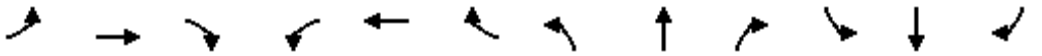
Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.97	
Intersection Signal Delay: 32.6	Intersection LOS: C
Intersection Capacity Utilization 94.4%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)/Pit Access

Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	388	41	36	73	864	4	4	786	410
v/c Ratio	0.97	0.03	0.19	0.57	0.95	0.01	0.09	0.86	0.29
Control Delay	65.2	0.1	15.5	34.4	39.3	0.0	15.5	28.5	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.2	0.1	15.5	34.4	39.3	0.0	15.5	28.5	0.5
Queue Length 50th (m)	59.6	0.0	2.4	7.4	122.0	0.0	0.3	102.1	0.0
Queue Length 95th (m)	#116.4	0.0	9.0	#28.8	#207.0	0.0	2.3	#178.9	0.0
Internal Link Dist (m)	704.1		111.7		173.7			579.0	
Turn Bay Length (m)		50.0		90.0		30.0	30.0		120.0
Base Capacity (vph)	401	1350	245	129	913	412	43	913	1401
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.97	0.03	0.15	0.57	0.95	0.01	0.09	0.86	0.29

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	346	4	37	11	11	11	66	778	4	4	707	369
Ideal Flow (vphpl)	1650	1650	1750	1550	1550	1550	1775	1900	1750	1775	1900	1750
Total Lost time (s)		4.0	1.0		4.0		4.0	4.0	4.0	4.0	4.0	1.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1453	1350		720		1619	1740	735	834	1740	1401
Flt Permitted		0.70	1.00		0.87		0.15	1.00	1.00	0.10	1.00	1.00
Satd. Flow (perm)		1071	1350		634		247	1740	735	84	1740	1401
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	384	4	41	12	12	12	73	864	4	4	786	410
RTOR Reduction (vph)	0	0	0	0	8	0	0	0	2	0	0	0
Lane Group Flow (vph)	0	388	41	0	29	0	73	864	2	4	786	410
Heavy Vehicles (%)	6%	100%	9%	100%	100%	100%	3%	8%	100%	100%	8%	5%
Turn Type	Perm	NA	Free	Perm	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases		4			8			2			6	
Permitted Phases	4		Free	8			2		2	6		Free
Actuated Green, G (s)		27.0	80.0		27.0		39.0	39.0	39.0	39.0	39.0	80.0
Effective Green, g (s)		30.0	80.0		30.0		42.0	42.0	42.0	42.0	42.0	80.0
Actuated g/C Ratio		0.38	1.00		0.38		0.52	0.52	0.52	0.52	0.52	1.00
Clearance Time (s)		7.0			7.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)		401	1350		237		129	913	385	44	913	1401
v/s Ratio Prot								c0.50			0.45	
v/s Ratio Perm		c0.36	0.03		0.04		0.30		0.00	0.05		0.29
v/c Ratio		0.97	0.03		0.12		0.57	0.95	0.01	0.09	0.86	0.29
Uniform Delay, d1		24.5	0.0		16.4		12.8	17.9	9.1	9.5	16.5	0.0
Progression Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		36.6	0.0		0.5		9.0	18.5	0.0	1.9	9.1	0.5
Delay (s)		61.2	0.0		16.8		21.9	36.4	9.1	11.4	25.5	0.5
Level of Service		E	A		B		C	D	A	B	C	A
Approach Delay (s)		55.3			16.8			35.2			17.0	
Approach LOS		E			B			D			B	

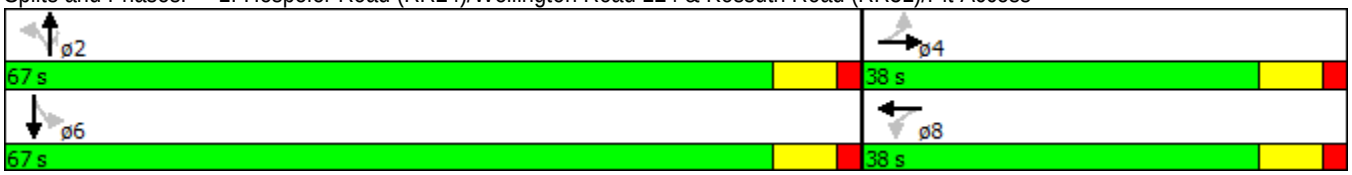
Intersection Summary			
HCM 2000 Control Delay	29.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	94.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	331	6	90	7	7	84	655	6	6	803	450
Turn Type	Perm	NA	Free	Perm	NA	Perm	NA	Perm	Perm	NA	Free
Protected Phases		4			8		2			6	
Permitted Phases	4		Free	8		2		2	6		Free
Detector Phase	4	4		8	8	2	2	2	6	6	
Switch Phase											
Minimum Initial (s)	12.0	12.0		8.0	8.0	30.0	30.0	30.0	30.0	30.0	
Minimum Split (s)	33.0	33.0		33.0	33.0	37.0	37.0	37.0	37.0	37.0	
Total Split (s)	38.0	38.0		38.0	38.0	67.0	67.0	67.0	67.0	67.0	
Total Split (%)	36.2%	36.2%		36.2%	36.2%	63.8%	63.8%	63.8%	63.8%	63.8%	
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-3.0			-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag											
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	Min	Min	Min	Min	Min	
Act Effct Green (s)		34.3	99.0		20.1	56.7	56.7	56.7	56.7	56.7	99.0
Actuated g/C Ratio		0.35	1.00		0.20	0.57	0.57	0.57	0.57	0.57	1.00
v/c Ratio		0.99	0.07		0.18	0.85	0.75	0.02	0.06	0.89	0.35
Control Delay		78.6	0.1		24.2	77.4	21.1	0.0	10.5	30.5	0.7
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		78.6	0.1		24.2	77.4	21.1	0.0	10.5	30.5	0.7
LOS		E	A		C	E	C	A	B	C	A
Approach Delay		62.1			24.2		27.3			19.7	
Approach LOS		E			C		C			B	

Intersection Summary	
Cycle Length: 105	
Actuated Cycle Length: 99	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.99	
Intersection Signal Delay: 29.4	Intersection LOS: C
Intersection Capacity Utilization 105.4%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)/Pit Access

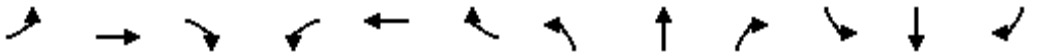


Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	375	100	24	93	728	7	7	892	500
v/c Ratio	0.99	0.07	0.18	0.85	0.75	0.02	0.06	0.89	0.35
Control Delay	78.6	0.1	24.2	77.4	21.1	0.0	10.5	30.5	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	78.6	0.1	24.2	77.4	21.1	0.0	10.5	30.5	0.7
Queue Length 50th (m)	~88.4	0.0	3.1	14.5	101.7	0.0	0.6	145.2	0.0
Queue Length 95th (m)	#147.3	0.0	8.9	#49.3	148.5	0.0	2.7	#219.7	0.0
Internal Link Dist (m)	704.1		111.7		173.7			579.0	
Turn Bay Length (m)		50.0		90.0		30.0	30.0		120.0
Base Capacity (vph)	380	1456	228	122	1095	486	123	1125	1428
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.99	0.07	0.11	0.76	0.66	0.01	0.06	0.79	0.35

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	331	6	90	7	7	7	84	655	6	6	803	450
Ideal Flow (vphpl)	1650	1650	1750	1550	1550	1550	1775	1900	1750	1775	1900	1750
Total Lost time (s)		4.0	1.0		4.0		4.0	4.0	4.0	4.0	4.0	1.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1470	1456		720		1603	1708	735	834	1756	1428
Flt Permitted		0.71	1.00		0.88		0.11	1.00	1.00	0.22	1.00	1.00
Satd. Flow (perm)		1099	1456		645		191	1708	735	193	1756	1428
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	368	7	100	8	8	8	93	728	7	7	892	500
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	3	0	0	0
Lane Group Flow (vph)	0	375	100	0	19	0	93	728	4	7	892	500
Heavy Vehicles (%)	4%	100%	1%	100%	100%	100%	4%	10%	100%	100%	7%	3%
Turn Type	Perm	NA	Free	Perm	NA		Perm	NA	Perm	Perm	NA	Free
Protected Phases		4			8			2			6	
Permitted Phases	4		Free	8			2		2	6		Free
Actuated Green, G (s)		31.2	98.9		31.2		53.7	53.7	53.7	53.7	53.7	98.9
Effective Green, g (s)		34.2	98.9		34.2		56.7	56.7	56.7	56.7	56.7	98.9
Actuated g/C Ratio		0.35	1.00		0.35		0.57	0.57	0.57	0.57	0.57	1.00
Clearance Time (s)		7.0			7.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)		380	1456		223		109	979	421	110	1006	1428
v/s Ratio Prot								0.43			c0.51	
v/s Ratio Perm		c0.34	0.07		0.03		0.49		0.01	0.04		0.35
v/c Ratio		0.99	0.07		0.08		0.85	0.74	0.01	0.06	0.89	0.35
Uniform Delay, d1		32.1	0.0		21.8		17.6	15.7	9.1	9.3	18.3	0.0
Progression Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		42.5	0.1		0.3		47.1	3.7	0.0	0.5	10.2	0.7
Delay (s)		74.7	0.1		22.1		64.7	19.4	9.1	9.9	28.5	0.7
Level of Service		E	A		C		E	B	A	A	C	A
Approach Delay (s)		59.0			22.1			24.4			18.5	
Approach LOS		E			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	27.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	98.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	105.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

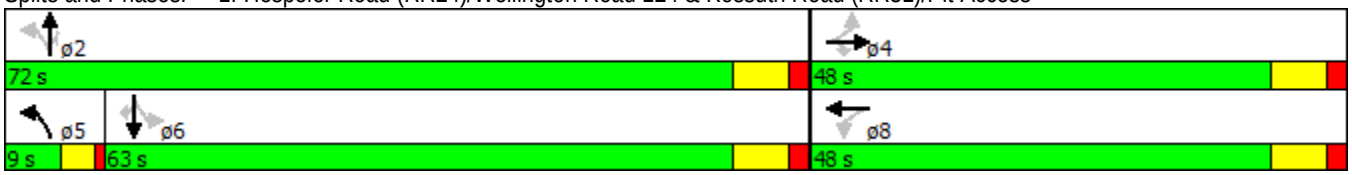
Appendix F

Future (2020) Total Traffic Synchro Capacity Analysis

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	442	4	48	11	11	84	993	4	4	902	471
Turn Type	Perm	NA	Perm	Perm	NA	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8	5	2			6	
Permitted Phases	4		4	8		2		2	6		6
Detector Phase	4	4	4	8	8	5	2	2	6	6	6
Switch Phase											
Minimum Initial (s)	12.0	12.0	12.0	8.0	8.0	5.0	30.0	30.0	30.0	30.0	30.0
Minimum Split (s)	33.0	33.0	33.0	33.0	33.0	9.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	48.0	48.0	48.0	48.0	48.0	9.0	72.0	72.0	63.0	63.0	63.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	40.0%	7.5%	60.0%	60.0%	52.5%	52.5%	52.5%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		-3.0	-3.0		-3.0	0.0	-3.0	-3.0	-3.0	-3.0	-3.0
Total Lost Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						Lead			Lag	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min
Act Effct Green (s)		44.0	44.0		31.0	68.0	68.0	68.0	59.0	59.0	59.0
Actuated g/C Ratio		0.37	0.37		0.26	0.57	0.57	0.57	0.49	0.49	0.49
v/c Ratio		1.26	0.10		0.23	0.73	1.12	0.01	0.14	1.17	0.56
Control Delay		171.0	3.3		23.8	48.4	93.7	0.0	30.0	119.5	4.6
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		171.0	3.3		23.8	48.4	93.7	0.0	30.0	119.5	4.6
LOS		F	A		C	D	F	A	C	F	A
Approach Delay		154.8			23.8		89.9			80.0	
Approach LOS		F			C		F			E	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Natural Cycle: 120	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.26	
Intersection Signal Delay: 95.3	Intersection LOS: F
Intersection Capacity Utilization 116.5%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)/Pit Access

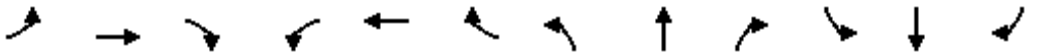


Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	495	53	36	93	1103	4	4	1002	523
v/c Ratio	1.26	0.10	0.23	0.73	1.12	0.01	0.14	1.17	0.56
Control Delay	171.0	3.3	23.8	48.4	93.7	0.0	30.0	119.5	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	171.0	3.3	23.8	48.4	93.7	0.0	30.0	119.5	4.6
Queue Length 50th (m)	~154.1	0.0	3.9	10.1	~314.6	0.0	0.5	~296.2	3.8
Queue Length 95th (m)	#221.6	5.4	12.3	#35.1	#396.6	0.0	3.7	#376.7	25.2
Internal Link Dist (m)	704.1		111.7		173.7			579.0	
Turn Bay Length (m)		50.0		90.0		30.0	30.0		120.0
Base Capacity (vph)	392	541	219	127	986	432	29	855	939
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.26	0.10	0.16	0.73	1.12	0.01	0.14	1.17	0.56

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	442	4	48	11	11	11	84	993	4	4	902	471
Ideal Flow (vphpl)	1650	1650	1750	1550	1550	1550	1775	1900	1750	1775	1900	1750
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1456	1350		720		1619	1740	735	834	1740	1401
Flt Permitted		0.70	1.00		0.79		0.07	1.00	1.00	0.07	1.00	1.00
Satd. Flow (perm)		1072	1350		577		114	1740	735	60	1740	1401
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	491	4	53	12	12	12	93	1103	4	4	1002	523
RTOR Reduction (vph)	0	0	34	0	8	0	0	0	2	0	0	251
Lane Group Flow (vph)	0	495	19	0	28	0	93	1103	2	4	1002	272
Heavy Vehicles (%)	6%	100%	9%	100%	100%	100%	3%	8%	100%	100%	8%	5%
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)		41.0	41.0		41.0		65.0	65.0	65.0	56.0	56.0	56.0
Effective Green, g (s)		44.0	44.0		44.0		65.0	68.0	68.0	59.0	59.0	59.0
Actuated g/C Ratio		0.37	0.37		0.37		0.54	0.57	0.57	0.49	0.49	0.49
Clearance Time (s)		7.0	7.0		7.0		4.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)		5.0	5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)		393	495		211		124	986	416	29	855	688
v/s Ratio Prot							0.03	c0.63			c0.58	
v/s Ratio Perm		c0.46	0.01		0.05		0.37		0.00	0.07		0.19
v/c Ratio		1.26	0.04		0.13		0.75	1.12	0.01	0.14	1.17	0.40
Uniform Delay, d1		38.0	24.4		25.3		27.2	26.0	11.3	16.6	30.5	19.3
Progression Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		135.9	0.1		0.6		25.9	67.1	0.0	4.5	89.7	0.8
Delay (s)		173.9	24.5		25.9		53.0	93.1	11.3	21.1	120.2	20.0
Level of Service		F	C		C		D	F	B	C	F	C
Approach Delay (s)		159.4			25.9			89.7			85.7	
Approach LOS		F			C			F			F	

Intersection Summary			
HCM 2000 Control Delay	98.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	116.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)/Pit Access

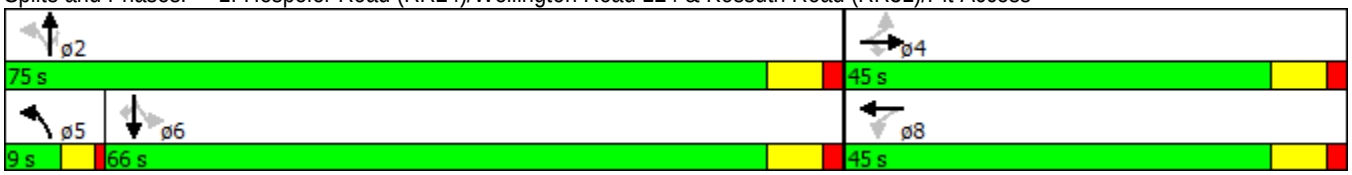
2/26/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	422	6	115	7	7	107	836	6	6	1024	574
Turn Type	Perm	NA	Perm	Perm	NA	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8	5	2			6	
Permitted Phases	4		4	8		2		2	6		6
Detector Phase	4	4	4	8	8	5	2	2	6	6	6
Switch Phase											
Minimum Initial (s)	12.0	12.0	12.0	8.0	8.0	5.0	30.0	30.0	30.0	30.0	30.0
Minimum Split (s)	33.0	33.0	33.0	33.0	33.0	9.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	45.0	45.0	45.0	45.0	45.0	9.0	75.0	75.0	66.0	66.0	66.0
Total Split (%)	37.5%	37.5%	37.5%	37.5%	37.5%	7.5%	62.5%	62.5%	55.0%	55.0%	55.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		-3.0	-3.0		-3.0	0.0	-3.0	-3.0	-3.0	-3.0	-3.0
Total Lost Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag						Lead			Lag	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min
Act Effct Green (s)		41.0	41.0		29.0	71.0	71.0	71.0	62.0	62.0	62.0
Actuated g/C Ratio		0.34	0.34		0.24	0.59	0.59	0.59	0.52	0.52	0.52
v/c Ratio		1.27	0.23		0.16	0.95	0.92	0.02	0.13	1.25	0.63
Control Delay		173.9	11.2		23.5	91.2	37.6	0.0	22.5	151.8	5.9
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		173.9	11.2		23.5	91.2	37.6	0.0	22.5	151.8	5.9
LOS		F	B		C	F	D	A	C	F	A
Approach Delay		139.4			23.5		43.4			99.1	
Approach LOS		F			C		D			F	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Natural Cycle: 120
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.27
Intersection Signal Delay: 88.6 — Intersection LOS: F
Intersection Capacity Utilization 113.0% — ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)/Pit Access

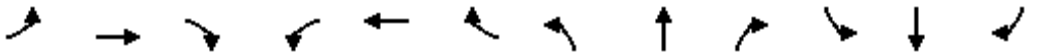


Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	476	128	24	119	929	7	7	1138	638
v/c Ratio	1.27	0.23	0.16	0.95	0.92	0.02	0.13	1.25	0.63
Control Delay	173.9	11.2	23.5	91.2	37.6	0.0	22.5	151.8	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	173.9	11.2	23.5	91.2	37.6	0.0	22.5	151.8	5.9
Queue Length 50th (m)	~148.4	6.5	2.7	14.4	194.8	0.0	0.9	~353.0	9.9
Queue Length 95th (m)	#215.5	20.9	9.4	#53.4	#298.5	0.0	4.4	#435.5	40.3
Internal Link Dist (m)	704.1		111.7		173.7			579.0	
Turn Bay Length (m)		50.0		90.0		30.0	30.0		120.0
Base Capacity (vph)	376	556	211	125	1010	449	53	907	1007
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.27	0.23	0.11	0.95	0.92	0.02	0.13	1.25	0.63

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	422	6	115	7	7	7	107	836	6	6	1024	574
Ideal Flow (vphpl)	1650	1650	1750	1550	1550	1550	1775	1900	1750	1775	1900	1750
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1475	1456		720		1603	1708	735	834	1756	1428
Flt Permitted		0.71	1.00		0.83		0.06	1.00	1.00	0.12	1.00	1.00
Satd. Flow (perm)		1102	1456		604		107	1708	735	104	1756	1428
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	469	7	128	8	8	8	119	929	7	7	1138	638
RTOR Reduction (vph)	0	0	59	0	5	0	0	0	3	0	0	269
Lane Group Flow (vph)	0	476	69	0	19	0	119	929	4	7	1138	369
Heavy Vehicles (%)	4%	100%	1%	100%	100%	100%	4%	10%	100%	100%	7%	3%
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)		38.0	38.0		38.0		68.0	68.0	68.0	59.0	59.0	59.0
Effective Green, g (s)		41.0	41.0		41.0		68.0	71.0	71.0	62.0	62.0	62.0
Actuated g/C Ratio		0.34	0.34		0.34		0.57	0.59	0.59	0.52	0.52	0.52
Clearance Time (s)		7.0	7.0		7.0		4.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)		5.0	5.0		5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)		376	497		206		122	1010	434	53	907	737
v/s Ratio Prot							0.04	c0.54			c0.65	
v/s Ratio Perm		c0.43	0.05		0.03		0.51		0.01	0.07		0.26
v/c Ratio		1.27	0.14		0.09		0.98	0.92	0.01	0.13	1.25	0.50
Uniform Delay, d1		39.5	27.3		26.8		30.7	21.9	10.1	15.0	29.0	18.9
Progression Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		139.3	0.3		0.4		73.9	13.5	0.0	2.4	123.7	1.1
Delay (s)		178.8	27.6		27.2		104.6	35.5	10.1	17.4	152.7	20.0
Level of Service		F	C		C		F	D	B	B	F	C
Approach Delay (s)		146.7			27.2			43.1			104.7	
Approach LOS		F			C			D			F	

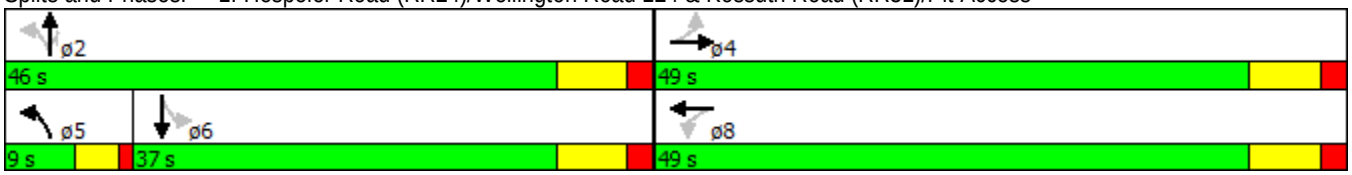
Intersection Summary			
HCM 2000 Control Delay	92.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	113.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	442	4	48	11	11	84	993	4	4	902	471
Turn Type	Perm	NA	Free	Perm	NA	pm+pt	NA	Perm	Perm	NA	Free
Protected Phases		4			8	5	2			6	
Permitted Phases	4		Free	8		2		2	6		Free
Detector Phase	4	4		8	8	5	2	2	6	6	
Switch Phase											
Minimum Initial (s)	12.0	12.0		8.0	8.0	5.0	30.0	30.0	30.0	30.0	
Minimum Split (s)	33.0	33.0		33.0	33.0	9.0	37.0	37.0	37.0	37.0	
Total Split (s)	49.0	49.0		49.0	49.0	9.0	46.0	46.0	37.0	37.0	
Total Split (%)	51.6%	51.6%		51.6%	51.6%	9.5%	48.4%	48.4%	38.9%	38.9%	
Yellow Time (s)	5.0	5.0		5.0	5.0	3.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	1.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-3.0			-3.0	0.0	-3.0	-3.0	-3.0	-3.0	
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag						Lead			Lag	Lag	
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	Min	Min	Min	Min	
Act Effct Green (s)		45.1	93.3		31.1	40.2	40.2	40.2	33.1	33.1	93.3
Actuated g/C Ratio		0.48	1.00		0.33	0.43	0.43	0.43	0.35	0.35	1.00
v/c Ratio		0.96	0.04		0.17	0.58	0.77	0.01	0.09	0.85	0.37
Control Delay		56.4	0.1		13.1	31.3	27.1	0.0	26.2	37.0	0.8
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		56.4	0.1		13.1	31.3	27.1	0.0	26.2	37.0	0.8
LOS		E	A		B	C	C	A	C	D	A
Approach Delay		51.0			13.1		27.3			24.6	
Approach LOS		D			B		C			C	

Intersection Summary	
Cycle Length: 95	
Actuated Cycle Length: 93.3	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.96	
Intersection Signal Delay: 29.8	Intersection LOS: C
Intersection Capacity Utilization 97.6%	ICU Level of Service F
Analysis Period (min) 15	

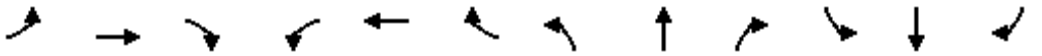
Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)/Pit Access



Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	495	53	36	93	1103	4	4	1002	523
v/c Ratio	0.96	0.04	0.17	0.58	0.77	0.01	0.09	0.85	0.37
Control Delay	56.4	0.1	13.1	31.3	27.1	0.0	26.2	37.0	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.4	0.1	13.1	31.3	27.1	0.0	26.2	37.0	0.8
Queue Length 50th (m)	90.1	0.0	2.4	10.3	91.0	0.0	0.5	94.1	0.0
Queue Length 95th (m)	#159.6	0.0	8.3	#22.1	117.1	0.0	3.3	#131.4	0.0
Internal Link Dist (m)	704.1		111.7		173.7			579.0	
Turn Bay Length (m)		50.0		90.0		30.0	30.0		120.0
Base Capacity (vph)	517	1350	309	161	1490	356	47	1174	1401
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.96	0.04	0.12	0.58	0.74	0.01	0.09	0.85	0.37

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	442	4	48	11	11	11	84	993	4	4	902	471
Ideal Flow (vphpl)	1650	1650	1750	1550	1550	1550	1775	1900	1750	1775	1900	1750
Total Lost time (s)		4.0	1.0		4.0		4.0	4.0	4.0	4.0	4.0	1.0
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1456	1350		720		1619	3305	735	834	3305	1401
Flt Permitted		0.70	1.00		0.86		0.12	1.00	1.00	0.15	1.00	1.00
Satd. Flow (perm)		1072	1350		628		200	3305	735	135	3305	1401
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	491	4	53	12	12	12	93	1103	4	4	1002	523
RTOR Reduction (vph)	0	0	0	0	6	0	0	0	2	0	0	0
Lane Group Flow (vph)	0	495	53	0	30	0	93	1103	2	4	1002	523
Heavy Vehicles (%)	6%	100%	9%	100%	100%	100%	3%	8%	100%	100%	8%	5%
Turn Type	Perm	NA	Free	Perm	NA		pm+pt	NA	Perm	Perm	NA	Free
Protected Phases		4			8		5	2			6	
Permitted Phases	4		Free	8			2		2	6		Free
Actuated Green, G (s)		42.1	94.1		42.1		38.0	38.0	38.0	30.1	30.1	94.1
Effective Green, g (s)		45.1	94.1		45.1		38.0	41.0	41.0	33.1	33.1	94.1
Actuated g/C Ratio		0.48	1.00		0.48		0.40	0.44	0.44	0.35	0.35	1.00
Clearance Time (s)		7.0			7.0		4.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)		513	1350		300		139	1440	320	47	1162	1401
v/s Ratio Prot							0.03	c0.33			c0.30	
v/s Ratio Perm		c0.46	0.04		0.05		0.24		0.00	0.03		0.37
v/c Ratio		0.96	0.04		0.10		0.67	0.77	0.01	0.09	0.86	0.37
Uniform Delay, d1		23.7	0.0		13.4		21.6	22.5	15.0	20.4	28.4	0.0
Progression Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		31.2	0.1		0.3		15.0	2.9	0.0	1.6	7.4	0.8
Delay (s)		54.9	0.1		13.7		36.6	25.4	15.0	22.0	35.8	0.8
Level of Service		D	A		B		D	C	B	C	D	A
Approach Delay (s)		49.6			13.7			26.3			23.8	
Approach LOS		D			B			C			C	

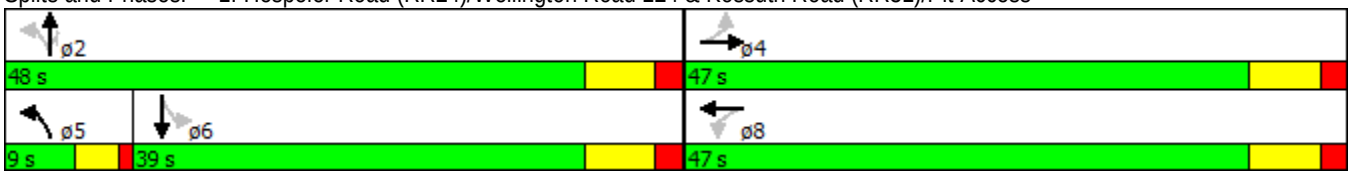
Intersection Summary			
HCM 2000 Control Delay	28.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	94.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	422	6	115	7	7	107	836	6	6	1024	574
Turn Type	Perm	NA	Free	Perm	NA	pm+pt	NA	Perm	Perm	NA	Free
Protected Phases		4			8	5	2			6	
Permitted Phases	4		Free	8		2		2	6		Free
Detector Phase	4	4		8	8	5	2	2	6	6	
Switch Phase											
Minimum Initial (s)	12.0	12.0		8.0	8.0	5.0	30.0	30.0	30.0	30.0	
Minimum Split (s)	33.0	33.0		33.0	33.0	9.0	37.0	37.0	37.0	37.0	
Total Split (s)	47.0	47.0		47.0	47.0	9.0	48.0	48.0	39.0	39.0	
Total Split (%)	49.5%	49.5%		49.5%	49.5%	9.5%	50.5%	50.5%	41.1%	41.1%	
Yellow Time (s)	5.0	5.0		5.0	5.0	3.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	1.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)		-3.0			-3.0	0.0	-3.0	-3.0	-3.0	-3.0	
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag						Lead			Lag	Lag	
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	Min	Min	Min	Min	
Act Effct Green (s)		43.0	95.0		24.1	44.0	44.0	44.0	35.0	35.0	95.0
Actuated g/C Ratio		0.45	1.00		0.25	0.46	0.46	0.46	0.37	0.37	1.00
v/c Ratio		0.96	0.09		0.14	0.74	0.62	0.02	0.09	0.93	0.45
Control Delay		57.9	0.1		16.0	44.6	21.4	0.2	23.0	42.7	1.0
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		57.9	0.1		16.0	44.6	21.4	0.2	23.0	42.7	1.0
LOS		E	A		B	D	C	A	C	D	A
Approach Delay		45.7			16.0		23.9			27.7	
Approach LOS		D			B		C			C	

Intersection Summary	
Cycle Length: 95	
Actuated Cycle Length: 95	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.96	
Intersection Signal Delay: 29.6	Intersection LOS: C
Intersection Capacity Utilization 94.0%	ICU Level of Service F
Analysis Period (min) 15	

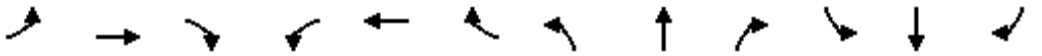
Splits and Phases: 1: Hespeler Road (RR24)/Wellington Road 124 & Kossuth Road (RR31)/Pit Access



Lane Group	EBT	EBR	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	476	128	24	119	929	7	7	1138	638
v/c Ratio	0.96	0.09	0.14	0.74	0.62	0.02	0.09	0.93	0.45
Control Delay	57.9	0.1	16.0	44.6	21.4	0.2	23.0	42.7	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.9	0.1	16.0	44.6	21.4	0.2	23.0	42.7	1.0
Queue Length 50th (m)	85.7	0.0	2.8	12.9	68.5	0.0	0.9	109.1	0.0
Queue Length 95th (m)	#152.8	0.0	6.7	#33.3	89.3	0.0	4.3	#152.8	0.0
Internal Link Dist (m)	704.1		111.7		173.7			579.0	
Turn Bay Length (m)		50.0		90.0		30.0	30.0		120.0
Base Capacity (vph)	498	1456	294	161	1502	365	82	1229	1428
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.96	0.09	0.08	0.74	0.62	0.02	0.09	0.93	0.45

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	422	6	115	7	7	7	107	836	6	6	1024	574
Ideal Flow (vphpl)	1650	1650	1750	1550	1550	1550	1775	1900	1750	1775	1900	1750
Total Lost time (s)		4.0	1.0		4.0		4.0	4.0	4.0	4.0	4.0	1.0
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00		0.98		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1475	1456		720		1603	3245	735	834	3336	1428
Flt Permitted		0.71	1.00		0.88		0.11	1.00	1.00	0.25	1.00	1.00
Satd. Flow (perm)		1102	1456		642		188	3245	735	223	3336	1428
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	469	7	128	8	8	8	119	929	7	7	1138	638
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	4	0	0	0
Lane Group Flow (vph)	0	476	128	0	20	0	119	929	3	7	1138	638
Heavy Vehicles (%)	4%	100%	1%	100%	100%	100%	4%	10%	100%	100%	7%	3%
Turn Type	Perm	NA	Free	Perm	NA		pm+pt	NA	Perm	Perm	NA	Free
Protected Phases		4			8		5	2			6	
Permitted Phases	4		Free	8			2		2	6		Free
Actuated Green, G (s)		40.0	95.0		40.0		41.0	41.0	41.0	32.0	32.0	95.0
Effective Green, g (s)		43.0	95.0		43.0		41.0	44.0	44.0	35.0	35.0	95.0
Actuated g/C Ratio		0.45	1.00		0.45		0.43	0.46	0.46	0.37	0.37	1.00
Clearance Time (s)		7.0			7.0		4.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)		5.0			5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)		498	1456		290		155	1502	340	82	1229	1428
v/s Ratio Prot							0.04	0.29			c0.34	
v/s Ratio Perm		c0.43	0.09		0.03		0.29		0.00	0.03		c0.45
v/c Ratio		0.96	0.09		0.07		0.77	0.62	0.01	0.09	0.93	0.45
Uniform Delay, d1		25.1	0.0		14.7		21.9	19.2	13.8	19.6	28.8	0.0
Progression Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		29.8	0.1		0.2		23.2	1.1	0.0	0.9	12.3	1.0
Delay (s)		54.8	0.1		14.9		45.1	20.3	13.8	20.5	41.1	1.0
Level of Service		D	A		B		D	C	B	C	D	A
Approach Delay (s)		43.2			14.9			23.0			26.7	
Approach LOS		D			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	28.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	94.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Appendix G
Curriculum Vitae

Curriculum Vitae

William C. Maria, P.Eng.
Transportation Engineer

Qualified. Ryerson University, Toronto, ON. Bachelor of Engineering, in Civil Engineering. 1998.

Connected. Member, Professional Engineers of Ontario, Institute of Transportation Engineers (ITE)

Relevance to project. Will's services to clients include: transportation planning; traffic engineering and parking; site traffic analysis; urban transit operations and project management. He has 15 years of experience in the traffic, parking and transportation planning fields.

Transportation Planning and Functional Design in the Multi-modal Context

Cooksville GO Station | Transportation Study | Mississauga, ON, Canada
Provided traffic impact study with a design assessment for temporary parking access for the proposed expansion to the existing parking lot. Provided parking traffic generation characteristics, existing and future traffic models in the GO peak hours, optimized the signalized future traffic operational characteristics and prepared functional circulation plans for buses and pedestrians.

Erindale GO Station | Transportation Study | Mississauga, ON, Canada
Determined the traffic impact of a parking expansion on the operation of the only access intersection, internal traffic patterns and bus circulation and delay. The study included alternative functional designs with consideration of drive aisle lane configurations to improve peak period circulation and pedestrian connectivity.

Richmond Hill GO Station | Transportation Study | Richmond Hill, ON, Canada
Undertook a traffic impact analysis of a proposed expansion to the existing parking lot on the various closely spaced access intersections. The analysis included an operation analysis with detailed optimization of the traffic signal coordination to manage the peak period queuing characteristics. The study also included functional design of the lane configuration and pedestrian crossing in the Newkirk Road corridor.

Rutherford GO Station | Transportation Study | Vaughan, ON, Canada
Undertook an analysis to determine the traffic impact of a shared access for drop-off/pick-up with the bus loop and the traffic progression on Rutherford Road. The impact of a parking expansion on the operations of the two access intersections was also reviewed. The project also included a functional design improvement of Westbourn Drive to manage the peak period queuing characteristics.

Additional studies at GO Stations include:
Rouge Hill, Bronte, Aldershot, Streetsville, Meadowvale, Maple, York University, Langstaff, Old Cummer.

Transportation Operations/Corridor Studies

Hurontario/Hwy 401 Off-Ramp Extension | Mississauga, ON, Canada
Developed a network simulation using Synchro 4.0 to determine the effectiveness of a collector road connection opposite the Highway 401 E-NS Ramp. Further analysis was undertaken by modeling the study area in integration and examining traffic redistribution due to congestion.

Highway 7, Highway 410 to Kennedy Road | Mississauga, ON, Canada

Participated in a study that examined the traffic operation through this corridor of Highway 7 and recommended mitigative measure to optimize traffic flow due to new developments.

Centrillium in Emery Village, Weston Road at Finch Avenue | Toronto, ON, Canada

Completed an extensive analysis of existing and future traffic conditions for the development of a 1,300 unit condominium complex, which included a sensitivity analysis for other developments in the area.

Finch Weston – Medallion, Weston Road at Finch Avenue | Toronto, ON, Canada

Completed an extensive analysis of existing and future traffic conditions for the development of a 1,500 unit condominium complex.

Neighborhood 408 Traffic Calming Study| Region of Peel, ON, Canada

Participated in a study to develop options for traffic calming measures to reduce traffic speeds.

Preliminary/Detail Design Studies/Environmental Assessments

Highway 7A/115/28 Interchange | Peterborough, ON, Canada

Examined the existing and future traffic volumes at the 115/28/7A interchange and approaching Highway and County Road links, as a component of the Ministry's rehabilitation project for the Highway 28 / 117 Northbound Overpass Structure. Developed a network simulation of the Interchange to review different options for traffic staging during construction.

Highway 7 | Peterborough, ON, Canada

Developed a network simulation of Highway 7 using the software package NETSIM which is part of the Traffic Software Integrated System produced by the Federal Highway Administration. The purpose of the simulation was to determine the effectiveness of different options to accommodate the future traffic growth.

Highway 77, West junction of Essex County Road 8 at Staples, Northerly 9.1 km to Essex County Road 46 at Comber | Essex, ON, Canada

Assessed the traffic impact on possible detour routes during rehabilitation of Highway 77 and made recommendations to optimize traffic flow.

Development Impact Assessments

Completed the following Traffic Impact and Parking studies:

- Petrolia Landfill Site, Petrolia.
- Glenridge Quarry Landfill Site, St. Catharines
- Erin Mills Development, Mississauga
- George Street Condominiums, Brampton
- Brampton Business Park, Region of Peel.
- Line 5 Landfill Site, Town of Niagara-on-the-Lake
- Ghanaian Presbyterian Church, North York District
- Greater Toronto Airport Authority, Derry Road/Bramalea Road Development
- Atomic Ave./The Queensway, Toronto
- Zenith Property, Toronto
- Mississauga Road/QEW, City of Mississauga

Parking Studies

- Wexford Centre, Scarborough
- York County Hospital, City of Vaughan
- Canadian Tire, Town of Pickering
- Dufferin Steeles Power Centre
- Yonge St./Clark St. Development, City of Vaughan

Key Areas of Experience:

- Urban Transportation Studies
- Transportation Impact Studies and Parking Utilization Studies
- Transportation Demand Management Studies
- Roads and Highway Design
- Strategic Advisory
- Development Charge By-law Review

James A. Bacchus, B.A., MITE

Service Group Manager, Transportation

Qualified. Saint Mary's University, Halifax, NS. Bachelor of Arts. 1991

Connected. Member, Institution of Transportation Engineers (ITE), Transportation Planning Council Member, Traffic Engineering Council Member, Parking Council Member, Expert Witness Council Member

Relevance to project. Jim is the Service Group Manager for the Transportation Sector in Canada. His services to clients include transportation planning, traffic engineering, expert testimony, and project management. He has 20 years' experience in the transportation planning field.

Jim's considerable domestic and international experience has consisted of the marketing, project management, and preparation of transportation-related studies in support of small and large-scale private development applications and public infrastructure projects. Assignments have included identification and mitigation of traffic impacts from land development, and preparation of conceptual roadway / highway layouts, site access schemes, internal circulation systems, plus queuing studies, speed studies, and parking needs reviews. In addition, key public sector experience includes Traffic Calming, Class EA's, Transportation Master Plan Studies, Corridor Studies, Secondary Planning Studies, Urban / Suburban Parking Studies, and Transit Studies.

Relevant Projects

- *Yonge - Steeles Corridor Study*, Town of Markham
- *Downtown Parking Study, comprehensive parking analysis*, City of Orillia
- *Comprehensive Road Inventory and Needs Assessment for Public Schools*, Region of Durham
- *Green Lane GO Station EA, Traffic Impact Study*, Town of East Gwillimbury
- *Peel Regional Headquarters Expansion, Traffic Impact and Parking Demand Study*, Region of Peel
- *Audley Road Class Environmental Assessment (Transportation Study),* Town of Ajax
- *Thickson Road Class Environmental Assessment (Transportation Study),* Region of Durham
- *Keele/McNaughton Class Environmental Assessment (Transportation Study)*, Region of York
- Fairall Street Class Environmental Assessment (Transportation Study), Town of Ajax
- *Seaton Community, Transit Implementation Plan,* City of Pickering
- *Seaton Community, MESP/Transportation Study*, City of Pickering
- *BramWest Secondary Plan, Riverview Heights System Alternatives Assessment*, City of Brampton
- *Waste Management, Haul Route Impact Study*, Richmond & Warwick Landfill Expansions
- *Britannia Landfill, Landfill Expansion*, City of Mississauga
- *West Gormley, MESP/Transportation Study*, Town of Richmond Hill
- *Carrville District Centre, Transportation Study*, City of Vaughan
- *Fletcher's Meadow Community*, City of Brampton
- *Leitchcroft Farms Master Plan*, Town of Richmond Hill
- *Escarpment Business Community, Traffic Impact Study*, Town of Milton
- *Foster Creek Subdivision, Traffic Impact Study and Traffic Calming Concepts*, Town of Newcastle

- *Victoria Business Park, Traffic Impact Study,* Town of Caledon
- *Royal Empress Gardens, Traffic Impact & Parking Study*, City of Vaughan Corporate Centre
- *Wayne Gretzky Parkway Retail Mall, Traffic Impact and Parking Study,* City of Brantford
- *Toronto Congress Centre, Traffic Impact and Parking Study,* City of Toronto (Etobicoke)
- *ClubLink Properties Inc., Kinghaven Golf and Country Club*, King City
- *Aggregate Extraction (Pits & Quarries), Truck Haul Route and Traffic Impact Analyses*, multiple sites throughout Ontario
- *Port of Spain East-West Corridor Transportation Study*, Trinidad and Tobago

Relevant Projects – Middle East

- *Dubai City Comprehensive Transportation Master Plan,* Dubai, United Arab Emirates (U.A.E.)
- *Burj Dubai Community, Traffic Impact Study*, Dubai, U.A.E.
- *Emirates Airlines Operations Centre & Headquarters, Traffic Impact Study,* Dubai, U.A.E.
- *Dubai Festival City, Traffic Impact Study*, Dubai, U.A.E.
- *Dubai Health Care City, Traffic Impact Study*, Dubai, U.A.E.
- *Jumeirah Islands Gardens, Traffic Impact Study*, Dubai, U.A.E.
- *Al Rashidiya Community, Traffic Impact & On Street Parking Study*, Dubai, U.A.E.
- *Arabian Ranches, Traffic Impact Study*, Dubai, U.A.E.
- *Al Bahia Corniche, Traffic Impact Study*, Abu Dhabi, U.A.E.
- *Doha City Centre Mall Expansion, Traffic Impact and Parking Study*, Doha Qatar
- *Qatar Petroleum Education City, Traffic Impact Study*, Doha, Qatar
- *Al Waab Community, Traffic Impact Study,* Doha, Qatar
- *Al Ain Hospital, Traffic Impact Study and Road Network Layout*, Al Ain, U.A.E.

Specialized Training

- Canadian Capacity Guide Seminar
- Institute of Transportation Engineers (ITE)
- Canadian Guide to Traffic Calming Seminar, ITE
- Professional Traffic Operations Engineer (PTOE)
- Preparation Course, ITE
- Pedestrian and Bicycling Seminar, ITE
- Project Manager's Bootcamp, PSMJ Resources Inc.
- Traffic Calming Seminar, Recommended Practices, ITE
- Transportation Impact Analyses for Site Development, ITE
- Management and Leadership Training, Ontario Society of Professional Engineers
- Trip Generation, Advanced Concepts and Applications Seminar, ITE
- Professional Transportation Planner (PTP) Preparation Course, ITE
- Principal's Bootcamp, PSMJ Resources Inc.

Case Study (2004) – National Society of Engineers, United Arab Emirates

Burj Dubai. Transportation Assessment and Mitigation for the World's Tallest Tower and Largest Retail Mall.

Other related areas of interest

- **IT savvy.** SYNCHRO/SIMTRAFFIC, VISSIM, SIDRA, HCS, HiCAP, CCGCALC, MTOP, and FORTRAN signal progression
- **Modelling.** TRANSCAD, EMME and VISUM

Curriculum Vitae

Hong Shen, M.Eng., P.Eng.
Transportation Engineer

Qualified. University of Waterloo, Waterloo, ON. Masters of Civil Engineering (Transportation). 2007. University of Tongji, Shanghai, China. Bachelor of Road and Traffic Engineering. 1984.

Connected. Member, Professional Engineers of Ontario.

Relevance to project. Hong has over 25 years' experience in transportation planning and engineering internationally. He has extensive knowledge with the development of transportation master plans, area modelling studies, traffic impact assessments, transit planning, parking studies and roadway design.

Relevant Project Experience

- *SmartCentres Barrie (S) Wal-Mart Expansion, Traffic Impact Study,* City of Barrie
- *Vaughan Valley Centre Expansion, Traffic Impact Study,* City of Vaughan
- *SmartCentres Innisfil Commercial Development, Traffic Impact Study,* Town of Innisfil
- *Jai Durga Hindu Centre Traffic Impact Study,* City of Toronto
- *Aurora Smart Centres Traffic Monitoring Study,* Town of Aurora
- *Jane Osler Boulevard Residential Development, Traffic Impact Study,* City of Toronto
- *Keele Finch Bus Terminal Impacts for Metropolitan Toronto Condominium, Traffic Study,* City of Toronto
- *50 Page Avenue Traffic Impact Study,* City of Toronto
- *Aurora Corporate Centre, Traffic Impact Study,* Town of Aurora
- *Olszowka Pit Traffic Impact Study,* County of Brant
- *Retail Development, Major Mackenzie – Weston, Traffic Impact Study,* City of Vaughan
- *Golfview Land Development Inc. Subdivision, Traffic Impact Study,* City of Pembroke
- *Fernbrook Homes Anthem Subdivision, Traffic Impact Study,* Town of Caledon
- *39 Green Belt Drive Residential Development, Traffic Impact Study,* City of Toronto
- *Metro Centre Residential and Commercial Development, Traffic Impact Study,* City of Toronto
- *3132 Eglinton Ave. E. Traffic Operations Assessment & Transportation Impact Study*, City of Toronto
- *Escarpment Business Community Traffic Impact Study*, Town of Milton
- *Thickson Road EA*, Town of Whitby
- *Gorham Street Retirement Residence, Traffic & Parking Study*, Town of Newmarket

- *Traffic Impact Study Update for West Gormley Developments,* Town of Richmond Hill
- *Traffic Impact and Parking Study for Charles/Watson Street Developments,* Town of Whitby
- *Traffic Impact Study for 15915 Leslie Street – Mixed Use Development*, Town of Aurora
- *Transportation Study for Carrville District Centre*, City of Vaughan
- *Traffic Impact Study for CWB Advanced Training Facility,* Town of Milton
- *Traffic Impact and Site Access Operational Review for Neubauer Gravel Pit*, Town of Puslinch
- *Traffic Impact Study Update for Jackson's Landing Adult Lifestyle Development*, Town of Georgina
- *Cedor Manor Homes Traffic Impact Study*, Town of Newmarket
- *50 Marmora traffic Study*, City of Toronto
- *Stoney Creek Urban Boundary Expansion Transportation Master Plan*, City of Hamilton
- *Oakville Midtown Business and Development Plan (Transportation System)*, Town of Oakville
- *Halton Transportation Master Plan Update,* Region of Halton
- *Guoyang County Transportation Master Plan*, Count of Guoyang, China
- *Chaohu Transportation Master Plan,* City of Chaohu, China
- *Hefei Shibei District Transportation Study*, City of Hefei, China
- *Anhui Province Roads Planning and Design Standards*, China
- *Suyu Overpass Access Highway Design,* Suzhou City
- *Road and Drainage Engineering Design of New Railway Station Road,* Suzhou City
- *Roundabout Engineering Design of Pingmenqiao,* Suzhou City
- *Reconstruction Engineering Design of South Renmin Road,* Suzhou City

Presentations

Planning & Design Standards

- Anhui Province Roads Planning and Design Standards
- Anhui Province Residential Area Planning and Design Standards

Publications

- Improving the Static Traffic – the Construction of Parking Lot, Journal of Contemporary Construction
- Overview of the Urban Plan of Port of Spain, Journal of City Construction Archives Study
- Research on Some Issues of Planning, Design and Construction of Hospitals, Journal of Anhui Architecture

Prizes Awarded

- Third Prize Award of Excellent Survey and Design Projects of Anhui Province, Guoyang County Transportation Master Plan
- Third Prize Award of Excellent Design of Suzhu City, Reconstruction Engineering Design of South Renmin Road

Curriculum Vitae

Michael Dowdall, Dipl.T.
Transportation Analyst

Qualified. Mohawk College, Hamilton, ON. Transportation Engineering Technology Advanced Diploma, Honours. 2010.
Connected. Member: Ontario Association of Certified Technicians and Technologists & Institute of Transportation Engineers.
Relevance to project. Michael has been with GHD Inc. for over five years. He is responsible for data assembly and review; undertaking technical analysis for traffic impact studies, parking studies and traffic operational assessments. Services to clients include transportation planning, functional road design, sightline analysis and traffic control plans.

Major Urban Expansion
Working on behalf of various landowner groups, Michael is currently working on several large scale urban expansions including:

Traffic Analyst | Sherwood Survey (Milton Phase II) | Milton, ON, Canada
This urban expansion, predominately on the west side of Milton, is under construction with a planned future population of 45,000.

Traffic Analyst | Boyne Survey (Milton Phase III) | Milton, ON, Canada
The next phase of development in south Milton will increase the population by approximately 45,000 persons.

Transportation Analyst | Chinguacousy Farm Residential Subdivision | Brampton, ON, Canada
Prepared a Traffic Impact Study for The Conservatory Group, completed an extensive analysis of future traffic conditions for the development of a 540 unit residential subdivision which satisfied MTO's requirements at the ramp terminals.

Traffic Analyst | Green Ginger Residential Subdivision | Oakville, ON, Canada
Completed a Traffic Impact Study for Green Ginger Developments Inc. for Draft Plan approval of a 2,000 unit residential subdivision, examined the future capacity and operations of the adjacent regional road network and prepared a Transit Facilities Plan consistent with the Town's transit plan.

Traffic Analyst & Designer | 1100 Caledonia Road Commercial Re-Development | Toronto, ON, Canada
Analysed the existing and future traffic volumes on the adjacent road network for Herefordshire Capital Corporation's re-development of an existing commercial building, recommended roadway improvements and completed functional design drawings for the sections of roadway to be improved.

Traffic Analyst | 740 & 817 Sheppard Avenue Condominiums | Toronto, ON, Canada
Retained by Royal Lake Sheppard North Ltd. to assess the traffic impacts of two 9–storey condominium buildings including ground floor commercial and prepared Traffic Impact Studies satisfying the City's requirements.

Traffic Analyst | Laird & Wicksteed Commercial Re-Development | Toronto, ON, Canada
Developed a detailed traffic model for a commercial re-development in the Leaside Community of Toronto for SmartCentres, Synchro traffic model confirmed the future development

can be accommodated on the adjacent road network and subsequently approved by the City of Toronto.

Designer | Traffic Control Plans | Milton, ON, Canada

Prepared Traffic Control Plans for a variety of residential subdivisions within the Sherwood Survey Secondary Plan in the Town of Milton including;

- Willmott Neighborhood Phase 1 & 2
- Capozzi Neighborhood Phase 2A
- Milton Main Street Homes

Traffic Analyst | Brookhill Neighbourhood Residential Subdivision | Bowmanville, ON, Canada

Completed a Traffic Impact Study for the Brookhill Developers Group for Draft Plan approval of a 1,500 unit residential subdivision in the Municipality of Clarington, analysis included extensive re-distribution of traffic, multiple road and development phasing, and intersection functional design.

Traffic Analyst | 70 Old Mill Road Mixed-Use Development | Oakville, ON, Canada

Developed a pedestrian circulation plan and assessed the traffic impact of a proposed mixed-use development for the Penalta Group Ltd., the traffic model included existing and future traffic generated from the new Oakville GO parking lot expansion and reviewed the operational and capacity restraints in the Cornwall Road corridor.

Traffic Analyst | Dixie Crossing Commercial | Mississauga, ON, Canada

Examined the future traffic volumes generated by the commercial development and prepared a Traffic Impact Study for the Mobius Corporation. With co-operation with the Region of Peel, a design was agreed upon for the site access onto Dixie Road, the study concluded that traffic generated by the proposed 53,693ft^2 of retail and restaurant GFA can be accommodated by the adjacent street system with the implementation of recommended access improvements.

Parking Studies

- Shingar Banquet Hall, City of Brampton
- Woodland Court Commercial, Town of Richmond Hill
- Oakville Entertainment Centre, Town of Oakville
- Meadowvale Christian Academy, City of Mississauga
- 2441 Finch Residential, City of Toronto
- Trafalgar Sports Park, Town of Milton
- Rotherglen School, Town of Oakville
- Chinguacousy Road Commercial, City of Brampton
- Eitz Chaim Synagogue, City of Toronto
- Faith of Life Place of Worship, City of Mississauga
- Oakleaf Academy, Town of Oakville
- Orchard Gardens Market, City of Mississauga
- Four Seasons Garden Condominium, Town of Richmond Hill
- Electric Building Condominiums, City of Toronto

Functional Design

- Highway 9 and First Line Localized Widening Design, Town of Mono
- Derry/Scott Commercial Access Design, Milton
- William Allen Road Commercial Access Design, Toronto
- Caledon-King Townline Residential Intersection Design, Caledon
- 7150 Edwards Boulevard Parking Lot Layout, Mississauga
- Richmond Hill GO Access Design, Vaughan
- Rotherglen School Parking Layout, Oakville
- Steeles and Financial Drive Access Design, Brampton

Key Areas of Expertise

- Synchro Traffic Analysis & Sim Traffic Simulation
- Autoturn Vehicle Swept Path Analysis
- Transportation Impact Studies and Parking Utilization Studies
- Roads and Highway Functional Design

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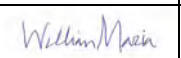
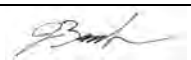
1	H Shen	Will Maria		Jim Bacchus		April 04/2014

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