Project File Report
Silvercreek Parkway
Class Environmental Assessment Study
City of Guelph Contract No. 11-098

Prepared for:

City of Guelph
Guelph City Hall
1 Carden Street
Guelph, Ontario
N1H 3A1

Delcan Corporation
675 Queen Street S., Suite 201
Kitchener, Ontario N2M 1A1
Tel: 519-744-4509

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JUNE 2012

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1.0 INTRODUCTION AND BACKGROUND

This Project File Report (PFR) documents the Class Environmental Assessment (EA) planning process that was undertaken for the improvements to Silvercreek Parkway, from north of Paisley Road to south of the Canadian National Railway (CNR) secondary line in the City of Guelph. Key study components included:

- Grade Separation of the Silvercreek Parkway at the CNR Mainline;
- the reconnection and alignment of Silvercreek Parkway between the CNR Mainline and the CNR Secondary Line consistent with the Silvercreek development Concept Plan;
- A new road to the east of Silvercreek Parkway as shown in the development Concept Plan (**Figure 1.1**) below; and
- the upgrading of underground services and utilities within the road allowance, including the drainage of the reconnected roadway and underpass.

A significant portion of the proposed undertaking is located in a vacant triangular parcel of land known as 35 and 40 Silvercreek Parkway South and bounded by the Canadian National Railway main line (to the north), the Canadian National Railway secondary line (to the south), and the Hanlon Parkway (to the west). Silvercreek Guelph Developments Limited has obtained necessary approvals to develop the property at 35 and 40 Silvercreek Parkway as a mixed-use development. A key plan of the study area is provided in **Figure 1.2**.

Figure 1.1 – Development Concept Plan

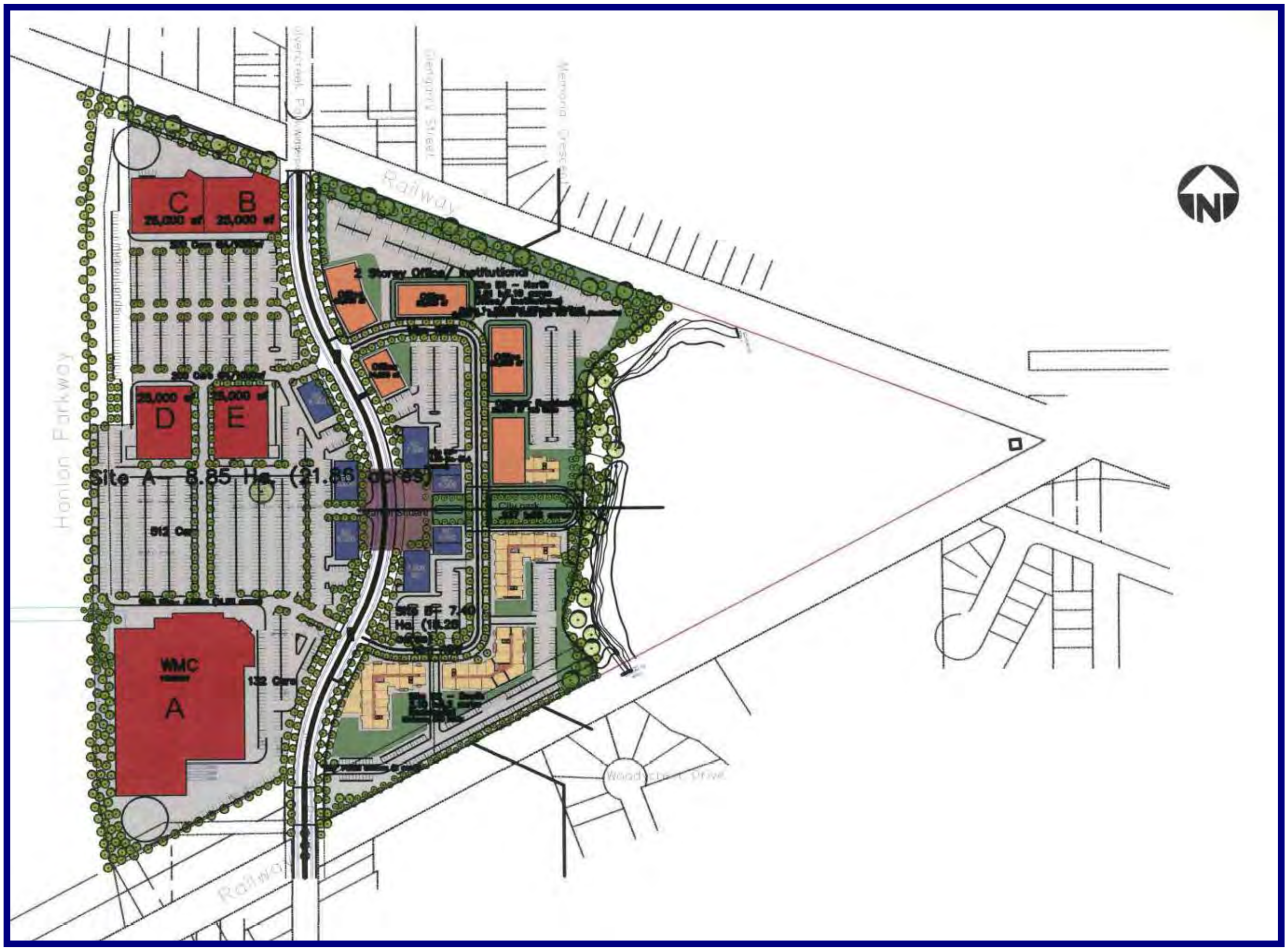


Figure 1.2 – Study Area

Until 1975 Silvercreek Parkway was a continuous road between Waterloo Avenue and Paisley Road with two at-grade crossings at the CNR Mainline (the Guelph Subdivision just south of Paisley Road) and the CNR Secondary Line (the Fergus Subdivision north of Waterloo Avenue). In 1975, following the Canadian Transport Commission Order, Silvercreek Parkway was closed at the CNR Mainline in conjunction with the construction of the Hanlon Expressway to the west including a grade separation at the CNR Mainline.

In 2009, the City of Guelph and Silvercreek Guelph Developments entered into a Minutes of Settlement for the Development of the lands bounded by the CNR Mainline, CNR Secondary Line and the Hanlon Expressway based on a development Concept Plan that includes Silvercreek Parkway as a continuous roadway between Waterloo Avenue and Paisley Road. The Minutes of Settlement identifies the need for a Grade Separation at the CNR Mainline in order to reconnect Silvercreek Parkway as a continuous road south of Paisley Road. The Minutes of Settlement also recognizes that (a) the construction of the Grade Separation, (b) the alignment of Silvercreek Parkway through the development lands, and (c) the construction of a new road within the development to the east of Silvercreek Parkway are subject to approval under the Municipal Class Environmental Process.

Guelph's Official Plan identifies Silvercreek Parkway as a continuous roadway between Wellington Street in the south and Paisley Road in the north, including a grade-separated crossing at the northern CN Mainline and an at-grade crossing at the southern CN secondary line. To the north of Paisley Road, Silvercreek Parkway is a four (4) lane arterial road to Speedvale Avenue, and a two (2) lane arterial road from Speedvale Avenue to the northerly limits of the city.

1.1 The Class Environmental Assessment Process

The Class EA process for Municipal Road Projects was established by the Municipal Engineers Association (MEA) and embodies a planning process that can be applied to projects that display important common characteristics (i.e. projects that are similar in nature and/or limited in scale; exhibit a predictable range of environmental effects; and responsive to mitigating measures). The Class EA process provides municipalities with a procedure approved under the EA Act to plan and undertake municipal road projects that exhibit such characteristics.

Under the Class EA process, municipal road projects are categorized according to their environmental significance and the effects they may impose on the environment. These categories, described by specific Class EA "schedules", prescribe planning methodologies for each category. At present, there are three schedule classification types including Schedule A, B and C. The main difference between each of the schedule types is the degree to which each project may adversely affect the existing environment. Schedule A projects have minimal adverse effects while Schedule C projects have the potential for significant environmental affects and must proceed under the full planning and documentation procedures specified under the Class EA document. Projects are also classed according to their relative financial costs in addition to their significant environmental impacts. For example, some types of road projects by their very nature may be relatively large in terms of their total cost, whereas their environmental impact may or may not be significant.

In addition to providing municipalities with a planning procedure approved under the EA Act for municipal road projects, the Class EA also serves as a public statement of the decision making process under which municipalities plan and implement road projects. The Class EA process provides various opportunities for public involvement and review. Public consultation is a key feature of environmental assessment planning. One of the principal aims of public consultation is to achieve resolution of differing points of view, thus reducing or avoiding controversy and, ultimately, avoiding the "bump up" procedure. If concerns are raised by the public during EA process that are related to anticipated negative environmental impacts and the concerns cannot be resolved in discussion between the proponent and the public, then the party raising the concern may request from the Ministry of the Environment that the project undergo part two of the EA Act (i.e. upgrade to an individual environmental assessment). If significant negative net environmental impacts are anticipated, the municipality will undertake an individual environmental assessment of the project.

In developing a recommended solution for the subject portion of Silvercreek Parkway, consideration was given to technical requirements of the City (e.g. address operational and safety requirements), the development concept plans already developed, needs/concerns of the local community, as well as local environmental and economic constraints.

Classified as a Schedule "C" undertaking at the commencement of the study, the project components and their overall impacts were reviewed by the Project Team and the study was subsequently reclassified as a Schedule "B" undertaking. In accordance with the *Municipal Class Environmental Assessment, October 2000, as Amended in 2007,* Schedule "B" process requirements are warranted since construction of the grade separation at the CN Mainline would be less than $10.7M and due to the fact that significant impacts to the environment are not anticipated as a result of the construction works associated with the study. It was determined that completing the study in accordance with the Schedule "B" Class EA process requirements would also adequately cover the other components of the study; the reconnection and alignment of Silvercreek Parkway, the new road to the east of Silvercreek Parkway developed through the Silvercreek Lands planning process and the upgrading of underground services and utilities.

1.2 Project Team Organization

The City of Guelph retained Delcan Corporation as their Prime Consultant to undertake this Class EA Study on their behalf. The "Project Team" consisted of members from the City of Guelph, the consultant representing Silvercreek Developments, and Delcan Corporation (Prime Consultant).

1.3 Data Collection

A major component of the study involved the review of existing information in order to develop and evaluate alternative solutions. As part of the data collection phase, stakeholder consultation was undertaken throughout the duration of the study. Target participants included property owners within the immediate study area, the general public and external agencies and interest groups. Information related to traffic demand/operations/safety, emergency vehicle requirements, rail/transit/pedestrian/cyclist requirements, land use, and other engineering related components was gathered. Details regarding the data collection phase of this study are included in **Section 2.0 – Study Area Conditions**. A listing of all agencies contacted and those who participated in the study are included in **Section 9.0 – Public and Agency Consultation**.

2.0 STUDY AREA CONDITIONS

The sections below describe the study area in terms of the existing natural, social/economic, transportation and cultural heritage environments.

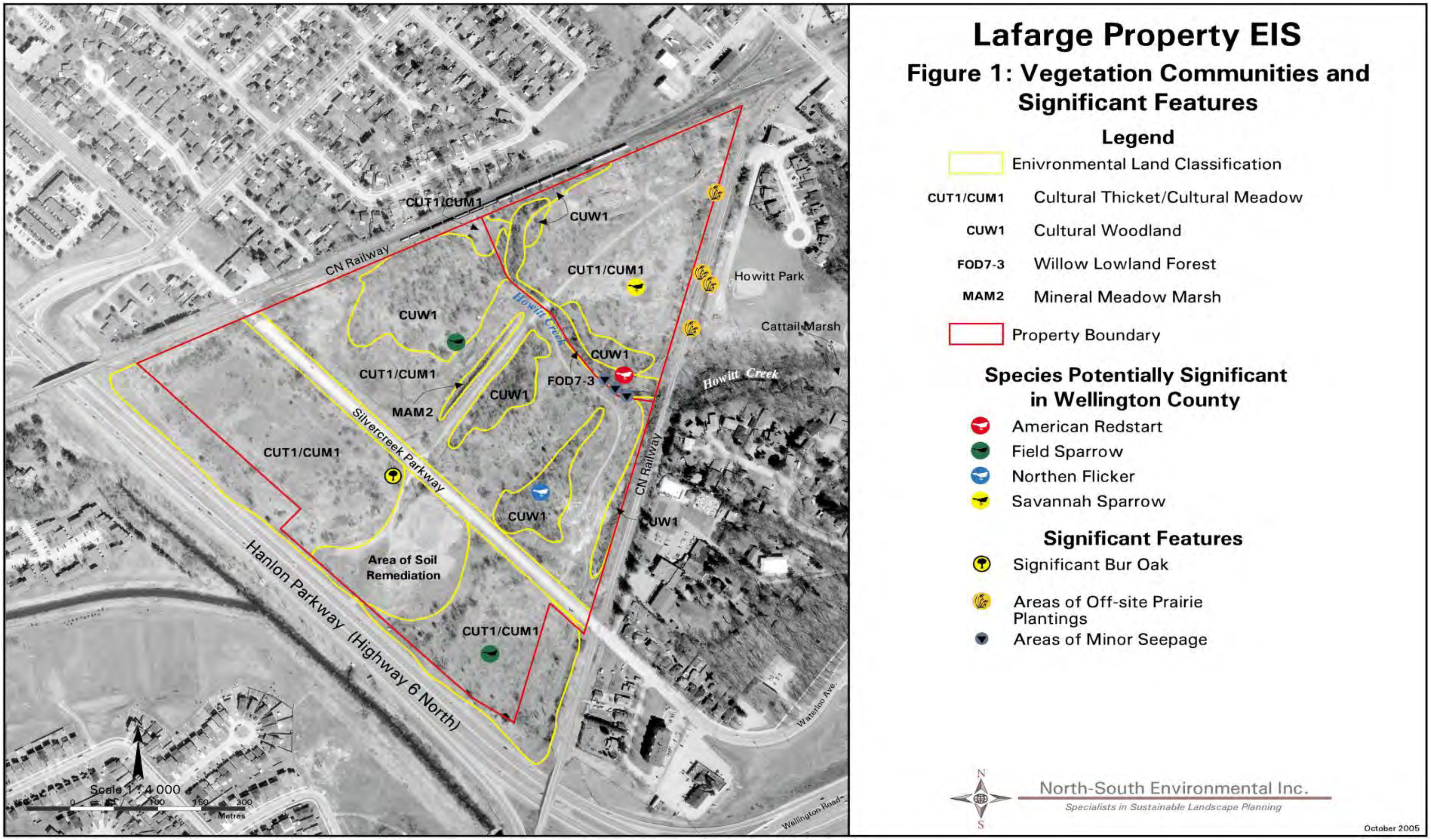
2.1 Natural Environment

The following summary of the area's natural environment is based on the *Environmental Impact Study* completed by North-South Environmental Inc. for the Lafarge Property (i.e. Silvercreek Development Lands) in 2005, and amended in May 2006, November 2007, April 2008 and August 2008:

- Phase 1 and 2 environmental site assessments completed in the area of the former Red-D-Mix Plant identified the presence of free product TPH in the soil and groundwater. The site was also found to contain underground fuel storage tanks. This area has since undergone soil remediation.
- Four vegetation communities, including one wetland community have been identified on the site. The vegetation communities do not provide habitat for significant populations of wildlife and no regionally or provincially significant plant species were found.
- A bur oak tree is situated on the west of Silvercreek Parkway, noteworthy for its ecological, aesthetic and heritage functions.
- Thirty-two species of wildlife were identified on the site, mostly birds and common mammals. Signs of white-tailed deer were noted along the western portion of the site. One amphibian was noted: leopard frog, along the Howitt Creek lowland forest. One Species at Risk in Canada, monarch butterfly, was seen in cultural thicket/meadow on all parts of the site.
- Howitt Creek, located approx. 350 metres northeast of Silvercreek Parkway, is classified as a cool water stream, but does not support cold water fish species.
- There are no natural features on the site subject to the Provincial Policy Statement, including Significant Wetlands, Significant Valleylands, Significant Wildlife Habitat, Significant Woodlands, or Significant Portions of the Habitat of Threatened or Endangered Species.

Figure 2.1 provides an illustration of the Vegetation Communities and Significant Features within the vicinity of the study area. The complete Environmental Impact Study and subsequent amendments are provided in **Appendix A**.

Figure 2.1 - Vegetation Communities and Significant Features



2.2 Social/Economic Environment

North of the CN Mainline, adjacent land use on the west side of the Silvercreek Parkway is comprised of seven single detached residential dwellings. Three properties access onto Silvercreek Parkway, south of Paisley Road. There is vacant commercial land east of the Silvercreek Parkway, north of the CNR Mainline.

South of the CN secondary line, at the south limits of the study area, the land use is comprised of single detached residential dwellings, an apartment building, hotel and Bible Chapel/conference centre.

Planned land use for the area of development (i.e. Silvercreek Development Lands) is Mixed-Use, consisting of a combination of:

- Warehouse membership Club or Home Improvement Retail Warehouse establishment
- Non-food retail uses
- Service commercial uses
- Residential uses.

2.3 Transportation Environment and Related Facilities

2.3.1 Road, Rail & Transit Network

Roads within the immediate study area include Paisley Road in the north, Silvercreek Parkway South and Waterloo Avenue in the south. In the northern portion of the study area, south of Paisley Road, there is a CN Mainline. A CN secondary line runs in the south portion of the study area, north of Waterloo Avenue. Both rail lines cross Silvercreek Parkway at-grade and are owned by GEXR/Rail America. Two bus routes operate within the study area, with a new route being planned between the downtown and Silvercreek Parkway.

Complete details on the study area road, rail & transit network are provided in the *Traffic Impact Study Update* (Revised December 2008, January 2009 and March 2009) completed for Silvercreek Guelph Developments Ltd and provided in **Appendix B**.

2.3.2 Existing & Future Traffic Conditions

The proposed reconnection of Silvercreek Parkway and the development of the Silvercreek lands will result in new traffic using Silvercreek Parkway south to Waterloo Avenue. The impact of projected traffic volumes has been analyzed and addressed in the Traffic Impact Study Update provided in Appendix B. Existing and future peak hour vehicular traffic volumes within the study area are illustrated in **Figure 2.2**. Existing and future rail traffic volumes are illustrated in **Figure 2.3**.

Figure 2.2 – Existing and Future Traffic Volumes

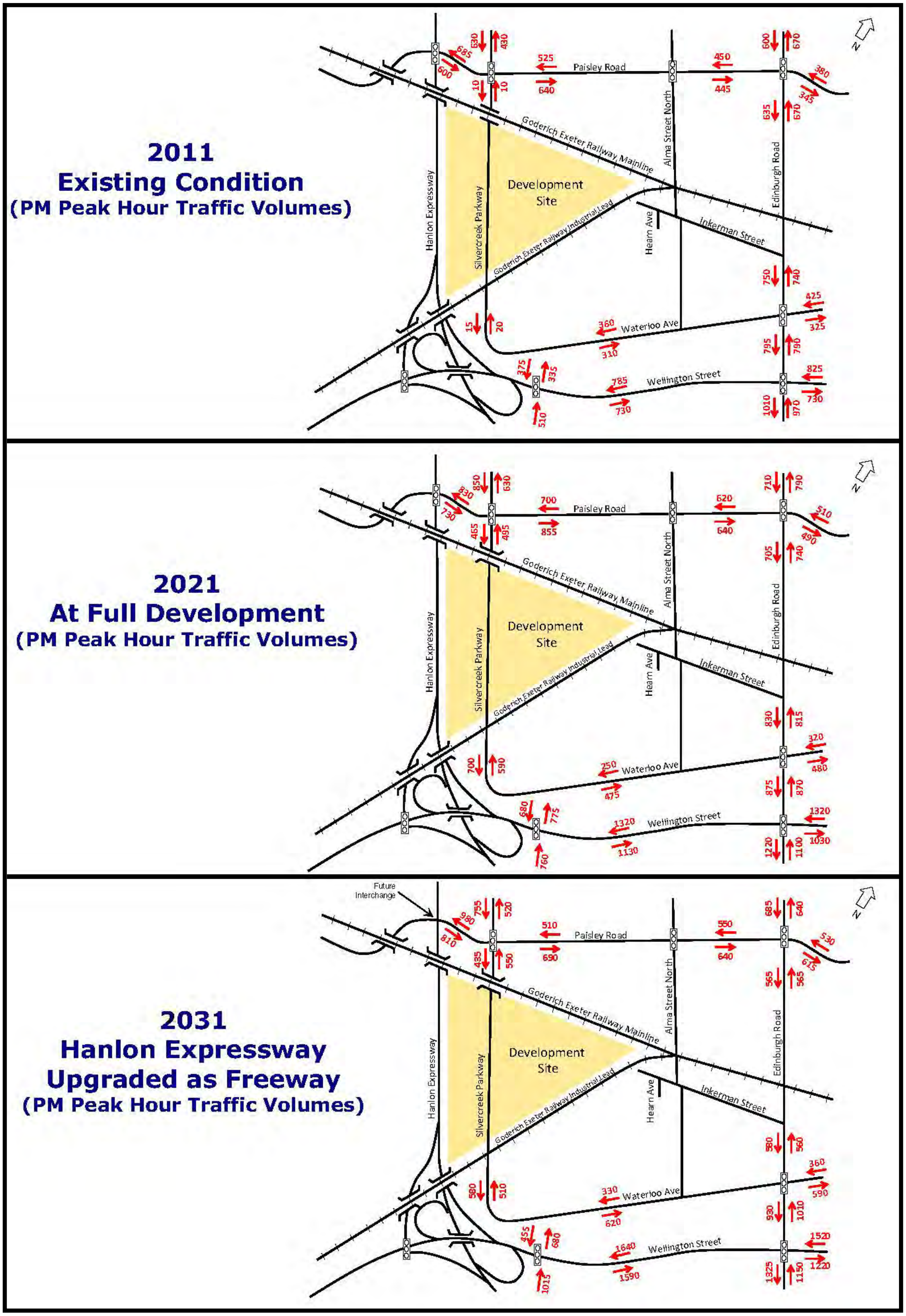


Figure 2.3 – Existing and Future Vehicular Rail and Traffic Volumes

Railway Crossing	2011 Existing			2021 Full Development			2031 Hanlon Expressway Upgraded as Freeway		
	AADT	Train/Day	Cross-product	AADT	Train/Day	Cross-product	AADT	Train/Day	Cross-product
Main Line	0	14	0	9,600	22*	211,200	9,800	34*	333,200
Secondary Line	0	1	0	12,900	1	12,900	10,900	6*	65,400

** Based on Future Projection*

The *Cross-product* refers to the product of the Average Annual Daily Traffic (AADT) multiplied by the Daily Train Traffic, and is one of several criteria used in the identification and determination of railway safety improvements. At the CN Rail Main Crossing for the Guelph Subdivision of the Silvercreek Parkway, the cross product of 333,200 forecasted for 2031 exceeds the threshold required for a grade separation.

Similarly, at the CN Rail Spur Line crossing for the Fergus Subdivision, there is far less train traffic, resulting in a cross product of only 65,400, which was one indicator used to determine that the existing at-grade crossing could be retained with improvements to the existing signal system. Recommended safety improvements at the crossing of the Secondary Line have been more fully detailed in a "Grade Crossing Safety Assessment" (GCSA), which is further discussed in *Section 5.4*.

2.3.3 Bicycle and Pedestrian Facilities

Between Paisley Road and the CNR secondary line to the south, pedestrians and cyclists have been observed within the vacant development lands. Immediately north of the study area, pedestrians are accommodated on both sides of Silvercreek Parkway. In the south, pedestrians are accommodated on the north side of the road only. At both ends of the study limits, cyclists are required to share the road with vehicular traffic (i.e. no dedicated bike lanes). The City's Transportation Master Plan identifies the subject portion of Silvercreek Parkway as part of the City's "on-road bike route".

2.4 Engineering Environment

2.4.1 Utilities

There is an existing above ground hydro line extending from Paisley Road to the southern limits of the study area. There are existing fibre optic (Bell360 Networks & Allstream) cables located alongside the CNR mainline. Additional existing utilities within the study corridor may include, but are not necessarily limited to cable, gas and Bell. Confirmation of the existence and location of these and any other utilities will be completed during the detailed design phase of the study.

2.4.2 Municipal Services (Sewers, Watermains) and Drainage

Existing services within the study area include watermain and sanitary sewers. The existing road surface and ROW drainage consists of a storm drainage system with associated catchbasins and sewers.

2.5 Cultural Environment

Due to the disturbed nature of the lands in the vicinity of Silvercreek Parkway (area to the west was home to a Red-D-Mix Plant and the area to the east was used as a gravel extraction area), no archaeological resources are anticipated to be found within the study area.

3.0 EA PHASE 1: PROBLEM STATEMENT

Under Phase 1 of the Municipal Class EA planning process, a "Problem Statement" is prepared which identifies, in detail, the various issues needing to be addressed by the Class EA study. In essence, the Problem Statement outlines the need and justification for the overall project and establishes the general parameters, or scope, of the study.

Based on a review of various background documents and works previously completed, the EA Terms of Reference, site visits, and consultation with various agencies and the public, the Project Team has developed the following problem statement for the Class EA study:

Silvercreek Parkway / CNR Grade Separation

- The reconnection of Silvercreek Parkway between south of Paisley Road is required to accommodate the proposed development of the Silvercreek lands. The development requires access to both Paisley Road in the north and Waterloo Avenue/Wellington Road in the south.
- Silvercreek Parkway cannot be reconnected with an at-grade crossing which was closed in 1975, and requires a grade separation at the CNR crossing.
- The City of Guelph Official Plan identifies Silvercreek Parkway as continuous roadway including a grade separation at the CNR Mainline.
- The projected development and future daily traffic volumes (AADT) on Silvercreek Parkway and the number of trains per day on the CNR Mainline justify the need for grade separation at the CNR Mainline.
- There will not be a need for grade separation at the CNR Secondary Line. The existing at-grade crossing will be upgraded as determined through a Safety Audit according to CNR guidelines.

Silvercreek Parkway Alignment

The old Silvercreek Parkway followed a straight alignment between the CNR Mainline and the CNR Secondary Line. The proposed curvilinear alignment is based on the development Concept Plan to meet intensification, mixed-use and urban design requirements. The geometric design of the new alignment will be determined through the EA process in conformity with safety requirements and design standards.

The New Development Road

The Development Concept Plan includes a new municipal road to the east of the Silvercreek Parkway to provide access within the mixed-use development area. The geometric design of the new alignment will be determined through the EA process in conformity with safety requirements and design standards.

4.0 EA PHASE 2: ALTERNATIVE SOLUTIONS

Under Phase 2 of the Class EA process, all reasonable alternative solutions to the problem are identified and evaluated, considering the impacts to the surrounding natural, social and economic environments. The Environmental Assessment Act requires that all reasonable alternatives to the undertaking be considered during the decision making process. Consultation with review agencies and the public is a key element at this Phase of the Class EA process.

4.1 Alternative Solutions

Silvercreek Parkway / CNR Grade Separation

Alternative solutions to address the reconnection of the Silvercreek Parkway and CNR Grade Separation are identified under *Silvercreek Parkway Alignment* below.

Silvercreek Parkway Alignment

Alternative A: Do nothing: Silvercreek Parkway would remain closed at the CNR mainline

Alternative B : Reconstruct Silvercreek Parkway on existing alignment, including Subway at the CNR mainline

Alternative C-1: Reconstruct Silvercreek Parkway on a new alignment as per Silvercreek Developments Concept Plan, including Subway at the CNR mainline

Alternative C-2: Same as Alternative C-1, but improved to meet design standards and safety requirements

Alternative D: Same as Alternative C-2, but with an at-grade crossing at the CNR Mainline

Alternative E: Same as Alternative C-2, but the Subway at the CNR mainline would be raised and shifted to the south

New Development Road

The alignment of the new road to the east of the Silvercreek Parkway alignment was established under the development planning process that was already undertaken as part of the Silvercreek lands development process. Therefore, the requirements of the planning process (e.g. consideration of alternatives) were considered to be satisfied. As part of the EA Study, the geometric design of this roadway incorporated design standards and safety requirements.

4.2 Evaluation of the Alternatives

Each of the identified alternatives was comparatively evaluated against screening criteria as illustrated in **Table 4.1**

4.3 Recommended Solution

Based on the results of the evaluation of the alternative solutions, the recommended solution is *Alternative C-2: Reconstruct Silvercreek Parkway on a new alignment as per Silvercreek Developments Concept Plan, but improved to meet design standards and safety requirements, including Subway at the CNR mainline.*

Table 4.1 – Evaluation / Screening Criteria

Transportation/ Technical	Socio-Economic Environment	Natural Environment	Cost
⇨ Roadway Performance ⇨ Roadway/Rail Safety ⇨ Pedestrian & Cyclist Accommodations ⇨ Network Continuity ⇨ Commercial Vehicles ⇨ Emergency Services ⇨ Planning Objectives ⇨ Utility Relocations	⇨ Direct Property Impacts ⇨ Compatibility with Area Land Use ⇨ Residential Access ⇨ Illumination Impact ⇨ Visual/Aesthetic Impact ⇨ Construction Disruption	⇨ Vegetation Impact ⇨ Wildlife and Habitat Impact ⇨ Special Designation Areas ⇨ Groundwater Impacts ⇨ Surface Water Impacts ⇨ Air Quality ⇨ Natural Hazards	⇨ Capital Cost ⇨ Operation and Maintenance ⇨ Property Costs

The results of the evaluation of the alternatives are provided in **Table 4.2**.

Table 4.2 - Comparative Evaluation of the Silvercreek Parkway / CNR Grade Separation and Silvercreek Parkway Alignment Alternatives

EVALUATION CRITERIA	**ALTERNATIVE A** *Do nothing, Silvercreek Parkway would remain closed at the CNR Mainline*	**ALTERNATIVE B** *Reconstruct Silvercreek Parkway on existing alignment / Subway at the CNR Mainline*	**ALTERNATIVE C-1** *Silvercreek alignment as per Concept Plan / Subway at the CNR Mainline*	**ALTERNATIVE C-2** *Same as Alternative C-1, but improved to meet TAC* engineering standards*	**ALTERNATIVE D*** *Same Alignment as C-2 / At-Grade Crossing at the CNR Mainline*	**ALTERNATIVE E*** *Same Alignment as C-2 / Subway at the CNR Mainline Raised & Shifted to the South*
TRAFFIC OPERATIONS & TECHNICAL	Vehicular, cyclist and pedestrian traffic requirements not addressed.	Vehicular, cyclist and pedestrian traffic requirements addressed. Lack of roadway curve would not address traffic calming requirements.	Vehicular traffic requirements not addressed (not in conformance with technical design standards -TAC).	Vehicular, cyclist and pedestrian traffic requirements addressed. Traffic access / egress modifications required at north end.	Would not accomodate projected traffic volumes on Silvercreek Parkway or the number of trains on the CNR Mainline.	Not compatible with CNR structures at Hanlon Parkway and Paisley Road.
SOCIO-ECONOMIC	Would not accommodate proposed development of the Silvercreek lands. Does not support the City's Official Plan.	Straight alignment would limit the amount of developable land west of the Silvercreek Parkway.	Accommodates proposed development of the Silvercreek lands.	Accommodates proposed development of the Silvercreek lands.	Accommodates proposed development of the Silvercreek lands.	Accommodates proposed development of the Silvercreek lands.
NATURAL ENVIRONMENT	No impacts to the area's natural environmental features.	Development of the Silvercreek lands will result in the loss of natural environmental features in the area. The selected roadway alignment would have negligible affects.	Development of the Silvercreek lands will result in the loss of natural environmental features in the area. The selected roadway alignment would have negligible affects.	Development of the Silvercreek lands will result in the loss of natural environmental features in the area. The selected roadway alignment would have negligible affects.	Development of the Silvercreek lands will result in the loss of natural environmental features in the area. The selected roadway alignment would have negligible affects.	Development of the Silvercreek lands will result in the loss of natural environmental features in the area. The selected roadway alignment would have negligible affects.
COST	No construction cost.	Moderate costs associated with construction.	Moderate costs associated with construction.	Moderate costs associated with construction.	High costs to convert at-grade crossing to a future subway at CNR Guelph mainline.	High costs associated with shifting of CNR structures and lines at Hanlon Parkway and Paisley Road.
EVALUATION SUMMARY	**Not Recommended**	**Not Recommended**	**Not Recommended**	**Recommended**	**Not Recommended**	**Not Recommended**

5.0 DESCRIPTION OF THE RECOMMENDED SOLUTION

This section of the report identifies the key features of the recommended solution. The preliminary design drawings and illustrations of the typical cross sections are provided in **Appendix C**.

5.1 CNR Grade Separation

5.1.1 Twin Span Railway Bridge

The structure developed for the Silvercreek Parkway / CNR grade separation shall include a twin spanned skewed rigid frame "subway" structure, featuring a 5.3 metre vertical clearance. The road grade approaching the subway southbound from Paisley Road is at a negative 8% while leading away from the structure it will be reduced to a positive 2.7%. The design will raise the northbound bike lane and sidewalk approximately 2m to provide separation from traffic as well as to lessen the uphill grade for pedestrians. Southbound, only the sidewalk is elevated to provide grade relief for pedestrian traffic. See **Figure 5.1** for a cross-sectional view of the subway. Additional details on the bridge structure are provided in the *Structural Design Report* in **Appendix D**.

5.1.2 Retaining Walls

Retaining walls will be constructed on the east and west sides of Silvercreek Parkway, from south of the CNR Mainline to just south of Paisley Road to accommodate the required grade change for the construction of the subway. The retaining walls shall be gravity wall systems.

5.1.3 Pedestrian & Cyclist Accommodation

South of Paisley Road, Silvercreek Parkway drops at an 8% grade in order to develop adequate vertical clearance under the railway subway. Consequently, sidewalks through the structure will be elevated to reduce the vertical grade to approximately 5%. However, given the 8% grade on Silvercreek Parkway between Paisley Road and the CNR subway, cyclists are likely to be moving at a considerable speed, and for this reason the bike lanes have been located adjacent to the driving lanes in the southbound direction. In the northbound direction the reverse is true, and the roadway will be climbing an 8% grade. In climbing an 8% grade, particularly in the case of younger riders, it is likely that many cyclists will need to dismount and walk their bikes up the grade. In that event, any walking cyclists would be located on the bike lane between the edge of driving lane and the retaining wall for the elevated sidewalk, which would present a safety issue to the cyclist. For this reason, it was decided to elevate the bike lane in the northbound direction, and locate the bike lane adjacent to the sidewalk.

To protect pedestrians and cyclists on the elevated sections through the CNR Subway, higher "bike proof' railings will be installed.

5.2 Silvercreek Parkway

5.2.1 Roadway Cross Section

The Silvercreek Parkway cross section will feature 2 through lanes, 1.5 metre wide bike lanes and sidewalks throughout (except in the Silvercreek Market Square area in which the sidewalks will be much wider in consideration of the urban intensification in Silvercreek Square). A 3 metre wide centre island median and on-street parking shall also be provided for at Silvercreek Square.

5.2.2 Silvercreek Parkway/Paisley Road intersection

Intersection improvements will be required on all four legs of the Silvercreek Parkway/Paisley Road intersection, including left turn lanes in the northbound, eastbound and westbound directions. In the southbound direction, a channelized right turn lane will be added.

Beyond the immediate area of the intersection, the north leg of Silvercreek up will be restriped as a 2-Lane roadway, including a continuous centre left turn lane and bike lanes to the intersection of Willow Road. As well, the west leg of the intersection will be widened into the median by narrowing the existing concrete median to provide for the construction of back-to-back left turn lanes between Silvercreek and the Hanlon Expressway.

5.2.3 Access Modifications to Silvercreek Parkway and Paisley Road

A new Service Road will be constructed to provide access to the existing residential properties (5 properties) located on the west side of Silvercreek Parkway, that currently have direct access to Silvercreek Parkway, north of the CNR mainline. The existing service road (Old Paisley Road) will be maintained, but will now be restricted to provide access right-in / right-out for the residential properties (8 properties) west of Silvercreek Parkway, north of the CNR mainline.

Following review of the public concerns expressed at PIC No. 2 regarding access to Paisley Road & Silvercreek Parkway, a "right-out" alternative was developed to provide direct right-out egress from Old Paisley Road to Paisley Road Eastbound leading to downtown Guelph. While it is recognized that the preferred design will restrict access to Silvercreek Parkway in the northbound direction, it is noted that MTO plans to construct a grade separation and interchange at the Paisley Rd / Hanlon Expressway, at which time the grade differential from Old Paisley Rd to Paisley Rd will largely disappear, and further access improvements will be possible.

5.2.4 Roadway Illumination

Illumination requirements for the Silvercreek Parkway (including the new Street 'A') from Paisley Road to the south limit of the Secondary (Fergus) crossing, as well as decorative lighting and illumination design at Silvercreek Square will be determined during the detailed design phase of the study.

5.3 New Development Road

A new roadway will be constructed to the east of the Silvercreek Parkway in accordance with the Silvercreek Development Concept Plan. This roadway was shown as Street 'A' at the study PICs.

5.4 Fergus Subdivision (CNR Secondary Line)

The following improvements for the Fergus Subdivision at the CNR secondary line will be implemented based on the recommendations of the *Detailed Safety Assessment* completed as part of this study and provided in **Appendix E**.

Roadway

The Railway authorities are responsible for the design of the railway crossing. While the crossing design has not been completed at this time, it is anticipated that the reconstructed railway crossing will include:

- A crossing warning system including flashing LED lights, bells and gates.
- Additional crossing lights may be required to provide coverage of the Guelph Bible Conference Centre service entrance.
- An active "Prepare to Stop at Railway Crossing" signing.
- Signing for "No Train Whistles at This Crossing".
- "Railway Advance Warning Signs" indicating a skewed crossing.

Sidewalks

- The sidewalk travelled surface be delineated within 8 metre of the nearest rail with a solid white line on both edges of the travelled surface.
- Stop lines be painted on the sidewalks to indicate where pedestrians should stop.
- "Pedestrians Stop Here When Lights are Flashing" signs be installed.
- A bell be installed on the closest signal mast to each sidewalk.
- Both front and back lights on the signal masts be included to provide coverage for pedestrians.
- Consideration be given to the use of coloured detectable tactile strips at the sidewalk cross bars to assist the visually impaired.

5.5 Municipal Services and Drainage

An updated design of the existing municipal services will be created during the detailed design phase of the study. Existing utilities will be removed from the previous alignment and new storm and sanitary sewers and watermain will be provided for on the proposed alignment. Consideration will be given to the main sanitary line and trunk watermain feeder line as they cross under the at-grade crossing. Steel casings will be designed to the approval of CNR so that these municipal services can pass under the at-grade crossing.

The road drainage shall be incorporated with the drainage design for the Silvercreek Development and implemented as a single design. Runoff generated by the road during storm events shall be collected into a municipal drainage system and outletted to the existing culvert at the south-west limit of the site. The outlet is a storm culvert that transfers runoff under the Hanlon Expressway to the natural outlet south-west of the Hanlon Expressway.

5.6 Utilities

Guelph Hydro will provide illumination throughout the project, except within the area of the Silvercreek Market Square, where the Developer has proposed the installation of decorative street lighting, which will be installed pending approval of Guelph Hydro.

All Utility Companies have been requested to provide current and future needs so that accommodations will be provided for during the detail design.

There will be numerous municipal & private utilities that will pass under the CNR Subway, generally passing under the sidewalk in the case of the telecommunication & local utilities, and located under the asphalt pavement in the case of the municipal water and storm sewers.

The existing fibre optic (Bell360 Networks & Allstream) cables located alongside the CNR mainline will have to be temporarily relocated for the construction of the rail diversion. These fibre optic cables will be restored following construction, and placed in ducts that will pass through the new CNR Subway.

At the at-grade crossing to the south of the study area (Secondary Fergus line), casings are being designed for the underground passing of requested utilities as well as municipal services.

5.7 Streetscaping

Details with respect to enhanced streetscape features along the corridor will be determined during the detailed design phase of the study.

5.8 Property Requirements

Silvercreek Parkway will be constructed in an earth cut north & south of the CNR Subway in order to achieve vertical clearance under the structure. Consequently Reinforced Soil Structures (RSS) retaining walls will be required adjacent to Silvercreek Parkway until grade is restored, and will extend approximately 80m north of the structure and 30m south of the structure.

The RSS wall design incorporates tieback straps and granular backfill to reinforce the soil structure behind the wall and retain the integrity of the retaining wall system. In addition, temporary shoring will also be required behind the RSS walls during construction. For these reasons, a Temporary Easement, 5m in width, will be required during construction for the 5 properties located on the west side facing Silvercreek, immediately north of the tracks. A similar easement will also be required for construction purposes on properties on the east side of Silvercreek Parkway. Any need for property to accommodate tiebacks on the eastside will be ascertained during detailed design.

5.9 Construction Staging

Construction is anticipated to commence in the Fall of 2012, beginning with the railway diversion & subway structure. As Silvercreek is dead-ended at the existing track, construction staging requirements will be limited to the Silvercreek / Paisley Road area where traffic lanes will be maintained, subject to short term (typically 1 day) closures required to construct local underground utility and road work.

5.10 Preliminary Cost Estimate

The estimated project cost for implementing the recommended design concept will be approximately $6 million. The final cost will be further refined during the detailed design phase of the study.

6.0 POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

Based on an assessment of the potential environmental impacts resulting from construction of the recommended design, implementation of the recommended solution will have impacts on the surrounding environment. It is recommended that various mitigation measures be employed in order to reduce the potential impacts resulting from implementing the recommended design. **Table 6.1** details the potential impacts resulting from the project works and their associated mitigation measures. The mitigation measures detailed below shall serve to avoid and / or minimize potential negative environmental impacts.

Table 6.1 - Construction-related Impacts and Mitigation

NO.	POTENTIAL IMPACT	MITIGATION MEASURES	NET IMPACT
1.0	**Transportation Environment**		
1.1	*Potential disruption to vehicular traffic (travelling public and commercial vehicles).*	• Traffic disruption at the northern portion of the study limits shall be minimized as much as possible during construction. At least one lane (under the control of flagmen) shall remain open at all times. A construction staging and traffic management plan will be developed during the detailed design phase of the project.	• Impacts will be negligible to minor. The majority of the study area is located within the Silvercreek Development Lands, which is currently unused by vehicular traffic.
1.2	*Potential disruption to rail traffic.*	• Rail traffic would be diverted to a temporary track to be located south of the existing track.	• Rail traffic may experience negligible to minor delays in travel time.
1.2	*Potential disruption to emergency response (i.e. ambulance, police and fire) vehicles.*	• Emergency services to be notified by contractor of construction – related activities and schedule to minimize/avoid delays during emergencies.	• Impacts will be negligible to minor. The majority of the study area is located within the Silvercreek Development Lands, which is currently unused by vehicular traffic.
1.3	*Potential disruption to transit services.*	• Guelph Transit to be notified of construction – related activities and schedule to minimize/avoid delays at the northern portion of the study area.	• Impacts will be negligible to minor. The majority of the study area is located within the Silvercreek Development Lands, which is currently unused by vehicular traffic.
1.4	*Potential disruption to pedestrians and cyclists.*	• NA. Silvercreek Parkway is closed to traffic, pedestrians and cyclists at the existing CNR crossing. During construction, the construction zone will be barricaded to prevent unauthorized access.	• Pedestrian and cyclist safety is not anticipated to be affected during construction as pedestrians and cyclists will be prohibited from the worksite.
2.0	**Socio-economic Environment**		
2.1	*Potential access restrictions to adjacent property driveways.*	• Every effort will be made to maintain driveway access during the construction period. Driveway access to the 5 Silvercreek residents will be restored immediately upon completion of the retaining wall, which is estimated to take 4-6 weeks.	• There are existing driveways servicing 5 residences located on the west side of Silvercreek, between the CN Rail Crossing and Paisley Rd. Access to these entrances will be closed during the construction of the west side retaining wall, during which time the residents will be forced to park alongside Old Paisley Rd. Driveways may be closed for short periods (1 day maximum is anticipated).
2.2	*Temporary access to properties north of CN Mainline may be required for construction of retaining walls for the CNR Subway.*	• Property owners will be notified. Any lands disturbed as a result of construction would be restored to their original state.	• Negligible to minor. Any lands disturbed as a result of construction would be restored to their original state.
2.2	*Property required to implement the recommended design.*	• Where possible, the project team will attempt to minimize any adverse property impacts. Where the purchase of property is required, the property owner will be contacted directly by the City of Guelph during the detailed design phase of the project.	• Preliminary property requirements are identified in *Section 5.8*.

NO.	POTENTIAL IMPACT	MITIGATION MEASURES	NET IMPACT
2.3	*Potential reduction in air quality due to dust and/or emissions from construction equipment.*	• Dust/debris control measures shall be undertaken to control roadway dust. Measures to be included in the construction plans include, but not be limited to: – application of water or non-chloride based compounds. – soil and other material storage piles to be stabilized/covered to prevent wind erosion. – fine particulate materials to be covered during transportation to and from the site. • Contractor to use new or well-maintained heavy equipment and machinery, preferably fitted with fully functional emission control systems/ muffler/ exhaust system baffles and engine covers.	• Negligible to minor, short term reduction in air quality providing application of identified mitigation measures.
2.4	*Potential noise impacts associated with construction activities.*	• All local noise control by-laws must be obeyed. Exemptions, where required, will be applied for through the municipality and should be included in the construction contract documents. • General noise control measures will be referred to, or placed into construction contract documents. The following constraints addressing construction equipment operation and maintenance should be included in the construction contract documents: – Equipment Maintenance: Equipment shall be maintained in an operating condition that prevents unnecessary noise, including but not limited to non-defective muffling systems, properly secured components and the lubrication of moving parts; – Equipment Operation: Idling of equipment shall be restricted to the minimum necessary to perform the specified work; – Additional noise constraints may be included at the discretion of the Environmental Planner. They could include, for example, the siting of the contractor's yard. • Any initial complaint from the public will require verification that the general noise control measures agreed to are in effect, any noise concerns will be investigated, and the contractor warned of any problems. • Notwithstanding compliance with the "general noise control measures", a persistent complaint will require a contractor to comply with the MOE sound level criteria for construction	• There will be some minor, short term noise impacts associated with roadway reconstruction.

NO.	POTENTIAL IMPACT	MITIGATION MEASURES	NET IMPACT
		equipment contained in the MOE Model Municipal Noise Control By-law. Subject to the results of field investigation, alternative noise control measures will be required, where these are reasonably available.	
3.0	**Natural Environment**		
3.1	*Potential impacts on the terrestrial environment (i.e. roadside vegetation and mature trees).*	• Construction activities are to avoid damaging existing, healthy trees located close to the ROW wherever possible. This is to be accomplished by installing suitable tree protection fencing, extending to the 'dripline' of trees designated for protection. This tree protection zone is to remain undisturbed by excavation, storage of materials and equipment, and other construction related activities. The fencing is to remain in place through the duration of construction activities. • All tree and shrub plantings within the corridor are to be salt-tolerant, non-invasive, low maintenance, disease/pest resistant and drought tolerant.	• Development of the Silvercreek lands will result in the loss of natural environmental features in the area. The selected roadway alignment would have negligible affects.
3.2	*Potential surface water impacts resulting from erosion and sedimentation.*	• The following temporary erosion and sedimentation control measures will be implemented prior to construction to mitigate negative impacts on water quality and fish habitat beyond the limits of this study area: – using erosion and sediment control (ESC) measures (e.g. heavy duty silt fence, rock flow checks, straw bale flow checks, fibre filtration tubes). – The extent and duration that soils are exposed to the elements will be kept to a minimum; – Disturbed areas will be stabilized through seeding, sodding, mulching or use of an erosion control blanket as soon as possible; – All erosion and sedimentation control measures will remain in place until soils have been re-stabilized; – The erosion and sedimentation control measures are to be inspected and monitored to ensure that damage to vegetation has been minimized.	• No negative impacts are anticipated. Erosion and sedimentation should not have any effect on surface water quality provided these measures are installed pre-construction, maintained during construction and removed post-construction following soil restabilization.
3.3	*Soil and surface/ground water contamination through spills and leaks.*	• During construction, contamination to soils caused by spills and leaks can be avoided by ensuring that fuel storage, refueling and maintenance of construction equipment are handled properly and not allowed in or adjacent to watercourses. Contingency plans shall be prepared prior to	• No significant negative impacts are anticipated.

NO.	POTENTIAL IMPACT	MITIGATION MEASURES	NET IMPACT
		construction for the control and emergency clean up of a spill should one occur. • No refueling of any construction equipment or vehicles shall occur within 50 metres of any watercourse.	
4.0	**Cultural Heritage / Archaeological Environment**		
4.1	*Archaeological resource impacts.*	• Should deeply buried archaeological remains be found during construction activities, the Heritage Operations Unit of the Ministry of Culture should be immediately notified; and • In the event that human remains are encountered during construction, the proponent should immediately contact both the Ontario Ministry of Culture and the Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ontario Ministry of Government Services, Consumer Protection Branch at (416) 326-8404 or toll-free at 1-800-889-9768.	• No negative impacts are anticipated.
5.0	**Utilities**		
5.1	*Relocation of existing utilities to accommodate the recommended design.*	• Existing utilities requiring relocation will be finalized during the detailed design stage of the study.	• It is not anticipated that significant relocations will be required.

Table 6.2 - Operational (Post-construction) Impacts and Mitigation

OPERATIONAL IMPACTS			
NO.	**POTENTIAL IMPACT**	**MITIGATION MEASURES**	**NET IMPACT**
6.0	**Socio-economic Environment**		
6.1	*Change in access movements to properties on the west side of Silvercreek Parkway north of the CN Mainline.*	• A service road will be provided with right-in, right-out access on Silvercreek Parkway. A right-out access onto Paisley Road will also be provided.	• Properties on the west side of Silvercreek Parkway north of the CN Mainline will be limited to right-in, right-out access onto Silvercreek Parkway and right-out access only onto Paisley Road.
7.0	**Natural Environment**		
7.1	*Stormwater quantity and quality impacts to watercourses.*	• No mitigation is required due to non-existent to minor increases in hydrological impacts resulting from the proposed reconstruction.	• The current drainage paths to multiple receiving systems would be maintained. The requirements for management of storm-water quantity and quality will be addressed in detailed design.

7.0 ADDITIONAL WORK/FOLLOW UP COMMITMENTS

Additional works to be completed during the detail design phase of the project, prior to construction, include but are not limited to, the following:

- Determine illumination requirements for the reconstructed roadway.
- Incorporate landscape features into the roadway design.
- Confirm utility relocation requirements.
- Confirm municipal servicing requirements/upgrades to be undertaken as part of the roadway reconstruction works.
- Develop a construction staging and traffic management plan.
- Refine costs associated with the roadway reconstruction works.
- Address property issues as appropriate.
- Determine the requirement for the following approvals:
  - MOE Certificate of Approval for local watermain, trunk feeder main, storm and sanitary sewer works. It is anticipated that the Developer will submit the permit applications for the project. This will be confiormed in detail design.
  - MOE Permit to Take Water if dewatering exceeds 50,000 litres per day.
- The following additional road modifications will be included in the detailed design and construction of the grade separation and the reconnection of Silvercreek Parkway:
  - the construction of back to back left turn lanes on Paisley Road between Silvercreek Parkway and the Hanlon Expressway;
  - the reconstruction of existing Silvercreek Parkway south of the CN secondary line including modifications to the intersection at Waterloo Avenue.

8.0 MONITORING

During construction, the contract administrator will ensure that full-time monitoring/inspection of the project works is undertaken to ensure that all environmental commitments identified in the Project File are adhered to by the contract team. The contract will provide a one-year warranty during which inspections will be carried out to ensure compliance with the *Ontario Provincial Standards Specifications* and *Supplementary Special Provisions* (to be identified in the contract documents).

9.0 PUBLIC AND AGENCY CONSULTATION

Consultation with the public, external agencies and other stakeholders was conducted in accordance with the requirements of the Schedule "B" Class EA process. Throughout the study, stakeholders were contacted via newspaper inserts and mail delivery of study commencement, Public Consultation Centres and study completion. Local residents, businesses, property owners, external agencies and interest groups were contacted. Copies of project stakeholder notification materials are provided in **Appendix F**.

9.1 Consultation with the Public and Review Agencies

9.1.1 Notice of Study Commencement

A Notice of Study Commencement was placed in the *Guelph Tribune* on September 22, 2011. The newspaper notice described the project, outlined the *Municipal Class Environmental Assessment* process, requested public involvement, identified the details of the first Public Consultation Centre and identified contact persons. The Notice of Study Commencement was mailed out to local residents, businesses, property owners, external agencies, and interest groups on September 27, 2011. Seven residents directly adjacent to the project received hand delivered notices. The Notice was also placed on the City's website.

9.1.2 Public Information Centre No. 1

Public Information Centre (PCC) No. 1 was held on November 24th, 2011 to provide local residents, external agencies and interest groups an opportunity to convey their issues/concerns and suggestions to the project team on the study problem/opportunity statement, local issues and area constraints, and alternative solutions being considered. The PIC was set up as a "drop-in" style information centre in which participants were encouraged to view the boards on display and to address their questions and concerns to members of the project team. Local area residents that were considered to be directly impacted by the project works were invited to meet the project team and discuss project-related issues and potential impacts prior to the actual start of the PIC.

Local area residents, special interest groups and technical agencies were invited to attend via regular mail, hand delivered notice (to local residents), the City of Guelph's website and newspaper publications in the *Guelph Tribune*.

All comments and concerns submitted at the PIC were reviewed for consideration in the evaluation and assessment of the preliminary design concepts. A summary of the comments received at the PIC and the Project Team's consideration of those responses are addressed in **Table 9.1**. A detailed summary of the PIC containing timing, notification, attendance, materials presented, comments received and major issues raised is provided as per the Public Information Centre No.1 Summary Report in **Appendix G**.

Table 9.1 - Public Information Centre No. 1 Comment Summary

Key Issue	Comment Summary	Project Team's Consideration of Comments
Support for Alternative "C-2"	Of the total written comments received, the majority (4 comments) were in support of reconstructing Silvercreek Parkway on a new alignment as per the Silvercreek development concept plan, refined to meet engineering standards, including a Subway at the CNR	Comments noted.

Key Issue	Comment Summary	Project Team's Consideration of Comments
	Mainline.	
Support for Alternative "B"	Of the total written comments received, 3 of the comments were in support of reconstructing Silvercreek Parkway on the existing alignment, including a new Subway at the CNR Mainline. Comments in support of this alternative were submitted by residents of Woodycrest Drive and eluded to the loss of green space behind their properties as the reason.	The alignment to be selected for the subject portion of Silvercreek Parkway would have no bearing on the loss of green space resulting from development of the Silvercreek lands.
Other	Additional comments were received that identified the following issues and concerns:	
	• Grade issues at Eden Street (potential for vehicles sliding through the stop sign and into traffic at Eden Street/Silvercreek Parkway).	With the exception of repainting Silvercreek Parkway to accommodate additional 1.5 metre bicycle lanes, the limits of roadway reconstruction do not extend to Eden Street. City Operational Services to address winter maintenance.
	• Shed inhibiting sightlines at the NW corner of Eden Street/Silvercreek Parkway.	Structures on lands designated as private property are subject to City Bylaws. This issue has been forwarded to the City's Building Department for review and potential follow up.
	• Separate cyclists and pedestrians from vehicular traffic.	Dedicated bicycle lanes and separate sidewalks will be provided in the preferred design of the roadway.
	• Raise bicycle and pedestrian grade under the rail bridge.	Alternative bicycle and pedestrian grades under the CN Subway are currently being investigated by the project team.
	• Lighting for the new road should be considerate of the surrounding neighbourhoods.	Street lighting will be provided in accordance with City standards.
	• Provision of left and right turn access in out of Paisley Service Road.	Access in and out of Paisley Road is anticipated to be provided via a right-in, right-out movement. This movement will be subject to MTO approval.
	• No road incline onto Paisley Road.	The connection to Paisley Road will be shifted to the east, closer to the Silvercreek Parkway intersection to reduce the current profile grade to City standards (6% grade).
	• Allow truck entrance / exit onto	Commercial trucks will be permitted

Key Issue	Comment Summary	Project Team's Consideration of Comments
	Silvercreek Parkway from Waterloo Avenue only.	to service the commercial development planned for the Silver Creek Lands. Trucks will be encouraged to use Waterloo Avenue, rather than Paisley Road.
	• Comments from adjacent property owner (provided in PIC Summary Report).	Project Team's consideration of these comments are provided in the PIC Summary Report).

9.1.3 Public Consultation Centre No. 2

PIC No. 2 was held on February 15th, 2012 to provide local residents, external agencies and interest groups an opportunity to convey their issues/concerns and suggestions to the project team on the study and the evaluation and selection of the project team's recommended solution(s). The PIC was set up as a "drop-in" style information centre in which participants were encouraged to view the boards on display and to address their questions and concerns to members of the project team. Local area residents that were considered to be directly impacted by the project works were invited to meet the project team and discuss project-related issues and potential impacts prior to the actual start of the PIC.

Local area residents, special interest groups and technical agencies were invited to attend via regular mail, hand delivered notice (to local residents), the City of Guelph's website and newspaper publications in the *Guelph Tribune*.

All comments and concerns submitted at the PIC were reviewed for consideration in the evaluation and assessment of the preliminary design concepts. A summary of the comments received at the PIC and the Project Team's consideration of those responses are addressed in **Table 9.2**. A detailed summary of the PIC containing timing, notification, attendance, materials presented, comments received and major issues raised is provided as per the Public Information Centre No.2 Summary Report in **Appendix H**.

Table 9.2 - Public Information Centre No. 2 Comment Summary

Key Issue	Comment Summary	Project Team's Consideration of Comments
General support for the Recommended Solution	The majority of the verbal comments received at the PIC were in support of the Project Team's overall recommendations.	Comments noted.
Access Restrictions to Northbound Silvercreek Parkway and Southbound Paisley Road	Study area residents on the southwest portion of the Paisley Road/Silvercreek Parkway intersection were against the Project Team's recommendation for right turn accesses onto Paisley Road and Silvercreek Parkway off of the proposed Paisley / Silvercreek Service Road. Residents stated that the proposed design does not accommodate them as the majority of their trips	Subsequent to the PIC, the access to Paisley Road was revised from a Right-In/Right-Out design to a Right Out only. This change will provide improved access to Paisley Rd in the eastbound (downtown) direction. It will also permit limited access to Silvercreek northbound in off-peak periods, subject to traffic conditions. Access to Paisley Rd can be significantly improved upon completion of the Paisley/Hanlon

Key Issue	Comment Summary	Project Team's Consideration of Comments
	are northbound on Silvercreek Parkway and southbound on Paisley Road.	Overpass in 10± years
Other	Additional comments were received that identified the following issues and concerns:	
	• Vehicle turning movements on access road (garbage trucks, snow plows etc.).	The local service road will be constructed 6.0m in width. There is insufficient ROW to construct a turn-around at the end of the access road. Hence garbage trucks and winter maintanance equipment will need to drive in/back out. The City may utilize a pickup truck to plow/and/salt the access road.
	• What will happen to the trees, rock and 30 foot privet on City land in front of my property?	The Silvercreek Road allowance (66 feet) will be fully utilized to construct the roadway, retaining walls and local access road.
	• Access restrictions will result in decreased property value.	Alternative accesses are being provided.
	• Construction impacts (noise, dust, access, etc.)	Impacts related to construction will be minimized to the extent possible. See *Section 6.0* for more information.
	• How much notice will I receive before construction?	Construction is planned to begin in the Fall of 2012. 1-2 weeks prior to construction, local residents will be provided with a handout including the proposed schedule, including emergency contact names and phone numbers in the event of any unforeseen circumstances.
	• Will there be a tax break for the inconvenience?	There will be no tax breaks associated with the construction works.
	• Question about traffic signals on Westwood Road due to increased traffic.	Traffic signals on Westwood Road are not recommended at this time. This area will be monitored for increased traffic following the construction works.
	• Plan for new transit route on Silvercreek Parkway	The City does intend to provide transit service on Silvercreek Parkway. However route details have not been determined at this time.
	• Protect for future grade separation at Fergus Subdivision.	Train volume on the CN Secondary (Fergus) crossing is extremely low. A grade separation would only be considered in the event of a major

Key Issue	Comment Summary	Project Team's Consideration of Comments
		change in track usage, such as for example implementation of LRT or other train service to Cambridge. This possibility is considered unlikely at this time. However, major track improvements along the corridor could be considered at that time when proposed usage has been determined.

9.1.4 Individual Meetings with Technical Agencies & Stakeholders

Throughout the study, the Project Team met with:

- Ministry of Transportation, June 22, 2011 and March 27, 2012
- CN Rail & GEXR (Rail America), July 26, 2011 and October 3, 2011
- RJ Burnside & Aecom, January 19, 2012, February 9, 2012 and February 21, 2012
- Armel Corporation, March 15, 2012

Meeting minutes outlining the items discussed in each of the above meetings are provided in **Appendix I**.

9.2 Comments Received from Technical Agencies and Special Interest Groups

All comments received from the technical agencies and special interest groups were taken into account during the study. Comments and concerns received, as well as the Project Team's consideration of those comments, are summarized in **Table 9.3**. Actual copies of the correspondence received from technical agencies and special interest groups are included in **Appendix J**.

9.2.1 Notice of Study Completion

A Notice of Study Completion was placed in the *Guelph Tribune* on June 21, 2012. The newspaper Notice of Study Completion identified main features of the recommended design, the Class EA process undertaken (including the "Part II Order" request process), and details on the Project File Report. Concurrent with the newspaper Notice of Study Completion, local residents, property owners, external agencies and other stakeholders were sent a final contact letter indicating that the Project File is available for review.

Table 9.3 – Comments Received and their Consideration in the Study

Agency / Interest Group	Comment Summary	Date Received	Project Team's Consideration of Comment
Indian and Northern Affairs Canada - Specific Claims Branch	In determining your duty to consult, you may wish to contact the First Nations in the vicinity of your area of interest to advise them of your intentions. To do this you may: 1. find the Reserves in your area of interest by consulting a map of the region such as the Province of Ontario Ministry of Aboriginal Affairs online map at http://www.ainc-inac.gc.ca/ai/scr/on/rp/mcarte/mcarte-eng.asp ; then 2. search for the First Nations located on those Reserves by using the *INAC Search by Reserve* site at http://pse5-esd5.ainc-inac.gc.ca/fnp/Main/Search/SearchRV.aspx?lang=eng. To determine the First Nations in your area of interest who have submitted claims please consult the *Reporting Centre on Specific Claims* at http://pse4-esd4.ainc-inac.gc.ca/SCBRI/Main/ReportingCentre/External/ExternalReporting.aspx?lang=eng.	October 6, 2011 & February 09, 2012	Study notification was provided to First Nations identified as potentially having an interest in the study/study area as follows: • Mississauga's of the New Credit First Nation • Six Nations Haudenosaunee Confederacy Council • Six Nations of the Grand River To date, no comments have been received.
GEXR/Rail America	The GEXR will be directly affected by the Project works. All applicable plans must be submitted to GEXR for review and approval.	October 11, 2011	The project team met with GEXR/Rail America twice during the study for their input. Design plans were submitted to GEXR for review and approval as requested.
Rogers Communications	Long Haul Fibre Optics on CN Tracks, servicing development and relocation of existing plant.	October 11, 2011	The existing Rogers fibre optic cables on the Guelph Subdivision will be maintained. Temporary relocation will be required during the construction of the rail diversion. However service will be maintained during construction work.
Grand River Conservation Authority	The subject lands include Howitt Creek, a tributary of the northwest drainage channel, floodplains and slopes.	October 11, 2011	Comments noted.
R.J. Burnside	I represent the Developer of the lands.	October 12, 2011	The project team met with R.J. Burnside during the study.
Howitt Park Neighbourhood	Require further information.	October 17, 2011	Howitt Park Neighbourhood Residents Association was, and will continue to be, invited to all key project consultation activities.

Agency / Interest Group	Comment Summary	Date Received	Project Team's Consideration of Comment
Residents Association			
Union Gas Limited	Can you please send us any digital drawings you may have of this project? Also do you know when this project may start if it goes through?	October 21, 2011	The requested drawings and study information were provided to Union Gas Limited as requested.
Ministry of Aboriginal Affairs	With respect to this project and based on the materials you have provided, the project appears to be located in an area where First Nations may have existing or asserted rights or claims in MAA's land claims process or litigation, that could be impacted by this project (First Nations contacts provided). MAA notes that the following Metis may be interested in your project given the proximity of their community to the area of the proposed project or your project's environmental impacts (Metis contacts provided).	November 23, 2011	Study notification was provided to First Nations identified as potentially having an interest in the study/study area as follows: • Mississauga's of the New Credit First Nation • Six Nations Haudenosaunee Confederacy Council • Six Nations of the Grand River Identified Metis contacts will be notified of the 30 Day review of the Project File. To date, no comments have been received.
XO Rail	The 2-span skewed rigid frame with approach slabs, and a 5.0 m vertical clearance (with crash beam) is acceptable to CN.	February 7, 2012	With this approval, the City is now proceeding on the detail structural design of the Rail Subway.
Paisley Street Resident	Increased development-related traffic on Paisley Street.	February 9, 2012	This issue is related to the development and is outside the scope of the EA Study.
Ministry of Transportation	The distance along Paisley Road between Highway 6 (Hanlon Expressway) and Silvercreek Parkway is approximately 175 metres. Based on the information from the 2006 Traffic Impact Study, the required left turn storage plus the parallel and taper for the westbound left at the Highway 6 and the eastbound left at Silvercreek Parkway may exceed the available space and therefore may not be able to be constructed. The distance between Wellington Road and Waterloo Road on the north leg of the ramp terminal is approximately 105 meters. The southbound left turn lane storage, parallel and taper required at Waterloo Road may exceed the available space and may not be able to be constructed. There also appears to be level of service and capacity concerns at some intersections as indicated in the table provided. Based on the information above the Ministry is requesting that the study area of the Class EA be	February 13, 2012	The Project Team held discussions with MTO in regard to these concerns. In order to address these concerns, the following additional work will be undertaken as part of the detailed design and construction of the grade separation and the reconnection of Silvercreek Parkway: (1) the construction of back to back left turn lanes on Paisley Road between Silvercreek Parkway and the Hanlon Expressway; and (2) the reconstruction of existing Silvercreek Parkway south of the CN secondary line including modifications to the intersection at Waterloo Avenue.

Agency / Interest Group	Comment Summary	Date Received	Project Team's Consideration of Comment
	expanded to include Silvercreek Parkway from north of Paisley Road to the Wellington Street interchange, including the intersection of Silvercreek and Waterloo Avenue, and that the traffic impact study prepared by BA Consulting be updated so that the impacts to our intersections can be re-evaluated and mitigated.		
Adjacent Property Owner (580 Paisley Road)	As part of EA process, has the City asked the Canadian Transport Agency (CTA) about the option of reopening Silvercreek Parkway with an at-grade crossing with the CN Mainline, without a grade separation? Was the option of moving the railway track to the south considered as this would help reduce the road grade required for the underpass at the railway location? With the grade separation as proposed, it will not be possible to access the property at 580 Paisley Road, on the east side of Silvercreek Parkway, and the property cannot be used for its intended use. The property owner would like to cooperate on this project and is interested in selling the property and suggested that it could be used to accommodate the proposed roadway improvements.	March 15, 2012 (Meeting)	As outlined in PIC #1 information and discussed at the March 15 meeting, the 'Need & Justification' for grade separation has been established based on information including current and projected daily roadway traffic volumes and the number of trains using the North Mainline. Given available information, the City's support for increasing passenger train service through Guelph, and collaboration with Metrolinx-GO, VIA Rail, CN Rail and Rail America, it will not be appropriate for the City to ask the Canadian Transport Commission whether Silvercreek Parkway could be reopened with an at-grade crossing forty years after it was closed. Southerly relocation of the railway tracks is not feasible based on the railway design criteria and the proximity of the crossing at Silvercreek Parkway to the existing grade separation structures at both the Hanlon Expressway and Paisley Road. The property at 580 Paisley Road has access on Paisley Road. A second access on Silvercreek Parkway cannot be provided given the vertical alignment required for the grade separation. This was notified by the City, in March 2008, in the context of the Site Plan Application (SP07C020) for this property submitted by BJC Architects Inc. The City will pursue this matter with the property owner.

10.0 SUBMISSION OF PROJECT FILE

The Project File Report will be placed on the public record for a 30-day review period. During this time, stakeholders will be encouraged to review outstanding issues with the study team.

10.1 Resolution of Outstanding issues

In the event that there are major issues which cannot be resolved, stakeholders may request the Minister of the Environment by order to require a proponent to comply with Part II of the EA Act before proceeding with a proposed undertaking which has been subject to Class EA requirements. This is called a "Part II Order". The Minister will make one of the following decisions:

1. Deny the request (with or without conditions);
2. Refer the matter to mediation; or
3. Require the proponent to comply with Part II of the EA Act, ordering a full Environmental Assessment.

All stakeholders are urged to try to resolve issues since it is preferable for them to be resolved by the municipality in which a project is located, rather than at the provincial level. To request a Part II Order, a person must send a written request to:

Minister of the Environment
77 Wellesley Street West, 11th Floor
Ferguson Block, Toronto, ON M7A 2T5

The request must address the following with respect to the identified concerns:

- Environmental Impacts and specific concerns;
- Adequacy of the planning and public consultation process;
- Involvement of the person in the planning process; and
- Details of discussions held between the person and the proponent.

APPENDIX A

ENVIRONMENTAL IMPACT STUDY

Environmental Impact Study for the Lafarge Property

City of Guelph

October, 2005

Prepared for:
Silvercreek Guelph Developments Limited

Prepared By:
North-South Environmental Inc.
35 Crawford Cres., Suite U5, PO Box 518
Campbellville, Ontario
L0P 1B0

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1.0 INTRODUCTION

This report discusses the potential environmental impacts related to a mixed-use commercial development proposed within the City of Guelph. The Lafarge Property, shown in Figure 1 (page 6), is situated at the south end of Silvercreek Parkway, just east of the Hanlon Expressway, between two active railway lines. The proposed development is almost entirely situated on waste land formerly used for gravel extraction and concrete production. However, there is a watercourse that crosses the property and drains southward to the Speed River. The area around the watercourse, along with the wooded area and steep slopes adjacent to the stream, has been included within the Lower Speed River Scheduled Area. The site is zoned B.4 (Industrial) but the watercourse crossing the site is defined as a Natural Heritage Feature on Schedule 2 of the Official Plan, with the result that an Environmental Impact Study (EIS) is required per section 6.3.1 of the Official Plan. The results of the terrestrial inventory, as well as the requirements for an impact analysis and recommendations for monitoring, are addressed in this report. The study of the fisheries habitat within the stream is appended to this report (Appendix 1).

A Terms of Reference was proposed for the site that included multi-season inventories of terrestrial flora and fauna, and a study of the stream's temperature regime, fish habitat and fauna. Preliminary development issues were identified and the project scoped at the beginning of the study. The Terms of Reference were presented to the Guelph Environmental Advisory Committee (EEAC) on June 8, 2005. EEAC noted that the study should address:

- naturalizing the stream;
- enhancing the stream corridor;
- using robust, native tree species of local stock for naturalization; and
- whether there are groundwater contributions to the stream.

Early comments on the proposal from Grand River Conservation Authority (2005) noted that any future development on the property should:

- address stormwater management (quality and quantity);
- ensure that a water balance is maintained (groundwater/surface water); and
- minimize impacts to the watercourse and associated woodland corridor downstream.

Comments on environmental issues from the City of Guelph Parks Department indicated that the EIS should:

- determine if the site is used by early-breeding species such as raptors and amphibians; and
- evaluate downstream habitats and downstream effects on the creek.

The objectives of this study are to:

- collect background information on environmental features;
- map and classify vegetation community boundaries;
- map the location of significant species and other features;
- identify impacts and mitigation; and
- recommend future monitoring.

2.0 METHODS

Background information was obtained for the site from the Grand River Conservation Authority. Local residents also provided information at a public meeting on June 21, 2005. The site was visited on 16 June, 24 July, 29 July and 21 September 2005. All visits focused on obtaining lists of wildlife and plants that use the site, mapping and describing vegetation communities, and obtaining lists of dominant species as well as any significant species or other features present. The first visit on June 16 was also conducted to obtain information on breeding birds and frogs, as well as summer flora. The visit was conducted beginning just at dawn, in weather appropriate for breeding bird and frog surveys. Searches for amphibian larvae were also conducted on the small area of standing water on site.

Earlier spring surveys (in late March to end of May), suggested by the City of Guelph Parks Department to detect raptors, salamanders and early breeding frogs, were not conducted because of the timing of the proposal (the study was initiated in mid June). However, summer surveys would have detected these groups had they been present, because the areas of potential breeding habitat were so small that a comprehensive survey was possible. The only area of standing water on the site was surveyed for amphibian larvae during the first survey in mid-June, well before they would have transformed into adults. Similarly, juvenile hawks or stick nests would have been seen on the site in June, had they been present.

Vegetation was mapped and classified to vegetation type wherever possible according to the protocols for Ecological Land Classification (Lee *et al.* 1998). Where vegetation communities did not correspond to listed vegetation types, they are classified according to a coarser level (ecosite). Soil samples were collected using a Dutch soil auger. Locations of sampling points and significant features were mapped using a hand-held GPS unit (Garmin-12). Boundaries of vegetation communities were mapped in the field on an ortho-rectified aerial photograph of the site, and then digitized using ArcInfo softwear.

Floristic Quality Analysis was used to evaluate the vegetation communities on the site. The protocols for this analysis are set out in Oldham *et al*. 1996. Coefficients of Conservatism used in the analysis are derived from the Natural Heritage Information Centre website (NHIC 2005). Provincial significance of flora and fauna was determined by comparing to lists of rare species published by NHIC (2005). Regional significance of flora was determined according to a draft list of significant species for Wellington County (Anderson, Draft, 2005). Because the list of significant species is still in draft form, the list of flora found on the site was also compared to the list of significant species for Waterloo County (Region of Waterloo 1999). Regional significance of fauna was determined according to a draft list of significant fauna for Wellington County (Dougan and Associates, Draft, 2005).

3.0 SITE SETTING AND CONTEXT

The Lafarge Property is situated in a highly developed area of the City of Guelph, Ontario. Extensive residential development lies to the north, east and south of the property, and a four-lane highway (Highway 6 North) abuts the site to the west. A well-used railway line situated on a steep embankment forms the northern boundary of the site, while a less-frequently travelled line, also on a steep embankment, forms the boundary to the south.

Figure 1 shows an aerial view of the site and its environs, based on 2004 ortho-rectified photography. The original vegetation and landform characteristic of the physiographic region are no longer present. The property was used for gravel extraction until 1974, and asphalt and concrete production until 1994. Heavy vehicles were repaired and maintained on the site. As a result of these activities, soil depth is variable on the site; areas of bare rock and compacted gravel are visible throughout. Internal gravel roads, visible in the aerial photo, run north-south as well as east-west through the site. Silvercreek Parkway presently provides vehicle access from Wellington Road to the south, but is closed at the northern extent of the site at the northern railway line.

The microtopography of the site has been highly influenced by the gravel extraction, gravel storage and filling associated with the former uses. In some areas, the substrate has been mounded up into hills of gravel and sand, while in other areas the substrate has been removed, creating steep bluffs and slopes of bare rock and gravel. However, successional vegetation has become established throughout the site, albeit sparsely in many areas. Contaminated soils have been found in some areas of the site, and soil has been removed recently as part of the remediation. This area is more sparsely vegetated than the rest of the site, and is noted in Figure 1.

A permanent cool-water stream (Howitt Creek) flows through the property from northwest to southeast, originating under the north railway embankment from an underground storm sewer system. The stream passes through a 2m high culvert under the railway embankment at the south end of the site, and continues along a treed, relatively natural channel for approximately 150 m. South of this point, the stream passes through a cattail marsh that stretches from Howitt Park, behind an Optimists' Club hall, to a parking lot behind an Orange Order hall. From this point the stream becomes a narrow treed, channelized watercourse before flowing first under Waterloo Avenue, then Wellington Road, through a manicured park, to the Speed River. The terrestrial and aquatic connections between the study site and the Speed River are interrupted by a parking lot, two major roads and mowed lawns. There are also several significant barriers to fish movement between the site and the river (see appended report by True North Associates 2005).

4.0 FISHERIES STUDY

A fisheries inventory, fish habitat assessment and temperature study were conducted during July and August, 2005 in Howitt Creek, which runs northwest to southeast through the site. The fisheries report (True North Associates 2005) is appended with this report (Appendix 1). Fish habitat was found to be severely degraded due to past land use practices throughout the watershed, although some areas did provide fish habitat. A total of 219 fish, consisting of nine different species, were caught in Howitt Creek during the electrofishing survey. However, almost all of these were caught in the section adjacent to the Speed River; only one species was caught upstream of Wellington Road. All of the fish species known to inhabit the study area are common warmwater species, and none are listed as species of concern by COSEWIC

Lafarge Property EIS

Figure 1: Vegetation Communities and Significant Features

Legend

Enivronmental Land Classification

CUT1/CUM1	Cultural Thicket/Cultural Meadow
CUW1	Cultural Woodland
FOD7-3	Willow Lowland Forest
MAM2	Mineral Meadow Marsh

Property Boundary

Species Potentially Significant in Wellington County

- American Redstart
- Field Sparrow
- Northen Flicker
- Savannah Sparrow

Significant Features

- Significant Bur Oak
- Areas of Off-site Prairie Plantings
- Areas of Minor Seepage

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(Committee on the Status of Endangered Wildlife in Canada). Based on the temperature data collected, Howitt Creek can be classified as having a cool water thermal regime.

Flash flows and barriers to upstream fish movement have adversely affected fish habitat, which is reflected in the low diversity of fish species found throughout the watercourse, upstream of the furthest downstream barrier. However, some fairly good quality fish habitat is present in some parts of Howitt Creek.

In summary, the report noted that there are few constraints related to fisheries, however, the existing ecological function of Howitt Creek should be maintained. This may be accomplished by:

- maintaining existing riparian vegetation to a distance of 15 metres from the centerline of the stream, to create a vegetated buffer strip totaling 30 metres in width;
- preventing further degradation of water quality through a comprehensive storm-water management plan; and
- undertaking measures to prevent the entry of silt into the watercourse during construction.

Due to the highly degraded state of the watercourse, relocating the channel, should it be required, is not expected to have a significant negative effect on the productive capacity of the fisheries resources of Howitt Creek; provided adequate mitigation and compensation measures are employed. Opportunities for fish habitat enhancement, if the stream is re-aligned, include the creation of storm-water management facilities for existing flash flows, removing barriers to fish migration and creating a more natural channel in the event that the channel is relocated.

5.0 TERRESTRIAL FIELD STUDIES

5.1 Vegetation Communities

Four vegetation communities are classified on the site (Figure 1). These communities are largely classified as cultural, which is defined by Lee *et al*. (1998) as “a vegetation community originating from, or maintained by, anthropogenic influences and culturally-based disturbances; often containing a large proportion of non-native species”. However, the cultural communities on the site have regenerated to a point where they serve ecological functions, for example by providing organic litter contributing to soil build-up on the depleted soils, and by providing habitat for some species of wildlife (see Section 5.3). Only two communities are classified as non-cultural according to Ecological Land Classification protocols, however both these communities also bear considerable evidence of disturbance from past industrial activities.

Upland communities dominate the site. Only one small wetland community has been identified on the property (0.14 ha). Generally, the guideline for the smallest patch size that should be delineated as a separate community is 0.5 ha, according to ELC protocols. However, wetland communities of smaller size can be delineated separately if they are potentially significant. Small wetlands can be significant in highly disturbed landscapes, and wetland communities of under 0.5 ha can be considered significant under the GRCA policy if they contain significant species, so the small meadow marsh (MAM) community was delineated and described separately to ensure its significance was adequately assessed.

Mineral Cultural Thicket/Cultural Meadow (CUT1/CUM1)
Cultural thicket is defined as a community originating from, and still highly influenced by, cultural processes, where shrubs occupy 25% or more of the area. Cultural meadow is defined as cultural communities where shrub cover is less that 25%. A complex including both these communities is classified here to a coarser level than vegetation type (ecosite) as, like most cultural communities, the dominant species do not correspond to listed ELC vegetation types. The community occupies the largest proportion of the site. The community is patchy, with large areas dominated by a variety of shrub species, and smaller areas dominated mainly by herbaceous plants or bare ground. The most common shrub species include sandbar willow (*Salix exigua*), red-osier dogwood (*Cornus stolonifera*), the non-natives basket willow (*S. purpurea*) and common buckthorn (*Rhamnus cathartica*). There are also small patches of young trees, including trembling aspen (*Populus tremuloides*), balsam popular (*P. balsamifera*) and occasionally hybrid willow (*Salix* x *rubens*). The ground layer is extremely variable, dominated mainly by a wide variety of species common as weeds in dry, cultivated areas such as Kentucky bluegrass (*Poa pratensis*), birdsfoot trefoil (*Lotus corniculatus*), tall and Canada goldenrods (*Solidago canadensis* and *S. altissima*, respectively), heath aster (*Aster ericoides*) and wild carrot (*Daucus carota*). There are a few small depressions dominated by giant reed grass (*Phragmites australis*).

The ground in areas dominated by this community is visibly disturbed in many places. There are still occasional mounds of debris, rusting implements and broken concrete on the site from past industrial use. Evidence of recreational use is widespread, including tracks and wide trails, fire pits, mattresses, forts and soil mounded into bike ramps. There is little natural debris in the form of fallen trees and leaf litter. Soils generally consist of compacted sand and gravel, with a moisture regime of moderately dry, though the moisture regime is likely variable depending on the extent of disturbance.

Mineral Cultural Woodland (CUW1)
Patches of cultural woodland represent areas where tree growth has been more rapid, generally in areas where soils have been deposited into larger mounds. The canopy is variable and relatively open (between 35% and 60%). These areas are dominated by pioneering and non-native tree species such as hybrid willow, trembling aspen, Siberian elm (*Ulmus pumila*), and green ash (*Fraxinus pennsylvanica*). Trees are generally between 15 and 40 cm diameter at breast height (dbh). The shrub layer mainly consists of common buckthorn, Tartarian honeysuckle (*Lonicera tatarica*) and red-osier dogwood. The ground layer mainly consists of garlic-mustard (*Alliaria petiolata*), coltsfoot (*Tussilago farafara*), field horsetail (*Equisetum arvense*), tall and Canada goldenrods, and Kentucky bluegrass, with patches of giant reed grass in some areas.

Soils vary from coarse gravel to fine sand to silty clay, with no mottling or gleying, indicating the absence of saturated soils at shallow depths. However, the moisture regime is likely variable, depending on the extent of disturbance.

Mineral Meadow Marsh (MAM 2)
A narrow wetland has become established in deep vehicle ruts just north of the clearly defined internal road that bisects the site from north to south. These ruts are visible in the aerial photograph (Figure 1). The dominant species in this community are variable, and do not correspond to established ELC categories, so the community is classified to a coarser level (ecosite). In places the dominants are shrub willows such as sandbar willow, as well as slender willow (*Salix petiolaris*) and pussy willow (*S. discolor*). Narrow-leaved cattail (*Typha angustifolia*) is dominant in other areas. The wettest portion, in the ruts through the centre of the marsh, is dominated by a somewhat unusual dense mat of articulated rush (*Juncus articulatus*), with occasional black rush (*J.gerardii*, a non-native), spike-rush (*Eleocharis smallii*) and retrorse sedge (*Carex retrorsa*). However, there were no rare species present. The soils consist of medium to coarse gravel and sand, mottled at a depth of 28 cm, with a moisture regime of very moist.

The ruts left by wheeled vehicles are visible through the middle of the marsh. Standing water collects in this area in the spring and after rain, and there was approximately 20 cm of water during the visits through 29 July, though no standing water was visible in September. No frogs or their larvae were seen in this area, and there were no wetland-dependent bird species associated with the community.

Willow Lowland Forest (FOD 7-3)
The riparian corridor along the creek is dominated by a wide mixture of native and non-native species of transitional habitats such as hybrid willow, Siberian elm, trembling aspen, Manitoba maple (*Acer negundo*) and green ash. The sub-canopy consists largely of Manitoba maple and basswood (*Tilia americana*). The shrub layer is largely red-osier dogwood, thicket creeper (*Parthenocissus inserta*) and Tartarian honeysuckle. The ground layer consists of garlic-mustard, goutweed (*Aegopodium podagraria*) and creeping bent-grass (*Agrostis stolonifera*), which are replaced by upland species such as tall goldenrod with increasing distance from the creek.

The stream was observed flowing on every field visit, with occasional pools approximately 30-60 cm depth throughout. The banks are eroded, with occasional patches of concrete debris along the creek course, and areas where woody debris has washed up during periods of high water. There were no areas of standing water noted along the creek in any of the visits. Small patches of watercress along the edge of the creek (shown in Figure 1) may indicate areas of minor groundwater discharge (no other indicators of seepage, such as upwelling or iron precipitates, were present).

The soils consist of sand and gravel, highly altered by stream flows.

5.2 Significant Species and Floristics

One hundred and ninety-seven plant species were found on the site (see Appendix 2 for a complete list). Only 91 (46%) of these were native, a low proportion in relation to the flora of Ontario as a whole, which is approximately 67% native. As a comparison, this proportion of non-native plants is lower than the proportion for many other urban natural areas in southern Ontario. For example, the proportion of non-native plants in the lower reach of the Credit River (Mississauga) and in Toronto ravines ranged between 48% and 52% (Geomatics 1996, Kaiser 1983). The plant species found on the site are typical of fields, cultural woodlands and small wetland patches in south-central Ontario, and lack southern or western species that would indicate unusual microclimatic conditions or significant plant communities on the site itself.

There were no provincially significant plant species found on the site itself. There were also no species regionally significant in Wellington County according to the current draft list (Anderson 2005). However, some prairie indicator species have been planted and others are probably adventive on the railway embankment off-site to the south. Big bluestem (*Andropogon gerardii*) and Indian grass (*Sorghastrum nutans*), native prairie indicator species, were found on the southern railway embankment by neighbouring residents in 1996. Other small areas of prairie were subsequently planted after 1996 on the embankment, mainly south of the railway line (again off - site), and these have continued to thrive (locations are shown in Figure 1). These plantings currently contain prairie indicators that include provincially and regionally significant species, for example big bluestem, Indian grass, side-oats grama grass (*Bouteloua curtipendula*), switch grass (*Panicum virgatum*), lance-leaved coreopsis (*Coreopsis lanceolata*) and purple coneflower (*Echinacea purpurea*) The latter species is native to prairies west and south of Ontario, but is not native to Ontario, and is likely horticultural in origin.

A Floristic Quality Index (FQI) was determined for the site. The FQI is a measure used to compare natural areas (Oldham *et al*. 1995). The FQI is derived from the assignment of a number between 1 and 10 to each native plant according to its habitat requirements (the Coefficient of Conservatism). The scores are averaged to obtain the Native Mean C and summed and divided by the square root of the number of species to obtain the FQI. Plants found in a diversity of habitats have low scores, and plants found only in a few, highly specific habitats have high scores. Therefore, very high quality habitats with a high diversity of species have higher FQIs and mean Coefficients of Conservatism (mean Cs).

The native component of the communities on the site is composed of generalist species, as can be seen from the low FQI and Native Mean Coefficient of Conservatism (Table 1). The native FQI of the Lafarge site overall is 25.6, with a native mean Coefficient of Conservatism of 2.7, indicating that the native component of the communities is generally of low vegetation quality. Individual communities have FQIs between 13 and 17, and a mean C of 1.9 to 3.8. As a comparison, communities in other urban areas of Ontario, for example Mississauga, typically have FQIs in the 15-30 range. FQIs of 40 to 45 are fairly high for agricultural landscapes. A mean C under 4 indicates that the site is primarily vegetated with adaptable species that can withstand a variety of habitat changes. Areas with higher coefficients may be more sensitive to disturbance for example a change in water regime, influx of native species or canopy disturbance.

Table 1. Community areas, numbers of native and non-native plant species found in plant communities on the site and immediately adjacent.

Ecosite	Total # Plants	# Native Plants	Native FQI	Native Mean C
SITE (23.7 ha)	197	91	25.76	2.7
CUT/CUM (16.2 ha)	121	51	13.86	1.94
CUW (3.9 ha)	72	33	13.40	2.33
FOD7 (0.56 ha)	68	31	15.63	2.81
MAM2 (0.14 ha)	40	27	17.59	3.38

Bur Oak Tree

A bur oak (*Quercus macrocarpa*) measuring 101 cm diameter at breast height (dbh) is situated on the western part of the site (Figure 1). Although this tree is not a significant species, it is noteworthy from the perspective of ecological function, as it potentially provides wildlife habitat related to trees of large canopy and produces copious seeds that promote regeneration of a forest canopy. This tree is also likely significant from the perspective of aesthetic and heritage functions.

5.3 Wildlife

A list of wildlife species noted is shown in Appendix 3. Thirty-two species were noted on the site. The most diverse group of wildlife on the site is birds, with twenty-six species noted, 22 of which were possibly breeding. Most mammal signs were those of common urban inhabitants such as skunks, raccoons and squirrels. Signs of white-tailed deer were infrequent, but were seen mainly on the western portion of the site next to the Hanlon Parkway. It is likely that deer occasionally walk across the Hanlon to the site from the undeveloped land on the other side of the road. No reptiles were found, though debris was searched extensively.

One Species at Risk in Canada, monarch butterfly (*Danaus plexippus*), was seen in cultural thicket/meadow on all parts of the site. This species is considered a Species of Concern because of threats to breeding and wintering habitat, as well as increasing use of herbicides (Environment Canada 2005). This species' summer breeding and foraging habitat, cultural fields with a mixture of milkweeds (required by the butterfly for breeding), goldenrods and asters, is plentiful in Ontario.

Amphibians

Only one amphibian was noted on the site itself: leopard frog, along the Howitt Creek lowland forest. This frog was noted outside the breeding season, likely indicating that it was foraging on the site and had bred in another location along the creek, probably in the cattail marsh off-site to the south.

Breeding choruses of frogs were not heard on any part of the site. There were no areas of standing water on the site large enough to afford breeding habitat for amphibians. The only area of standing water on the site was the narrow wetland north of the road that has become established in old vehicle ruts. Standing water was confined to a narrow pool along the deepest ruts, to a maximum depth of approximately 20 cm. No adult or larval amphibians were noted within or in the vicinity of this wetland on any of the field visits, though standing water was present during the field visit until the end of July. Large areas of standing water are not visible on the site in the aerial photo.

Birds
Most of the birds noted on the site were those that adapt to a wide range of habitats including thickets, small woodlands, urban parks and gardens, such as black-capped chickadee, northern cardinal, song sparrow and American robin. A few single individuals of successional-habitat-dependent bird species were noted, including American redstart, yellow warbler, savannah sparrow and field sparrow.

No nationally or provincially significant species of wildlife were noted on the site. Several birds are listed in the draft list of significant species for Wellington County (Dougan & Associates 2005).

Table 2. Birds noted as rare in Wellington County (Dougan & Associates 2005)

Common Name	**Habitat**
Northern Flicker	Forest, forest edges and successional areas with dead trees.
Purple Martin	In southern Ontario, largely dependent on nest boxes, probably transient (foraging) on the site
American Redstart	Cultural woodland, forest edges and thickets
Field Sparrow	Open cultural thicket
Savannah Sparrow	Cultural meadows

5.4 Ecological Functions of the Site within the Landscape

The site mainly functions as a small area of thicket and cultural woodland habitat within an intensively developed urban setting, and mainly sustains common, adaptable plant and animal species characteristic of such habitat. The cultural woodlands and thickets provide habitat for many generalist species, and also a small number of habitat-specific wildlife species (species largely confined to a specific type of habitat, as opposed to generalist species that occur in a wide variety of habitats) such as yellow warbler and American redstart. The marsh serves as habitat for a small number of wetland-dependent plant species.

Howitt Creek functions as aquatic habitat for coolwater species, including fish. Howitt Creek also serves a local linkage function within the landscape, providing linkage among the habitat on the site, the Speed River, and the cattail marsh off-site to the south, though this linkage is narrow, and is interrupted by roads and manicured lawns. Minor areas of groundwater seepage, which may contribute to water quality in Howitt Creek, may be indicated by patches of watercress along the east bank.

There are no natural features on the site that would be subject to the Provincial Policy Statement, including Significant Wetlands, Significant Valleylands, Significant Wildlife Habitat, Significant Woodlands, or Significant Portions of the Habitat of Threatened or Endangered Species. The vegetation communities on the site are small (including the wetlands and cultural woodlands), and do not provide habitat for significant populations of wildlife. There is only one small, narrow area of standing water on the site, which does not appear to serve a function as breeding habitat for frogs or other species for which temporary pools are a critical component of habitat.

6.0 DESCRIPTION OF THE PROPOSED UNDERTAKING

6.1.1 Development Concept

Figure 2 presents a conceptual plan of the site, superimposed on the vegetation communities and environmental features. Details of the development will be finalized through the Site Plan Approval process. The proposed undertaking is a commercial development, including small and large retail outlets (Figure 2). Only the area west of the creek corridor is proposed for development. Access to the site would be provided by Silvercreek Parkway. The possibility of providing an additional access via an exit off the Hanlon Parkway is being discussed with MTO, so this exit is also shown conceptually on Figure 2. Parking will be interspersed among the retail outlets, and will be sufficient to meet City of Guelph standards.

All of the development is proposed to take place on the western part of the site, west of Howitt Creek. The eastern part of the site (east of Howitt Creek) will not be developed, but will be conveyed to the City as a park. Howitt Creek will be preserved. The riparian area along the creek will be retained by a 15 m setback from either side of the creek course, which will retain the trees immediately along the creek but also successional vegetation outside the immediate riparian zone. The large oak tree on the site will be protected, and treed areas along the railways will be retained. Prairie species along the railway line will not be affected by development.

The development will remove most natural vegetation from the western part of the site, and replace it with surfaces such as roofs and parking lots, with some lawns and flower beds. The exception to this is that the large oak tree on the site will be retained and buffered from the development. Approximately 11 ha of cultural meadow and thicket will be removed, as well as 3 ha of cultural woodland, and 0.14 ha of meadow marsh. This will result in the loss of some habitat for two species considered significant in Wellington County according to the draft report by Dougan & Associates (2005): northern flicker and field sparrow. Habitat will be retained for two individuals of species significant in Wellington County: savannah sparrow and field sparrow.

Lafarge Property EIS

Figure 2: Development Concept

Legend

ELC Classified Lands

CUT1/CUM1	Cultural Thicket/Cultural Meadow
CUW1	Cultural Woodland
FOD7-3	Willow Lowland Forest
MAM2	Mineral Meadow Marsh

Building Locations

Property Boundary

Development Limit

Parking Lot Designations

Species Potentially Significant in Wellington County

American Redstart

Field Sparrow

Northen Flicker

Savannah Sparrow

Significant Features

Significant Bur Oak + 2m Buffer

Areas of Off-site Prairie Plantings

Areas of Minor Seepage

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6.1.2 Stormwater Management Plan

Storm water from the development will be captured by the City of Guelph storm sewer system. The summary of the storm water design is included in Section 4.2 of the "Planning Study".

For the purposes of stormwater design, the site has been divided into three (3) catchments:

- T1 comprises approximately 4.4 ha. east of the Howitt Creek. This area presently drains to Howitt Creek and this drainage pattern will be maintained as overland flow, as this part of the site is not proposed for development.
- T2 comprises approximately 4.2 ha. in the northwest corner of the site. This area presently drains under the Hanlon Parkway though an exiting 600 mm CSP Culvert. This drainage pattern will be maintained.
- T3 comprises approximately 14.7 ha. in the southwest corner of the site. This area presently drains under the Hanlon Parkway though an exiting 3750 x 2290 Culvert. This drainage pattern will be maintained.

Roof drainage within T2 and T3 will be routed through control flow roof drains and then to an underground pipe system. The control flow roof drains will create roof ponds. Ponding volumes will be available for storing up to the 1:100 year storms. T2 and T3 loading docks and parking area roofs will be routed through control flow orifices in the final manhole before discharging into the existing Hanlon Parkway R.O.W. as it does at present. Ponding volumes will be available for storing up to the 1:100 year storms on the pavement and in the loading docks. If insufficient volumes are available on the pavement and in the loading docks, then dry SWM ponds will be built to hold the additional volumes. In order to achieve Level II quality protection, the final routing before discharging to the existing ditches along the Hanlon and then to the existing culverts will be through a Storm Ceptor or equal settling chamber where it will be cleaned to 70% TSS.

Overland flow routes for storms greater than 1:100 year storms will overflow to Howitt Creek for T1 areas and to the Hanlon Parkway ROW for areas T2 and Ts, in accordance with the present overland flow routes.

In summary, the surface water balance of the creek will not be affected by development, as the water that currently flows to the creek will be maintained, and the runoff that currently flows away from the creek will continue to flow away from it.

7.0 GROUNDWATER

Minor evidence of groundwater inputs (the presence of watercress) was found in one area during the inventories of the creek (Figure 1). Watercress was mainly found on the east side of the creek. However, the evidence was very slight. There were no other signs of groundwater discharge such as active upwelling, seepage or iron precipitates. The slight groundwater discharge in this area may be a result of local channels in the soils created by filling and compaction, as information derived from existing wells in the area suggests that the groundwater table is below the creek bed (Blackport 2005 pers. comm.). However, further studies are being conducted to determine whether there are significant groundwater inputs to the creek, and whether the development could have impacts on groundwater inputs, if any.

8.0 POTENTIAL IMPACTS OF THE UNDERTAKING

Direct impacts on natural features will be confined to the west portion of the property, as the eastern portion will be retained. Indirect impacts are those that stem from direct impacts.

8.1 Short-Term Direct Impacts

Short term impacts include those that potentially arise due to construction, including removing vegetation, grading, excavating, dewatering, installing services, use of large vehicles, stockpiling materials, etc. Short-term impacts are not expected to continue to occur after construction is complete, but most existing vegetation west of Howitt Creek will be permanently removed.

8.1.1 Siltation and Disruption of Adjacent Natural Areas Resulting from Construction

Heavy rainfall during construction can dislodge soil particles from exposed soils in stripped areas, which then wash into adjacent habitat downgrade. Dewatering during construction of services can also increase erosion and siltation in a watercourse, if the water picks up silt before being discharged to a receiving stream. This impact would be most significant for the aquatic habitat in Howitt Creek, as the terrestrial habitat on site is highly resilient to siltation. If not controlled, sediment could impair water quality in Howitt Creek and, ultimately, may have effects on the Speed River.

<u>Recommended Mitigation</u>

- A grading plan and erosion and sedimentation control plan should be submitted to the City for review, prior to any additional grading of the site, to accommodate the proposed development. The plan should contain specific details for preventing silt from entering Howitt Creek during construction.
- Prior to the commencement of any construction activities (*e.g.*, grading, servicing, vegetation removal, *etc*.) appropriate storm water management facilities (permanent or temporary) should be installed to mitigate sedimentation resulting from surface water runoff from stripped soils, or from dewatering during construction of services.
- Perimeter silt fencing, backed by paige wire fencing, should be installed adjacent to the west boundary of the riparian buffer along Howitt Creek.
- Silt and erosion control measures should be monitored for performance throughout construction and especially following heavy rain events.
- Constructed areas near the creek should be re-vegetated with native species as soon as possible after construction.
- Stockpiles of soil should be temporarily vegetated to prevent erosion.
- Where feasible, potential impacts resulting from erosion and sediment deposition should be reduced by timing construction such that the high rainfall period of spring is avoided, and the re-vegetation of exposed soils is completed prior to the commencement of the high rainfall and snow melt period in the late fall and spring.

- Vegetation should be used for controlling erosion whenever possible, including seeding exposed soils located in green space or in future development areas with grasses and forbs.
- Significant erosion/sedimentation events should be reported and remediated promptly.

8.1.2 Direct Short-Term Impacts on Trees to be Saved

Impacts to trees that are scheduled for retention could potentially result from construction activities. Heavy equipment can damage trees by compacting the soil around their roots, and depositing heavy topsoil or stockpiling materials over root systems can smother them. This is particularly important from the point of view of the large bur oak tree, which potentially has an extensive root system that could extend at least to the dripline. Water from dewatering activities can drown upland vegetation communities.

<u>Recommended Mitigation</u>

- A Tree Saving Plan should be developed at the detailed design stage to show locations of individual trees within and at the edges of the development that are proposed for retention, particularly the riparian vegetation along the creek but also the large oak tree and any others that could potentially be retained.
- The undisturbed space buffering the oak tree should be equivalent to the dripline plus at least 2 m. The development plan should leave as much space as possible between the dripline and any grading, filling, piling of materials or equipment, or vehicle traffic.
- The riparian corridor, the large oak tree, and any other trees to be saved should be fenced or boarded outside the buffer limit (dripline plus at least 2 m, in the case of the oak tree) prior to grading, to ensure that there is no construction activity near the roots of the tree in these areas, and to prevent impacts from construction activity such as human or vehicular access, equipment or material storage, vehicle servicing, *etc*. Details of the location for fencing and the type of fencing should be developed as part of a Tree Saving Plan.

8.1.3 Soil/Groundwater Contamination During Construction

Surface and groundwater contamination can result from spills and discarded lubricants during the refueling and daily maintenance of construction vehicles.

<u>Recommended Mitigation</u>

- Refueling and maintenance should occur at a suitable location away from the vicinity of natural features, using appropriate precautions to prevent spillage, or contain spillage if such an event were to occur. This should be detailed in a separate plan that is available on site to construction crews.

8.2 Long-term Direct Impacts

Long-term direct impacts are those expected to be associated with permanent removal or alteration of habitat in the ecosystem.

8.2.1 Loss of Successional Habitat

Notwithstanding their cultural origins, the cultural woodland and thickets that will be removed from the site serve some functions within an urban context. They represent successional processes becoming increasingly scarce in urban landscapes, they contribute to soil rehabilitation by providing organic material and they provide habitat for some habitat-sensitive and regionally significant wildlife species. Successional areas on the site also support common milkweed, which provides habitat for monarch butterfly, a Species at Risk in Canada, however, this species is abundant in Ontario.

However, minimal mitigation of this impact is required. The habitat in question is highly degraded by past industrial activities. Moreover, the development is proposed for an area within the designated urban boundaries. The planning philosophy of developing within and around nodes of development, such as villages, towns and cities, helps reduce urban sprawl by limiting the extent to which development extends into surrounding rural areas. The only habitat lost from developing this site is marginal, and is already degraded by past industrial development and by the proximity of residences and roads.

<u>Recommended Mitigation</u>

- The land east of Howitt Creek should be allowed to continue to naturalize. Consideration should be given to enhancing the habitat on the remaining eastern part of the site with plantings of native species wherever opportunity allows. This would add diversity and promote a return to a more natural landscape. The planting should include milkweed species that would enhance habitat for monarch butterfly (milkweed is already present on the eastern part of the site). A sculptured seeding approach could be used to restore this area, a technique that involves creating subtle variations in contours to create a wider diversity of habitats.
- Consideration should be given to sculpting depressions on the eastern part of the site, potentially creating suitable microhabitat where water could persist and wetland conditions could develop over time. Depressions created for this purpose should have shallowly sloping sides (with grades no steeper than 1:10, for example) to foster development of a soil moisture gradient and corresponding zonation of vegetation.
- Native prairie species planted on the railway embankment above the site have thrived in gravelly soils similar to those on the site (see Section 5.2). These species tend to be drought-tolerant and survive in nutrient-poor conditions, and therefore could provide a template for the species used in restoration efforts. However, only native prairie species should be used.

8.2.2 Loss of Wetland Habitat

The development of the western part of the site will result in the loss of a marsh of approximately 0.14 ha. The GRCA Wetlands Policy (GRCA 2003) has stated that wetlands will generally be protected from construction and placement of fill, except where a naturally-occurring wetland is less than 0.5 ha, and is not significant in other ways (for example, it is not part of a provincially significant wetland, and does not contain regionally or provincially significant plant species or contribute to groundwater recharge). This marsh is not naturally occurring (it has become established as a result of human activities, likely because of the rutting and soil compaction created by heavy vehicles). It is not a significant plant community, and does not contain regionally or provincially significant species or protect groundwater discharge. Impacts from removal of this vegetation would be minor.

Recommended Mitigation

- Mitigation for the loss of this small, artifical wetland area is not proposed.

8.2.3 Habitat Loss for Wildlife Species Rare in Wellington County

The proposal for development would remove cultural thicket, meadow and cultural woodland vegetation. Some of the habitat for northern flicker and field sparrow will be lost, as well as for a few other species of successional habitats such as yellow warbler. These generally nest in small to large patches of cultural meadow and thicket in agricultural settings. However, only two individual significant birds were found on the portion of the site to be developed. Minimal mitigation for this impact is required. The small size of the habitat, and the fact that it has developed on a highly disturbed site, has reduced the value of the cultural communities on the site as habitat so they would not attract highly area-sensitive species.

Recommended Mitigation

- Cultural thicket/meadow habitat could be enhanced on some parts of the eastern part of the site, where the vegetation is in many places very sparse and disturbed. This could provide habitat for a small number of additional species and individuals, such as savannah sparrows, field sparrows and northern flickers. Successional habitat could be managed through planting the eastern part of the site with native grass and shrub species as discussed in Section 6.2.1.

8.2.4 Potential for Impacts to the Watercourse Downstream

The watercourse downstream will not be affected by the development. All runoff from the site will be treated before it enters the watercourse, with the exception of the runoff from the eastern (undeveloped) part of the site, where drainage will be maintained as it is at present. The water balance will be maintained within the creek, as runoff from the western part of the site will continue to flow away from Howitt Creek to the municipal storm system. The existing quality of the runoff on the eastern part of the site will be enhanced if the soils are further stabilized with additional plantings. Downstream habitats will also not be affected by development.

Minor areas of groundwater seepage may be indicated by the presence of small areas of watercress along the bank of Howitt Creek. The potential for groundwater discharge to affect the creek is being investigated (see Section 7.0).

Urban development typically results in some activities that have the potential to degrade groundwater or surface water quality. These include residual amounts of road salts and lubricants that wash off of roads and driveways into the storm water system (this is particularly applicable if snow is stored such that it can run off to the creek without treatment).

Recommended Mitigation

- Storm water will be controlled and prevented from entering the tributary in developed areas. There will be no impacts to Howitt Creek from runoff from the development.
- Snow storage areas should be situated such that all runoff is directed to storm sewers.

8.2.5 Potential Impacts of Noise and Lighting

Noise and lighting will increase on the western part of the site due to development. Increased light levels have the potential to affect migrating bird species, and excessive noise can mask breeding birds' attempts to form pairs and maintain territories. However, there are no species identified on the site that are unusually sensitive to urban noise and light, and there are already high light levels on the site from surrounding residential areas and the Hanlon Parkway. Noise levels will increase somewhat as a result of traffic, but cars will not reach excessive speeds on the site.

<u>Recommended Mitigation</u>

- Consideration should be given to lowering the site lighting at night, or using directed lighting to reduce overhead light scatter.
- The riparian corridor along the creek should be allowed to continue to naturalize so that it can provide a screen from noise and lighing.

9.0 CONCLUSIONS AND RECOMMENDATIONS

It can be concluded from this study that there are no regionally or provincially significant vegetation communities on the site. There are no provincially significant plant or animal species on the site. Some habitat will be removed for two regionally significant wildlife species, but habitat for these species will be preserved on other parts of the site. The large oak tree on the site will be preserved.

All functions associated with the creek will be preserved. These include aquatic habitat (water quality and quantity), surface water balance and the riparian corridor associated with the creek. The potential for riparian vegetation to be indirectly affected in the short term by construction of the adjacent land can be mitigated with a suitable erosion and sediment control plan. Downstream habitat will not be affected by the development.

The impacts resulting from the loss of successional vegetation will be minor. The vegetation is primarily of non-native origin. Impacts to successional habitat on the site will be reduced by developing only the western part of the site. Enhancement of the eastern, undeveloped part of the site is recommended in order to preserve the greatest function possible for the site.

The recommendations for mitigation for potential impacts can be summarized as follows:

- avoid disrupting riparian vegetation during all phases of construction and allow it to continue to naturalize over time;
- carefully control areas of construction;
- control erosion and sediment during construction;
- maintain a buffer at least 2m outside the dripline adjacent to treed areas to be maintained;
- limit human and vehicle traffic access to the vegetation to be retained through fencing;
- allow the open space area to the east to naturalize;
- sculpt contours on the eastern part of the site to enhance microhabitat development;
- plant/seed native species on the eastern part of the site to enhance native vegetation; and
- limit lighting on the site at night.

With implementation of these mitigation measures, net impacts of the development on Howitt Creek and on regionally significant species are expected to be low. It should be noted that this EIS addresses a development concept. Should the ultimate proposed development of the site vary significantly from the development concept, particularly with respect to the stormwater management strategy, then additional environmental studies should be required by the City.

10.0 MONITORING RECOMMENDATIONS

Short-term monitoring should take place throughout the construction period, to ensure that silt controls are functioning as designed and silt is not entering into Howitt Creek. The monitoring should also ensure that the appropriate buffers are maintained around retained trees throughout the construction period. Monitoring should be conducted at intervals appropriate to cover all stages of construction, and should particularly be conducted after heavy rain events.

Long-term monitoring of the creek should take place in the future after rain events that would allow flows from the developed portion of the site to enter the creek; i.e. events greater than the 100-year storm.

11.0 REFERENCES

Anderson, Allan. 2005. (Draft). Rare plants and the number of sites in Wellington County. Unpublished report by Allan Anderson, Guelph, Ontario.

Blackport, R. 2005, pers. Comm. Blackport Hydrogeology, Waterloo, Ontario.

Dougan & Associates. 2005. Guelph Natural Heritage Strategy Phase 2: Terrestrial Inventory & Identification of Locally Significant Natural Areas. First Draft Report, March 2005. 27 pp + Appendices.

Lee, H.T., W.D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray. 1998. Ecological Land Classification for Southern Ontario: First Approximation and its Application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

Natural Heritage Information Centre (NHIC). 2005. Natural Heritage Information website. www.mnr.gov.on.ca/MNR/nhic/nhic.cfm

True North Consultants. 2005. Fisheries Assessment of Howitt Creek, Ontario. Report for North-South Environmental, Campbellville, Ontario.

Grand River Conservation Authority (GRCA) 2003. Wetlands Policy. Approved by the Grand River Conservation Authority March 28, 2003. Resolution No. 40-03.

Geomatics Inc. 1996. City of Mississauga Natural Areas Survey. Report prepared for Planning and Building Department, City of Mississauga.

Kaiser, J. 1983. Native and exotic plant species in Ontario: a numerical synopsis. The Plant Press 1(2):25-26.

Oldham, M.J., W.D. Bakowsky and D.A. Sutherland. 1995. Floristic Quality Assessment system for southern Ontario. Natural Heritage Information Centre, Ontario Ministry of Natural Resources, Box 7000, Peterborough, Ontario.

Environment Canada. 2005. Species at Risk: Monarch Butterfly. www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm?

APPENDIX 1. FISHERIES STUDY

TRUE NORTH
ENVIRONMENTAL CONSULTANTS

207 Woolwich Street
Guelph, Ontario
Canada, N1H 3V4

Phone (519) 780-1107
Fax (519) 780-1748
e-mail: truenorth@tnec.ca
URL: www.tnec.ca

August 24, 2005

Sarah Mainguy, M.Sc.
North-South Environmental
35 Crawford Cres. P.O. Box 218
Campbellville, Ontario
L0P 1B0

RE: A Fisheries Assessment of Howitt Creek, Guelph Ontario.
True North Project Number 05023

Dear Ms. Mainguy,

The following letter report provides an assessment of fisheries resources in Howitt Creek, Guelph, Ontario. This fisheries assessment was completed in support of a proposed commercial development in the vicinity of Howitt Creek. The information provided herein may be incorporated into an EIS (Environmental Impact Study) completed in support of a proposed commercial development on the subject lands. The location of the subject lands and Howitt Creek are shown in Figure 1. The purpose of the fisheries assessment was to identify constraints related to fisheries issues and evaluate the sensitivity of the fisheries resources.

Methods

Fish habitat descriptions found in this report are based on a fish habitat assessment conducted on July 27, 2005. The fish habitat assessment was conducted over the entire length of Howitt Creek from the mouth at the Speed River upstream to where the creek originates at a large storm sewer. For the purpose of describing fish habitat, the stream was divided into reaches of similar habitat. Within each reach, qualitative observations were made pertaining to the following fish habitat features:

- Instream cover;
- Bank stability;
- Substrate composition;
- Stream morphology;
- Wet Width;
- Channel Width;
- Barriers to fish movement;
- Aquatic vegetation;
- Riparian vegetation; and,
- Canopy cover.

In-situ measurements of pH, temperature and conductivity were recorded in each reach.

One reach (Reach 4) was located on the subject lands. Within this reach, a more quantitative estimate of wet width and channel width were obtained by taking width measurements at six transects located at regular intervals along the watercourse.

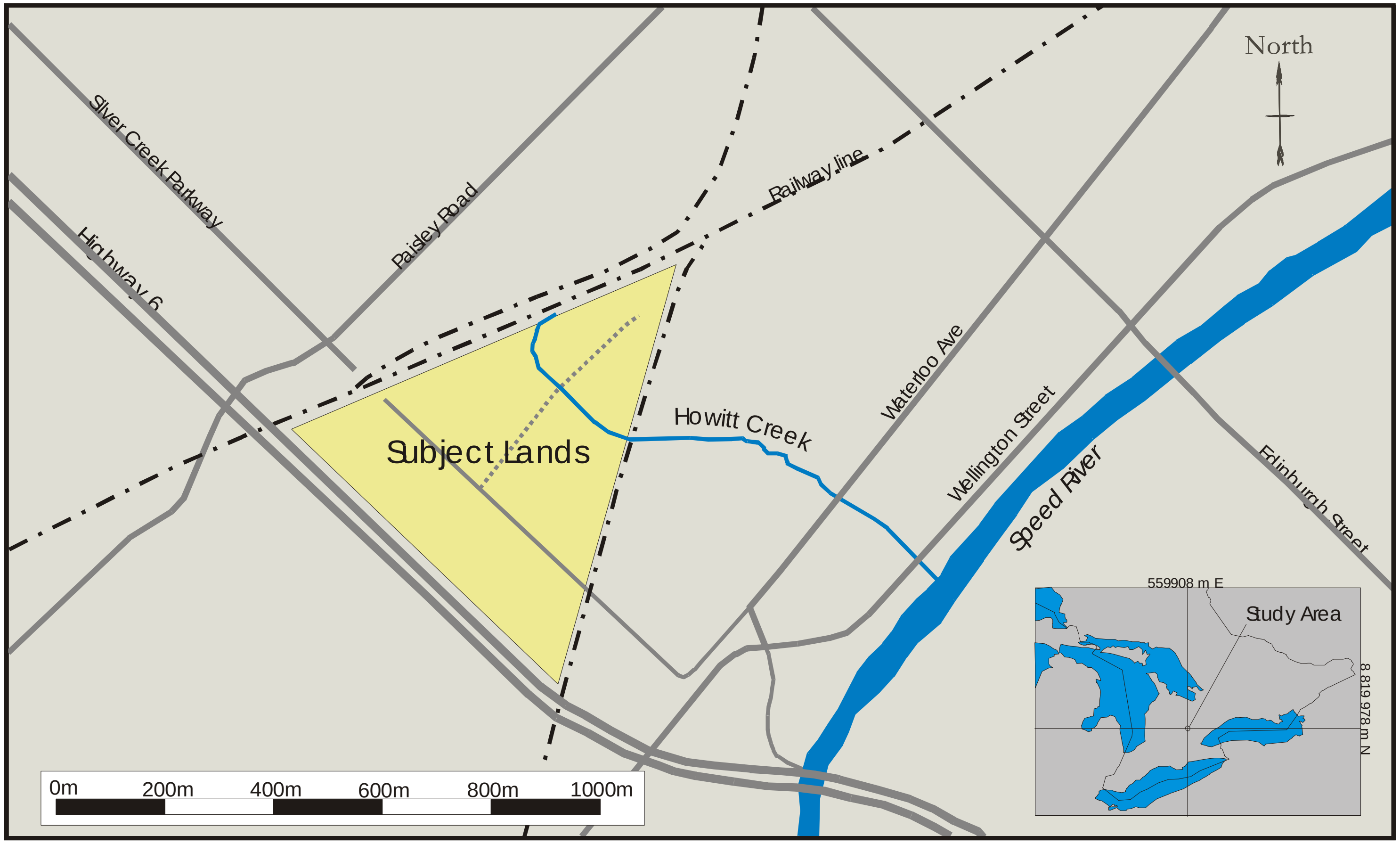

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Figure 1: Location of Subject Lands

Prepared for: Rosewater Management Group and North- South Environmental

Project name:	Date:	File Number:	Scale:
Lafarge Property	Aug 2,2005	05023_1	1:12,700

To determine thermal regime, one temperature logger was placed in the watercourse, and another temperature logger was attached to a tree adjacent to the watercourse. Both temperature loggers were located in the shade, and recorded temperature at 30-minute intervals from July 27, 11:30 am through August 8, and 12:30 PM. The results section of this letter report compares surface water temperatures to corresponding air temperatures. The fish community observed was also used to determine thermal regime.

Fish community descriptions were based on a fisheries inventory conducted on August 05, 2005. The inventory was conducted using a backpack electrofisher using a single pass method to determine the fish species utilizing the study area and their relative abundance. The Ministry of Natural Resources, and Grand River Conservation Authority were contacted to obtain historical data for this site; however, no fisheries information was provided by these agencies.

Fish Habitat

Overall, fish habitat in Howitt Creek was found to be severely degraded due to past land use practices throughout the watershed. Immediately upstream of the subject lands, the upper portion of the watershed has been urbanized, and the stream channel is now an enclosed storm sewer. Within the subject lands, flash flows, instream waste concrete, and a perched twin culvert have adversely influenced the natural morphology of the watercourse. An old dam was observed downstream of the subject lands, which is a barrier to fish passage. Farther downstream, the watercourse has been chanelized straight, and long sections of the watercourse flowed underground through concrete storm sewers. The lower portion of the watershed contains several barriers to fish passage. Despite the severely altered nature of this watercourse, some areas of fair fish habitat were present. Although a chemical analysis of the water was not conducted, poor water quality may also be a factor limiting the use of this watercourse by some fish species. Based on qualitative observations made on July 27 and Aug 5, 2005, the flow regime of Howitt Creek is believed to be permanently flowing, year round.

Howitt Creek was found to contain four reaches of similar habitat. These reaches were labeled 1 through 4, from downstream to upstream, and are discussed individually in the following text. The locations of the four reaches are shown in Figure 2. A summary of fish habitat features for each reach is provided in Table 1. Photographs are provided as an attachment to this letter report.

<u>Reach 1</u>

Reach 1 was located from the mouth of Howitt Creek upstream for a distance of 280 metres. This reach had been chanelized straight in the past, with long sections of vertical concrete banks (Photo 1). Near the mouth of Howitt Creek, a large vertical drop over a concrete ledge created a barrier to upstream fish passage (Photo 2). A similar barrier was also present just upstream of Wellington Street (Photo 3). Long sections of this reach flowed through closed bottom box culverts under Wellington Street and Waterloo Ave. These culverts did not contain natural substrates, and may inhibit upstream fish passage during high flows.

A variety of substrates were present in Reach 1 including cobble and boulder with some sand. Stream morphology was predominantly run, but some riffle and deep pool was also present. There was fairly good riparian canopy through parts of Reach 1, while riparian vegetation was predominantly grass in the lower section.

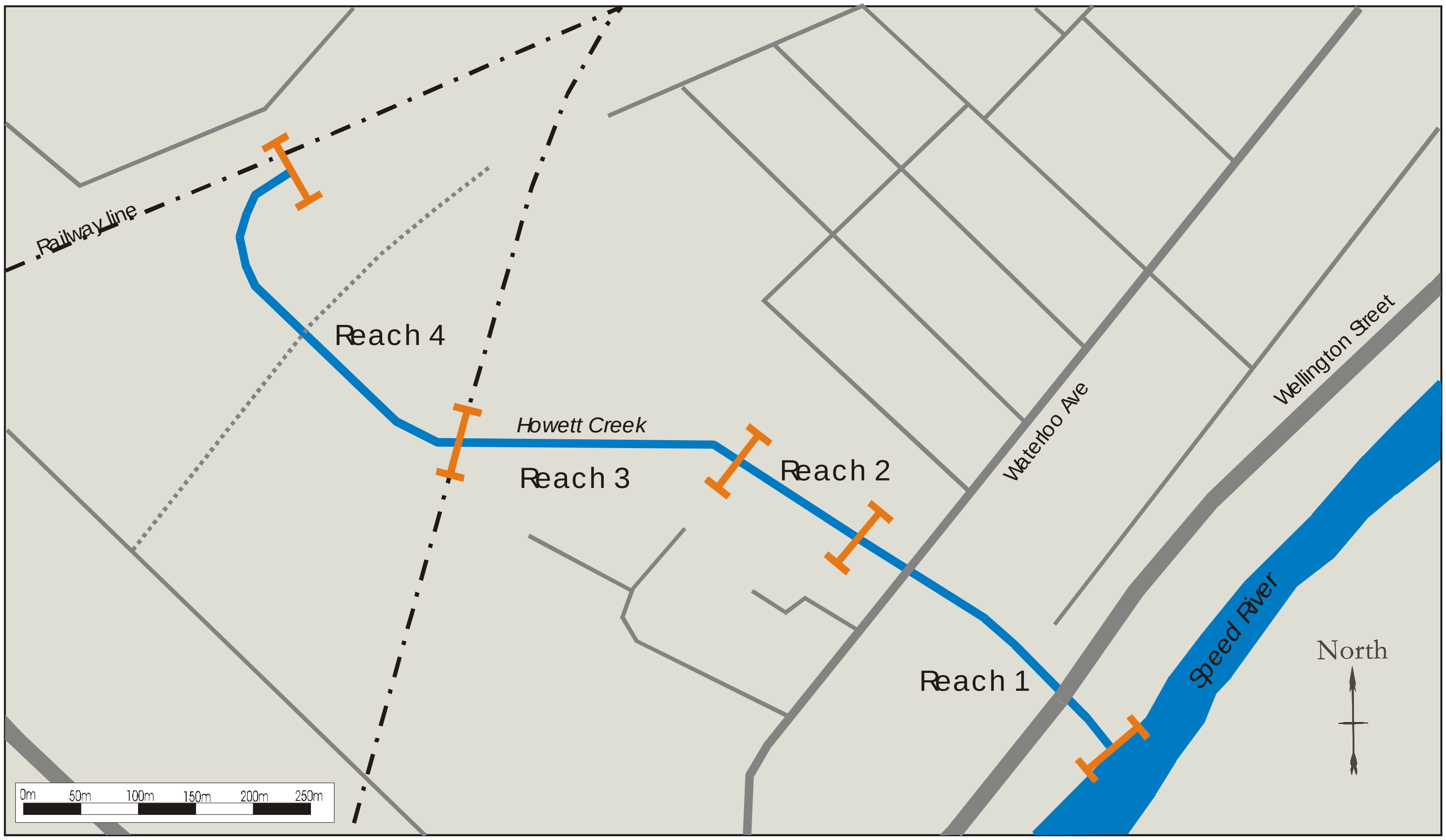

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Figure 2: Reach Breaks delineating Stream Reaches of Similar Habitat.

Prepared for: Rosewater Management Group and North- South Environmental			
Project name: Lafarge Property	Date: Aug 2,2005	File Number: 05023_2	Scale: 1:5,070

Table 1: Summary of fish habitat measurements and observations.

	Reach 1	Reach 2	Reach 3	Reach 4
Date	August 5, 2005	August 5, 2005	August 5, 2005	August 5, 2005
Time	8:52 am	9:27 am	9:49 am	10:37 am
Air temperature (°C)	19	20	21	23
Water temperature (°C)	18.6	17.7	17.8	16.8
pH	8.00	8.07	7.86	7.99
Conductivity	1494	1424	1064	1083
Water clarity	slightly turbid	slightly turbid	slightly turbid	slightly turbid
Water colour	grey/green tinge	grey/green tinge	grey/green tinge	grey/green tinge
In-stream cover	deep pool, boulder, Undercut concrete walls, tree roots	deep pool, boulder	Deep pool, root mass, woody debris	Deep pool, root mass, overhanging shrubs and boulder
Bank stability	20% stable 5% vulnerable 5% eroding 70 % protected	40% stable 10% vulnerable 20% eroding 30 % protected	20% stable 15% vulnerable 60% eroding 5 % protected	40% stable 25% vulnerable 25% eroding 10 % protected
Substrate composition	concrete, cobble and boulder with some sand	cobble and boulder	Sand and gravel with some cobble	Sand, gravel cobble and clay with some boulder
Stream morphology	15 % riffle 75 % run 10 % pool	80 % riffle 15 % run 5 % pool	40 % riffle 40 % run 20 % pool	15 % riffle 75 % run 10 % pool
Wet width (m)	2.5	3.0	2.0	1.8
Bank full width (m)	6	6	4	4.0
Average depth (m)	0.20	0.10	0.15	0.15
Maximum pool depth (m)	0.75	0.40	0.45	0.60
Barriers (to upstream movement)	3 complete	1 complete	none	1 partial
Aquatic vegetation	none	none	emergent - common	none
Riparian vegetation	deciduous trees & shrubs	mature deciduous	wetland plants & mature deciduous	deciduous trees & shrubs
Canopy cover	25% open 65% closed 10% partly open	0% open 95% closed 5% partly open	40% open 60% closed 10% partly open	05% open 75% closed 20% partly open
Flow regime	permanent	permanent	permanent	permanent
Thermal regime	cool water	warm water	warm water	warm water
Photograph numbers	DSCN3018 – DSCN3027	DSCN3010 – DSCN3017	DSCN2993 – DSCN3009	DSCN2963 – DSCN2992

Note: Date and time correspond to when water and air temperatures were recorded.

Reach 2

Reach 2 was located upstream of Waterloo Ave (from the old dam, downstream for approximately 90 metres). The stream gradient in this area was fairly steep (approximately 3 %), and substrates consisted mostly of large cobble and boulder. There was a dense canopy cover through most of this reach provided by mature deciduous trees. Boulders and a few deep pools provideed cover in this reach. Photographs 4 and 5 show typical habitat of Reach 2.

Reach 3

Reach 3 was located from the dam, upstream to a railway crossing located at the south edge of the subject lands. This reach was approximately 280 metres in length. Stop logs from the old dam have been removed, and the watercourse has carved a channel through the old reservoir bed (Photo 6). In this area, the meander pattern of Howitt Creek was sinuous and a good mixture of riffle, run and pool habitats were present. The riparian vegetation in the lower part of this reach was predominantly wetland vegetation, which provided little canopy cover (Photo 7). The upper half of this reach contained many mature willow trees, which provided good canopy cover. The root structures of these willow trees also provided cover, along with deep pools, and woody debris. Substrates in this reach were a mixture of sand and gravel with some cobble.

Garbage and woody debris accumulating in this area created debris jams, which inhibited water flow, and caused water to back up in some areas (Photo 8).

Reach 4

Reach 4 was approximately 340 metres in length and was located on the subject lands (from the railway along the southern property line to the railway along the northern property line). The surface watercourse originated at a large storm sewer at the upstream end of Reach 4 (Photo 9). Refuse in the riparian vegetation above the stream was indicative of very high, flashy flows coming from the storm sewer network (Photo 10). Many large pieces of concrete and steel were observed in the watercourse throughout Reach 4. A perched concrete culvert created a barrier to upstream fish passage in the middle of this reach (Photo 11).

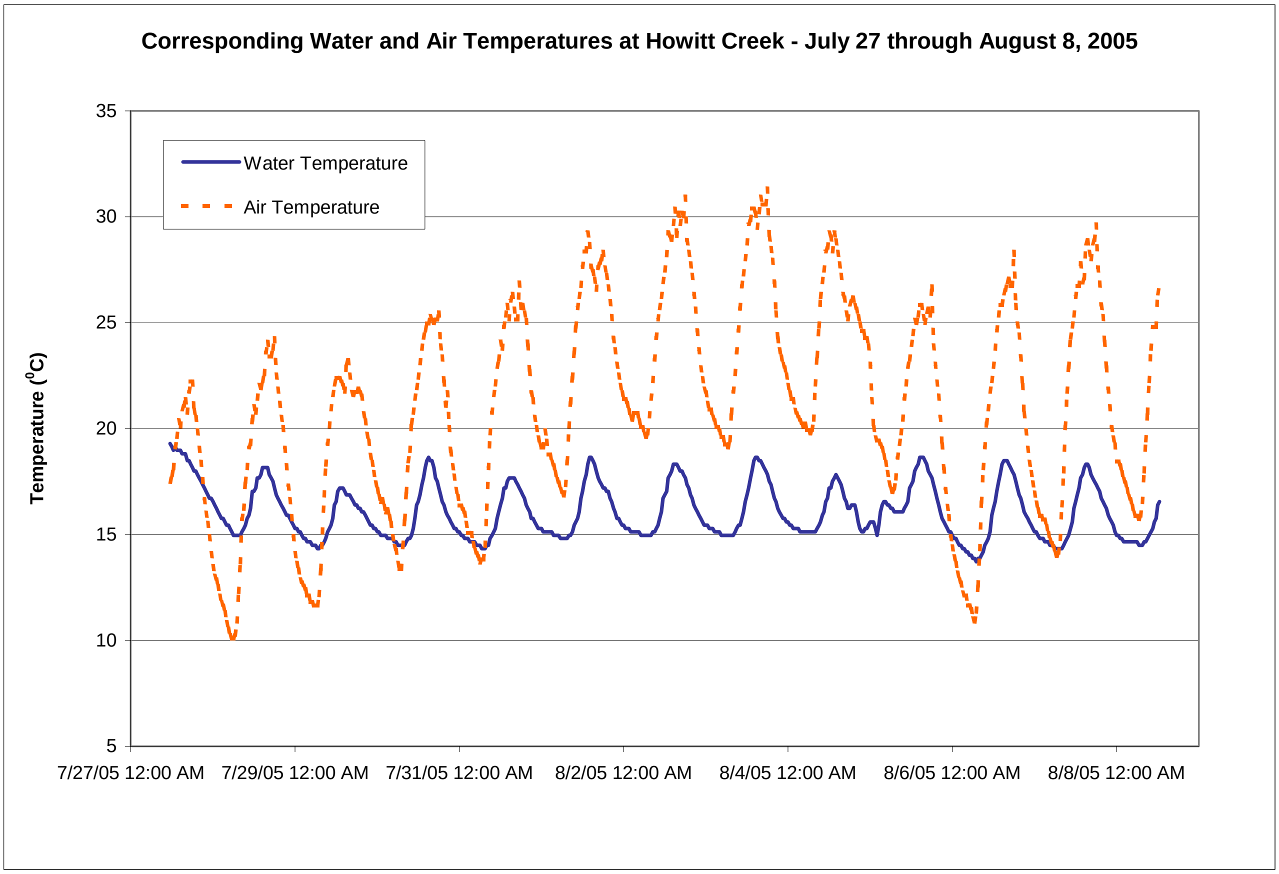
Although there was some sinuosity to the channel in this reach, it appears as though this section of the watercourse had been chanelized in the past (Photo 12). Steam morphology was predominantly run, with some riffle and deep pool. These pools provided good cover, along with overhanging shrubs, root structures and sporadic boulders. Riparian trees and shrubs provided good canopy cover through most of Reach 4. Substrates were comprised of a mixture of sand, gravel, cobble and some boulders.

Thermal Regime

Temperature loggers placed in Reach 4 revealed a cool water thermal regime. While air temperatures ranged from 10.09°C to 31.34°C, water temperatures ranged from 13.71°C to 19.29°C during the same time period. Mean air temperature between July 27 and August 8 was 21.11°C, while the mean water temperature for that same period was 16.08°C. Figure 3 shows corresponding air and water temperatures measured in Reach 4 from July 27 through August 8, 2005. Based on the temperature data collected, Howitt Creek can be classified as having a cool water thermal regime.

Although water temperatures were cool, cold water fish species were not observed in the Howitt Creek, nor is it likely that cold water species could survive in Howitt Creek.

Figure 3: Corresponding air and water temperatures measured in Reach 4 from July 27 through August 8, 2005.



Fisheries Inventory

A total of 219 fish consisting of nine different species were caught during our electrofishing survey on August 5 2005. Catch results and electrofishing effort are summarized in Table 2. A single pass method was used in each reach, with the exception of Reach 2, where two passes were made. An effort was made to expend equal fishing effort in all habitat types.

One hundred and thirty two fish consisting of nine species of fish were caught in the lower end of Reach 1, which has a direct connection to the Speed River. All of the fish from Reach 1 were caught below the furthest downstream fish movement barrier. Some of the deeper pools in this area likely provide important refuge habitat to young of the year species such as white sucker and small mouth bass. Numerous young of the year fish of these two species were caught in the lower reach of Howitt Creek. Above the barriers in Reach 1, far fewer fish were caught. No fish were caught in Reach 2. Reaches 3 and 4 supported only creek chub (*Semotilus atromaculatus*). Catch per unit effort was low in all three reaches upstream of Reach 1.

All of the fish species known to inhabit the study area are common warmwater species, and none are listed as species of concern by COSEWIC (Committee on the Status of Endangered Wildlife in Canada).

Table 2: Catch per unit effort and abundance of various fish species captured in Howitt Creek - August 5th, 2005.

Scientific Name	Common Name	Reach 1	Reach 2	Reach 3	Reach 4	Totals
Catostomus commersonii	white sucker	40	0	0	0	40
Cyprinus carpio	common carp	7	0	0	0	7
Etheostoma nigrum	johnny darter	9	0	0	0	9
Micropterus salmoides	smallmouth bass	4	0	0	0	4
Phoxinus eos	northern redbelly dace	3	0	0	0	3
Pimephales promelas	fathead minnow	14	0	0	0	14
Rhinichthys atratulus	longnose dace	3	0	0	0	3
Rhinichthys cataractae	blacknose dace	3	0	0	0	3
Semotilus atromaculatus	creek chub	49	0	75	12	136
	Total number of fish	132	0	75	12	219
	Total number of species	9	0	1	1	9
Total electrofishing effort (seconds)		371	602	595	766	2334
Catch per Unit Effort (fish captured per minute)		21.3	0.0	7.6	0.9	5.6

Discussion/Recommendations

Flash flows and barriers to upstream fish movement have adversely affected fish habitat, which is reflected in the low diversity of fish species found throughout the watercourse, upstream of the furthest downstream barrier. However, some fairly good quality fish habitat is present in some parts of Howitt Creek.

There are few constraints related to fisheries, however, the existing ecological function of Howitt Creek should be maintained. This may be accomplished by:

- ✓ Maintaining existing riparian vegetation to a distance of 15 metres from the centerline of the stream, for a vegetated buffer strip totaling 30 metres in width.
- ✓ Preventing further degradation of water quality through a comprehensive storm-water management plan.
- ✓ Measures should be taken to prevent the entry of silt into the watercourse during construction.

It is not yet know if final development plans will require the realignment of the existing watercourse. Due to the highly degraded nature of the watercourse, and the previous channel realignments, relocating the stream channel (should this be necessary) is not expected to have any significant effects on the productive capacity of the fisheries resource. In fact, there are many opportunities for fish habitat enhancement in the event that the proponent wishes to relocate the existing channel. It is important to note that fish habitat compensation or enhancement works may only be required if the existing watercourse channel is altered or relocated. Possible opportunities for on-site habitat enhancement include:

- ✓ Construction of storm-water management facilities to buffer existing flash flows. This may be considered for the upstream end of the subject lands to buffer flash flows coming from storm sewers upstream of the subject lands.
- ✓ The feasibility of including wetland filtration as a part of storm water management may be explored.

- ✓ Reconstructing the existing cannel using principals of natural channel design to create meanders and enhance habitat diversity. This may be accomplished at several locations on-site, where the existing channel has been straightened.
- ✓ Removal of barriers or creating means for fish to bypass barriers would greatly enhance the productive capacity of the watercourse. Although most of the impassable barriers exits downstream of the subject lands, there is a fish barrier at the existing twin concrete culverts in the middle of the subject lands. This barrier could be easily removed during the construction of road crossings over the watercourse.
- ✓ Removal of in-stream refuse, and placing cobble and gravel in strategic locations to enhance substrate diversity.

Summary

In July and August of 2004, a fisheries inventory and fish habitat assessment was conducted in Howitt Creek, Guelph Ontario. This fisheries assessment was completed in support of a proposed commercial development in the vicinity of Howitt Creek. Fish habitat was found to be severely degraded due to past land use practices throughout the watershed, although some areas did provide fair fish habitat. A total of 219 fish consisting of nine different species were caught in Howitt Creek during our electrofishing survey. However, only one species was caught upstream of Wellington Road. All of the fish species known to inhabit the study area are common warmwater species, and none are listed as species of concern by COSEWIC (Committee on the Status of Endangered Wildlife in Canada). Based on the temperature data collected, Howitt Creek can be classified as having a cool water thermal regime.

Constraints to development included maintaining the existing riparian corridor, and preventing further degradation of water quality. However, due to the highly degraded state of the watercourse, relocating the channel, should it be required, is not expected to have a significant negative effect on the productive capacity of the fisheries resources of Howitt Creek; provided adequate mitigation and compensation measures are employed. Opportunities for fish habitat enhancement, if the stream is re-aligned, include the creation of storm-water management facilities for existing flash flows, removing barriers to fish migration and creating more natural channel in the event that the channel is relocated.

Thank you for the opportunity to work with you on this important project. If you have any questions or comments, please call.

Sincerely,

Mike Johns

Terrain and Water Resources Technologist
True North Environmental Consultants
207 Woolwich Street,
Guelph, Ontario
N1H 3V4

Photo 1: Channelized section in Reach 1, July 27, 2005.

Photo 2: Barrier to upstream fish movement in Reach 1. July 27, 2005.

Photo 3: Barrier to upstream fish passage in Reach 1. July 27, 2005.

Photo 4: Typical fish habitat downstream of old dam in Reach 2. July 27, 2005.

Photo 5: Typical fish habitat in Reach 2. July 27, 2005.

Photo 6: Howett Creek immediately upstream of old dam. July 27, 2005.

Photo 7: Wetland habitat in reach 3. July 27, 2005.

Photo 8: Debris jam causing backwater in Reach 3. July 27, 2005.

Photo 9: The origin of the watercourse is a storm sewer. July 27, 2005.

Photo 10: Refuse in the riparian vegetation is indicative of flash flows. July 27, 2005.

Photo 11: Perched twin culverts in Reach 4 inhibit fish passage. July 27, 2005.

Photo 12: Reach 4 has likely been channelized in the past, and supports dense riparian vegetation. July 27, 2005.

APPENDIX 2. VASCULAR PLANT SPECIES

Appendix 2. Plant species documented on the Lafarge Site. An asterisk indicates a non-native species. Taxonomy follows Newmaster *et al*. (1998). Provincial rarity status follows (NHIC 2004). Rarity for Wellington County follows Anderson 2005. Rarity for the Region of Waterloo follows Region of Waterloo 2001. [1] Species are significant only if demonstrably indigenous. Vegetation communities correspond to the broad categories discussed in Section 5.1.

	Scientific Name	**Common Name**	**Rarity**			**Community**			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
	Equisetaceae								
	Equisetum arvense L.	Field Horsetail	G5	S5				✓	✓
	Pinaceae								
	Picea glauca (Moench) Voss	White Spruce	G5	S5	/Rare[1]	✓			✓
*	Pinus sylvestris L.	Scotch Pine	G?	SE5		✓	✓		
	Cupressaceae								
	Juniperus virginiana L.	Eastern Red Cedar	G5	S5			✓		
	Ranunculaceae								
	Anemone virginiana L.	Virginia Anemone	G5	S5		✓		✓	
*	Ranunculus repens L.	Creeping Buttercup	G?	SE5					✓
	Ulmaceae								
	Ulmus americana L.	American Elm	G5?	S5		✓		✓	✓
*	Ulmus pumila L.	Siberian Elm	G?	SE3		✓		✓	✓
	Juglandaceae								
	Juglans nigra L.	Black Walnut	G5	S4	/Rare[1]	✓		✓	✓
	Fagaceae								
	Quercus macrocarpa Michx.	Bur Oak	G5	S5		✓		✓	
	Betulaceae								
	Betula papyrifera Marshall	White Birch	G5	S5					✓

	Scientific Name	Common Name	Rarity			Community			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
*	Betula pendula Roth	European Weeping Birch	G?	SE4		✓			
	Chenopodiaceae								
*	Chenopodium album L. var. album	Lamb's Quarters	G5T?	SE5		✓			
	Caryophyllaceae								
*	Dianthus armeria L.	Deptford-pink	G?	SE5				✓	
*	Saponaria officinalis L.	Bouncing-bet	G?	SE5		✓		✓	
*	Silene vulgaris (Moench) Garcke	Bladder Campion	G?	SE5		✓		✓	
	Polygonaceae								
*	Polygonum persicaria L.	Lady's Thumb	G3G5	SE5			✓		✓
*	Rumex crispus L.	Curly Dock	G?	SE5					✓
	Guttiferae								
*	Hypericum perforatum L.	Common St. John's-wort	G?	SE5		✓		✓	
	Tiliaceae								
	Tilia americana L.	American Basswood	G5	S5					✓
*	Tilia cordata Miller	Little-leaf Linden	G?	SE1					✓
*	Tilia heterophylla Vent.	White Basswood	G5T5	SE1					✓
	Violaceae								
*	Viola odorata L.	Sweet Violet	G?	SE2					✓
	Viola sororia Willd.	Woolly Blue Violet	G5	S5					✓
	Salicaceae								
*	Populus alba L.	White Poplar	G5	SE5		✓		✓	
	Populus balsamifera L. ssp. balsamifera	Balsam Poplar	G5	S5		✓		✓	✓

	Scientific Name	Common Name	Rarity			Community			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
	Populus deltoides Bartram ex Marshall ssp. monilifera (Aiton) Eckenwalder	Cottonwood	G5T4T5	S5	/Rare[1]		✓		
*	Populus nigra L.	Lombardy Poplar	G5	SE4			✓		
	Populus tremuloides Michx.	Trembling Aspen	G5	S5		✓	✓	✓	✓
*	Populus x canadensis Moench	Carolina Poplar	HYB	SE1		✓			
*	Salix alba L.	White Willow	G5	SE4		✓			
	Salix discolor Muhlenb.	Pussy Willow	G5	S5				✓	
	Salix eriocephala Michx.	Heart-leaved Willow	G5	S5		✓			✓
	Salix exigua Nutt.	Sandbar Willow	G5	S5		✓	✓		
*	Salix fragilis L.	Crack Willow	G?	SE5		✓		✓	✓
	Salix lucida Muhlenb.	Shining Willow	G5	S5			✓		
	Salix petiolaris Sm.	Slender Willow	G5	S5			✓	✓	
*	Salix purpurea L.	Basket Willow	G5	SE4		✓	✓		
*	Salix x rubens Schrank	Hybrid Willow	HYB	SE4				✓	✓
	Brassicaceae								
*	Alliaria petiolata (M. Bieb.) Cavara & Grande	Garlic Mustard	G?	SE5				✓	✓
*	Barbarea vulgaris R. Br.	Yellow Rocket	G?	SE5		✓			
*	Diplotaxis tenuifolia (L.) DC.	Slime-leaf Wallrocket	G?	SE5			✓		
*	Hesperis matronalis L.	Dame's Rocket	G4G5	SE5		✓			✓
*	Lepidium campestre (L.) R. Br.	Field Pepper-grass	G?	SE5		✓			
*	Nasturtium microphyllum (Boenn.) Reichb.	Water-cress	G?	SE5					✓

	Scientific Name	Common Name	Rarity			Community			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
	Primulaceae								
	Lysimachia ciliata L.	Fringed Loosestrife	G5	S5		✓			
	Crassulaceae								
*	Sedum acre L.	Mossy Stonecrop	G?	SE5		✓			
	Rosaceae								
?	Amelanchier sp.	misc. Serviceberry	G?	S?					✓
*	Crataegus monogyna Jacq.	English Hawthorn	G5	SE5		✓			
	Fragaria virginiana Miller ssp. glauca (S. Watson) Staudt	Strawberry	G5	S5		✓		✓	
	Geum aleppicum Jacq.	Yellow Avens	G5	S5		✓		✓	✓
	Geum canadense Jacq.	White Avens	G5	S5		✓			
*	Malus pumila Miller	Common Crabapple	G5	SE5		✓			
*	Potentilla recta L.	Sulphur Cinquefoil	G?	SE5		✓		✓	
*	Potentilla x inclinata Vill.	Ashy Cinquefoil	G?	SE4		✓			
*	Prunus avium (L.) L.	Sweet Cherry	G?	SE4					✓
	Prunus virginiana L.	Choke Cherry	G5	S5		✓		✓	
*	Rosa multiflora Thunb. ex Murray	Multiflora Rose	G?	SE4		✓			
?	Rosa sp.	misc. Rose	G?	S?		✓	✓		
	Rubus idaeus L. ssp. melanolasius (Dieck) Focke	Red Raspberry	G5T5	S5		✓		✓	
	Rubus occidentalis L.	Black Raspberry	G5	S5		✓		✓	
*	Sanguisorba minor Scop.	Salad Burnet	G5	SE4		✓			
*	Sorbus aucuparia L.	European Mountain-ash	G5	SE4		✓	✓		

	Scientific Name	Common Name	Rarity			Community			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
	Fabaceae								
*	Coronilla varia L.	Crown-vetch	G?	SE5		✓			
*	Lotus corniculatus L.	Birds-foot Trefoil	G?	SE5		✓			
*	Medicago lupulina L.	Black Medic	G?	SE5		✓			
*	Melilotus alba Medik.	White Sweet Clover	G5	SE5		✓			
*	Robinia pseudo-acacia L.	Black Locust	G5	SE5		✓	✓	✓	✓
*	Trifolium hybridum L. ssp. elegans (Savi) Asch. & Graebn.	Alsike Clover	G?	SE5		✓			
*	Trifolium repens L.	White Clover	G?	SE5					✓
	Elaeagnaceae								
*	Elaeagnus angustifolia L.	Russian Olive	G?	SE3		✓			
*	Elaeagnus umbellata Thunb.	Autum Olive	G?	SE3				✓	
	Lythraceae								
*	Lythrum salicaria L.	Purple Loosestrife	G5	SE5		✓	✓		✓
	Onagraceae								
	Circaea lutetiana L. ssp. canadensis (L.) Aschers. & Magnusson	Enchanter's Nightshade	G5	S5				✓	
	Oenothera biennis L.	Common Evening-primrose	G5	S5		✓			
	Oenothera parviflora L.	Small-flowered Evening-primrose	G4?	S4?		✓			
	Oenothera sp.	Evening-primrose	G?	S?		✓			
	Cornaceae								
	Cornus alternifolia L. f.	Alternate-leaf Dogwood	G5	S5					✓
	Cornus foemina Miller ssp. racemosa (Lam.) J.S. Wilson	Grey Dogwood	G5	S5		✓			

	Scientific Name	Common Name	Rarity			Community			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
	Cornus stolonifera Michx.	Red-osier Dogwood	G5	S5		✓		✓	✓
	Euphorbiaceae								
*	Euphorbia esula L.	Leafy Spurge	G5	SE5				✓	
	Rhamnaceae								
*	Rhamnus cathartica L.	European Buckthorn	G?	SE5		✓		✓	✓
	Vitaceae								
	Parthenocissus inserta (A. Kern.) Fritsch	Virginia Creeper	G5	S5		✓		✓	✓
	Vitis riparia Michx.	Riverbank Grape	G5	S5		✓		✓	
	Aceraceae								
	Acer negundo L.	Manitoba Maple	G5	S5		✓		✓	✓
*	Acer platanoides L.	Norway Maple	G?	SE5					✓
	Anacardiaceae								
	Rhus typhina L.	Staghorn Sumac	G5	S5		✓		✓	
	Balsaminaceae								
	Impatiens capensis Meerb.	Spotted Jewel-weed	G5	S5					✓
	Apiaceae								
*	Aegopodium podagraria L.	Goutweed	G?	SE5					✓
*	Daucus carota L.	Wild Carrot	G?	SE5		✓		✓	✓
*	Pastinaca sativa L.	Wild Parsnip	G?	SE5					✓
*	Torilis japonica (Houtt.) DC.	Erect Hedge-parsley	G?	SE4					✓
	Apocynaceae								
	Apocynum androsaemifolium L.	Spreading Dogbane	G5	S5			✓		

	Scientific Name	Common Name	Rarity			Community			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
	Apocynum cannabinum L.	Indian Hemp	G5	S5		✓			
	Asclepiadaceae								
	Asclepias syriaca L.	Common Milkweed	G5	S5		✓		✓	
	Solanaceae								
	Physalis heterophylla Nees	Clammy Ground-cherry	G5	S4				✓	
*	Solanum dulcamara L.	Climbing Nightshade	G?	SE5					✓
	Convolvulaceae								
	Calystegia sepium (L.) R. Br.	Hedge Bindweed	G5	S5		✓	✓		
	Boraginaceae								
*	Echium vulgare L.	Common Viper's-bugloss	G?	SE5		✓		✓	
	Lamiaceae								
	Clinopodium vulgare L.	Field Basil	G5	S5		✓			
*	Leonurus cardiaca L.	Motherwort	G?	SE5				✓	
*	Origanum vulgare L.	Wild Marjoram	G?	SE5		✓			
	Prunella vulgaris L. ssp. lanceolata (W.C. Barton) Hultén	Heal-all	G5T5	S5					✓
*	Satureja hortensis L.	Summer Savory	G?	SE2		✓			
	Plantaginaceae								
*	Plantago lanceolata L.	English Plantain	G5	SE5		✓		✓	
*	Plantago major L.	Nipple-seed Plantain	G5	SE5					✓
	Plantago rugelii Decne.	Black-seed Plantain	G5	S5		✓			
	Oleaceae								
	Fraxinus americana L.	White Ash	G5	S5		✓			

	Scientific Name	**Common Name**	**Rarity**			**Community**			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
*	Fraxinus excelsior L.	European Ash	G?	SE2				✓	
	Fraxinus pennsylvanica Marshall	Green Ash	G5	S5				✓	
*	Syringa vulgaris L.	Lilac	G?	SE5		✓			
	Scrophulariaceae								
*	Linaria vulgaris Miller	Butter-and-eggs	G?	SE5		✓		✓	
*	Verbascum thapsus L.	Great Mullein	G?	SE5		✓		✓	
	Rubiaceae								
	Galium palustre L.	Marsh Bedstraw	G5	S5			✓		
	Caprifoliaceae								
*	Lonicera morrowii A. Gray	Morrow Honeysuckle	G?	SE3				✓	
*	Lonicera tatarica L.	Tartarian Honeysuckle	G?	SE5				✓	✓
*	Viburnum opulus L.	Guelder Rose	G5	SE4				✓	✓
	Asteraceae								
*	Achillea millefolium L.	Common Yarrow	G5T?	SE		✓		✓	
	Ambrosia artemisiifolia L.	Annual Ragweed	G5	S5		✓			
	Ambrosia trifida L.	Great Ragweed	G5	S5		✓			✓
	Anaphalis margaritacea (L.) Benth. & Hook. f. ex C.B. Clarke	Pearly Everlasting	G5	S5			✓		
	Antennaria neglecta Greene	Field Pussy-toes	G5	S5			✓		
*	Arctium minus (Hill) Bernh.	Common Burdock	G?	SE5		✓			
	Aster ericoides L. ssp. ericoides	White Heath Aster	G5T?	S5		✓			
	Aster lanceolatus Willd. ssp. lanceolatus	Panicled Aster	G5T?	S5			✓		✓
	Aster lateriflorus (L.) Britton var. lateriflorus	One-sided Aster	G5T5	S5		✓	✓	✓	✓

	Scientific Name	Common Name	Rarity			Community			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
	Aster novae-angliae L.	New England Aster	G5	S5		✓		✓	
	Aster pilosus Willd.	Hairy Aster	G5T?	S5		✓		✓	
	Aster puniceus L.	Purple-stemmed Aster	G5T?	S5					✓
*	Carduus nutans L. ssp. nutans	Nodding Thistle	G?T?	SE5				✓	
*	Centaurea maculosa Lam.	Spotted Starthistle	G?	SE5		✓		✓	
*	Chrysanthemum leucanthemum L.	Oxeye Daisy	G?	SE5		✓			
*	Cichorium intybus L.	Chicory	G?	SE5		✓			
*	Cirsium arvense (L.) Scop.	Canada Thistle	G?	SE5		✓		✓	
*	Cirsium vulgare (Savi) Ten.	Bull Thistle	G5	SE5		✓		✓	
	Conyza canadensis (L.) Cronquist	Canada Fleabane	G5	S5		✓			
*	Crepis capillaris (L.) Wallr.	Smooth Hawksbeard	G?	SE1					✓
	Erigeron annuus (L.) Pers.	White-top Fleabane	G5	S5		✓			
	Erigeron philadelphicus L.	Philadelphia Fleabane	G5T5	S5		✓			✓
	Erigeron strigosus Muhlenb. ex Willd.	Daisy Fleabane	G5	S5		✓			
	Eupatorium maculatum L. ssp. maculatum	Spotted Joe-pye-weed	G5T?	S5					✓
	Eupatorium perfoliatum L.	Common Boneset	G5	S5					✓
	Euthamia graminifolia (L.) Nutt.	Flat-top Fragrant-golden-rod	G5	S5		✓		✓	
*	Hieracium caespitosum Dumort. ssp. caespitosum	Yellow Hawkweed		SE5		✓			
*	Hieracium pilosella L.	Mouse-ear Hawkweed	G?	SE5		✓			
*	Hieracium piloselloides Vill.	Tall Hawkweed	G?	SE5		✓			
*	Onopordum acanthium L.	Scotch Thistle	G?	SE4		✓			
	Rudbeckia hirta L.	Black-eyed Susan	G5	S5		✓			

	Scientific Name	**Common Name**	**Rarity**			**Community**			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
	Solidago altissima L. var. altissima	Tall Goldenrod	G5T5	S5		✓		✓	
	Solidago canadensis L.	Canada Goldenrod	G5	S5		✓		✓	✓
	Solidago nemoralis Aiton ssp. nemoralis	Gray Goldenrod	G5T5	S5		✓			
*	Taraxacum officinale G. Weber	Common Dandelion	G5	SE5		✓		✓	✓
*	Tragopogon dubius Scop.	Meadow Goat's-beard	G?	SE5		✓		✓	
*	Tragopogon pratensis L. ssp. pratensis	Meadow Goat's-beard	G?T?	SE5		✓		✓	
*	Tussilago farfara L.	Colt's Foot	G?	SE5		✓		✓	✓
	Juncaceae								
	Juncus articulatus L.	Jointed Rush	G5	S5			✓		
	Juncus brevicaudatus (Engelm.) Fern.	Narrow-panicled Rush	G5	S5			✓		
	Juncus dudleyi Wiegelb	Dudley's Rush	G5	S5			✓		✓
	Juncus effusus L. ssp. solutus (Fern. & Wiegand) Hämet-Ahti	Soft Rush	G5	S5?			✓		
	Juncus filiformis L.	Thread Rush	G5	S4S5					✓
*	Juncus gerardii Loisel.	Blackgrass Rush	G5	SE3			✓		
	Juncus tenuis Willd.	Path Rush	G5	S5					✓
	Cyperaceae								
	Carex bebbii (L.H. Bailey) Olney ex Fern.	Bebb's Sedge	G5	S5			✓		
	Carex cristatella Britton	Crested Sedge	G5	S5			✓		
	Carex deweyana Schwein.	Short-scale Sedge	G5	S5				✓	
	Carex granularis Muhlenb. ex Willd.	Meadow Sedge	G5	S5		✓	✓		
	Carex retrorsa Schwein.	Retrorse Sedge	G5	S5			✓		
	Carex sp.	Sedge	G?	S?				✓	

	Scientific Name	Common Name	Rarity			Community			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
*	Carex spicata Hudson	Spiked Sedge	G?	SE5		✓		✓	✓
	Carex sprengelii Dewey ex Spreng.	Longbeak Sedge	G5?	S5				✓	
	Carex vulpinoidea Michx.	Fox Sedge	G5	S5			✓		
	Eleocharis smallii Britton	Creeping Spike-rush	G5?	S5			✓		
	Scirpus atrovirens Willd.	Dark-green Bulrush	G5?	S5			✓		
	Scirpus validus L.	Softstem Bulrush	G?	S5			✓		
	Poaceae								
*	Agrostis gigantea Roth	Red-top	G4G5	SE5		✓	✓		
	Agrostis stolonifera L.	Spreading Bentgrass	G5	S5					✓
*	Arrhenatherum elatius (L.) P. Beauv. ex Presl	Tall Oatgrass	G?	SE4		✓			
*	Bromus inermis Leyss. ssp. inermis	Smooth Brome	G5T?	SE5		✓		✓	✓
*	Bromus tectorum L.	Cheat Grass	G?	SE5		✓			
*	Dactylis glomerata L.	Orchard Grass	G?	SE5		✓		✓	✓
*	Digitaria sanguinalis (L.) Scop.	Hairy Crabgrass	G5	SE5		✓			
*	Elymus repens (L.) Gould	Quack Grass	G5	SE5		✓			
*	Festuca arundinacea Schreb.	Kentucky Fescue	G?	SE5		✓	✓		✓
	Festuca sp.	Festuca	G?	S?					✓
	Glyceria striata (Lam.) A. Hitchc.	Fowl Manna-grass	G5	S5					✓
	Panicum acuminatum Sw. var. acuminatum	Acuminate Panic Grass	G5T5	S5		✓	✓		
	Panicum capillare L.	Witchgrass	G5	S5		✓			
	Phalaris arundinacea L.	Reed Canary Grass	G5	S5		✓	✓		✓
*	Phleum pratense L.	Meadow Timothy	G?	SE5		✓			

Scientific Name		Common Name	Rarity			Community			
			G Rank	S Rank	Wellington/ Waterloo	CUT/ CUM	MAM2	CUW	FOD7
	Phragmites australis (Cav.) Trin. ex Steud.	Common Reed	G5	S5		✓		✓	
*	Poa compressa L.	Canada Bluegrass	G?	SE5		✓		✓	
	Poa pratensis L. ssp. pratensis	Kentucky Bluegrass	G5T5?	S5		✓		✓	
*	Setaria pumila (Poir.) Schult.	Yellow Foxtail	G?	SE5		✓			
*	Setaria viridis (L.) P. Beauv.	Green Bristle Grass	G?	SE5		✓			
	Typhaceae								
*	Typha angustifolia L.	Narrow-leaved Cattail	G5	SE5			✓		
	Iridaceae								
*	Iris pseudacorus L.	Yellow Iris	G?	SE3					✓
	Orchidaceae								
*	Epipactis helleborine (L.) Crantz	Eastern Helleborine	G?	SE5				✓	✓

* an asterisk denotes a non-native species
? in the first column denotes species that were identified to genus, where origin could not be determined

APPENDIX 3. WILDLIFE SPECIES

Appendix 3. Fauna of the Lafarge Property. Taxonomy follows NHIC (2005). Provincial rarity status follows NHIC (2005). Rarity status for Wellington County follows Dougan & Associates 2005 (Draft). Communities correspond to the broad categories discussed in Section 5.1. A checkmark indicates species that were likely breeding on the site. "T" indicates a species that was likely transient.

Scientific Name	**Common Name**	**Rarity Status**			**Community**			
		G Rank	**S Rank**	**Wellington**	**CUT/CUM**	**MAM2**	**CUW**	**FOD7**
Bird								
Anas platyrhynchos	Mallard	G5	S5B,SZN		T			
Actitis macularia	Spotted Sandpiper	G5	S5B,SZN		✓			
Zenaida macroura	Mourning Dove	G5	S5B,SZN		✓			
Picoides pubescens	Downy Woodpecker	G5	S5					✓
Colaptes auratus	Northern Flicker	G5	S5B,SZN	Rare	T		✓	
Tyrannus tyrannus	Eastern Kingbird	G5	S5B,SZN		✓			
Vireo gilvus	Warbling Vireo	G5	S5B,SZN		✓			
Vireo olivaceus	Red-eyed Vireo	G5	S5B,SZN				✓	
Cya citta cristata	Blue Jay	G5	S5		✓			
Progne subis	Purple Martin	G5	S4B,SZN	Rare	T			
Poecile atricapillus	Black-capped Chickadee	G5	S5		✓			
Turdus migratorius	American Robin	G5	S5B,SZN					✓
Dumetella carolinensis	Gray Catbird	G5	S5B,SZN		✓			
Sturnus vulgaris	European Starling	G5	SE		✓			
Dendroica petechia	Yellow Warbler	G5	S5B,SZN		✓			
Setophaga ruticilla	American Redstart	G5	S5B,SZN	Rare	✓			
Spizella passerina	Chipping Sparrow	G5	S5B,SZN		✓			
Spizella pusilla	Field Sparrow	G5	S5B,SZN	Rare	✓			
Passerculus sandwichensis	Savannah Sparrow	G5	S5B,SZN	Rare	✓			
Melospiza melodia	Song Sparrow	G5	S5B,SZN		✓		✓	✓
Zonotrichia albicollis	White-throated Sparrow	G5	S5B,SZN					T
Cardinalis cardinalis	Northern Cardinal	G5	S5		✓		✓	✓
Agelaius phoeniceus	Red-winged Blackbird	G5	S5B,SZN		✓			
Quiscalus quiscula	Common Grackle	G5	S5B,SZN		✓			
Molothrus ater	Brown-headed Cowbird	G5	S5B,SZN					
Carduelis tristis	American Goldfinch	G5	S5B,SZN		✓		✓	

Scientific Name	Common Name	Rarity Status			Community			
		G Rank	S Rank	Wellington	CUT/CUM	MAM2	CUW	FOD7
Mammal								
Sylvilagus floridanus	Eastern Cottontail	G5	S5		✓			
Sciurus carolinensis	Grey Squirrel	G5	S5		✓		✓	✓
Procyon lotor	Raccoon	G5	S5					✓
Mephitis mephitis	Striped Skunk	G5	S5					✓
Odocoileus virginiana	White-tailed Deer	G5	S5		T			
Amphibian								
Rana pipiens	Northern Leopard Frog	G5	S5					T

Silvercreek Junction

Addendum IV. Revised Impact Assessment Associated with Revised Storm Water Management Plan, August 2008.

Study Team:
Michael Johns, Gartner-Lee Limited
Robin McKillop, Gartner-Lee Limited
Sarah Mainguy, North-South Environmental Inc.
Rick Clement, TSH Limited.

1.0 INTRODUCTION

Impacts to the terrestrial and aquatic environment from the development of the Lafarge site have previously been addressed in an EIS dated October 2005, and addenda dated May 2006, November 2007 and April 2008. This addendum addresses a re-design of the original stormwater facility proposed in the feasibility and open space report (Landplan 2007). The redesign of the facility was necessary in light of revised calculations of storm flows from residential and commercial developments north of the site, which found that storm flows would be greater than originally determined.

The stormwater detention facility is proposed within the Lafarge property, on the east side of Howitt Creek. Its primary function is to ensure that outflow from the storm sewer system, which daylights within the subject property as the open-channel headwater of Howitt Creek, does not spill into the neighbouring watershed.

North-South Environmental Inc. and Gartner-Lee Ltd. were retained to address the potential impacts to the terrestrial and aquatic environments, as well as downstream impacts associated with the revised stormwater design proposed by TSH, August 2008. This memorandum has been prepared in response to the request made by Grand River Conservation Authority (GRCA), in their letter dated February 27, 2008, for completion of an assessment of potential impacts to channel morphology and erosion rates in Howitt Creek in association with the proposed development. It also addresses impacts related to the most recent design of the pond.

2.0 DESCRIPTION OF THE PROPOSAL

The proposed stormwater detention facility is specifically designed to reduce existing flow conditions in Howitt Creek downstream of the subject property. The maximum flow currently conveyed downstream of the property is 16 m^3s. The flows will now be controlled to 10.8 m^3s.

Floodwater that currently spills into the neighbouring watershed at the under-capacity twin culverts will be stored temporarily within the existing floodplain and in an excavated stormwater storage facility on the east side of the creek. The stormwater storage facility bottom is sloped gradually from the creek up to existing grades at the northeast corner of the site, simulating natural valleyside conditions. Flow control is to be provided by twin culverts, sized to limit downstream flows to less than current conditions to suit the capacity of the existing culvert under Waterloo Avenue. The new twin culverts will be designed to not inhibit fish passage. The in-stream and riparian storage mimics natural conditions created by the existing culverts.

Eventually, as floodwaters subside, all of the water will pass through the culverts and continue down Howitt Creek.

Figure 1 shows the revised alignment for the detention facility and berms used to capture and detain flows from lands upstream of the site. The proposed stormwater detention facility will occupy roughly the same amount of area east of Howitt Creek as was proposed in the November 2007 Open Space Feasibility Study.

The following describes impacts to the Howitt Creek from the current design that have not been described in previous studies:

- Removal of approximately 30 m of riparian vegetation in the area of the outlet to the detention facility;
- Removal of approximately 25 m of riparian vegetation from the creek bank adjacent to the twin culverts; and
- Reconfiguration of the creek channel in the vicinity of the twin culverts associated with their removal.

3.0 GEOMORPHIC AND EROSION ASSESSMENT

The frequency and magnitude of flows in Howitt Creek are expected to be reduced as a result of the construction of the proposed stormwater detention facility. Therefore, assuming the appropriate design of the twin culvert outlet trajectory and pool, the proposed development will likely reduce erosion rates downstream of the subject lands. Within the reach upstream of the proposed berm, where several eroding cut-banks are located, the rate of erosion may also actually decrease. Backwatering and in-stream storage will reduce velocities and thus the erosive capacity of flow. Given the GRCA's concern with the erosion observed in Howitt Creek, regardless of its cause, field investigations were completed in order to help explain its distribution and process.

A reconnaissance walk was conducted along the entire length of Howitt Creek on April 14, 2008, from its confluence with Speed River upstream to the outlet of the storm sewer. This initial site visit provided the opportunity to identify and characterize erosion sites in each of the four stream reaches identified in the memorandum prepared by True North Environmental Consultants (August 24, 2005) and select the most representative locations for subsequent field investigations. On August 11, 2008, detailed geomorphic measurements were completed at representative locations along each of the four reaches. As a basis for estimating channel stability under different flow conditions, measurements were made of bankfull cross-section, local energy gradient (slope) and bed material grain size distribution. Visual estimates of Manning's n (resistance to flow) were completed based on past experience and on Hicks and Mason (1998). The susceptibility of the channel bed downstream of the proposed berm to erosion under different flow conditions – based on Manning's relation, the continuity equation and Lane's (1955) relation – is summarized in Table 1.

Table 1. Percent of Bed Material Potentially Mobile During Different Flows

Reach	25 mm ($3.8\ m^3/s$)	5-year ($7.6\ m^3/s$)	100-year ($10.8\ m^3/s$)
4	92	96	97
3 [a]	22	22	22
2	42	86	98
1	92	97	97 [b]

Notes:
Flow estimates provided by TSH on August 7, 2008.
[a] "Bankfull" cross-section is small and within broad, flat floodplain; therefore, assumed no significant increase in depth or erodible grain diameter once banks overtopped.
[b] Assumed no significant increase in depth or erodible grain diameter once stone walls overtopped.

Howitt Creek has a history of anthropogenic change. Its planform configuration and longitudinal profile have been altered through channelization works and the construction of weirs and culverts. At present, Howitt Creek exhibits a straightened to sinuous pattern. Urbanization of the watershed upstream of the subject lands led to a dramatic increase in the area of impervious surfaces and the subsurface piping of the entire headwaters. In response to the imposed spatial constraints and altered hydrologic regime, Howitt Creek has begun to adjust its cross-sectional shape and dimensions. Overall, the creek is down-cutting and widening. The erosional processes active within each reach are summarized below, from upstream to downstream.

Reach 4 crosses a glaciofluvial outwash plain composed of stratified gravelly sand, interbedded with cobbles and seams of clayey silt. The unusual alternation along the stream bed between cohesive clayey silt and clast-supported gravelly cobbles is the result of the differential erosive resistance of each material. Where clayey silt is exposed along the bed, the sandy banks are being preferentially eroded through undercutting. Sediments derived from bank erosion appear to be easily transported through the reach. Even during relatively moderate storms (e.g., 25 mm event), nearly all grains comprising the riffles are susceptible to movement (Table 1).

Bank erosion is less extensive in Reach 3, where the channel cross-section is shallow and the floodplain is broad and flat. Even during relatively frequent, moderate flows, water breaks onto the floodplain, where its energy and erosive capacity quickly dissipate. An old concrete weir at the downstream end of the reach provides a local control on base level, preventing complete erosion of the pond-deposited sediment. Lacustrine silts are still visible along the bed of the meandering channel, where not obscured by alluvial sand. During major storms, less than one-quarter of the bed material is susceptible to erosion (Table 1).

Downstream of the weir, which separates Reaches 2 and 3, water cascades down a short bedrock step into a small scour pool. Bedrock is exposed along the eastern bank through Reach 2, which has led to the preferential erosion of the alluvial western bank. The bed exhibits a plane-bed riffle morphology, dominated by cobbles and small boulders. The lack of fine sediment within the reach is explained by the channel gradient, in addition to the process of degradation (down-cutting) commonly observed below sediment-trapping dams. Although the bed resists erosion during low to moderate flows, high flows are capable of destabilizing most of the cobbles (Table 1).

Most of Reach 1 has been straightened and confined within stone or concrete walls. It has a natural bed composed of cobbles and small boulders, which storm flows have arranged into poorly developed riffles. Like Reach 2, Reach 1 has a relatively steep gradient and lacks fine sediment, even in the pools. Based on the hydraulic calculations, overbank flooding through the channelized portion of the reach is not uncommon. However, evidence of erosion in the channel-side areas is limited to minor scour marks across the mowed lawn and around valleyside tree trunks. Erosive forces are concentrated where water depth and velocity are greatest, in this case between the stone walls (Table 1).

3.1 Conclusions and Recommendations

The proposed stormwater detention facility is designed to reduce existing flows in Howitt Creek and, therefore, is not expected to affect channel morphology, and will likely reduce erosion rates downstream of the subject property. The existing rate of bed and bank erosion may persist, however, until the channel achieves dimensions and a configuration that minimize energy expenditure in the downstream transport of water and sediment. Several recommendations are provided to address existing erosion and avoid exacerbating the problem:

1. Orient the trajectory of the proposed twin culverts along the channel centerline to inhibit localized bank erosion;
2. Incorporate a scour pool of an appropriate area and depth at the outlet of the proposed twin culverts to combat relatively high outflow velocities and avoid a perched condition;
3. Depending on spatial constraints, consider naturalizing channelized segments of reaches to better accommodate storm flows; and
4. Consider manually installing erosion pins (rebar) into the cut-banks along Reach 4, in particular downstream of the proposed berm and flood storage outlet, as a basis for monitoring erosion rates.

4.0 FISH & FISH HABITAT

4.1 Existing Conditions

Fish habitat within Howitt Creek was described in the EIS (True North Consulting 2005, in North-South Environmental 2005). Howitt Creek was divided into four reaches of similar habitat. Reach 4 traversed the subject lands and was described as follows:

"*Although there was some sinuosity to the channel in this reach, it appears as though this section of the watercourse had been channelized in the past. Steam morphology was predominantly run, with some riffle and deep pool. These pools provided good cover, along with overhanging shrubs, root structures and sporadic boulders. Riparian trees and shrubs provided good canopy cover through most of Reach 4. Substrates were comprised of a mixture of sand, gravel, cobble and some boulders*".

The fish community observed within Howitt Creek reflected the impaired habitat conditions throughout the watercourse. Only one species of fish was observed (*Semotilus atromaculatus*) upstream of a barrier near the mouth of Howitt Creek, and catch per unit effort was low upstream of this barrier. Creek chub is a commonly occurring, warm water species. On the basis of the temperature regime measured within the creek, Howitt Creek has been classified as a coolwater stream (True North Consulting 2005, in North-South Environmental 2005). Howitt creek does not have potential to support coldwater species, given the current urbanized state of the watershed upstream of the subject lands.

4.2 Potential Impacts to Fisheries

The proposed storm water management plan calls for the removal of one on-line structure, and the creation of a new on-line structure further downstream. The new structure will regulate downstream flows, and control flow into a storm water pond to the east of the Creek.

There are potential short term and long term impacts from the proposed plan.

Potential short term effects on fish and fish habitat include:

- Sediment transport during construction;
- Fish kills during in-water work;
- Removal of bank vegetation;
- Disruption of spawning habitat and egg development;
- Disruption of existing habitat; and
- Deleterious substances entry into the watercourse.

Potential long term effects on fish and fish habitat include:

- Direct loss or reduction of in-stream fish habitat;
- Creation of migration barriers from new in-stream structures and changes in flow regime;
- Erosion of stream channel due to changes in flow regime; and
- Warming of the watercourse from increased ambient light and increased retention time.

4.2.1 Mitigation of Short-Term Impacts

The short term effects identified in section 4.2 can be mitigated using standard construction mitigation techniques.

To control sediment transport during construction, a detailed erosion and sediment control plan should be submitted prior to in-stream work. In-stream work should be avoided where possible, and the duration of any required in-stream work should be kept to a minimum. The sediment and erosion control plan should outline the detailed sequence of construction events, and sediment control/mitigation measures implemented during each phase of construction.

To avoid fish kills during in-water work, fish should be transferred out of the work area prior to construction, and prevented from accessing the construction are for the duration of in-stream work. Fish should be allowed back into the work area after the work is complete.

Key spawning periods for fish species known to inhabit the watercourse should be avoided.

A detailed planting plan to control runoff, and provide riparian shading should be completed prior to construction. Riparian planting should be monitored and watered (if necessary) to ensure a high rate of survival. Any bank vegetation removed should be replaced by native species selected for their suitability to the site, and ability to provide habitat for local fish and wildlife.

Disruption of existing habitat should by kept to a minimum, by avoiding in-stream work unless absolutely necessary, and by minimizing the footprint of required in-stream work. Areas of in-stream habitat disrupted during construction should be restored to their pre-construction state, or better.

The sediment and erosion control plan should also include details on how deleterious materials will be prevented from entering the watercourse. This includes ensuring all equipment coming into contact with the water and stream sediments are free of deleterious substances and refuelling of equipment is completed well away from watercourse.

During construction, a qualified environmental inspector should be on site to ensure sediment erosion and control features are functioning as designed.

4.2.2 Mitigation of & Compensation for Long-term Impacts to Fisheries

Many of the long term effects identified in section 4.2 can be mitigated using standard construction mitigation techniques. For impacts where mitigation is not possible, there are good opportunities for fish habitat enhancement and compensation on site.

During the installation of the new control structure, a portion of the existing stream channel will be covered when a new culvert(s) are installed. Compensation for this loss of fish habitat will be required. Potential compensation measures include the removal of the existing culverts, which currently create a barrier to fish passage. There are also opportunities for in-stream habitat enhancement on site, where the existing watercourse is degraded. Potential enhancements include:

- including wetland filtration (for example, within the storm water detention area) as a part of storm water management may be explored;
- the creation of in-stream cover;
- removal of in-stream refuse;
- placing cobble and gravel in strategic locations to enhance substrate diversity.; and
- reconstructing the existing channel using principals of natural channel design to create meanders and enhance habitat diversity. This may be accomplished at several locations on-site, where the existing channel has been straightened.

Erosion of the stream channel due to changes in flow regime is not expected to be an issue, as the new storm water management facilities will buffer the peak flows downstream of the subject property. This is discussed further in sections 2 and 3 of this addendum. The new culverts will be designed to allow for fish passage under various flow conditions. In-stream structures will be designed to avoid creating barriers such as the one associated with the twin culverts further upstream. The downstream end of the culvert may be designed (if necessary) with a series of gradually descending riffles and pools so that fish can pass upstream. The culverts themselves will also be designed to promote fish passage. They should be designed in such a way that their outlets are not perched. An appropriately-sized scour pool, its level maintained by a cobble/rim or riffle, should be incorporated into the design.

The fish community found in Howitt Creek is tolerant of warm water conditions. Minor changes in stream temperature are not expected to have any effect on the aquatic community in Howitt Creek. Warming of the watercourse from increased ambient light will be minimized by selecting riparian species for planting, which maximize shading potential and riparian canopy cover. The new storm water design will minimize warming by providing partial storage within the existing flood plain, thereby taking advantage of the existing canopy and shade conditions.

Mitigation of impacts from vegetation removal consists of restoration of vegetation overhanging the stream as soon as is feasible following construction. The recommended principles for restoration for addressing impacts to both the terrestrial and aquatic environments of removing vegetation from the edge of Howitt Creek are described in Section 5.

4.3 Conclusions

Recommendations from the EIS (True North Consulting 2005, in North-South Environmental 2005) included:

- *"Construction of storm-water management facilities to buffer existing flash flows [is recommended]. This may be considered for the upstream end of the subject lands to buffer flash flows coming from storm sewers upstream of the subject lands".*

- *"Removal of barriers or creating means for fish to bypass barriers would greatly enhance the productive capacity of the watercourse. Although most of the impassable barriers exist downstream of the subject lands, there is a fish barrier at the existing twin concrete culverts in the middle of the subject lands. This barrier could be easily removed during the construction of road crossings over the watercourse."*

The new storm water management plan will achieve these recommendations, and improve fish habitat in Howitt Creek by buffering flash flows and removing a barrier to fish passage. Standard mitigation methods can be employed to avoid impacts to fish habitat in most cases. Where impacts to fish habitat can not be avoided, such as where the new outlet control feature will be created, there are good compensation options on site for enhancing existing fish habitat.

5.0 ANALYSIS OF IMPACTS ON TERRESTRIAL AND AQUATIC ENVIRONMENTS FROM VEGETATION REMOVAL

Removal of vegetation from two areas of the riparian zone of Howitt Creek has potential impacts to both the aquatic environment (as previously described) and the terrestrial environment. Though the vegetation along the creek is predominantly non-native, the riparian area functions to protect and enhance the quality of the aquatic habitat (as discussed above). Like most riparian areas, the vegetation along the creek also provides a terrestrial function, enhancing the diversity of habitat within the site and providing habitat for locally rare species within Wellington County.

Impacts to the terrestrial environment from removal of vegetation to construct the stormwater detention area include:

- Removal of habitat for species locally rare in Wellington County, including American redstart;
- Removal of one of the most diverse areas of habitat on the site.

5.1 Recommendations

Considerable tree and shrub planting has been recommended to enhance the riparian habitat along the creek as part of mitigation for the development on the west side of the site in Addendum I (North-South Environmental et al. 2006). It is recommended that a well-stratified assemblage of native trees, shrubs, and ground flora be restored in all riparian areas where vegetation is removed in the course of constructing the stormwater detention facility. The planting plan should follow the general recommendations that have been outlined in Addendum 1 (North-South Environmental et al. 2006), with modifications to ensure that the shading functions of the trees along the bank be re-established as quickly as possible. Native trees of large calliper (as large as can be obtained from nursery stock) should be planted in order to provide an overhanging canopy in as short a time as possible. Plantings should be specific to the soil conditions that vary according to frequency of flooding, as follows:

- Tree species that develop an overhanging canopy and are relatively tolerant of dry conditions (where flooding almost never occurs) should be planted along the top of the bank, including the following species: red oak, white oak, sugar maple, red maple, and white pine.
- Tree species adapted to cooler, moister conditions (where flooding may occur rarely) should be planted in mid-slope locations, including eastern hemlock, sugar maple, red maple, eastern white cedar and basswood.
- Tree species tolerant of inundation should be planted within the floodplain next to the creek, in areas flooded regularly (for up to approximately two months per year): silver maple, eastern white cedar, black maple, green ash, black willow, pussy willow and peachleaf willow.
- Shrub species should be planted in the understory of the tree plantings, including shrub species noted for various conditions in Addendum 1;
- Grasses and herbs should be planted in the ground layer under shrub and tree plantings, using recommendations for species provided in Addendum 1.

As noted in Section 4, a detailed planting plan to control runoff, and provide riparian shading should be completed prior to construction. Riparian planting should be monitored and watered (if necessary) to ensure a high rate of survival. Any bank vegetation removed should be replaced by native species selected for their suitability to the site, and ability to provide habitat for local fish and wildlife.

6.0 RECOMMENDATIONS FOR PLANTINGS WITHIN STORMWATER DETENTION FACILITY

Warming of water within the detention facility is not expected, since the water will drain out very rapidly (in much less than 36 hours). However, these effects could be partly mitigated by plantings in the vicinity of the deeper portions of the pond, and additional plantings within the pond itself. This would help to shade the standing water within the pond and would also provide additional wildlife habitat enhancement for the site.

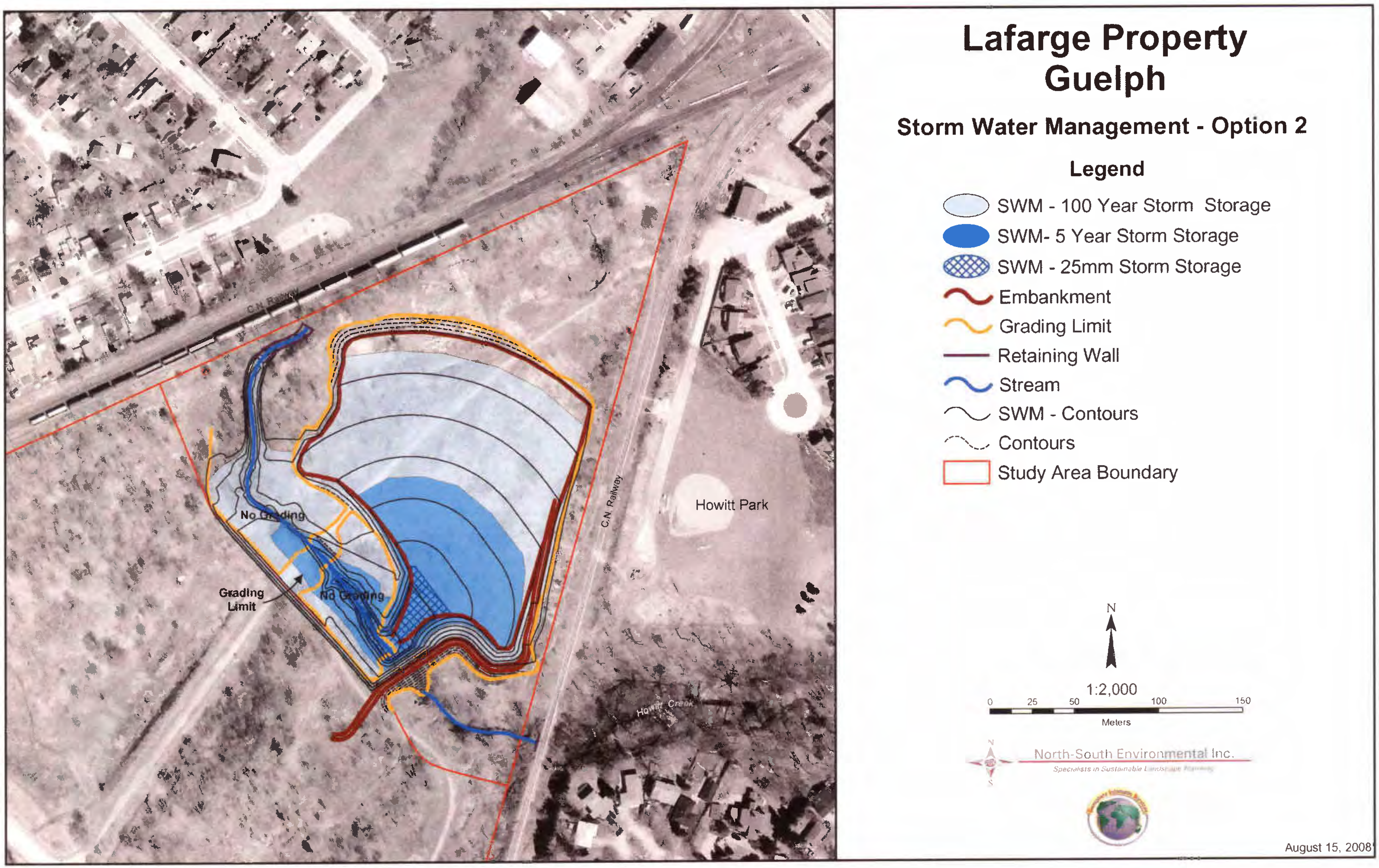
The edges of the outlet should be planted with overhanging native tree species wherever feasible, using species recommended above. Further enhancement of the habitat within the site can be accomplished by planting within the stormwater detention facility. The large detention facility east of the creek is expected to be flooded rarely, with flooding becoming less frequent with distance from the inlet. Opportunities for habitat enhancement are provided by this facility because flooding will occur very infrequently, and because when flooding does occur the facility will drain in less than 36 hours, but will drain slowly enough that vegetation will not be disturbed by water movement.

It is recommended that sandbar willow, balsam poplar and eastern white cedar be planted within this facility. These species are already common in open areas throughout the site. Their roots are highly efficient at binding loose substrates, allowing the substrates to be stabilized so that other species can colonize.

Memo prepared by Sarah Mainguy (North-South Environmental)

Sarah Mainguy

with assistance from Robin McKillop, Michael Johns and Rick Clement


Lafarge Property
Guelph
Storm Water Management - Option 2
Legend
SWM - 100 Year Storm Storage
SWM- 5 Year Storm Storage
SWM - 25mm Storm Storage
Embankment
Grading Limit
Retaining Wall
Stream
SWM - Contours
Contours
Study Area Boundary
C.N Railway
C.N Railway
Howitt Park
Howitt Creek
No Grading
No Grading
Grading Limit
N
1:2,000
0 25 50 100 150
Meters
North-South Environmental Inc.
August 15, 2008

LAFARGE PROPERTY
ADDENDUM TO THE
ENVIRONMENTAL AND SERVICING REPORTS

In support of an application for an Official Plan Amendment and Zoning Amendment on the Lafarge property, the following reports have been submitted to the Grand River Conservation Authority:

- Desktop Hazard Lands Boundary (V.A. Wood, February 2206)
- Groundwater Assessment of the Lafarge Property (Blackport Hydrogeology, January, 2006)
- Environmental Impact Study for Lafarge Property (North-South Environmental, October 2005)
- Planning Study – SilverCreek Guelph Developments Limited (BSR&D Limited, September 2005)
- Site Plan Option B – Drawing SP-104 (Venchiarutti Galiardi Architects Inc., September 22, 2005)
- Stormwater Management Analysis, Silvercreek Parkway Site (CCL, November 1991)
- Schedules 1, 2 and 3 (Notice of Application, City of Guelph)

The Grand River Conservation Authority provided their comments on this application to the City of Guelph on March 6, 2006. This letter is included as Appendix A.

The purpose of this report is to address questions and provide further clarification on certain matters that were raised by the Grand River Conservation Authority.

SLOPE STABILITY

1. Delineation of steep slope hazard or floodplain

This information is addressed in V. A. Wood “Hazard Lands Boundary” report, which is based on the Terms of Reference, approved by the Grand River Conservation Authority at a meeting held March 22, 2006. The Terms of Reference and the report are attached as Appendix B to this response. Although there is no specific discussion of steep slope hazard or floodplain, this information has been taken into account in the slope stability design analysis.

a. The Provincial Standard (Confined System, Erosion hazard limit where toe of valley slope is located less than 15 metres from watercourse) was used to determine the hazard lands boundary.

b. The soils obtained from a visual inspection and logging of the exposed creek slope valley soils along the west side of Howitt Creek including the drilling of nine boreholes are discussed in the Sub/surface Conditions of the VAW Land Boundary report.

c. The boreholes and soils are plotted within the cross-sections, Enclosures 15 to 24 of the VAW Hazard Land Boundary report.

d. A computer slope stability analysis was conducted at each cross-section location based on the sub/surface soils and groundwater conditions, obtained from the borehole investigation and visual logging of the valley slope as shown in Appendix ‘C’ of the VAW Hazard Lands Boundary report. A slope stability Factor of Safety for existing and proposed grading & development (i.e. buildings, parking area fills) was completed as shown in Appendix ‘C’ and summarized in the Discussion and Recommendations of the VAW Hazard Lands Boundary report. The GRCA slope stability Factor of Safety of 1.75 was used to establish the final slope stability setback for a safe slope given on the cross-sections, Enclosures 15 to 24 of the VAW Hazard Lands Boundary report.

e. Nine boreholes, drilled within 35 metres of the creek on the west side, revealed the ground water levels to be very near or below the present creek water levels. Three groundwater monitoring wells were installed near cross-section B-B' and at cross-sections, E-E' and J-J to verify the groundwater levels and profiles. The groundwater levels are plotted on the cross-sections and discussed in the Groundwater Conditions of the VAW Hazard Lands Boundary report.

f. Toe erosion was determined using the provincial minimum toe erosion allowance (table) for typical sand/silt type soils encountered along the creek. Visual inspection of the creek valley slope noted active erosion at cross-sections D-D' and I-I' only. Therefore, with a creek bankfull width of less than 5m, cross-sections C-C', E-E', F-F', G-G', H-H' and J-J' were given a toe erosion of 2m where no active erosion was evident. A minimum toe erosion of 8m was given to cross-sections D-D' and I-I' where there was active erosion.

g. The provincial minimum 6m structural setback was used in the revised slope stability analysis of the hazard lands boundary report.

h. The plan drawing and cross-sections showing the setbacks were revised according to the above information. It is noted, the revised slope stability study did not establish a hazard lands boundary at cross-sections A-A' and B-B' because of the adjacent existing Canadian National Railway.

i. The final drawings has been stamped and signed by a qualified geotechnical engineer.

2. Secondary and Tertiary Top of Bank

Primary, secondary and tertiary were terms (feature descriptions) given to breaks along the valley slope, similar to first, second and third. The creek top of bank (toe of slope) was used to establish the setbacks as shown on the cross-sections, Enclosures 15 to 24 of the VAW Hazard Lands Boundary report.

3. Seepage Areas

Visual inspection of the slopes noted no seepage in February and March 2006. Three groundwater monitoring wells were installed along the west side of Howitt Creek. The EIS noted seepage within the areas of cross-sections I-I' and J-J'. One groundwater monitoring well was installed along cross-section J-J'. Examination of the west slope near I-I' noted predominate surface runoff erosion. The groundwater profiles along cross-sections, I-I' and J-J' are shown on the cross-sections of the computer slope stability analysis in Appendix 'C' of the VAW Hazard Lands Boundary report.

FLOODPLAIN

4. Identification of Storm Flow Routes

It has been confirmed that the storm water flow concerns with the creek, are from the north (The Alma Street Relief Storm Sewer built by the City of Guelph in the late 60's & early 70's.), which are a closed storm system of approximately 260 hectares, with no overland component.

Base inflow is due to leakage into the extensive upstream underground storm system.

This storm system has probably been designed to meet the 5 year storm but surcharges during greater storms causing flows greater than the 1:5 year flows.

The developer is prepared to proceed with more detailed design and research into the upstream system to verify the maximum flow during the 1:10 to 1:100 year storms.

The developer is also prepared to solve the worst case scenario as presented in the CCL 1991 Report by a proposed storm pond located on lands east of the creek, which the developer is prepared to dedicate to the City of Guelph.

Preliminary Modeling has confirmed that the worst case Scenario in the CCL report can be accommodated (i.e. 27m3 per second peak flow) with 16m3 diverted to the pond on lands east of the creek under a 1:100 year storm event and 11 m3 flow south along the creek.

It is not the responsibility of the developer to solve the historical storm water issues with regard to the creek, but we are prepared to contribute the land, the main component required to assist the City and the GRCA in improving the situation.

The developer is responsible for maintaining the flood control line and will provide a pond/swale with a capacity of approximately 1638 M3 to compensate for the filling of the spill zone to the west of the creek with a capacity of approximately 782 M3 by the proposed development. See PVA drawings attached.

5. Culvert Improvements and Modeling

The developer is prepared to remove the culvert obstruction & design & construct a weir control system which will regulate maximum flow to the south of 11 m3/ sec as is now the case & divert 16 m3/ sec to the proposed worst case scenario storm pond proposed east of Howitt Creek as described above.

Please see a preliminary proposed design on PVA drawings attached.

NB: This design will also allow the fish to migrate easily past the culvert obstruction which at present in now only possible under high flows, which are very infrequent.

6. Assessment of 1991 Report Regarding Flow Diversion

Please refer to the discussion under **FLOODPLAIN** – *Item 4* - above as these concerns are being addressed there.

7. Upstream Overland Flow

A detailed visual study has been done by PVA Consultants Limited & it has been confirmed that there is not an overland flow route to Howitt Creek.

The CNR railway is higher at all points to the north & is ditched so no overland flow can reach Howitt Creek.

FISHERIES

8. Thermal Regime of Howitt Creek

Technical Assessment

The EIS concluded that Howitt Creek has a coolwater thermal regime, and we support this conclusion. There are two commonly used methods for determining thermal regime in Southern Ontario. One method uses maximum summertime temperature. The maximum observed temperature in Howett Creek was 19.3^{o}C, which, as stated in your letter, falls within the range for coolwater systems (19 to 25^{o}C). A second method, which is recommended by the Ontario Stream Assessment Protocol (OSAP), compares water temperature at 4:00 pm with maximum daily air temperature (Stoneman & Jones, 1996). Using this method, eight out of the nine points plotted fell within the coolwater thermal regime. One point out of nine fell within the coldwater thermal regime. Nine points were plotted because they corresponded to days when maximum air temperatures were in excess 25^{o}C, as recommended in Stoneman et al. Based on the best available data, and using methods promoted by Fisheries and Oceans Canada and the Ontario Ministry of Natural Resources, Howitt Creek has a coolwater thermal regime.

Groundwater Assessment of the Thermal Regime

One of the major factors controlling whether a stream is a coldwater or coolwater stream is the contribution of groundwater to the stream flow. Based on the site-specific groundwater information obtained to date, it is interpreted that there is minimal contribution from local groundwater to Howitt Creek. It is our interpretation that the coolwater thermal regime on this portion of the Howitt Creek is primarily due to the flow from the deep storm water system upstream of the Lafarge property. The storm water system is relatively deep in the ground and as a result there is a cooling effect as the water moves through the storm sewer system. It is also likely that there is some seepage of groundwater into the storm sewer system, given the depth and age of the system. It is our understanding that there is continuous flow onto the Lafarge property even during extended periods when there is no precipitation.

The coolwater thermal regime is not a function of local groundwater discharge. There will be limited onsite groundwater discharge to buffer creek temperatures. Maintaining the recharge function of the property will have no impact on the thermal regime in Howitt Creek. Monitoring of groundwater levels on the site indicates that groundwater flow is generally from north to south across the property so the area of proposed development provides little potential for contribution to Howitt Creek. As previously indicated in the Hydrogeological report by Blackport Hydrogeology, historical monitoring of groundwater levels showed the water levels to be below the creek levels, with the possible exception of the most southerly portion of the creek. Recently installed monitoring wells, by V.A. Wood (Guelph) Incorporated, indicate the local groundwater levels are at or just above the creek levels near the extreme upstream and downstream portion of the creek during the spring runoff, however the groundwater levels decline quickly after the spring recharge period. Refer to the STORMWATER MANAGEMENT section of this response for details of the roof water recharging system, which has been designed to maximize the potential ground water recharging from the proposed development, which will be an improvement over the existing condition.

Data collected to date indicate that groundwater flow and local recharge on site do not contribute to maintaining the thermal regime of this portion of Howitt Creek regardless of whether it is classified as a coldwater or coolwater stream.

With respect to the proposed undertaking, we understand the GRCA recommends a 30 metre buffer for both coolwater and coldwater systems. Therefore, if the GRCA maintains that Howitt Creek has a coldwater thermal regime, we do not wish to contest this issue, provided there are no extraneous project requirements based on a coldwater designation.

Buffer Zones

In general, riparian vegetation serves to improve water quality and fish habitat by:

- providing detritus to the watercourse, which enhances substrate and species diversity
- providing root mass and large organic debris for cover
- filtering/removing nutrients from surface runoff
- filtering particulates/sediment from surface runoff
- providing shade and thereby reducing water temperatures

Maintaining Ecological Function

The ecological function of the study area, as it currently exists, is to provide fish habitat for creek chub (*Semotilus atromaculatus*), during all life stages. This includes benthic macro-invertebrate production as a food source for creek chub, and possibly other wildlife as well. The site also serves to transport flows to support a more diverse fish community near the mouth of Howitt Creek.

Creek chub are a commonly occurring fish species, and are not known to be sensitive to development. The benthic community is most likely impacted by water quality from the upstream storm sewer and it is a reasonable assumption that the benthic invertebrate community is not sensitive to development. The proposed works will not result in any changes to direct fish habitat, and will not contribute to the degradation of water quality in Howitt Creek.

We are in agreement that Howitt Creek, within the subject lands, does provide fish habitat. However, we are proposing a reduced setback along the west side of Howitt Creek. We feel that this will not negatively impact the ecological function of Howitt Creek. The development plan calls for a 30 metre vegetated buffer on the east side of the property. The existing vegetation within this buffer zone will be supplemented with native trees and shrubs, according to the enclosed planting plan. The planting plan has been developed to maximize the benefits to the watercourse (as detailed under Items 13 and 14 of this report).

Beyond the 30 meter buffer on the east side, the site will remain "semi-natural." The only proposed land use on the east side of this buffer is a vegetated storm water management pond (dry). This storm water management pond will be designed to handle flows that would otherwise flow into the development area during peak flow events. Details of the storm water management plan can be found in the Storm Water Management section of this response and the attached Plans. Furthermore, the proponent is willing to set aside some of the development property for future storm water management by the City of Guelph. Future expansions to the proposed storm water management pond could have significant positive effects on the quality of fish habitat in Howitt Creek by buffering the existing flash flows coming from the storm sewer at the upstream end of the property.

Along the west side of Howitt Creek, the development plan calls for a buffer of varying width. The total proposed west buffer will average 24 metres in width, with a maximum width of 32.4 metres and a minimum width of 16.5 metres. Within this buffer zone, there will be a "no-grading" area, and a perimeter area where grading is required to achieve stable slopes. The total proposed "no-grading" zone would average 14.5 metres in width, with a maximum width of 26.1 and a minimum width of 10.5 metres. The graded area on the perimeter of the "no-grading" area will be planted according to the attached Riparian Restoration plan to achieve maximum benefit to Howitt Creek.

The following items address the aforementioned benefits of buffer zones and provide detail with respect to how reduced setbacks will not negatively impact the ecological function of Howitt Creek.

"providing detritus to the watercourse, which enhances substrate and species diversity"

It is expected that most organic material contributed to the stream comes from bank vegetation immediately adjacent to and above the stream. Bank vegetation and trees providing canopy cover will not be disturbed as a result of the development project (with the exception of the construction of the high flow inlet channel into the storm water management pond). Organic material from existing vegetation within **9.2** metres of the watercourse will continue to provide detritus to the watercourse. Furthermore, shrubs planted along the banks of the watercourse will contribute additional organic matter, and additional native trees and shrubs will diversify the organic content to the stream.

"providing root mass and large organic debris for cover"

Again, only trees and shrubs immediately adjacent to the stream are expected to provide direct cover in the form of root mass and large organic debris. Bank vegetation and existing vegetation within 10.5 metres of the watercourse will not be disturbed as a result of the development project. Furthermore, the existing vegetation, which is quite sparse in many areas, will be supplemented with native tree and shrub plantings. The total buffer width after development will be a minimum of 16.5 meters, and 24 metres wide on average, which will be sufficient to maintain the ecological function of the riparian zone, as it relates to cover for fish.

"filtering/removing nutrients from surface runoff"

A wide riparian zone provides the greatest benefit in terms of its ability to filter nutrients and suspended solids from surface runoff, and thereby improve water quality. Precipitation falling within the new riparian zone will be directed toward the creek. Precipitation falling beyond the riparian zone will not degrade the water quality of Howitt Creek because precipitation falling in this area will flow into storm water management facilities. These storm water management facilities have been designed to control the quality and quantity of runoff from the site (See the STOMRWATER MANAGEMENT section of this report and the attached drawings).

"filtering particulates/sediment from surface runoff"

In most natural systems, the riparian function of filtering sediment from surface runoff is improved with a greater riparian width. However, within the subject lands, Howitt Creek is not a natural system in that is has been relocated from its original path. As such, Howitt Creek has an unnatural valley shape, since the existing channel has been cut through a height of land. Due to the topography in the vicinity of the existing channel, and as a result of the site grading plan, only precipitation which falls within the new riparian zone (on the east side) will actually flow into the Howitt Creek. Precipitation falling outside the riparian zone will be directed into storm water management facilities.

"providing shade and thereby reducing water temperatures"

The existing canopy cover is good, and the proposed Riparian Restoration plan does not call for the removal of any trees providing canopy cover. The proposed reduced buffer width will not result in reduced shading to Howitt Creek. In fact, shading can be enhanced by planting coniferous trees near the perimeter of the riparian zone to provide better shading during early and late day periods, when the angle of the sunlight is low.

We acknowledge that Howitt Creek, within the subject lands, does provide fish habitat. However, we feel, given the degraded state of the watercourse, and the proposed enhancements, a reduced setback is justified, provided the ecological function of Howitt Creek is maintained. In reviewing our request for reduced setbacks, please keep in mind that Howitt Creek is a highly altered, highly degraded watercourse. At the upstream end of the site, Howitt Creek receives 100% of its flow from an enclosed storm sewer. There is minimal contribution from on-site groundwater flow and recharge. Although no water quality or benthic invertebrate sampling was conducted, it is a reasonable assumption that water quality is severely impacted by upstream land use. Bank vegetation in Howitt Creek is littered with refuse, washed down from upstream during flash flow events. Howitt Creek has been moved to its current location, and the natural flow regime is disrupted by various restrictions and barriers. Only one species of fish, creek chub (*Semotilus atromaculatus*), inhabits Howitt Creek within the subject lands. To implement the highest standards of environmental protection on this degraded watercourse is, we feel, unnecessary. Although a buffer width less than 30 metres is proposed, this new buffer area will enhance the existing ecological function through the implementation of a detailed planting plan, which has been designed to enhance riparian protection of the watercourse (See attached Riparian Restoration plan).

Site Specific Enhancement Opportunities

To maintain the existing function of Howitt Creek and adjacent riparian vegetation and to encourage future opportunities for enhancement we are proposing environmental mitigation and enhancement of Howitt Creek.

1) Existing vegetation in the setback will be supplemented with native trees and shrubs to diversify the vegetation community and to enhance riparian function.
2) Shrubs will be planted along the banks of Howitt Creek to provide direct cover and fish habitat. Planting sites will be selected where survival is expected to be good.
3) Existing in-stream refuse will be removed from Howitt Creek within the subject lands.
4) The twin concrete culverts, which currently create a barrier to fish passage will be removed. An alternative flow control structure may be required in place of the culvert. This alternative flow control structure will be designed to allow fish passage at various flow rates.

9. Top of Bank setbacks

The setback should be measured from the top of bank. All setback measurements have been measured, and are referenced from top of bank. It is our opinion that the revised plan will not negatively impact the ecological function of Howitt Creek.

STORMWATER MANAGEMENT

10. Enhanced SWM Quality Control
11. Oil and Grit Separators
12. Infiltration to Pre-development Levels or Greater

Discussions have been held with GRCVCA on the concept plan submitted on SP1 previously referred to above & the concept has been accepted.

On the concept plan SP1, the development is split into 5 Zones. The first zone shows the storm water design proposed for phase 1. This consists of roof storage with control flow roof drains & loading dock storage for storms up to the 1:10 year storms & limited parking lot storage for larger storms. The stormwater is then routed through an Oil Grit separator which removes up to 70% TSS. The stormwater is then routed through an underground storm sewer to the Northwest drainage system through an eventual dry pond & then to a culvert under the Hanlon to the Northwest drainage channel.

Phase I is expected to be under construction this summer for a user that meets the existing zoning. The rest of the development, for which an Official Plan Amendment and Rezoning application is underway, is expected to be developed as approvals are obtained.

The first phase is 2.7 hectares, and does not affect the flood plain issues consequently the GRCA has agreed that this can proceed, subject to other issues being satisfactorily addressed.

For the remainder of the site, written confirmation of the storm water modeling parameters and criteria dated June 9th from the City Engineering Department with regard to the development, were previously submitted to the GRCVA.

The design utilizes roof storage with control flow roof drains & loading dock storage for storms up to the 1:10 year storms & limited parking lot storage for larger storms. The stormwater is then routed through Oil Grit separators which removes up to 70% TSS. The stormwater is then routed through an underground storm sewer to the Northwest drainage system through an eventual dry pond & then to a culvert under the Hanlon to the Northwest drainage channel.

In the concept design the rain water from the roof will be separately handled and will be used to recharge the creek using recharge galleries, approximately 70M for phase 1 and additional galleries from the other buildings proposed along the eastern boundary of the site. Other roof overflow will be conducted through swales as detailed to the dry ponds, so the actual sedimentation control will exceed the 70% parameter required.

The GRCVA accepted the design concept as detailed on the plan and will not be insisting on wet water ponds for the development as wet ponds are not allowed along the Hanlon by the City & by MTO.

The ground water recharging system will be included in the EIS as it will enhance the creek riparian zone.

GRCA concurs with the conclusions of the Groundwater Assessment report by Blackport Hydrogeology that there will be insignificant impacts to the creek and regional groundwater due to loss of recharge from the site. Notwithstanding the lack of impact as a result of potential loss in recharge, storm water management practices are proposed to maintain existing site infiltration wherever possible. Local infiltration galleries are proposed in several areas that would allow for infiltration to the groundwater system. Periodic flooding of the proposed for the soccer field, during major storm events would result in some of this water infiltration to the groundwater system. BMP's will be followed whenever possible with respect to increasing infiltration.

FISHERIES

13. Improvements to Enhance Stream Corridor

Background

North-South Environmental prepared an Environmental Impact Study (EIS) for the Lafarge property in Guelph Ontario, in 2005 (North-South Environmental 2005). The report included a fisheries study for Howitt Creek (conducted by True North Environmental Consultants, now Gartner-Lee Limited). Howitt Creek originates in storm water flow north of the site, enters the site through a culvert under the railway that forms the north boundary, and roughly bisects the site, entering the Speed River approximately 650 m downstream of the site. There are significant barriers (a drop culvert) to fish under Wellington Road, which runs parallel to the river. Fish habitat was found to be severely degraded throughout the creek due to past land use practices throughout the watershed, although some areas within the site boundaries did provide fair fish habitat. A total of 219 fish consisting of nine different species were caught in Howitt Creek during the electrofishing survey. However, only one species was caught upstream of Wellington Street. All of the fish species known to inhabit the study area are common warmwater species, and none are listed as species of concern by COSEWIC (Committee on the Status of Endangered Wildlife in Canada).

Based on the temperature data collected, Howitt Creek was classified as having a cool water thermal regime. This is because though the creek originates in stormwater flows, the storm water inputs run for a considerable distance underground and may be enhanced by groundwater infiltration of underground storm pipes (point 4). In addition, the riparian corridor along the stream is well-treed, with overhanging shade most of its length. Constraints to development included maintaining the existing riparian corridor, and preventing further degradation of water quality. Consequently, the EIS recommended a 15 m buffer along the west side of the creek, in order to maintain the existing riparian vegetation and preserve the present water quality and fish diversity within the creek. There is no development planned for the east side of the creek, and the land to the east will be used for a stormwater management area and open space/recreation, with the result that there is an effective 30 m setback on the east side of the creek.

GRCA has voiced its concern that the setback along the west side of the creek be increased to 30 m, because the thermal regime indicates that the creek is a coolwater system. This letter is being prepared in response to GRCA requests for a planting plan that would provide enhancements supporting the rationale and justification for reducing the setback. As also discussed in "point 8", even in an urban setting, the riparian corridor must provide the following functions related to fish habitat:

1. attenuating nutrients, contaminants and sediment in runoff from the adjacent landscape;
2. providing detritus to the watercourse;
3. providing root mass and large organic debris for cover;
4. maintaining the shading provided by the riparian vegetation along the creek corridor to maintain water temperature within the creek.

Additional functions of riparian buffers in terms of terrestrial habitat also include:

5. enhancing biodiversity within the creek corridor (both in a terrestrial and a fisheries context)
6. Providing adjunct habitat for species that use habitat immediately along the creek (in case of flooding);
7. providing linkage for vulnerable species through the urban habitat;
8. providing flood control.

North-South Environmental and Gartner-Lee Limited were retained in the spring of 2006 to recommend a planting plan for the proposed buffer that would retain these functions. Fisheries concerns are addressed by Gartner-Lee Associates (point 8). This response details the Riparian Restoration plan, and describes how the proposed vegetation addresses required buffer functions. The attached Riparian Restoration plan shows the recommended planting as a schematic. A detailed planting plan will be submitted as part of the detailed design. The following section discusses each of these functions, and provides a rationale for the approach taken in designing the width of the buffer and the restoration proposed.

The soil conditions along the creek are expected to be variable. The area between the hazard land boundary and the edge of the development will be cleared, and graded or filled to provide a consistent 3:1 slope between the hazard line and the development line. A layer of topsoil will be placed on this slope. Most of the proposed upland species of trees, shrubs and ground flora are expected to thrive in this zone. The upper slopes of the creek valley will likely be relatively dry, with the coarse soils presenting a challenge to species that depend on high moisture levels and rich soils. The slopes are steep in some places, adding to the requirement for species that can tolerate droughty soils. The lower slopes of the creek, as well as the floodplain, are likely to represent habitat particularly for wetland shrub and tree species. There will be limitations to the success of some plant materials on the creek banks, because of periodic high water flows and possibly ice scour. Therefore, species recommended for the creek bank are those with extensive root systems.

Description and Rationale for the Functions Provided by the Riparian Restoration Plan

Along the west side of Howitt Creek, the development plan calls for a buffer of varying width. The total proposed west buffer will average 24 metres in width, with a maximum width of 32.4 metres and a minimum width of 16.5 metres. Within this buffer zone, there will be a “no-grading” area, and a perimeter area where grading is required to achieve stable slopes. The total proposed no-grading zone will average 14.5 metres in width, with a maximum width of 26.1 and a minimum width of 10.5 metres. The entire riparian area will be planted according to the attached planting plan to achieve maximum benefit to Howitt Creek.

The attached Riparian Restoration plan addresses plantings along the creek corridor. The following sections describe the building of the planting plan according to the function served best by various plant materials. The tree, shrub, herb and grass species recommended for certain functions are not restricted to a single function, but rather are selected to serve several of the functions required. Species are mentioned first according to their primary function, but are reiterated later in the plan where they serve additional functions.

Attenuation of nutrients and contaminants from the adjacent landscapes

Runoff from adjacent landscapes can affect streams because it can carry nutrients and sediments picked up through soil erosion. Nutrients can also be picked up by runoff if it washes over paved areas, lawns or soils where contaminants (e.g. pesticides, fertilizers, road salt) have been deposited. Contaminant and sediment loading can increase with decreasing size of soil particles, as finer particles can carry more contaminants than coarse particles, and finer particles are more easily carried greater distances in runoff. Some nutrients and contaminants (e.g. nitrates) can also enter a creek through subsurface runoff.

It must be emphasized that the western part of the site is expected to be almost completely paved. All runoff from the site will be directed west to the storm sewer system. Therefore, the main function of the buffer with respect to attenuation of runoff would be to prevent dust from migrating into the creek, and to prevent sediment originating from erosion within the 15-30 m area immediately adjacent to the creek. We recommend that to achieve this function, existing shrubs and trees be retained, and enhanced with a variety of native trees, shrubs and herbaceous plants (see Riparian Restoration plan), to produce a dense, rough vegetation cover that will retain runoff, allowing sediment to drop out.

The rationale for this is as follows. Buffer quality (not just width) is important for maintaining stream quality. If buffers are properly designed, sediment and contaminants in runoff tend to be deposited within the buffer area. The width, the gradient and the type of vegetation within the riparian buffer are all important for retaining sediment and/or uptaking nutrients and contaminants.

Recommendations

Contaminant and sediment release to Howitt Creek from the developed portion of the site is expected to be entirely mitigated by collection of runoff. Therefore, the proposed buffer of 16-32 m (Riparian Restoration plan), enhanced by plantings, will be appropriate for the local treatment of runoff from the edges of the site, given that it needs to serve other functions as well (see providing detritus to watercourse and enhanced shading points below). A stratified buffer adjacent to the creek is recommended, with an outer layer of dense, herbaceous vegetation, and within the existing riparian corridor, in-planting with additional shrubs and trees. Herbaceous vegetation is recommended as the outermost layer because soils with dense, “rough” vegetation attenuate runoff more effectively than soils with little or no vegetation. The vegetation acts as a filter, but also the vegetation slows the speed of the runoff so sediment drops out. Rough vegetation also allows runoff to sink into the soil. The recommended species are deeply rooted, and therefore have the capability of taking up subsurface contaminants or nutrients.

We also recommend plantings on the slopes and at the toe of the slope. The slopes of the riparian corridor are steeper near the creek. The gradient of a riparian buffer is important because water runs faster downhill, and sediment, contaminants and nutrients are carried more effectively by faster-moving water. Runoff moving downhill tends to form channels, and may move more quickly than sheet runoff. If runoff is allowed to sink into the soil, it may slowly percolate through soils toward the creek, and this reduces contaminants because as runoff sinks into the soil, many nutrients are adsorbed onto soil particles.

Annual rye grass should be used to stabilize soils prior to planting. This cover will die off in one or two years, but will allow native species plantings to take hold. Recommended species for the top of the bank particularly include native, mat-forming herb and grass species tolerant of coarse, droughty soils. However, many other species of cultural meadow would be suitable, including the last three species on this list:

Grasses and Herbs (shown on Riparian Restoration plan)

- Big bluestem
- Little bluestem
- Indian grass
- Switch grass
- Poverty grass
- Hair grass
- Pennsylvania sedge
- Canada Wild Rye Grass
- Black-eyed Susan
- Heath Aster
- Wild Bergamot
- Woodland Sunflower
- New England aster
- Canada goldenrod
- Tall goldenrod

The following species are acceptable for the purposes of native grass-herb cover establishment:

- Annual Rye grass (used as a nurse crop)
- Non-native Fescues (Chewings, Sheeps, Hard, Tall)

Enhancement of the buffer with additional trees and shrubs is also recommended. Tree and shrub species will be recommended below.

Additional Recommendations

To increase the effectiveness of the riparian buffer, it is recommended that activities often associated with edges of commercial developments, such as storing garbage or snow, be located away from the riparian corridor. Storing garbage is likely to encourage urban predators such as skunks and foxes to the natural area. Snow storage near the riparian area may increase the likelihood that contaminants such as road salt will be released to the creek if they overrun the storm system.

Providing detritus to the watercourse; providing root mass and large organic debris for cover

Many invertebrates that provide prey for fish, birds and mammals feed on organic detritus (or the bacteria that grows on detritus). This detritus originates from vegetation, mainly trees, in the riparian zone, often the leaves falling from overhanging branches. Root masses of large trees suited to moist locations growing along the river bank also tend to project above the water at the edges of creeks, and provide overhangs for fish and cover for small mammals. Standing dead trees adjacent to the stream provide snags for cavities, and logs fall on the banks and into the stream to provide cover.

Recommendations

The attached Riparian Restoration plan shows groves of native trees that tend to grow to a large size and develop a broad, overhanging canopy. Trees could be planted on any stable area of the creek bank, as the bank is steep, and the canopy should be relatively broad. The recommended species are tolerant of changes in moisture regimes. It is recommended that a variety of trees and large shrubs with differential growth rates and longevity be planted, particularly including those that are longer-lived than those currently present. These include:

Trees for Dry Locations (shown on Riparian Restoration plan): long-lived, slow growing species

- Bur oak
- Red oak
- Sugar maple
- Bitternut hickory
- American beech
- Black cherry

Trees for Dry Locations (location shown on Riparian Restoration plan): short-lived, fast growing species

- Hop-hornbeam
- Basswood
- Paper birch
- Large-toothed aspen
- Trembling Aspen
- Ironwood

Trees for Moist Locations (shown on Riparian Restoration plan)

- Silver maple
- Red Maple
- Blue-beech
- Yellow birch
- Balsam poplar
- Peach-leaved willow
- Slippery elm
- Pussy willow
- Black willow
- Speckled alder

Additional Recommendations

It is recommended that planting on the area where slopes will be modified (between the edge of the development and the hazard line) be the first priority. It should be accomplished as quickly as possible following grading in this area, in order to stabilize the soils. Silt fencing should be placed on the downslope side of the creek prior to the first tree clearing in this area. The area between the hazard line and the development line should be monitored during construction to ensure that topsoil is not being washed out into the creek.

Enhancing the shading provided by the riparian vegetation along the creek corridor to maintain water temperature within the creek.

The coolwater status of the stream stems from several factors: the origin of the stream in stormwater piped for a long distance underground, the groundwater inputs through the pipe, and the extensive overhanging shade along the creek. Since most of the factors upstream are not controllable, enhancement of the shade along the creek will provide insurance in case any of the other factors change.

Recommendations

The planting concept shown on the Riparian Restoration plan is configured to enhance riparian shade. Though there is already a heavy overhanging cover, many of the existing trees are short-lived, shade-intolerant species, many of which are non-native (Siberian elm, crack willow, European basswood) or may be threatened by disease in the present or in the future (American elm, green ash). Therefore, planting of the species recommended above will enhance shade, with a variety of long-lived, slow growing species and also shorter-lived, faster-growing species. In addition, cedar and white spruce (coniferous species, Riparian Restoration plan) are recommended along the upper portion of the banks to reduce the amount of light penetrating the side canopy at times of the day when the light is at a low angle (evening and morning). This will also act as a windbreak to reduce the drying winds (and dust) that enter the riparian area.

Dense Coniferous Trees (shown on Riparian Restoration plan)

Eastern white cedar
White spruce

Additional Recommendations
None

Enhancing biodiversity within the creek corridor (both in a terrestrial and a fisheries context); providing adjunct habitat; providing linkage

Riparian areas can be used as habitat by small mammals, reptiles and amphibians, and many bird species. They are especially important in an urban context where they may represent the only remaining natural habitat. At times of flooding, the riparian corridor must provide enough habitat for species that inhabit the corridor to move to higher ground. There should be continuous cover to provide linkage for small, vulnerable species that require protection from predators and other environmental factors. In particular, it should provide cover for amphibians, which are highly vulnerable to drying as well as predation.

Recommendations

The Riparian Restoration plan has been specifically designed to enhance diversity and provide habitat and linkage. Diversity of planted vegetation, in both a structural context and a species context, will promote diversity of wildlife use. Twenty-four tree species and fourteen shrub species have been recommended. These include a variety of seed-bearing species with considerable value to wildlife as forage species, as well as species that provide nesting and roosting habitat. As shown on the Riparian Restoration plan, it is recommended these species be planted in clusters to provide a variety of open and closed-canopy habitats. Continuous cover will be enhanced by shrub, grass and herb plantings along the riparian corridor. The dense coniferous trees for the top of the bank will provide additional cover and shade.

Additions to species recommended above, selected to provide a greater diversity of forage, include the following shrub species (the ones listed here do not include those that are already very common on the site):

Shrubs for Moist soils

- Nannyberry
- Highbush cranberry
- Silky dogwood
- Bebb's willow
- Sandbar willow
- Heart-leaved willow
- Ninebark
- Elderberry

Shrubs for Dry Soils

- Downy serviceberry
- Smooth serviceberry
- Snowberry
- Bush honeysuckle
- Alternate-leaved Dogwood
- Staghorn Sumac

Additional Recommendations

Nest boxes should be provided to encourage the use of the site by cavity-nesting species. Debris such as logs and rocks should also be placed throughout the habitat.

TERRESTRIAL

14. Detailed Landscape Plan

A Riparian Restoration Plan is attached to this response.

FILL PERMIT

15. Fill , Construction and Alteration to Waterways Permit

An application for Fill, Construction and Alteration to waterways Permit will be submitted to the GRCA as part of the Site Plan Approval process which will follow the Official Plan Amendment and Zone Change planning approval process.

Addendum Report Prepared by:

North-South Environmental Inc.
Sarah Mainguy

Addendum Report Prepared by:

Blackport Hydrogeological
Ray Blackport

Addendum Report Prepared by:

PV Consultants Ltd.
Peter Van Parham

Addendum Report Prepared by:

____

V. A. Wood (Guelph) Incorporated
John Broad

Addendum Report Prepared by:

____

Gartner Lee Ltd.
Mike Johns

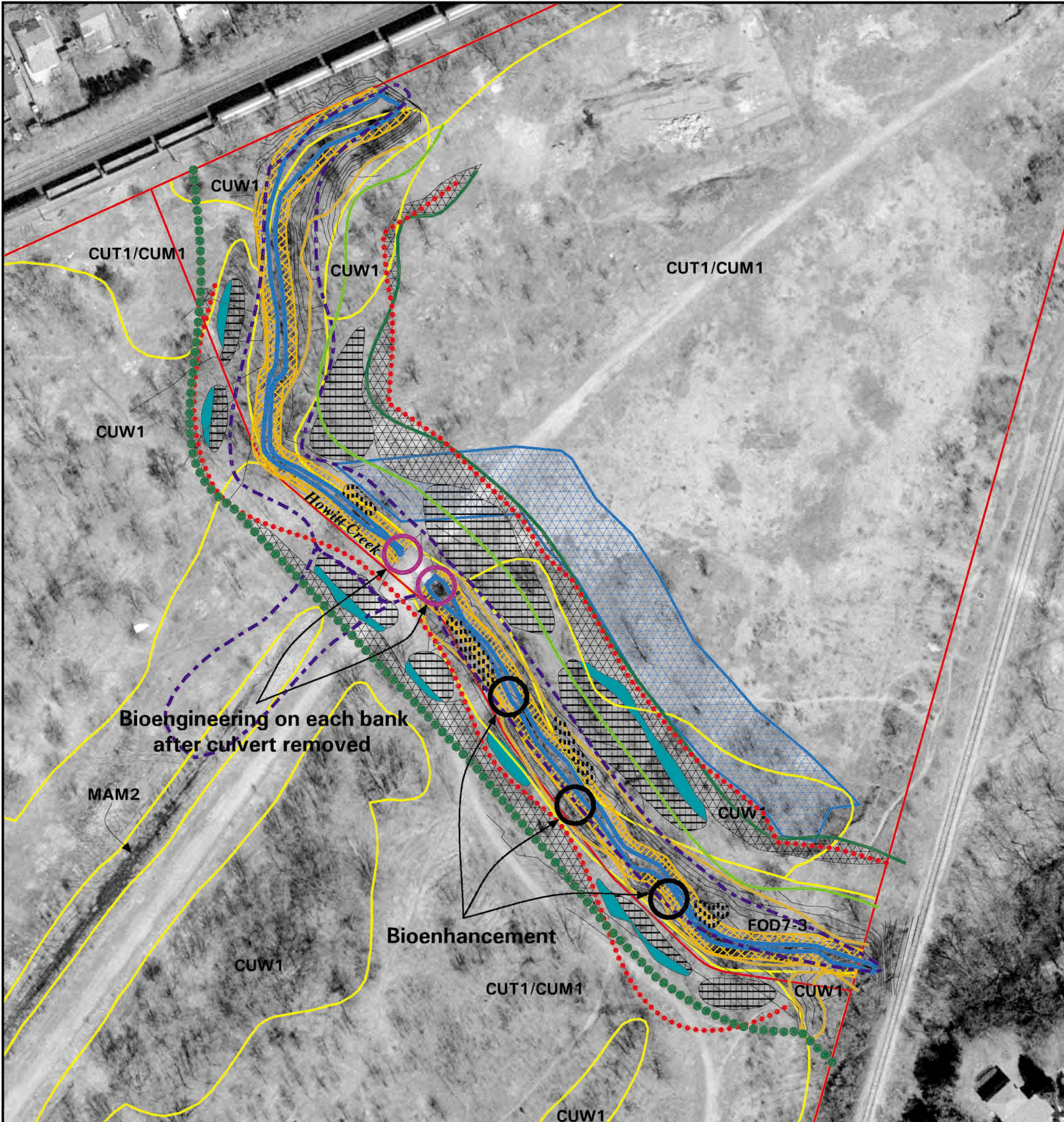
Addendum Report Prepared by:

____
Black, Shoemaker, Robinson & Robinson Limited
Nancy Shoemaker, MCIP, RPP

ANALYSIS BEFORE & AFTER DEVELOPMENT LINE MOVED BACK BETWEEN G-G & D-D
AS PER TUES APRIL 04 06 MEETING

X-section	EXIST Grade @ Hazard Line	PROP Grade @ Develop-ment Line	Δ Negative Values Slope Down To Creek. +ve Values slope down to Parking Lot	X3	Actual Distance of Development Line From Hazard Line (Available for Sarah's Plants on the 3:1 Max slope) B4 Ajustment	Distance of Hazard Line From Creek Stable Bank B4 & After Adjustment (Ie Same In Both cases)	Actual Distance of Development Line From Creek Stable Bank B4 Adjustment F + G	Actual Distance of Development Line From Hazard Line (Available for Sarah's Plants on the 3:1 Max slope) After Ajustment @ E-E & F-F	Actual Distance of Development Line From Creek Stable Bank After Adjust-Ment I + G	HAZARD LINE COULD MOVE AT E-E & F-F AS FOLLOWS
J-J	318.2	321.25	-3.05	-9.15	10	12	22	10	22	**12**
I-I	321.5	321.25	0.25	0.75	2	26.1	28.1	2	28.1	**17.5**
H-H	319.8	321.25	-1.45	-4.35	5	11.5	16.5	5	16.5	**11.5**
G-G	320	321.25	-1.25	-3.75	5	12.1	17.1	5	17.1	**12.1**
F-F	319.1	321.25	-2.15	-6.45	7.5	11.5	19	20.9	32.4	**24.9**
E-E	319.9	321.25	-1.35	-4.05	5	10.5	15.5	19.4	29.9	**24.9**
D-D	320.7	321.25	-0.55	-1.65	3	16.4	19.4	3	19.4	**16.4**
C-C	322.9	321.25	1.65	4.95	6	15.7	21.7	6	21.7	**15.7**
B-B	325.5	321.25	4.25	12.75	14	14.8	28.8	14	28.8	**14.8**
A-A	NOT Applicable									
			AVERAGES		6.4	14.5	20.9	9.5	24.0	**16.6**

Lafarge Property EIS
Riparian Restoration



Legend

	Environmental Land Classification
CUT1/CUW1	Cultural Thicket/Cultural Meadow
CUW1	Cultural Woodland
FOD7-3	Willow Lowland Forest
MAM2	Mineral Meadow Marsh
	Trees and Shrubs for Moist Soils
	Grasses and Herbs
	Trees for Dry Locations
	Trees for Moist Locations
	Dense Coniferous Trees
	Storm Water Management Area
	Property Boundary
	Howitt Creek
	Top of Slope
	30m Setback from Howitt Creek Bank (Toe of Slope)
	15m Setback from Howitt Creek Bank (Toe of Slope)
	Hazard Limits
	Floodline
	Development Limits
	Contours

Planting Plan (see text for list of species)

N

Scale 1:1 250

20 0 20 40 60 80

Metres

North-South Environmental Inc.

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April 2006

N

S

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Specialists in Sustainable Landscape Planning

Environmental Impact Study for the Lafarge Property Addendum II: Impacts of Revised Design and Tree Conservation Plan

City of Guelph

November, 2007

Prepared for:
Silvercreek (Guelph) Developments Limited

Prepared By:
North-South Environmental Inc.
35 Crawford Cres., Suite U5, PO Box 518
Campbellville, Ontario
L0P 1B0

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1.0 Introduction

In October 2005, North-South Environmental submitted an Environmental Impact Study focusing on existing conditions and potential impacts from proposed development of the approximately 23 ha former Lafarge Quarry west of Howitt Creek. Comments were received on that report from Grand River Conservation Authority (GRCA) and from the Guelph Environmental Advisory Council (EEAC), and were addressed in an addendum to the EIS, dated May 2006 (North South Environmental 2006a). In October 2006, a tree-saving plan was submitted for the initial phase of the Leon's store development on the property (North-South Environmental 2006b).

The May 2006 addendum primarily addressed the restoration of trees, shrubs and herbaceous species to the creek corridor to enhance aquatic and terrestrial habitat. One additional comment has been received from GRCA since that addendum was submitted (letter from Fred Natolochny, GRCA to Melissa Castellan, City of Guelph dated May 17 2007):

- "The floodplain analysis needs to be updated to reflect the revised flows and the existing and proposed grading".

The City of Guelph requested an updated EIS to address the revised site plan, to provide a tree conservation plan, and to address the issue of the floodline of the creek raised by GRCA (letter from Peter Pickfield, Garrod Pickfield LLP to Steve Zakem, Aird & Berlis LLP dated June 29 2007). North-South Environmental Inc. was retained by Silvercreek (Guelph) Developments Limited to update the EIS for the former Lafarge quarry in Guelph based on the revised site plan for the western part of the site, and also to address the impacts of development of the park east of the creek. Though the 2005 EIS for the area east of Howitt Creek proposed the eastern part of the site be left as a park, the planting plan for the park has now been formalized, and includes a plan for a storage area for extreme flooding events (exceeding the 10-year floods) from the creek, including runoff from the eastern part of the site and the urban area north of the site. This stormwater storage concept has been approved by GRCA subject to review of detailed engineering plans. In summary, the purpose of the present report is to:

- Note the finding of an additional plant species (provincially significant) during tree surveys on the site;
- Show the present floodline and post-development storage area on the site;
- Discuss additional impacts (if any) from the revised site plan;
- Provide a tree conservation report for the entire property, including the Leon's site (already submitted in October 2006) and the plan for the eastern portion of the site.

2.0 Provincially Significant Plant species

Since the EIS and subsequent addendum were submitted, one provincially significant plant species, biennial gaura (*Gaura biennis*) was noted on the site, in September 2006 (during tree surveys for the Leon's site). Its status in Ontario is S2; defined as
"Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province."

This species is not regulated as an endangered species or Species at Risk in Ontario or Canada. It is thought to be adventive (introduced by human activities) in parts of its Ontario distribution. On the site, the plant is probably of non-native origin (Oldham 2007, pers. comm.), as it is growing on an area where soils were removed and where no remnant native habitat is extant, among predominantly non-native vegetation. The centre of distribution for this species is in Lambton County, and the nearest occurrences in Ontario are in Brant County and Niagara Region (Argus *et al*. 1984).

It is recommended that the plant be re-located to Junction Park east of Howitt Creek to conserve it, even though the plant is not native to the site. This should be done to preserve the plant's genetic material and heritage significance. The plant's location should be flagged prior to site grading, and seed collected in the fall. Since the plant is a biennial, the first year rosettes can be harvested as well. The plants should be seeded and rosettes planted into similar habitats in Junction Park.

3.0 Revised Site Plan

The revised site plan is shown in Figure 1. The plan includes 16.29 ha of commercial development west of Howitt Creek (excluding Silvercreek Parkway), and 3.89 ha of naturalized parkland east of Howitt Creek. The natural open space of the Howitt Creek corridor comprises 1.61 ha. A further 0.21 ha will be added to the open space along the west side of the creek between the development line and the hazard line.

3.1 Commercial Development West of Howitt Creek

As before, the present plan includes development of all lands west of Howitt Creek for commercial uses. As in the original site plan, all trees will be removed from the development area, up to a slightly revised development line along the creek shown on Figure 1, with the exception of the large bur oak (*Quercus macrocarpa*) identified for preservation in the original EIS. Recommendations for conservation of the oak tree within the present design were provided in the original EIS, and were also provided in the subsequent Leon's tree saving plan. In addition, contrary to what was noted in the tree-saving plan for the Leon's development (North-South Environmental 2006b), trees will now be removed from the railway embankment on the southern boundary of the site to allow for more efficient site planning.

3.1.1 Additional Impacts and Mitigation Associated with Revised Development

Impacts from the revised site plan west of the creek have not changed from those associated with the previous plans for the site with the exception of the fact that the current plan includes removal of trees along the railway embankment on the northern and southern boundaries of the site, west of Howitt Creek. Trees on the north embankment must be removed as the railway line will be temporarily diverted during construction of the underpass that will allow vehicle traffic to enter the site along Silvercreek Parkway north of the site.

Mitigation recommended for this impact is re-planting of trees along the railway embankments. A tree conservation plan for the west side of the site is found in Section 3.1.

Lafarge Property Guelph

Figure 1: Development Plan, Silver Creek Junction Retail Development and Park

Legend

- Proposed Plantings
- Existing Vegetation
- Bur Oak Conservation Site
- Development Limit
- Existing Flood Line (resulting from quarrying activites)
- Top of Slope
- Howitt Creek
- Flood Attenuation Area
- Trails
- Buildings

N

1:4,000

0 50 100 200 300

Meters

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3.2 Silver Creek Junction Park (East of Howitt Creek)

Current Floodplain and Stormwater Design

The present floodplain of the creek (which has resulted from the considerable excavation on the site over its industrial lifetime) is shown in Figure 1. Frm time to time, flood water from the creek traverses the site and pools in a shallow depression on the western boundary of the site, where it backs up before flowing through the culvert under the Hanlon Expressway into the North West Drainage Channel.

The post-development flood storage area is also shown in Figure 1. The stormwater design east of the creek has been revised to include a storage area with enough capacity for all flows that enter Howitt Creek, including those from the eastern area of the site and the urban area north of the site. Flooding west of the creek will no longer occur. Because of the development west of the creek, flooding events will be much less frequent than they are at present, with water entering the storage area approximately every two years. The construction of the storage area will mainly eliminate non-native herbaceous and shrubby vegetation along the southeast side of the site adjacent to the railway tracks. The storage area will be approximately 16,500 m2, with gently undulating topography. In most places the floor of the storage area will be at or just below grade, though in small areas of the site the sides will be approximately 2 m in height. The maximum slope will be approximately 4:1. The storage area will almost always be dry, or with minimal amounts of pooled water, except in extreme flooding events, when water is expected to reach an average depth of approximately 1.5 m (maximum 2 m) for a period of approximately half an hour. More detail can be found in the feasibility study for Junction Park (The Landplan Collaborative Ltd. 2007).

Water will drain out of the storage area through two catch basins and a headwall into Howitt Creek. Water from the western (developed) portion of the site will drain into swales on the site. The swales will be constructed to allow infiltration of most flows. However, the remaining flows from the western portion of the site will be directed to the large culvert under the Hanlon Expressway (shown by the arrow in Figure 1), which will be dredged to ensure that drainage is improved to the Northwest Drainage Channel. The main east-west swale through the middle of the site will be constructed to improve ecological linkage through the site, using plantings of native herbs, shrubs and trees. The culvert will be cleaned to ensure it can be used for passage under the Hanlon.

Silver Creek Junction Park

Soil will be imported on to the site using the gravelly soils available after grading and servicing the western part of the site (which could likely be approximately 20,000 tonnes, resulting in an average depth on the eastern part of the site of approximately 10 cm). In accordance with the recommendations of the EIS (North-South Environmental 2005), the park will be left sparsely vegetated except at the periphery. Soils will be used judiciously to provide topographic variation in the substrate. The original EIS recommended retention of the largely open character of the site east of the creek, sculptured seeding with soils to vary the terrain and encourage diversity in plant species, and planting with native species suited to a variety of conditions, particularly including dry soils. The current design includes addition of some soil to increase diversity of substrate for vegetation, and planting of approximately 2200 native trees, as well as additional plantings of shrubby and herbaceous native species.

3.2.1 Impacts and Mitigation of Proposed Park Design

The flood storage area should be designed to permit its potential function as a natural system as much as possible, within the requirement to design for storage. Because of the small area within which the storage area is situated, the requirement for an area large enough to retain flows from an extreme flood event will constrain the design to a certain extent. The storage area is 2 m below grade in a limited area, though it is at grade in most places. Where possible, soils and contours within the area should be diversified to provide areas suitable for a diversity of plant growth that can withstand occasional flooding. However, the storage area will largely be dry except during extreme flooding events. The storage area should be vegetated with a variety of adaptable native species suited to the conditions.

As noted in the 2005 EIS, plantings on the terrestrial part of the site should be native species suited to the droughty conditions that will likely still be present even after addition of the small amount of topsoil from the western part of the site within the park. Trees should particularly be suited to droughty soils, though there may be some opportunity to mound soils in some areas, providing deeper soils where there would be some additional choice of species. The park design should include native shrub and herbaceous plantings as well as trees, as noted in the 2005 EIS.

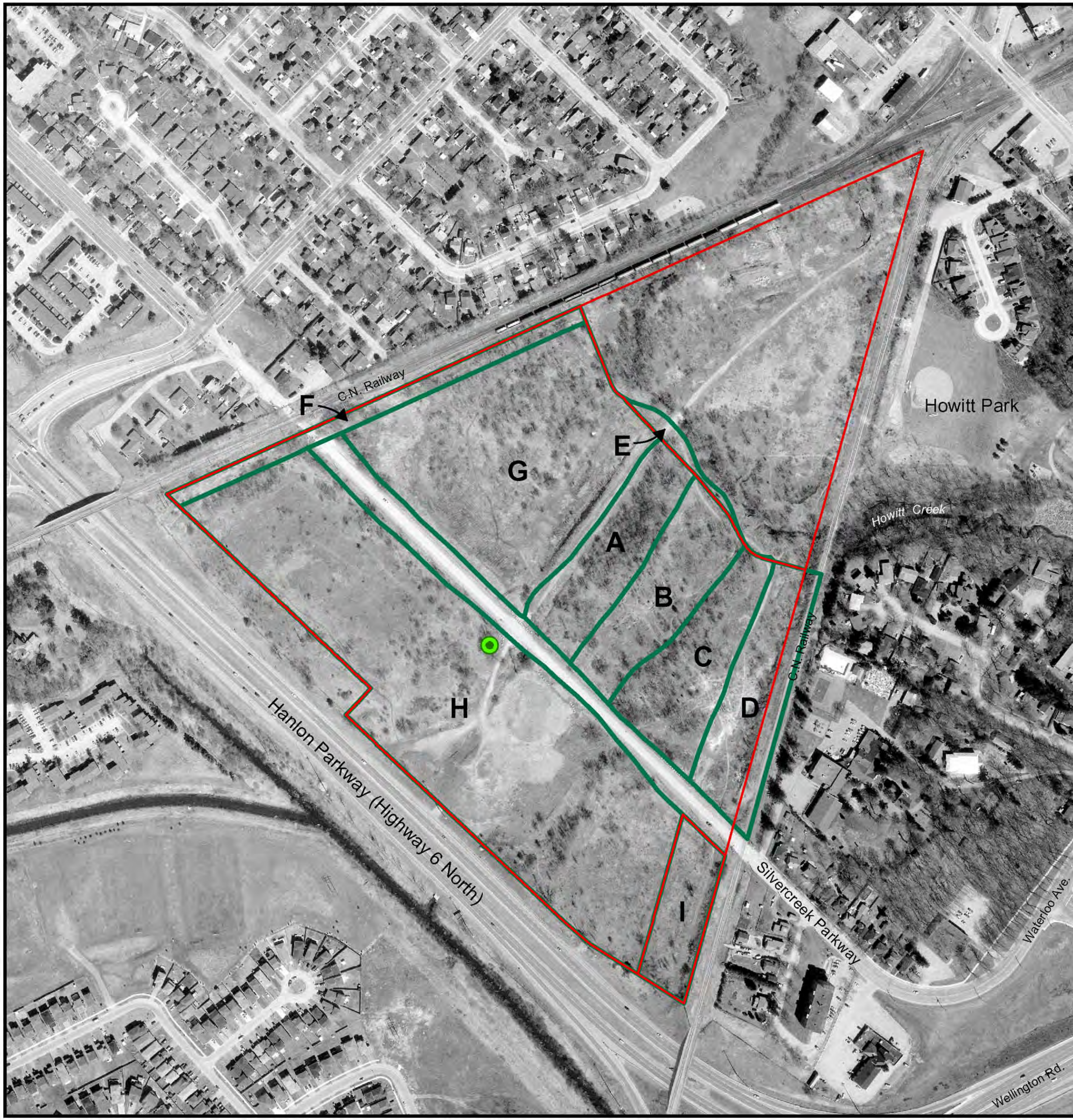
4.0 Tree Survey

The purpose of the tree conservation plan is to provide an evaluation of the species, number and condition of trees affected by the development. The Lafarge Property is situated at the south end of Silvercreek Parkway, just east of the Hanlon Expressway, between two active railway lines. The proposed development is almost entirely situated on waste land formerly used for gravel extraction and concrete production. However, Howitt Creek crosses the property and drains southward to the Speed River. The area around the watercourse, along with the wooded area and steep slopes adjacent to the Howitt Creek, has been included within the Lower Speed River Scheduled Area. The treed area southwest of the watercourse was surveyed in 2006 as part of the tree survey for the Leon’s development (North-South Environmental 2006b), and was submitted at that time. Results from that survey have been incorporated into this report, which addresses the impact and mitigation of tree removal for the entire western portion of the site, which will be developed for commercial purposes. The tree survey did not include the trees along the creek valley, which will not be removed. It also did not include the eastern part of the site, where construction of the flood storage area will mainly be confined to areas that are not treed.

The current survey was completed to determine the tree loss due to the development of land and the compensation proposed on the rest of the property. The highest level of effort was focused in areas D, E, F and I (shown in Figure 2), as these are the areas where it may be possible to conserve some trees, or in which trees can be directly replaced after re-grading. Other areas (A, B, C, G and H where buildings and parking lots will be developed), were surveyed more generally, as described in the next section.

Lafarge Property Guelph

Figure 2: Tree Survey Areas



Legend

- A Tree Survey Locations
- Study Area Boundary
- Location of Bur Oak

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0 50 100 200 300

Meters

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4.1 Methods

Field inspections were undertaken for the Leon's site on September 19th, 26th, and October 5th 2006. All trees over 10 cm in diameter at breast height (dbh) were included in the survey. Nine areas (shown in Figure 2 as areas A to I) were delineated roughly based on areas of tree concentration. The majority of Area A is a cultural woodland. Area B is mainly cultural thicket and cultural meadow. The dominant community in Area C is a cultural woodland community as well as some cultural thicket and cultural meadow. The area adjacent to the railroad track is Area D. This area is primarily cultural thicket and cultural meadow with some cultural woodland closer to the railway line. The final area included in the first survey, Area E, is the upper riparian land around Howitt Creek between the development line and the hazard line along the creek, where the creation of a 3:1 slope is proposed, though the area will not be developed *per se*. This area is primarily Willow Lowland Forest, with cultural woodland at the top of the bank.

Areas A to C are proposed to be completely developed and all trees in these areas will be lost. In these areas, the focus was on counting the number of each species. Area D includes the edge of the developed area, with some portions within and some outside the development. Though the railway embankment is now proposed to be re-graded, there are opportunities for planting native species on the slope. No development is proposed in Area E, and tree-saving efforts will be focused on the periphery, at the edge of development. Therefore the trees in Areas D and E were each evaluated in terms of their condition as well as species.

For the remainder of the site, field inspections were undertaken on August 2nd and 3rd, 2007. All trees over 10 cm in diameter at breast height (dbh) were included in the survey. Four areas (shown in Figure 2 as Areas F to I) were delineated roughly based on areas of tree concentration. Area F is a cultural woodland, the majority of which is located on a slope (the northern railway embankment). This area was delineated based on a 15 m setback from the property boundary, which was surveyed and flagged prior to the site visit. The dominant community in Area G is cultural woodland with some small areas of cultural meadow. Area H is a complex of cultural thicket and cultural meadow communities. The final area, Area I, is not located within the subject property area boundary. However, this area was surveyed because it is directly adjacent to the subject property and according to the development plan, the commercial development will occur right up to the edge of this area. This area is primarily cultural thicket and cultural meadow.

Areas G and H are proposed to be completely developed and all trees in these areas will be lost. Therefore in these areas, the focus was on counting the number of each species. Area F includes the edge of the developed area; approximately 15 m from the edge of the northern property boundary. The exact limits of disturbance in this area are uncertain, as the railway embankment will have to be re-graded because the railway track in this location must be re-routed in order to build the underpass for Silvercreek Parkway. However, it would be considered desirable to replace or save suitable native trees in good condition if it is feasible. Area I is just outside the property and will not be directly affected but could be impacted by the adjacent development; therefore it is important to identify trees which are important for preservation. Since Areas F and I have potential for tree conservation or replacement, the trees in these two areas were each evaluated in terms of their condition.

The overall condition of each tree in Areas A, D, F and I was assessed by examining the trunk for defects and evidence of rot or damage; specifically looking at the trunk integrity, crown structure, and crown vigour. The tree vigour class was determined using this information. Classes ranked from 1 to 6. Class 1 trees are in excellent condition and at no risk, while class 6 trees are dead and have no live foliage present. The classes between 1 and 6 ranked as follows: good condition (class 2), fair condition (class 3), poor condition (class 4), and very poor condition (class 5). Appendix 1 provides details of the conditions and classes used to assess these trees.

4.2 Findings

4.2.1 Tree Inventory

The trees identified in the tree survey are described in Appendices 2-10. A summary of the native and exotic tree species found in each area is located in Appendix 11. A summary of the number of trees lost in each area of the development is found in Table 1.

Almost all trees on the site are either non-native, or are native but relatively short-lived pioneer tree species unsuitable for retention within the development. There are no remnant mature forest tree species in good condition other than one large (>100 cm dbh) Bur Oak (*Quercus macrocarpa*), already scheduled to be retained, along Silvercreek Parkway. Locations for this tree is shown in Figure 2.

Table 1: Summary of native and non-native trees on the Lafarge study site (native trees are primarily balsam poplar and trembling aspen).

Location	Total	Native	Exotic
Area A	160	33	127
Area B	117	95	22
Area C	157	99	58
Area D	62	34	28
Area E	19	7	12
Area F	288	60	228
Area G	203	17	186
Area H	112	65	47
Area I	20	12	8
Total	**1138**	**422**	**716**

The majority of trees in areas A to E are pioneer and fast-growing species such as Trembling Aspen (*Populus tremuloides*), Balsam Poplar (*Populus balsamifera ssp. balsamifera*), Manitoba Maple (*Acer negundo*), and Hybrid Willow (*Salix x rubens*). These tree species are quick to colonize disturbed ground. There are no remnant mature forest tree species in these areas. Generally, most trees on the site are between 5 and 30 cm dbh, with a few large willows exceeding that diameter.

The majority of trees in areas F to I are short-lived pioneer and fast-growing species; predominantly non-native species such as Siberian elm (*Ulmus pumila*) and Manitoba maple (*Acer negundo*), but with some natives, mainly trembling aspen (*Populus tremuloides*) and balsam poplar (*Populus balsamifera ssp. balsamifera*). These tree species are on the site because they are species adapted to colonizing disturbed ground.

Generally, most trees on the site are between 10 and 30 cm dbh, with a few large hybrid willows which greatly exceed that diameter (Appendix 1). The one exception to this is the massive bur oak west of Silvercreek Parkway.

4.2.2 Tree Condition

Condition was evaluated in areas D, E, F and I (see Methods). A summary of the condition of trees in these areas is found in this section.

Areas D-E
Summary of condition for areas D and E is noted in Table 2, below. Tree condition in areas F and I are summarized separately.

Table 2. Summary of condition of trees in areas D and E, Lafarge property, Guelph

Area Number	**Number of Exotic trees**	**Number of Native trees**				
		Condition				
		Poor	**Fair**	**Good**	**Excellent**	**Total**
Area D (62 trees)	28	0	6	16	12	34
Area E (19 trees)	12	0	0	6	1	7
Total	**40**	**0**	**6**	**22**	**13**	**41**

The most common tree defects are split stem, adventitious branching, and moderate dead wood in the crown.

Conclusion
Trees in these areas are mainly in good or excellent condition. To replace and enhance the function of the trees along the embankment, it is recommended that large-caliper native trees and shrubs be planted at a high density in Area D. Infill planting, particularly of shrubs and herbaceous species, is recommended in Area E to improve coverage by longer-lived native species, to improve terrestrial and aquatic habitat function, and to provide a protective edge to the forest along the ravine, as outlined in the May 2006 EIS Addendum.

Area F
In Area F there are 290 trees in total. A summary of the trees in Area F is as follows:

- 32 trees in good condition, 79 trees in fair condition, 163 trees in poor condition, and 16 trees which are in very poor condition.
- Of the 290 trees, 60 (21%) are native, 228 are non-native, and 2 are unknown in terms of status.
- 13 different tree species;
    - 6 species are native, 6 are non-native, and 1 species has unknown status.

The most common tree defects are broken or severed primary limbs as well as foliar chlorosis.

This area is unusual in that it supports one mid shade-tolerant native tree (Black Walnut), a longer-lived species in fair condition, as well as a large number of short-lived successional species in good condition. A summary of the native trees in good condition is shown in Table 3. The black walnut is a longer-lived native species, but is multi-stemmed, and has some dead twigs and branches and was considered in fair condition. Large-toothed aspen and trembling aspen are generally short-lived successional species.

Table 3. Summary of species and size of native trees in good condition in Area F

Native Species (good condition only)	**Size (dbh)**	**Number**
Large-toothed aspen	12 cm	1
Trembling aspen	10-60 cm	26

Conclusion
If native trees were predominant on this slope, it would be beneficial to recommend that trees in good condition be retained. However, since most trees are in poor to fair condition or are non-native, and a large proportion are short-lived successional species, drastic measures to retain the trees (such as preservation of the upper portions of the slope through construction of a retaining wall) are not recommended. Replacement of the current embankment by a steeper slope (which may be required to provide the appropriate building setback) would allow more trees to be planted on the slope than if a retaining wall were constructed.

Area I
The trees in Area I should remain primarily un-affected because they are not on the subject property, however they may be subject to some edge effects due to the adjacent development. A summary of the 20 trees in Area I is as follows:

- 4 trees in good condition, 10 trees in fair condition, and 6 trees which are in poor condition.
- Of the 20 trees, 12 are native and 8 are non-native.
- 6 different tree species;
    - 4 species are native and 2 are non-native.
- The most common tree defects are broken or severed primary limbs.

Conclusion
There are no significant native trees in good condition in this area that would be affected by adjacent development.

4.3 Potential Impacts from Grading Changes

Grading changes have not been determined in detail. However, the following are impacts related to grading changes currently understood to be specific to certain areas of the site:

- The southern railway embankment is proposed to be re-graded. All trees will be lost from Area D. However, the re-graded slope will provide suitable location for native trees to be planted.
- Under the current site plan, there will be no re-grading within Area E. No trees will be removed. The grades within the development will be matched to those within Area E, so the only trees that might be affected would be those at the development edge of this zone.
- Grade changes in Area F will result in the loss of trees on the slope; however some trees near the top of the slope could possibly be maintained provided precautionary measures were taken to preserve the trees. The re-graded slope will provide a suitable location for tree planting.
- Grade changes and construction in Areas A, B, C, G and H will result in all trees being lost, except for the large Bur Oak tree west of Silvercreek Parkway (area H), which will be preserved and protected in the over-design for the development of this property.
- A 14 m setback from the Hanlon Expressway will be maintained, and will provide a suitable location for some tree planting (that could enhance linkage through the culvert), though it is expected that visibility of businesses along the Hanlon will be requested.
- There will be no grade changes in Area I since it is not located on the subject property. Grade changes on the property adjacent to Area I could potentially affect the trees growing directly adjacent to the southwestern property boundary. If the grade changes are greater than 0.5 m, a retaining wall is recommended to stabilize the soils on the soils adjacent to Area I and ensure that roots are not exposed and no trees are lost.

4.4 Mitigation

4.4.1 Tree Retention

Areas A-E
Most trees will be lost from Areas A to C. These areas are not expected to be suitable sites for tree planting to serve an ecological function, though there will be extensive tree planting among parking areas and along the periphery of the development. Trees will be lost from Area D, but the configuration of the slope will allow re-planting. Area E will be largely undeveloped. In all

of these areas, approximately half the trees in these areas are non-native, and the rest are pioneering species.

While grading adjacent to and within Area E, awareness of tree conservation should be maintained and, where possible, trees should be preserved. Trees recommended for protection should be flagged prior to grading. Individual trees which can be preserved within these areas should be fenced off 1 m past the edge of the drip-line. Construction vehicles and equipment should be kept away from the trees, as tree root systems are sensitive to exposure and soil compaction. Young native trees should be planted in Area E, among existing trees, to enhance the ecological function of the vegetation at the ravine edge. Herbaceous and shrub species should also be planted to enhance the edge function.

Tree planting has been proposed throughout the parking lot to help shade the asphalt surface of the area. It is a general recommendation of this report that trees planted within the development be primarily native species. Tree planting on the site is addressed in Section 3.4.2.

Area F
Most of the trees in Area F are non-native, in fair to poor condition, and are located on a slope. Most of the native trees are species of poplar; pioneering species that are not likely to survive long. There are very few native species in good condition that would be suitable for long-term conservation. Much of this slope must be unavoidably disturbed during construction of the railway underpass. According to the current development plans, if trees are to be protected in the area of the embankment it would require construction of a retaining wall, which would reduce the number of trees that could be planted on the slope. This construction would leave only the trees along the top of the slope; along the edge of the railway tracks; trees which do have the potential to die off relatively soon because of their current degraded condition and the fact that they are typically not long-lived species.

Alternatively, the potential loss of trees could be addressed by re-grading of the railway embankment to a 3:1 slope and replacement of the short-lived, primarily non-native trees along the slope with longer-lived native species. Therefore, it is generally recommended that trees be removed from the slope prior to construction, and then a high density of large-caliper, native tree species planted on the re-constructed slope. It is recommended that a mixture of coniferous and deciduous trees be considered. A variety of seed and berry-bearing shrubs should be planted under the tree canopy as an understory to provide additional ecological values.

Area G-H
All trees will be lost from Area G and H. For the most part, trees lost consist of non-native trees in poor condition. The one exception is the bur oak tree (>1 m dbh) west of Silvercreek Parkway.

There are few suitable locations in which to plant trees on the western part of the site to replace trees lost from the site except on the reconstructed railway embankment and in other plantings on the periphery of the property. There are some opportunities for replacing trees on the drainage channel through the property as well. The ecological functions of trees on the western part of the site (mainly as habitat for bird species) would be almost impossible to replicate in a developed setting, and replacement of these trees for ecological function is not recommended. Tree replacement efforts should be focused within Junction Park, on the railway embankment and the creek channel, as recommended in this report and as originally recommended in the tree-saving report prepared for the Leon's site (North-South Environmental 2006b). Recommendations for tree planting are provided in Section 3.4.2.

The Bur Oak that is to be retained west of Silvercreek Parkway is approximately 100 m north of the proposed sewer pipeline. This is sufficient distance to prevent direct degradation to the tree due to the construction of the pipeline. However, protection measures will still be required to ensure the survival of the tree during construction. Rigorous fencing should be placed around this tree to avoid undue stress or damage to the tree from construction vehicles, stockpiling of soils or equipment. At minimum, this fencing should extend 2 m past the edge of the tree drip-line. Preservation of this tree has been outlined in a previous report (North-South Environmental 2006a).

The tree should be monitored frequently to determine if it is becoming stressed by the surrounding construction. In particular, signs of drought, or conversely, signs of excessive flooding should be noted immediately. The tree should be watered if it appears drought stressed, and water should be diverted from the tree if it becomes flooded.

Area I
While grading adjacent to Area I, awareness of tree conservation should be maintained and roots of trees within this area should not be damaged.

4.4.2 Proposed Protection Measures During Construction

The following procedures should be observed to protect trees identified for retention:

1. Snow fencing should be installed around areas proposed for tree retention prior to any grading or site clearing and should remain in place until all site work has been completed. Wherever possible snow fencing should be installed at the dripline plus 1 metre from the canopy edge of retained trees.

2. Proper root pruning should be undertaken when and if roots of retained trees are exposed by construction activities. Exposed roots will be covered with soil or mulch to the extent possible, as soon as possible following damage to prevent further damage and desiccation.

3. Within the area proposed for tree retention there should be no:
   - Grade changes;
   - Dumping, stockpiling or storage of any materials;
   - Parking or storage of any machinery or equipment;
   - Disposal of waste, garbage, brush or stumps or any burning of materials or disposal of ashes;
   - Use of any machinery without prior approval; or
   - Activity of any kind without permission of the environmental inspector.

4. Any accidental damage to vegetation within a tree preservation zone should be examined by the environmental inspector and recommendations made, where necessary for treatment (*e.g.*, pruning or sealing).

4.4.3 Tree Compensation

If all native trees are removed from the entire Lafarge property (with the exception of the Bur Oak tree), the total trees lost would be 423 native trees. As shown in Section 4.2.1 and 4.2.2, almost all native trees on the site consist of trembling aspen and balsam poplar: fast-growing, short lived species that quickly colonize disturbed ground. Most trees are in poor to fair condition. There are opportunities for tree planting along the creek, and on the eastern part of the Lafarge property, east of the creek, as well as a few opportunities within the site: along the southern and northern railway embankments, and within the developed area of the site.

Planting within Junction Park

Some of the area east of the creek should be retained as open habitat as it currently has several ecological functions and potential functions related to open successional habitat. The planting within the proposed park is designed to leave large portions of the habitat open, as recommended in the EIS. However, within this context approximately 2200 trees are proposed within the area of Junction Park, mainly on the periphery. Proposed tree plantings should consist of long-lived, native forest tree species to add to the long-term ecological sustainability of the site in its urban context. Tree compensation should be focused in areas where they could bring the greatest ecological benefit, because the proposed development will not be a suitable site to replace trees for ecological purposes. Other plantings within the park should enhance habitat for species that require open areas.

Planting along Railway Embankments

Tree planting for the northern and southern railway embankment should consist of a mix of deciduous and coniferous native tree species, replacing a seasonal buffer with planting that will provide a year-round screen.

Planting along Howitt Creek

The planting plan for Howitt Creek recommends a total of 400 native trees in the riparian corridor through the Lafarge site, as well as 400 shrubs and a grass-herb seed mix to be planted along the upper edge of the creek. It is expected that the current non-native tree cover along the creek will gradually be replaced by growth of the planted native tree species. The planting plan includes plantings between the development and hazard lines along the creek, and also proposes additional infill plantings along the slopes and bottomlands of the creek.

The planting plan should be completed along the creek adjacent to the development site at the time that each phase of the development proceeds. The planting along the creek should follow the recommendations in the EIS Addendum (North-South Environmental 2006a), which was designed to improve the quality of the terrestrial and aquatic habitat along the creek. The vegetation planted on the creek banks has been recommended to provide benefits to aquatic habitat: to provide stabilization and prevent erosion as well as promoting attenuation of nutrients, stream shading, and providing detritus for the watercourse. As noted in the planting plan, the planting should focus on young trees, but should also include shrubs and herbaceous cover that will initially (while trees are small) enhance the function of the creek. Initially, the relatively low abundance of trees between the development and hazard lines will be beneficial for the colonization of shrubs because more light is allowed to infiltrate through the canopy to the understory below. Shrubs will assist in stabilizing the banks of the creek because of the dense branching which provides a physical barrier to dust and light. On slopes at the greatest risk of erosion, it is recommended that grasses and herbs be planted to stabilize the soils. Grasses and herbs have a greater ability to stabilize the banks than trees due to their fibrous root systems and their low height, acting as a filter to trap and hold sediment which is being eroded down the slope. These measures ensure that sediment is not being deposited into the creek which could degrade aquatic habitat.

Landscape Planting within the Developed Area
As part of the landscaping within the commercial development, it is recommended that native trees be used as much as possible for plantings. Native species, preferably Bur Oak trees, can especially be planted along the edge of the development lines and/or along the edge of the railway track. Planting along the edge of the track will allow this area to function as a refuge for local wildlife. This function will be enhanced by the connection of the railway with the creek.

Planting along the Drainage Channel
Trees planted along the east-west swale could enhance linkage of the site between the Northwest Drainage Channel west of the site by encouraging passage of wildlife from the eastern portion of the site and the creek corridor under the Hanlon Expressway through the culvert. At present, there is no evidence that this linkage is required (North-South Environmental 2005), but it may be possible to enhance the use of the site by wildlife by providing this linkage. Trees, shrubs and herbaceous species should be used to enhance the linkage, providing both shade and cover. If feasible, plantings along the Hanlon Expressway should be concentrated next to the culvert to enhance the function of the drainageway.

5.0 Conclusion

Tree-saving opportunities on the site are rare, and for the most part, it would be more effective to replace the trees lost with higher-quality native species. For example, since the majority of the tree species in Area F are non-native and are generally in fair to poor condition, it is not recommended that these trees be retained. However, it is recommended that large caliper, long-living, shade-tolerant tree species, as well as a shrub understory, be planted along the slope in Area F; along the northern edge of the property boundary.

The proposed commercial development on the study area will result in the removal of 423 native trees. However, approximately 2600 trees are proposed to be planted along the creek and on the east side of the property. Some new tree and shrub restoration opportunities are available along the northern edge of the development. Additional trees will be incorporated into the landscaping around the commercial units, throughout the parking areas, along the drainage channel and along the Hanlon Expressway.

6.0 References

Argus, G.W., K.M. Pryer, D.J. White and C.J. Keddy. 1982-1987. Atlas of the rare vascular plants of Ontario. Four Parts. National Museums of Canada, Ottawa (looseleaf).

The Landplan Collaborative Limited. 2007. Feasibility study for public parkland and trails. Junction Park, Guelph.

North-South Environmental Inc. 2005. Environmental Impact Study for the Lafarge Property. Unpublished report for Silvercreek (Guelph) developments Limited.

North-South Environmental Inc. 2006a. Lafarge property addendum to the environmental and servicing reports. Unpublished report to City of Guelph in conjunction with Blackport Hydrogeological, V.A. Wood(Guelph) Incorporated, and Black, Shoemaker, Robinson & Donaldson Limited.

North-South Environmental Inc. 2006b. Tree survey of Leon's Site Plan Application. Unpublished report for Neil Robinson, Neil Robinson Real Estate Consultants Inc.

Appendices

Appendix 1: Tree Inventory Data Collection

Tree Species:
Common name & scientific binomial (genus, species)

Tree Size:
Diameter at breast height (DBH)

Trunk Integrity:

r	root damage or decay
st	split stem/weak crotch
br	butt rot
l	excessive lean (e.g. 30° to 45°)
h	upper stem holes/decay
w	wound (bark damage, large pruning cuts)
f	fungus (conks)
ib	insect borers
b	burl
wh	woodpecker holes
s	seam or cracks
c	cankers

Crown Structure:

bt	broken top
bl	broken or severed primary limbs
p	pollarded (severe and improper pruning)
ab	adventitious branching (clusters of new shoots on main trunk)

Crown Vigour:

dl	moderate dead wood (e.g. 11 to 35% secondary branches mostly)
d	significant crown dieback (e.g. >35% dead wood in primary limbs)
u	undersized leaves
fc	foliar chlorosis/yellowing
fn	foliar necrosis/browning
id	insect defoliators (species if known)
di	disease (species if known)

Tree Vigour Classes:

Class 1 Excellent Condition, No Risk Trees

Sound, thrifty, full crowned trees of natural shape with no dead limbs in the top of the crown and no significant evidence of decline.

Class 2 Good Condition, Low Risk Trees

Full to medium crowned trees of natural shape with a live crown ratio ≥40% that exhibit no more than minor dead wood (e.g. up to 10% secondary branches only and mainly in the lower crown) and no more than one moderate trunk defect or indicator of decline.

Class 3 Fair Condition, Medium Risk Trees

Full to small crowned trees with a live crown ratio ≥25% that exhibit no more than moderate dead wood (e.g. 11 to 35% secondary branches mostly) and no more than two moderate trunk defects or indicators of decline.

Class 4 Poor Condition, High Risk Trees

Medium to very small crowned trees (e.g. live crown ratio < 25%) that exhibit one or more of the following conditions.

a) Trees with significant foliage of poor colour and less than normal size.
b) Trees with significant crown dieback (e.g. > 35% dead wood in primary limbs).
c) Trees with major trunk defects or decay (e.g. one extensive problem, or 3 or more distinct but moderate decline indicators).

Class 5 Very Poor Condition, Very High Risk Trees

Dying trees with very little live crown.

Class 6 Dead Tree

No live foliage present

Appendix 2: Area A tree count

Scientific Name	Common Name	Count
Populus alba L.	White Poplar	12
Salix x rubens Schrank	Hybrid Willow	101
Prunus avium (L.) L.	Sweet Cherry	1
Fraxinus americana L.	White Ash	1
Acer negundo L.	Manitoba Maple	14
Rhamnus cathartica L.	European Buckthorn	2
Populus tremuloides Michx.	Trembling Aspen	13
Salix purpurea L.	Basket Willow	11
Populus deltoides Bartram ex Marshall ssp. monilifera (Aiton) Eckenwalder	Cottonwood	4
Populus balsamifera L. ssp. balsamifera	Balsam Poplar	1
Total		160

Appendix 3: Area B tree count

Scientific Name	Common Name	Count
Ulmus americana L.	White Elm	1
Salix x rubens Schrank	Hybrid Willow	14
Populus balsamifera L. ssp. balsamifera	Balsam Poplar	11
Populus deltoides Bartram ex Marshall ssp. monilifera (Aiton) Eckenwalder	Cottonwood	7
Salix purpurea L.	Basket Willow	5
Pinus resinosa Sol. ex Aiton	Red Pine	1
Populus tremuloides Michx.	Trembling Aspen	73
Robinia pseudo-acacia L.	Black Locust	2
Acer negundo L.	Manitoba Maple	2
Populus alba L.	White Poplar	1
Total		117

Appendix 4: Area C tree count

Scientific Name	Common Name	Count
Populus balsamifera L. ssp. balsamifera	Balsam Poplar	13
Betula papyrifera Marshall	White Birch	1
Acer negundo L.	Manitoba Maple	3
Salix sp.	Willow species	2
Ulmus americana L.	White Elm	9
Populus deltoides Bartram ex Marshall ssp. monilifera (Aiton) Eckenwalder	Cottonwood	11
Populus tremuloides Michx.	Trembling Aspen	61
Salix purpurea L.	Basket Willow	15
Salix x rubens Schrank	Hybrid Poplar	41
Juglans nigra L.	Black Walnut	1
Total		157

Appendix 5: Tree count and condition in Area D and Area E

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class
1	Area D	Acer negundo L.	12.4	st	ab		1
2	Area D	Juglans nigra L.	18.5				1
3	Area D	Juglans nigra L.	20.8				1
4	Area D	Juglans nigra L.	21.0				1
5	Area D	Populus balsamifera L. ssp. balsamifera	22.3				1
6	Area D	Populus balsamifera L. ssp. balsamifera	13.5				3
7	Area D	Acer negundo L.	15.3				1
8	Area D	Salix x rubens Schrank	22.0	st	ab		2
9	Area D	Populus balsamifera L. ssp. balsamifera	19.0		ab		2
10	Area D	Populus balsamifera L. ssp. balsamifera	16.7		ab		2
11	Area D	Salix x rubens Schrank	33.0	l, w	ab, bl		3
12	Area D	Salix x rubens Schrank	33.5	w	ab, bl	dl	3
13	Area D	Salix x rubens Schrank	26.0	w	ab, bl		3
14	Area D	Salix x rubens Schrank	15.4	l, w	bl		3
15	Area D	Populus tremuloides Michx.	21.3				1
16	Area D	Salix x rubens Schrank	10.7		ab		2
17	Area D	Salix x rubens Schrank	26.0	st	ab, bl		3
18	Area D	Populus balsamifera L. ssp. balsamifera	10.7		ab		2
19	Area D	Betula papyrifera Marshall	12.3		ab		1
20	Area D	Ulmus pumila L.	21.5	st, w	ab		3
21	Area D	Salix x rubens Schrank	12.6	st	ab		2
22	Area D	Juglans nigra L.	10.5		bl		2
23	Area D	Fraxinus americana L.	13.5	st			1
24	Area D	Populus tremuloides Michx.	10.5		ab		2
25	Area D	Populus balsamifera L. ssp. balsamifera	12.8		ab, bl		2
26	Area D	Populus balsamifera L. ssp. balsamifera	10.7		bl		2
27	Area D	Robinia pseudo-acacia L.	11.6		ab		1

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class
28	Area D	Populus balsamifera L. ssp. balsamifera	27.8	w	ab		3
29	Area D	Salix x rubens Schrank	27.0	at	ab		2
30	Area D	Salix x rubens Schrank	19.0	st	ab, bt, bl	d	4
31	Area D	Ulmus americana L.	17.3	l, w	bl		3
32	Area D	Populus deltoides Bartram ex Marshall ssp. monilifera (Aiton) Eckenwalder	11.1	l, w	bl		3
33	Area D	Salix x rubens Schrank	22.0	w	bl		3
34	Area D	Populus tremuloides Michx.	14.9		ab		1
35	Area D	Populus deltoides Bartram ex Marshall ssp. monilifera (Aiton) Eckenwalder	11.0		ab		1
36	Area D	Salix purpurea L.	22.2		bl	d	4
37	Area D	Populus tremuloides Michx.	22.3			dl	2
38	Area D	Populus tremuloides Michx.	15.7	st			2
39	Area D	Populus tremuloides Michx.	17.0	l		dl	2
40	Area D	Ulmus pumila L.	24.0	st	ab	d	4
41	Area D	Populus tremuloides Michx.	23.2			dl	2
42	Area D	Ulmus pumila L.	18.8	w	bl	d	3
43	Area D	Populus tremuloides Michx.	11.6				1
44	Area D	Ulmus pumila L.	23.8	w	bl	dl	6
45	Area D	Populus balsamifera L. ssp. balsamifera	17.9			dl	3
46	Area D	Populus balsamifera L. ssp. balsamifera	13.4			dl, d	3
47	Area D	Populus balsamifera L. ssp. balsamifera	16.6				6
48	Area D	Populus tremuloides Michx.	11.7			dl	2
49	Area D	Populus tremuloides Michx.	10.6		ab	dl	6
50	Area D	Populus tremuloides Michx.	18.3		ab	dl	2
51	Area D	Populus tremuloides Michx.	16.7		ab	dl	2
52	Area D	Populus tremuloides Michx.	14.5				2
53	Area D	Ulmus pumila L.	40.0				6
54	Area D	Ulmus pumila L.	12.8				6
55	Area D	Ulmus pumila L.	27.3				6

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class
56	Area D	Ulmus pumila L.	41.5				6
57	Area D	Ulmus pumila L.	20.6				6
58	Area D	Ulmus pumila L.	12.7		ab		1
59	Area D	Ulmus pumila L.	20.2		ab		1
60	Area D	Ulmus pumila L.	10.3		ab		2
61	Area D	Ulmus pumila L.	37.5		ab		1
62	Area D	Ulmus americana L.	57.9	st	bl	dl	2
63	Area E	Ulmus pumila L.	18.0				2
64	Area E	Ulmus pumila L.	11.5				2
65	Area E	Ulmus pumila L.	17.0	st			2
66	Area E	Populus tremuloides Michx.	20.0				2
67	Area E	Populus tremuloides Michx.	13.5				2
68	Area E	Ulmus pumila L.	25.0	st			2
69	Area E	Populus tremuloides Michx.	18.0				6
70	Area E	Populus tremuloides Michx.	18.0				6
71	Area E	Acer negundo L.	44.0	st			2
72	Area E	Populus deltoides Bartram ex Marshall ssp. monilifera (Aiton) Eckenwalder	14.5				2
73	Area E	Ulmus pumila L.	25.0				2
74	Area E	Populus deltoides Bartram ex Marshall ssp. monilifera (Aiton) Eckenwalder	20.0				2
75	Area E	Populus alba L.	40.6	st, l			2
76	Area E	Populus alba L.	10.0	st			2
77	Area E	Ulmus pumila L.	12.0				2
78	Area E	Pinus sylvestris L.	11.0	ib	di		3
79	Area E	Populus tremuloides Michx.	13.5				1
80	Area E	Populus balsamifera L. ssp. balsamifera	13.0				2
81	Area E	Elaeagnus angustifolia L.	11.5	st, l			2

Appendix 6: Tree count and condition in Area F

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class	Comments
1	Area F	Ulmus pumila	20.0		ab	id	3	vines
2	Area F	Ulmus pumila	29.0		ab	id	3	vines
3	Area F	Pinus sylvestris	46.0	st	bt, bl	dl	4	vines
4	Area F	Acer negundo	26.5	st	bl	dl	4	
5	Area F	Ulmus pumila	24.5		bl, ab	dl, id	4	
6	Area F	Salix sp.	63.5		bl, ab	dl	4	
7	Area F	Ulmus pumila	21.5	st	bl	dl, id	4	
8	Area F	Acer negundo	40.5	st	bl, ab	dl	4	
9	Area F	Acer negundo	71.5	st	bl	dl	4	
10	Area F	Populus tremuloides	19.0		bl, ab	d	5	
11	Area F	Populus balsamifera	25.0		bl	d	5	
12	Area F	Ulmus pumila	17.5		bl	dl, id	4	
13	Area F	Salix sp.	28.0	l	bl	dl	4	
14	Area F	Acer negundo	29.5	l	bl	dl	4	
15	Area F	Acer negundo	76.5	st	bl, ab	dl	4	
16	Area F	Ulmus pumila	11.0		bl	dl, id	3	
17	Area F	Robinia pseudoacacia	12.0			dl	3	
18	Area F	Acer negundo	30.5	st, w	bl	dl	5	vines
19	Area F	Acer platanoides	22.0	f			2	
20	Area F	Acer negundo	13.0	l		dl	3	
21	Area F	Ulmus pumila	22.0		bl	dl, id	4	
22	Area F	Ulmus pumila	10.5			dl, id	4	
23	Area F	Ulmus pumila	13.0	w	bl	dl, id	4	
24	Area F	Ulmus pumila	14.5		bl	d, id	5	
25	Area F	Acer negundo	26.0	w	bl	dl	5	
26	Area F	Acer negundo	72.5	st, w, s	bl	d	5	
27	Area F	Ulmus pumila	14.5		bl	d	4	
28	Area F	Acer negundo	10.5			dl	3	
29	Area F	Ulmus pumila	23.0			dl, id	3	

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class	Comments
30	Area F	Ulmus pumila	11.8		bl	dl, id	4	
31	Area F	Ulmus americana	26.5		bl	dl	4	
32	Area F	Ulmus pumila	18.5		bl	dl	4	
33	Area F	Acer negundo	37.0	st, s	bl	dl	4	
34	Area F	Ulmus pumila	15.5			d	4	
35	Area F	Ulmus pumila	17.0			dl, id	4	
36	Area F	Ulmus pumila	23.0	st		dl	4	
37	Area F	Ulmus pumila	16.0			dl, id	3	
38	Area F	Ulmus pumila	15.5		bl	d	4	
39	Area F	Ulmus pumila	53.0		ab	d	4	
40	Area F	Ulmus pumila	21.0		bl	dl	3	
41	Area F	Ulmus pumila	11.5		bl	dl	3	
42	Area F	Ulmus pumila	11.0		bl	dl, id	4	
43	Area F	Ulmus pumila	26.0		bl	dl, id	3	
44	Area F	Ulmus pumila	17.0		bl, ab	dl, id	3	
45	Area F	Ulmus pumila	30.0	st	bl	dl, id	3	
46	Area F	Ulmus pumila	33.5	st	bl, ab	dl, id	4	
47	Area F	Ulmus pumila	56.0	st	bl, ab	dl, id	3	
48	Area F	Ulmus pumila	51.0	st	bl, ab	dl, id	4	
49	Area F	Ulmus pumila	25.5		bl	dl, id	3	
50	Area F	Ulmus pumila	33.5	st	bl	dl, id	4	
51	Area F	Ulmus pumila	40.5	st	bl	dl, id	4	
52	Area F	Ulmus pumila	16.0		bl	d, id	4	
53	Area F	Ulmus pumila	12.5		bl	dl, id	4	
54	Area F	Ulmus pumila	24.3	st	bl	dl, id	4	
55	Area F	Ulmus pumila	11.3		bl	dl, id	4	
56	Area F	Ulmus pumila	19.7		bl	dl, id	4	
57	Area F	Ulmus pumila	13.0		bl	dl, id	4	
58	Area F	Ulmus pumila	10.5		bl	dl, id	4	
59	Area F	Ulmus pumila	12.7		bl	dl, id	4	
60	Area F	Ulmus pumila	20.3	st	bl	dl, id	4	

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class	Comments
61	Area F	Ulmus pumila	13.5		bl	dl, id	4	
62	Area F	Ulmus pumila	20.2	st	bl, ab	dl	4	
63	Area F	Ulmus pumila	18.6	st	bl	d	4	
64	Area F	Ulmus pumila	15.0		bl	dl, id	4	
65	Area F	Ulmus pumila	10.5		bl	dl, id	4	
66	Area F	Ulmus pumila	14.0		bl	dl, id	4	squirrel nest in tree
67	Area F	Ulmus pumila	33.0		bl	dl, id	4	
68	Area F	Ulmus pumila	11.0		bl	dl, id	4	
69	Area F	Ulmus pumila	10.6		bl	dl, id	4	
70	Area F	Ulmus pumila	16.3		bl	dl, id	4	
71	Area F	Ulmus pumila	16.7		bl	dl, id	4	
72	Area F	Ulmus pumila	15.5	w, s	bl	dl, id	4	
73	Area F	Ulmus pumila	24.5		bl	dl, id	4	
74	Area F	Ulmus pumila	21.3		bl	dl, id	4	
75	Area F	Ulmus pumila	13.5		bl	dl, id	4	
76	Area F	Ulmus pumila	16.0		bl	dl, id	3	
77	Area F	Ulmus pumila	14.1		bl	dl, id	4	
78	Area F	Ulmus pumila	12.5		bl	dl, id	4	
79	Area F	Ulmus pumila	36.7	st	bl	dl, id	4	
80	Area F	Ulmus pumila	11.0		bl	dl, id	4	
81	Area F	Ulmus pumila	10.6		bl	dl, id	4	
82	Area F	Ulmus pumila	20.0		bl	dl, id	4	
83	Area F	Ulmus pumila	30.0	w	bl	dl, id	4	
84	Area F	Ulmus pumila	18.0		bl	dl, id	4	
85	Area F	Ulmus pumila	38.5	st	bl	dl, id	4	
86	Area F	Ulmus pumila	21.3		bl	dl, id	4	
87	Area F	Acer negundo	10.3		ab	dl	3	
88	Area F	Ulmus pumila	18.8			dl, id	3	
89	Area F	Ulmus pumila	18.5		bl	dl, id	3	
90	Area F	Ulmus pumila	59.0	st	bl	dl, id	3	
91	Area F	Ulmus pumila	13.3			dl, id	3	

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class	Comments
92	Area F	Ulmus pumila	10.6	w, s	bl	dl, id	3	
93	Area F	Ulmus pumila	23.4	st	bl	dl, id	4	
94	Area F	Ulmus pumila	23.3	st	bl	dl, id	4	
95	Area F	Ulmus pumila	21.0	st	bl, ab	dl, id	4	
96	Area F	Ulmus pumila	11.2		bl	dl, id	4	
97	Area F	Ulmus pumila	11.0		bl	d, id	4	
98	Area F	Ulmus pumila	43.6	st	bl	d, id	3	
99	Area F	Ulmus pumila	25.2	st	bl	dl, id	4	
100	Area F	Ulmus pumila	18.3		bl	dl, id	3	
101	Area F	Ulmus pumila	30.1	st	bl, ab	dl, id	4	
102	Area F	Ulmus pumila	11.5		bl	dl, id	4	
103	Area F	Populus balsamifera	34.7	st, w	bl	dl	4	
104	Area F	Populus tremuloides	14.7	w	bl, ab	dl	3	
105	Area F	Populus tremuloides	10.3		bl	dl	2	
106	Area F	Ulmus pumila	20.5		bl, ab	dl, id	4	
107	Area F	Ulmus pumila	10.2		bl	dl, id	4	
108	Area F	Ulmus pumila	11.5		bl	dl, id	4	
109	Area F	Ulmus pumila	29.3	st	bl	dl, id	4	
110	Area F	Ulmus pumila	26.9	st	bl	dl, id	4	
111	Area F	Ulmus pumila	19.8	st	bl, ab	dl, id	4	
112	Area F	Ulmus pumila	42.5	st	bl, ab	dl, id	4	
113	Area F	Ulmus pumila	10.0		bl	dl, id	4	
114	Area F	Ulmus pumila	13.7		bl	dl, id	4	
115	Area F	Ulmus pumila	33.0	st	bl, ab	dl, id	4	
116	Area F	Ulmus pumila	21.0	st	bl, ab	dl, id	4	
117	Area F	Ulmus pumila	11.2	l	bl	dl, id	4	
118	Area F	Ulmus pumila	10.0		bl	dl, id	4	
119	Area F	Ulmus pumila	27.7	st	bl, ab	dl, id	4	
120	Area F	Ulmus pumila	10.5		bl, ab	dl, id	4	
121	Area F	Ulmus pumila	10.2		bl	dl, id	4	
122	Area F	Ulmus pumila	11.1		bl	dl, id	4	

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class	Comments
123	Area F	Ulmus pumila	10.7		bl	dl, id	4	
124	Area F	Ulmus pumila	20.5	st	bl	dl, id	4	
125	Area F	Ulmus pumila	41.7	st	bl	d, id	4	
126	Area F	Ulmus pumila	29.0	st	bl	d, id	4	
127	Area F	Ulmus pumila	17.3		bl	d, id	4	
128	Area F	Ulmus pumila	11.0		bl	dl, id	4	
129	Area F	Ulmus pumila	11.5		bl	dl, id	4	
130	Area F	Ulmus pumila	19.6		bl	d, id	4	
131	Area F	Ulmus pumila	22.7		bl	dl, id	4	
132	Area F	Ulmus pumila	16.0		bl, ab	dl, id	4	
133	Area F	Ulmus pumila	23.7	w	bl	dl, id	4	
134	Area F	Ulmus pumila	14.2		bl	dl, id	4	
135	Area F	Ulmus pumila	10.7		bl	d, id	5	
136	Area F	Ulmus pumila	12.0		bl	dl, id	4	
137	Area F	Ulmus pumila	24.0		bl, ab	dl, id	4	
138	Area F	Ulmus pumila	10.5		bl, ab	d, id	5	
139	Area F	Ulmus pumila	10.4		bl, ab	dl, id	4	
140	Area F	Ulmus pumila	12.0		bl	dl, id	4	
141	Area F	Ulmus pumila	20.0	st	bl	dl, id	4	
142	Area F	Ulmus pumila	26.0	st	bl	dl, id	4	
143	Area F	Ulmus pumila	19.2	st	bl	dl, id	4	
144	Area F	Ulmus pumila	46.9	w	bl	dl, id	3	
145	Area F	Acer negundo	20.9	st		dl, fc	3	
146	Area F	Juglans nigra	33.4	st	ab	fc	3	
147	Area F	Acer negundo	11.5	l		fc	3	
148	Area F	Ulmus pumila	16.0			dl, id	3	
149	Area F	Acer negundo	11.5		bl	d, id	4	
150	Area F	Ulmus pumila	27.0	st, w	bl	dl, id	4	
151	Area F	Ulmus pumila	15.0		bl	dl, id	4	
152	Area F	Ulmus pumila	26.1	st	bl, ab	dl, id	4	
153	Area F	Ulmus pumila	17.0		bl	dl, id	4	

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class	Comments
154	Area F	Ulmus pumila	11.0		bl	dl, id	4	
155	Area F	Ulmus pumila	10.5		bl	dl, id	4	
156	Area F	Ulmus pumila	13.7		bl	dl, id	4	
157	Area F	Acer negundo	40.3	w, l	bl	dl	4	
158	Area F	Acer negundo	37.5	w	ab	dl	3	
159	Area F	Acer negundo	31.0	l	bl, ab	dl	4	
160	Area F	Acer negundo	33.2		bl	dl	3	
161	Area F	Acer negundo	34.9	st, l		dl	3	
162	Area F	Acer negundo	12.0	w, l	ab	dl, fc	4	
163	Area F	Acer negundo	40.1	l	bl	dl	4	
164	Area F	Ulmus pumila	10.4		bl	dl, id, fc	5	
165	Area F	Ulmus pumila	15.8	w	bl	dl, id	5	
166	Area F	Ulmus pumila	19.7		bl	dl, id	4	
167	Area F	Ulmus pumila	29.2		bl	d, id	4	
168	Area F	Ulmus pumila	12.0	w	bl	dl, id	5	
169	Area F	Ulmus pumila	19.9	st, w	bl	dl	4	
170	Area F	Ulmus pumila	13.5			dl	2	
171	Area F	Acer negundo	49.0	st, w	bl	dl	5	
172	Area F	Ulmus pumila	38.2		bl	dl, id	3	
173	Area F	Ulmus pumila	14.7		bl	d, id	4	
174	Area F	Ulmus pumila	17.6		bl	dl, id	4	
175	Area F	Ulmus pumila	20.0		bl	dl, id	3	
176	Area F	Ulmus pumila	10.0		bl	d, id	4	
177	Area F	Ulmus pumila	15.6		bl	dl, id	4	
178	Area F	Ulmus pumila	25.0	st	bl	dl, id	4	
179	Area F	Ulmus pumila	13.0			dl, id	3	
180	Area F	Ulmus pumila	13.7			dl, id	3	
181	Area F	Ulmus pumila	17.6		bl	dl, id	4	
182	Area F	Ulmus pumila	11.4		bl	d, id	5	
183	Area F	Ulmus pumila	12.5		bl	dl, id	4	
184	Area F	Ulmus pumila	24.5		bl	dl, id	4	

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class	Comments
185	Area F	Ulmus pumila	22.0		bl	dl, id	4	
186	Area F	Ulmus pumila	12.3		bl, ab	dl, id	4	
187	Area F	Ulmus pumila	10.5		bl	dl, id	4	
188	Area F	Ulmus pumila	10.7		bl	dl, id	4	
189	Area F	Ulmus pumila	18.5		bl	dl, id	4	
190	Area F	Fraxinus pennsylvanica	37.7	st		dl, fn	3	
191	Area F	Ulmus pumila	22.0			dl, id	3	
192	Area F	Salix fragilis	142.0	st			3	
193	Area F	Salix fragilis	57.0			dl, fn	3	vines
194	Area F	Salix fragilis	110.3	st		dl, fn	4	
195	Area F	Acer negundo	72.0	st, s, l	bl	dl	5	
196	Area F	Fraxinus pennsylvanica	28.2		ab		3	
197	Area F	Acer negundo	14.4	w, l	ab	fc	4	
198	Area F	Acer negundo	61.0	st		dl	4	
199	Area F	Acer negundo	14.8	l	ab	dl	4	
200	Area F	Acer negundo	18.6		bl	dl	4	
201	Area F	Acer negundo	70.0	st	bl, ab	dl	3	
202	Area F	Acer negundo	14.0	w, l	ab		3	
203	Area F	Acer negundo	66.5	st		dl	3	
204	Area F	Acer negundo	18.0	st	bl	dl, fc	4	
205	Area F	Acer negundo	65.0	st, l	bl	dl	4	
206	Area F	Acer negundo	16.2	l		d	4	
207	Area F	Acer negundo	27.5	st	bl	d	4	
208	Area F	Acer negundo	45.7	st	bl, ab	dl	4	
209	Area F	Acer negundo	13.9	l	bl	dl	4	
210	Area F	Acer negundo	61.5	st	bl	dl, id	4	
211	Area F	Acer negundo	22.7		bl	dl	3	vines
212	Area F	Acer negundo	51.0	st, l	bl	dl	4	
213	Area F	Acer negundo	14.5		bl	d	5	
214	Area F	Acer negundo	35.3	st, w	bl	dl	4	

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class	Comments
215	Area F	Acer negundo	58.9	st	ab	dl	3	
216	Area F	Acer negundo	33.0	st	ab	dl	3	
217	Area F	Acer negundo	32.1	st	bl, ab	dl	4	two trunks sawed off
218	Area F	Acer negundo	41.4	st	bl	dl	4	
219	Area F	Acer negundo	21.3	st, w, l			5	
220	Area F	Acer negundo	20.0	w	bl	dl	3	
221	Area F	Acer negundo	38.6	st, w, s			3	vines
222	Area F	Salix fragilis	60.0		bl	dl	3	
223	Area F	Acer negundo	34.5			fn	3	
224	Area F	Acer negundo	41.8	st		fc	3	
225	Area F	Ulmus pumila	22.0		p	id	2	
226	Area F	Acer negundo	74.0	st	bl	dl, fc	4	vines
227	Area F	Acer negundo	28.7	l	bl	dl	4	
228	Area F	Acer negundo	107.8	st	bl	dl, fc	3	
229	Area F	Acer negundo	30.0			fc	3	
230	Area F	Acer negundo	30.6			dl, fc	3	
231	Area F	Acer negundo	26.0	st		dl, fn	3	
232	Area F	Ulmus pumila	50.0		bl	dl, fn	2	
233	Area F	Salix fragilis	72.9	st	bl	dl	3	vines
234	Area F	Salix fragilis	59.0	st	bl, ab	dl	3	
235	Area F	Populus tremuloides	57.0	st			2	
236	Area F	Populus tremuloides	17.8		ab	dl	3	
237	Area F	Populus tremuloides	15.9	w	bl	dl	4	nails in trunk
238	Area F	Populus tremuloides	11.6	w		dl	3	
239	Area F	Populus tremuloides	11.0			dl	2	
240	Area F	Populus tremuloides	10.3			dl	2	
241	Area F	Populus tremuloides	13.2			dl	2	
242	Area F	Populus tremuloides	11.6			dl	2	
243	Area F	Populus grandidentata	12.2			dl	2	
244	Area F	Populus balsamifera	19.0			d, fc	4	
245	Area F	Populus tremuloides	17.8	w			2	

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class	Comments
246	Area F	Populus balsamifera	10.2	l		fc	3	
247	Area F	Populus tremuloides	20.8				2	
248	Area F	Populus tremuloides	13.6	w		dl	3	
249	Area F	Populus tremuloides	17.4		bl, p		2	nails in trunk
250	Area F	Populus tremuloides	11.1			dl	2	
251	Area F	Populus tremuloides	12.5	w	bl, p	dl	3	duct tape around trunk
252	Area F	Populus tremuloides	10.1			dl, id	3	
253	Area F	Populus tremuloides	14.2	w		dl	3	
254	Area F	Populus tremuloides	12.6	w	bl, p	d	4	wood nailed to side of trunk
255	Area F	Populus tremuloides	13.6	w	bl	d	4	nails in trunk; duct tape around trunk
256	Area F	Populus tremuloides	10.7	w		dl	3	
257	Area F	Populus balsamifera	19.2	w		dl	3	
258	Area F	Populus balsamifera	18.3			dl	3	
259	Area F	Salix fragilis	84.2	st		dl	2	
260	Area F	Populus tremuloides	10.4				2	
261	Area F	Salix fragilis	36.0		ab	dl	3	
262	Area F	Salix fragilis	18.5	st	bl	dl	4	
263	Area F	Salix fragilis	23.4			dl	3	
264	Area F	Populus tremuloides	12.8			dl	2	
265	Area F	Populus tremuloides	12.1			dl	2	
266	Area F	Populus tremuloides	15.1			dl	2	
267	Area F	Populus tremuloides	12.1			dl	2	
268	Area F	Populus tremuloides	13.8			dl	2	
269	Area F	Populus tremuloides	10.8			dl	2	
270	Area F	Acer negundo	25.8	st		fc	3	vines
271	Area F	Ulmus pumila	17.5			id	3	vines
272	Area F	Ulmus pumila	63.4	st		dl, id	3	vines
273	Area F	Populus tremuloides	13.2			dl	2	
274	Area F	Populus tremuloides	44.0	st		dl	2	

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class	Comments
275	Area F	Populus tremuloides	33.6	st			2	
276	Area F	Populus tremuloides	15.0			dl	2	
277	Area F	Populus tremuloides	17.5			dl	2	
278	Area F	Populus tremuloides	18.1			dl	2	
279	Area F	Populus tremuloides	18.8			dl	2	
280	Area F	Populus tremuloides	14.6			dl	2	
281	Area F	Populus tremuloides	16.9			dl	3	
282	Area F	Populus tremuloides	19.0			dl	2	
283	Area F	Ulmus pumila	33.2			dl, id, fn	4	
284	Area F	Robinia pseudoacacia	21.1			dl, fc	3	
285	Area F	Robinia pseudoacacia	13.3			dl, fc	4	
286	Area F	Robinia pseudoacacia	18.6		bl	d, fc	4	
287	Area F	Ulmus pumila	23.3		bl	dl, id	4	
288	Area F	Robinia pseudoacacia	80.2	st		fn	3	
289	Area F	Ulmus pumila	12.7		bl	dl, id	3	vines
290	Area F	Acer negundo	38.0			fc	3	

Appendix 7: Trees identified in Area G

Scientific Name	Common Name	Count
Ulmus pumila	Siberian Elm	125
Acer negundo	Manitoba Maple	3
Populus balsamifera	Balsam Poplar	10
Populus tremuloides	Trembling Aspen	43
Populus grandidentata	Large-tooth Aspen	8
Populus alba	White Poplar	14
Total		203

Appendix 8: Area H tree count

Scientific Name	Common Name	Count
Ulmus americana	American Elm	2
Ulmus pumila	Siberian Elm	12
Salix sp.	Willow species	10
Salix fragilis	Crack Willow	7
Quercus macrocarpus	Bur Oak	1
Prunus serotina	Black Cherry	1
Populus tremuloides	Trembling Aspen	25
Populus grandidentata	Large-tooth Aspen	1
Populus balsamifera	Balsam Poplar	35
Robinia pseudoacacia	Black Locust	19
Acer negundo	Manitoba Maple	9
Total		122

Appendix 9: Tree count and condition in Area I

Tree Number	Location	Tree Species	Diameter (cm)	Trunk Integrity	Crown Structure	Crown Vigour	Tree Vigour Class
1	Area I	Populus tremuloides	12.7			dl	3
2	Area I	Populus tremuloides	23.0	st		dl	4
3	Area I	Populus tremuloides	15.0		bl	dl	3
4	Area I	Populus tremuloides	12.0		bl	dl	3
5	Area I	Salix fragilis	23.0		ab	dl	4
6	Area I	Populus tremuloides	38.0		bl	d	4
7	Area I	Populus balsamifera	18.8	w		dl	3
8	Area I	Populus tremuloides	24.0	st	bl	dl	4
9	Area I	Populus tremuloides	18.2			fc	3
10	Area I	Salix fragilis	59.8		bl	dl	2
11	Area I	Juglans nigra	18.9		bl		2
12	Area I	Acer negundo	39.0	st	bl	dl	4
13	Area I	Ulmus americana	24.3			id	2
14	Area I	Salix fragilis	28.0		bl	dl	3
15	Area I	Populus balsamifera	14.0	w	bl	dl, fc	4
16	Area I	Salix fragilis	28.8	st	bl	dl	3
17	Area I	Populus balsamifera	50.0			dl	3
18	Area I	Salix fragilis	36.0	st		dl	3
19	Area I	Salix fragilis	49.5	st		dl	2
20	Area I	Acer negundo	65.5	st		dl	3

Addendum III. Response to EAC Comments April 9th 2008

The following addresses the comments by Guelph EAC in the order in which they were submitted.

General

1. Section 1.0 (Addendum II): the section in the introduction (page 1) should have read "Comments were received on that report [the original 2005 EIS] from the Grand River Conservation Authority…" [delete reference to EAC]. EAC previously commented on the terms of reference for the EIS.

2. This comment notes the features that should be overlaid on a grading plan. The following features requested by the City are indicated on the aerial photo base showing the development footprint, where all vegetation will be removed, on the west side of the site; and the grading plan for the east side of the site.

- Howitt Creek (shown on all figures in EIS + Addenda);
- Setbacks from Howitt Creek bank (current development limit shown in Addendum II);
- Location of Stable Top of Bank (hazard line shown in Addendum II);
- Location of the setback from the steep slopes (hazard line shown in Addendum II);
- Development Limits (shown in Addendum II).

Figure 1 attached to this present addendum summarizes all these features over the grading plan (shown over the aerial photo base); and in response to comment 2 also shows:

- Location of the revised pre-development and the post-development floodplain;
- Location of the setback from the watercourse (with the edge of the watercourse measured as the bankfull width according to Ontario Stream Assessment protocols, as recommended by GRCA);
- Location and setbacks to the drainage swale.

Significant Species and Flora

3. Locally significant bird species are shown in relation to the development plan overlay (for which the footprint has changed very little) in the 2005 EIS. Figure 1 of this addendum reiterates this information using the present development overlay. Impacts are the same as those discussed in the EIS. Figure 2 also shows the location of Biennial Gaura, the provincially significant plant species noted in Addendum II; this was not previously mapped because it was described in Addendum II as being within the development footprint. Mitigation for this species was proposed (it will be transplanted to the park on the eastern portion of the site). However, as noted in Addendum II, based on comments received from Mike Oldham, the botanist at the Natural Heritage Information Centre of the Ministry of Natural Resources, this species is likely to be non-native if it occurs in a non-native setting with an assemblage of predominantly non-native plant species, as is the situation on the Lafarge property.

We did not note the two "rare vegetation" species noted in point 3 of EAC comments: sand dropseed and narrow-leaved water plantain. If these records came from another source we would like to consult that source for their location, and would appreciate receiving contact information for the source. On receipt of this information we will add it to the mapping, determine potential impacts from development, and if required, develop recommendations for mitigation.

Community Park

4. The proposed gravelly soils to be added to the community park were in response to a recommendation in the EIS that the present character of the site, as a largely open area where drought-tolerant vegetation is colonizing the existing area, be retained and enhanced. To that end, the EIS recommended placing additional soil on the site and sculpting it to provide topographic variation. The EIS recommended that additional plantings include mainly drought-tolerant species of open habitats, providing as an example the prairie plantings that have thrived on top of the southern railway embankment. These species are most successful in stressful soil conditions where other species do not thrive, and thus we do not recommend topsoil be placed on the site to the minimum required for City parklands.

A concept for the proposed park is outlined in the *Feasibility Study for Public Park Land & Trails, Junction Park, Silver Creek Junction.* That concept does not contemplate a manicured park of turf; instead it:

- preserves the Silver Creek valley in a natural state;
- conserves the existing vegetation, some of it temporarily until it can be replaced by plantings of native species;
- preserves meadows and successional thickets for wildlife habitat;
- provides flood storage capacity;
- provides trails for walking, dog-walking, cycling, cross-country skiing, nature appreciation;
- makes connections to the neighbourhoods, the community, the adjacent development, and the City at large through a trail system that respects the City's Trail Master Plan;
- offers interpretive signage to interpret the rich natural and cultural heritage of the site and its environs;
- offers opportunity for a natural outdoor skating rink of nearly a hectare (2 acres);
- provides emergency and service vehicular access via a public easement on a development street and via a pedestrian access from Inkerman Street.

Howitt Creek

5. The hazard lands boundary is shown for the east and west sides of Howitt Creek in the Riparian Restoration Plan of Addendum I, again in Figure 1 of Addendum II, and is reiterated again here in Figure 1. The description of how this boundary was delineated is found in Addendum I.

6. The proposed buffer widths were discussed at length with Jennifer Wright of GRCA, and Addendum II, which addressed the buffer widths with the mitigation plan, was accepted by GRCA. **There will be no grading within this buffer zone**. The perimeter area proposed to be graded to achieve stable slopes is no longer proposed. The extensive mitigation plan, a planting plan proposed for the creek in Addendum I, was proposed in order to address the proposed reduction in buffer width, which is less than 30 m for the west side of the creek only.

The setbacks from the stream (the development line) were re-calculated using the bankfull channel width of the stream as suggested by GRCA in comments submitted on Feb 27, 2008. The bankfull channel width was measured at several points along the stream during fisheries surveys by Mike Johns of Gartner-Lee, and the figure used for the bankfull channel width, 3.5 m from the centre line of the stream, is the maximum observed from those measurements. Using this conservative calculation, the buffers would be a minimum of 12.9 m, a maximum of 24 m, with an average of 18.9 m, on the west side of the stream, and greater than 30 m on the east side of the stream. The previous average for the buffer width, obtained by measuring from the edge of the channel, was 24 m. The calculation of buffer widths will be refined when we have obtained mapping of the actual bankfull width (instead of applying the maximum to the entre stream).

Tree Conservation and Preservation

7. The linkage will be designed for small vertebrates such as amphibians, reptiles and small mammals that can easily pass through the culvert. The Hanlon Expressway is hazardous to animals vulnerable to road-kill and it is not recommended that linkage be designed for medium-sized or large mammals.

8. As detailed in Addendum II, species, size and condition of all trees over 10 cm were listed for each area to assist with calculations for tree replacement, but locations were not shown as this information would be superfluous: none of the trees within the development limits can be retained, so the focus is on tree planting where opportunities permit, rather than documenting the exact location of trees that will be lost. This approach was agreed on in discussions with Carrie Musselman, City of Guelph, and Nancy Falkenberg (NSE) in July of 2006, prior to the first tree inventory on the south side of the site.

9. All plantings adjacent to the creek will be installed at one time in an early phase of development.

10. There will be no grading in area E.

11. Trees will be planted along the edge of the drainage channel, not within the channel, on the west side of the site.

Stormwater Management

12. The location and design of the stormwater management facility in proximity to the creek, as well as proposed buffers from the watercourse, is shown in Figure 1 of Addendum II. We have reiterated it in Figure 1 of this report. We have based the buffer calculations on the bankfull width of the stream, as recommended by GRCA.

13. The design of the storm pond is preliminary, and is expected to be refined as the development concept is refined. Increases in flow in the creek from the stormwater pond are expected to be negligible (Van Arnhem, pers. comm. 2008). No impacts are anticipated to downstream terrestrial or aquatic environments based on this finding. Impacts of the proposed

stormwater design on downstream systems will be confirmed when stormwater design is finalized.

14. Similar to other developments within the City, impacts related to the following will be addressed in more detail in a subsequent Environmental Implementation Report (EIR) as the development design is refined, as follows:

- the drainage from Silvercreek Parkway and the proposed underpass has been addressed by the stormwater management report (Van Arnhem 2007). This drainage will be captured with catch basins that will direct flows to the culvert under the Hanlon Parkway, leading to the Northwest Drainage Channel;
- storm runoff from the developed part of the property will be directed to infiltration galleries, and remaining flows will be directed to the culvert under the Hanlon Parkway, leading to the Northwest Drainage Channel;
- the ability of infiltration galleries to maintain pre-development infiltration rates is being calculated as stormwater management proposals are refined responding to refinements in the development proposal; however, infiltration galleries have been approved throughout the city and specific details will be provided as part of the EIR;
- details for the Howitt Creek attenuation pond (flood control area) will be refined in the EIR;
- erosion and sediment control plan will be submitted as part of the EIR.

Mitigation/Compensation

15. The total number of trees to be removed on the site is 1138 (as noted in Addendum II). The number to be planted along the creek and on the east side of the property is 2600, and the number to be planted (both native and non-invasive exotic) on the west side of the property is estimated at 2400: a total of 5000 trees to be planted on the entire property. The ratio of planted trees to trees lost is greater than 4:1.

16. A letter of assurance from the Ministry of Transportation that the 14 m setback from the Hanlon Expressway will be available for plantings will be requested. If this assurance is refused, trees will not be planted in this location.

17. The twin culverts on the creek will not be removed, as a service road is required to access the park and the flood control area on the east side of the site. The barrier to fish already present in this location will be mitigated by designing a gradual drop through the use of weirs that will facilitate passage of fish. The weir design will be submitted as part of an EIR.

18. The overall detailed compensation planting plan will be submitted as part of the EIR.

APPENDIX B

TRAFFIC IMPACT STUDY

Traffic Impact Study Update
Proposed Mixed-Use Development

35 & 40 Silvercreek Parkway South
Silvercreek Junction
City of Guelph, Ontario

Prepared For:
Silvercreek Guelph Developments Limited

Revised Dec. 2008, Jan. 2009, Mar. 2009, Apr. 2012

BA Consulting Group Ltd.
45 St. Clair Avenue West, Suite 300
Toronto, Ontario M4V 1K9
416.961.7110(tel) 416.961.9807(fax)
www.bagroup.com
bagroup@bagroup.com

GROUP
Transportation Consultants

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1.0 Introduction

BA Consulting Group was retained by Silvercreek Guelph Developments Limited to carry out a Traffic Impact Study (TIS) for a proposed mixed use development at 35 and 40 Silvercreek Parkway South, i.e., the Lafarge lands, in the City of Guelph, Ontario.

This TIS report is provided as an update to earlier BA Group reports for the site, submitted in January 2006 and later revised in October 2007, May 2008 and March 2009. This updated report incorporates the revised land use plan that was developed during Ontario Municipal Board (OMB) mediation sessions which will form the basis of an Agreement between Silvercreek Guelph Developments Limited, the City and the Howitt Park Association. The revised plan is illustrated in Appendix Figure 1. This updated TIS report effectively supersedes the Traffic Impact Study, revised March 2009.

The updated TIS report documents the potential traffic impact of the following development phases and addresses comments provided by the MTO dated March 22, 2012:

- **Phase 1** of the development consists of a Warehouse Membership Club or Home Improvement Retail Warehouse establishment with a gross floor area of approximately 145,000 ft^2 and any residential or business park uses.

- **Phase 2** of the development consists of non-food-oriented Retail uses with a GFA of 56,000 ft^2 and 42,000 ft^2 of Service Commercial uses. Building permits for these uses may not be issued until the removal of the holding symbol or September 1, 2012.

- **Phase 3** of the development consists of the remaining GFA, i.e., 44,000 ft^2 of non-food-oriented Retail uses. Occupancy of Phase 3 building to occur no sooner than March 1, 2015.

For analysis purposes, retail uses for Phases 1 and 2 above were combined to form a total GFA of 243,000 ft^2 for the first development phase. Two scenarios are to be investigated for the second development phase. Each would include the remaining 44,000 ft^2 non-food-oriented Retail uses plus, either 350 units residential units, 100 unit institutional (nursing home), or 350 residential units and 106,000 square feet of office space. Other possible uses include a hotel, church or curling club, each of these could displace 100 residential units.

This TIS report also incorporates additional and updated material as follows:

- Includes explicit evaluation of the Edinburgh / Paisley signalized intersection;

- Includes supplemental material related to: (1) Daily traffic flows on area streets, (2) Truck traffic generation, and (3) potential for traffic infiltration;

- Includes updated signal timing phasing parameters for the Hanlon / Paisley signalized intersection.

The Lafarge lands are the former quarry site, roughly triangular in shape and approximately 22 hectares (54 acres) in total area. The site is presently completely undeveloped and unused. Figure 1 shows the general location of the site within the City of Guelph.

The site is bound on the north-east diagonal and the south-east diagonal by lines of the Goderich Exeter Railway. The rail line abutting the property on the north is the former CN Guelph subdivision mainline. The railway mainline and the industrial line merge to the east of the subject site. We are advised that this line typically carries six or eight through train movements per day plus some shunting movements associated with a small two-track sorting yard located along the north limit of the property. The rail line to the south of the property is an industrial lead which serves a number of businesses in the City of Cambridge south-west of Guelph. We are advised that the south line is relatively lightly used, typically carrying three train movements per week with usually no more than five or six cars travelling at under 15 kilometres per hour. Both lines pass over the Hanlon Expressway on bridges.

The site is currently divided into east and west sections by an existing municipal road known as Silvercreek Parkway South which runs roughly parallel to, and approximately 200 metres east of (centreline-to-centreline), the Hanlon Expressway.

Vehicular access will be provided via several full movement access driveways and intersections along Silvercreek Parkway. In conjunction with the proposed development Silvercreek Parkway will be realigned (between the rail crossings) and will be extended north to Paisley Road. This northerly extension will include a CNR underpass structure. The level crossing of Silvercreerk Parkway with the Goderich Exeter Railway will be retained.

1.1 Study Approach

Based upon discussions with City of Guelph Transportation Staff, a scope of work was established for the purposes of traffic impact analyses. The limits of the Study Area were Paisley Road to the north, Wellington Street to the south, Imperial Road to the west and Edinburgh Road to the east.

Study area intersections, methodology, assumptions and analysis procedures used in this study have been expanded in response to comments raised by other parties to the OMB hearing on the subject site. The study area intersections are summarized below:

<u>Study Area Intersections</u>

- Hanlon Expressway / Paisley Road signalized intersection;
- Paisley Road / Silvercreek Parkway signalized intersection;
- Paisley Road / Edinburgh Road signalized intersection;
- Waterloo Avenue / Edinburgh Road signalized intersection;
- Wellington Street / Edinburgh Road signalized intersection;
- Waterloo Avenue / Silvercreek Parkway South unsignalized intersection;
- Wellington Street/ Silvercreek Parkway/ East Ramp Terminal signalized intersection;
- Wellington Street / West Ramp Terminal signalized intersection; and
- Wellington Street / Imperial Road signalized intersection;

Analysis Scenarios

- Baseline traffic conditions;
- Future background five years hence.
- Future total traffic conditions with Phases 1 & 2 retail development;
- Future total traffic conditions with Phase 3 development scenarios – **Opening Day**;
- Future total traffic conditions five years after opening day; and
- Future total traffic conditions ten years after opening day.

Analysis Time Periods

- Weekday p.m. peak hour;
- Saturday peak hour.

Analyses of the intersections were carried out using the methods outlined in the Highway Capacity Manual (HCM 2000) with the assistance of Synchro 7 software. Volume-to-capacity (V/C) indices, levels of service and delay values were calculated for each of the study area intersections.

Details of the procedures, assumptions, findings, conclusions and recommendations resulting from the study are summarized in subsequent sections of this report.

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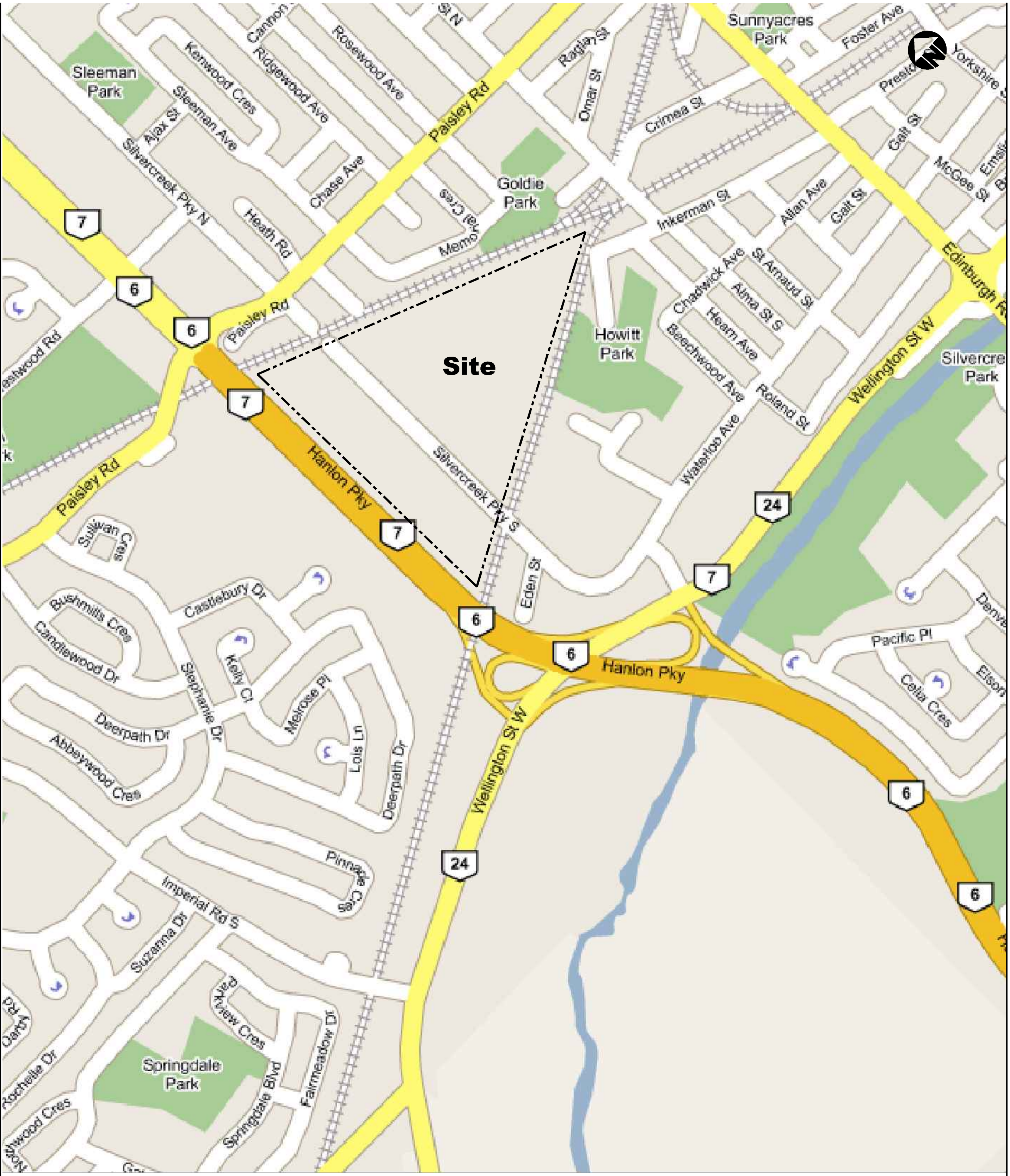


SITE LOCATION

GROUP

Silvercreek Guelph Developments

7041-01, April 2012

Figure 1

2.0 Existing Transportation Conditions

2.1 Existing Road Network

The area road network lane configurations and intersection traffic control are illustrated in Figure 2. A brief description of key road links follow:

Hanlon Expressway is a four-lane, divided, controlled-access highway under the jurisdiction of the Ministry of Transportation of Ontario (MTO). Hanlon Expressway has progressively been upgraded over the years, and the long range objective is that the facility will eventually become a full expressway with grade-separated interchanges and crossovers replacing the existing signal-controlled at-grade intersections. It is our understanding that there is a plan for the upgrading of the intersection of the Hanlon Expressway with Paisley Road to a grade-separated partial interchange. At this time we are not aware of the specific design of the interchange, planned timing of the upgrade or whether the project has been incorporated in a budget plan. The Lafarge property is situated immediately east of the Hanlon Expressway, between the partial-cloverleaf interchange at Wellington Road and the signalized intersection of Paisley Road.

Paisley Road is a major east-west arterial roadway within the City of Guelph. Within the vicinity of Hanlon Expressway Paisley Road is a four lane arterial with auxiliary lanes at the intersection of Hanlon Expressway/ Paisley Road. The lane configurations at the Hanlon Expressway/ Paisley Road are as follows:

- 1 EB Lt. & Thru + 1 EB Thru + 1 EB channelized Rt. (free flow to Hanlon Expressway);
- 1 WB Lt. + 1 WB Thru + 1 WB shared thru & Rt.
- 1 NB Lt. + 2 NB Thru + 1 NB channelized Rt.
- 1 SB Lt. + 1 SB Thru + 1 SB shared Thru & Rt.

Wellington Street is the major east-west arterial road in Guelph. Formerly Highway 24, Wellington Street provides access to the Guelph central area and provides a linkage between County Road 124, Highway 7 and the Hanlon Expressway. Near the site Wellington Street has a six lane cross section with auxiliary lanes at the east ramp terminal. Wellington Street continues as a six-lane arterial to the west and changes to a four-lane cross section east of Silvercreek Parkway / east ramp terminal intersection. The posted speed on Wellington Street within the study area is 50 km/h.

Existing lane configurations at the Wellington Street / Silvercreek Parkway / East Ramp Terminal intersection are as follows:

- EB Lt. + 3 EB Thru;
- 2 WB Thru + WB shared Thru & Rt.;
- 1 NB Lt.+ 1 shared NB Thru & Left + NB Rt.;
- 1 SB Lt. + 1 SB Rt.

The East and West Ramp Terminal intersections at Wellington Street are signalized.

Edinburgh Road is a north / south road under the jurisdiction of the City of Guelph. Edinburgh Road has a basic four lane cross section near Wellington Street and changes to a 2-lane cross section near Waterloo Avenue with auxiliary lanes at the intersection of Edinburgh Road and Waterloo

Avenue. Edinburgh / Waterloo, Edinburgh / Paisley and Edinburgh / Wellington intersections are all signalized.

Waterloo Avenue is two-lane City of Guelph road that extends east from Silvercreek Road into the central area of the City. Waterloo Avenue is connected to Wellington Street by a short four lane link (approximately 140 metres centreline-to-centreline). The north end of the link is a three-legged intersection controlled by a stop sign for northbound traffic. The great majority of northbound motorists presently turn right to travel eastbound along Waterloo Avenue. The south end of the link between Waterloo Avenue and Wellington Street is a signal controlled intersection which includes the one-way northbound Off-Ramp from the Hanlon Expressway. All turning movements (except the westbound left turn, the eastbound right turn, and the southbound through) are accommodated at this intersection.

Existing lane configurations at the Silvercreek Parkway and Waterloo Avenue are as follows:

- EB Thru + EB Right;
- WB Thru + WB Left; and
- NB Left + NB Right.

Silvercreek Parkway South is a major municipal arterial road which, at one time, extended north from Wellington Road to Highway 7 and beyond. At that time, Silvercreek Parkway crossed both the aforementioned rail lines at conventional level crossings, thereby providing access to the Lafarge property from both the north and the south. Currently, it has a basic 4-lane cross section north of Waterloo Avenue. Silvercreek Parkway continues as a 4-lane road across the rail line abutting the south site periphery and terminates immediately south of the rail line abutting the property on the north.

In 1991, the City of Guelph commissioned a preliminary design study of the potential grade separation of Silvercreek Parkway passing under the main rail line. The study undertaken by Cumming Cockburn Limited Consulting Engineers and Planners, concluded that grade separation was feasible and that costs (in 1991 dollars) could be as high as $4.324 million.

Imperial Road is a north / south basic 4-lane road under the jurisdiction of the City of Guelph. The Imperial Road and Wellington Street intersection is signalized.

The area to the north and south of the Lafarge property is generally residential in character. There are also a few relatively small institutional and commercial uses. To the east of the site, the rail corridors converge and are crossed at level crossings by a two-lane municipal roadway known as Alma Street. Alma Street extends south to Waterloo Avenue and intersects with Inkerman Street, which runs parallel to and south of the rail corridor. The west limit of Inkerman Street extends to the rail corridor. No access to Inkerman Street or Alma Street is contemplated as part of this study.

2.2 Existing Traffic Volumes

In order to establish an understanding of existing traffic conditions in the immediate vicinity of the subject site, BA Group conducted weekday afternoon and Saturday peak period turning movement counts at the study area intersections on Saturday, June 11, 2005 and at the Hanlon Expressway/

Paisley Road intersection on September 10, 2005. Also, 2002 to 2004 turning movement counts and traffic signal timing plans were obtained from the Transportation Department of the City of Guelph and the Ministry of Ontario (MTO). Turning movement counts at the signalized intersection of East Ramp Terminal / Wellington Street and the unsignalized intersection of Waterloo Avenue / Silvercreek Parkway for the weekday afternoon peak hour and the signal timing plans the Ramp terminal intersections on Wellington Street were obtained from the BA Group Traffic Study, December 2002[1]. Weekday p.m. peak hour turning movement counts at the Hanlon Expressway/ Paisley Road was obtained from the Ministry of Transportation Ontario (MTO). Turning movement counts for the Hanlon Expressway/ Paisley Road were completed August 30, 2004. All the turning movement counts at all the study area intersections were factored up to the baseline counts applying the derived corridor growth rate. The corridor growth rate has been discussed in the corresponding section followed later in this report.

Recent turning movements counts were obtained through the services of Traffic Information Group (TIG) in early January 2009 at all study area intersections during both weekday and Saturday peak hours. A comparison of the January 2009 peak hour turning movements show that the baseline volumes used in this study are higher than the recent (January 2009) turning movement counts. Therefore baseline counts used in this study are more reflective of 2009 / 2010 conditions.

Current signal timing plans are shown in Appendix B. The resulting composite baseline traffic volumes, updated and balanced, are illustrated in Figure 3.

The results of a review of existing volumes at the study area intersections carried out by the City are as follows:

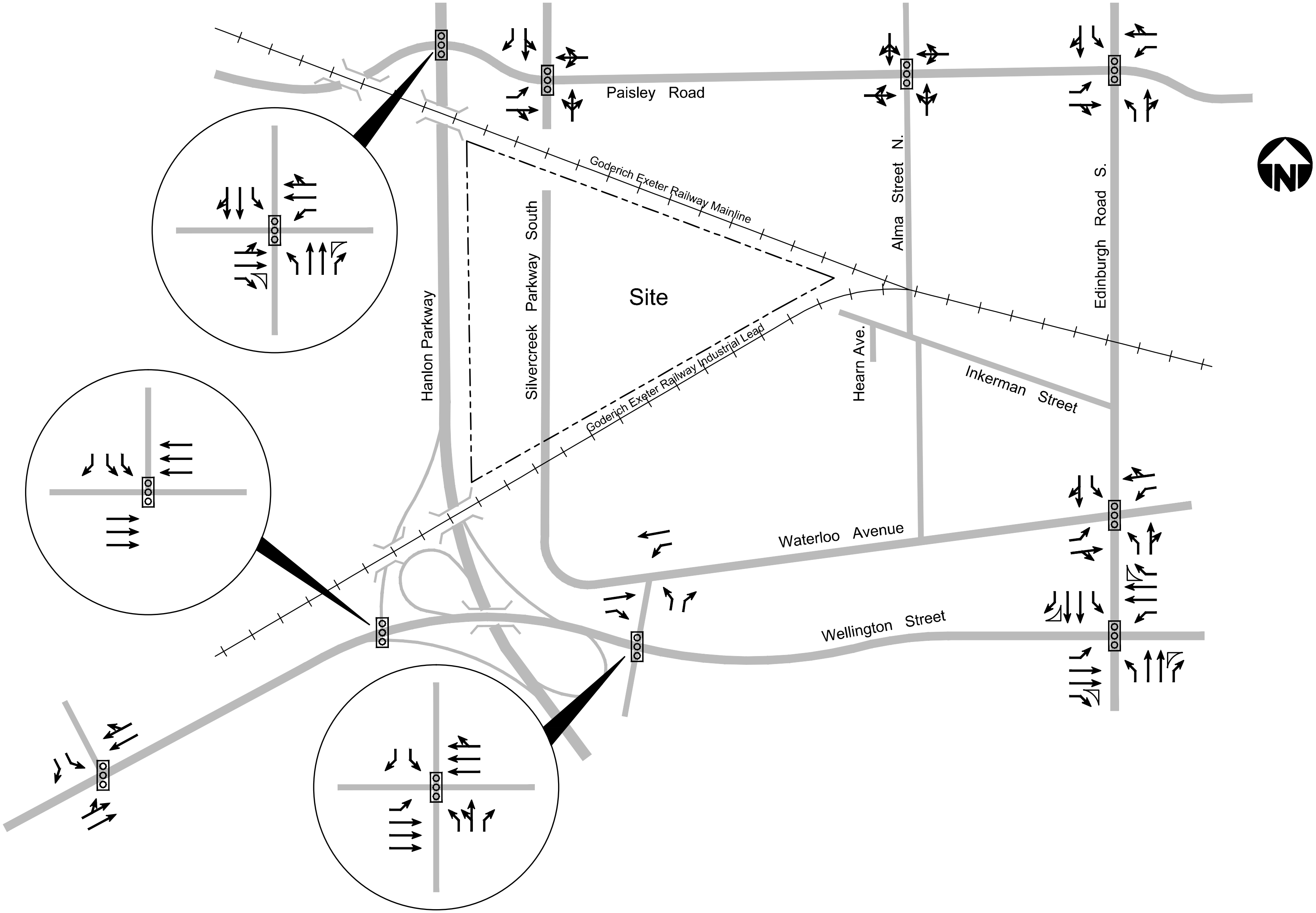
- At the Hanlon/Paisley intersection, MTO's 2011 volumes are generally lower than those in the report especially in the SBL, SBR and WBL directions. Therefore it is considered conservative to use the report volumes (they have been factored to 2011 conditions).
- At Paisley/Silvercreek intersection, City's 2011 TMCs are used. It is noted that except for EBL volumes which are 55 vehicles lower, the TMC volumes are comparable to the report volumes.
- The report volumes at intersections of Silvercreek/Waterloo and Wellington/east ramp terminal are used. It is assumed no change along Waterloo and Wellington. In fact City's 2011 TMCs at Edinburgh/Wellington shows a decrease in traffic volumes along Wellington between Edinburgh and the east ramp terminal. Therefore it is considered conservative to use the report volumes (they have been factored to 2011 conditions).

2.3 Public Transit

The site is served by two bus routes, i.e., Perimeter Routes 70A / 70B and Route 3 Waterloo / Fife. Bus stops are available at Waterloo and Silvercreek intersection, which is a 3 minute walk from the south limit of the development.

A new bus route is being contemplated with development. This new route would travel between the downtown and the subject site. We note that due to the generous road allowance width, i.e., 30 m, of Silvercreek Parkway, introduction of Bus Lay By facilities can easily be accommodated within the existing right of way.

[1] Existing Conditions and Directions Traffic Planning Considerations – The Lafarge Canada Inc. – Silvercreek Parkway Property – Guelph, Ontario – December 2002



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EXISTING LANE CONFIGURATIONS

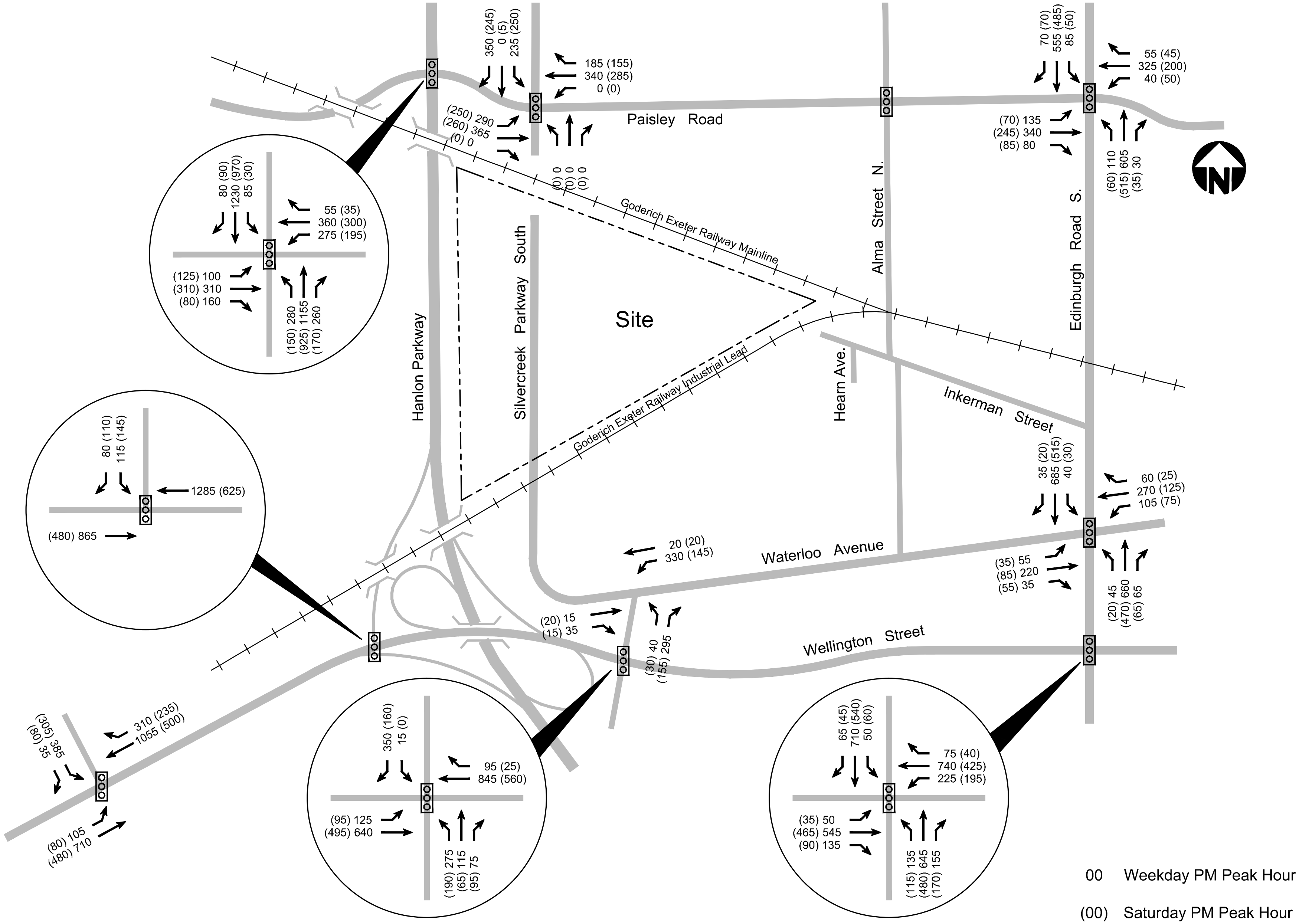
Existing Traffic Signal

BA GROUP

Silvercreek Guelph Developments

7041-01, April 2012

Figure 2



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BASE TRAFFIC VOLUMES

BA GROUP

Silvercreek Guelph Developments
7041-01, April 2012

Figure 3

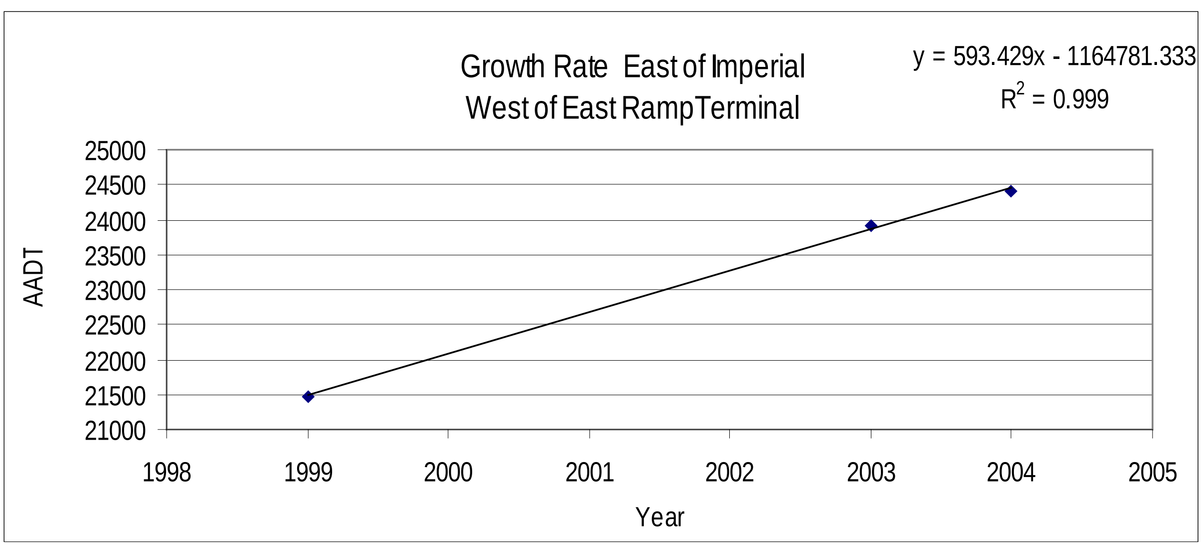
3.0 Background Traffic Forecasts

3.1 Corridor Growth

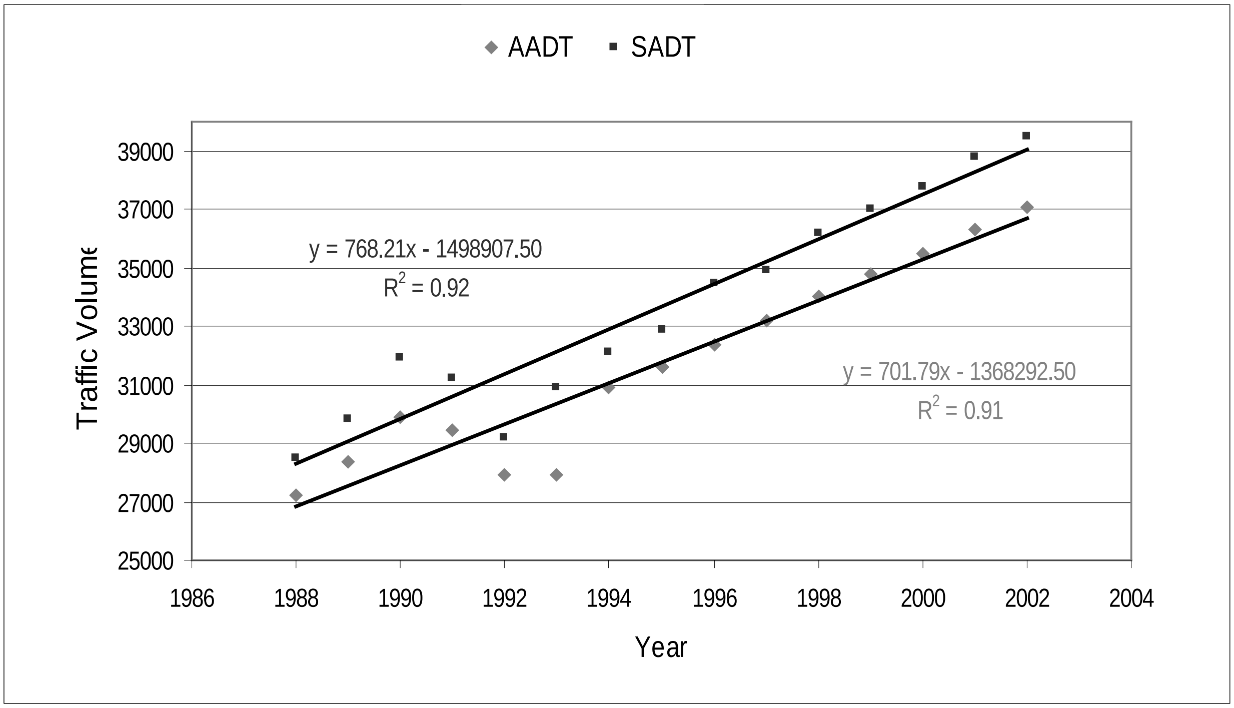
In order to understand the implications of the proposed development in context of corridor growth along Wellington Street, historical traffic volumes were reviewed. Regression analyses were carried out based on a review of AADT volumes obtained from the Transportation Department of the City of Guelph to derive the growth rate on Wellington Street, Edinburgh Road and Waterloo Avenue. AADT volumes along almost all these corridors have been decreasing. However, a regression analysis on the AADT volumes on Wellington Street west of the East Ramp Terminal and Imperial Road showed a variable growth. Based on the AADT and SADT volumes on Hanlon Expressway a regression analysis was completed to establish a growth rate for Hanlon Expressway traffic. The following graphs illustrate the results of the regression analysis. The results indicated a simple growth rate of 2% per annum on Wellington Street and Hanlon Expressway. This rate was therefore applied to the intersection movements to arrive at future background volumes at the study area intersections along Wellington Street and Hanlon Expressway. For the purposes of this analysis a simple growth rate of 0.5% per annum was applied to intersections along Paisley Road and Edinburgh Road.

For analysis purposes we have applied 2% increase in traffic volumes per year to turning movement counts to derive the updated baseline traffic volumes (i.e. a 2% increase for counts carried out in 2004, or a 6% increase for counts carried out in 2002). To derive the future corridor volumes a 10% increase for 5 years and a 20% increase for 10 years were applied to baseline through and turning movement volumes on Hanlon Expressway and Wellington Street. Five year and ten year planning horizons were evaluated to estimate the impact on the neighbouring road area network.

Estimation of Corridor Growth based on AADT Volumes on Wellington Street



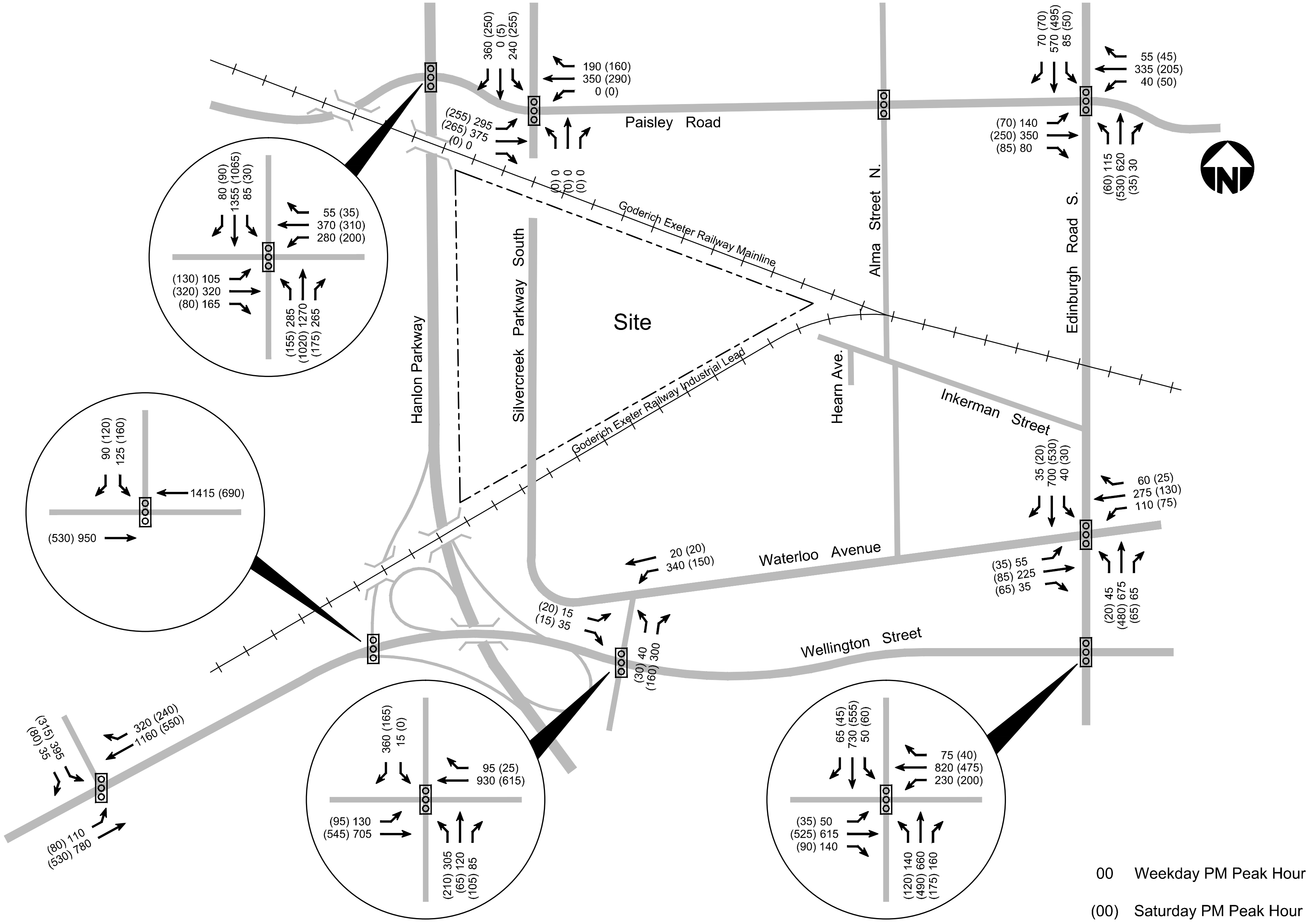
Estimation of Corridor Growth based on SADT Volumes on Hanlon Pkwy at Wellington Street



Similarly, we have applied 0.5% increase in traffic volumes per year to turning movement counts to derive the updated baseline traffic volumes (i.e. a 0.5% increase for counts carried out in 2004, or a 1.5% increase for counts carried out in 2002). To derive the future corridor volumes a 2.5% increase for 5 years and a 5% increase for 10 years were applied to baseline through and turning movement volumes on Paisley Road and Edinburgh Road.

Resultant future background traffic volumes five years hence are illustrated in Figure 4.

In March 2012, the City of Guelph confirmed that their 2021 future traffic projections for the intersections and the boundary roads are in line with the 10-year volumes contained in this report.



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FUTURE BACKGROUND TRAFFIC VOLUMES
5 Year Traffic Growth

BA GROUP

Silvercreek Guelph Developments

7041-01, April 2012

Figure 4

4.0 Site Traffic Forecast

4.1 Trip Generation

Trip generation rates for the land uses contemplated in development Phases 1 to 3 were derived based upon a review of the Institute of Transportation Engineer's (ITE) Trip Generation Manual, 7th Edition. ITE land use codes used for this project are set out in Table 1.

Table 1
ITE Land Use Codes

Land Use	ITE Code
Phase 1 & 2 Retail	#820
Phase 3 Office	#710
Phase 3 Retail (based on 287,0000 ft^2)	#820
Phase 3 Residential	#232
Phase 3 Nursing Home	#252

The resultant traffic volumes for Phases 1 &2 retail uses are set out in Table 2. It is estimated the retail uses in Phases 1 and 2 would generate approximately 975 and 1305 net new two-way trips during the weekday p.m. and Saturday peak periods, respectively.

Pass-by trip percentages for the weekday p.m. and Saturday peak hours were based upon our experience relating to similar land uses of similar size in the GTA and a review of pass-by rates extracted from the ITE Trip Generation Manual.

Table 2
Phases 1 & 2 Site Trip Generation – Silvercreek Developments

Development Phases & Land Use	WEEKDAY PM Peak Hour			SATURDAY Peak Hour		
	In	**Out**	**2-Way**	**In**	**Out**	**2-Way**
Phases 1 & 2 – 243,000 ft^2 Retail						
Directional Distribution	48%	52%	100%	52%	48%	100%
Trip Rate (per 1,000 ft^2)	2.22	2.41	4.63	3.30	3.04	6.34
Gross Trips	540	585	1125	800	740	1540
Seasonal Adjustment (15% - weekday, 6% - Saturday)	80	90	170	50	45	95
Sub Total – Phase 1 & 2 Volumes	620	675	1295	850	785	1635
Pass-by Trips 25% Weekday / 20% Saturday	-160	-160	-320	-165	-165	-330
Phase 1 &2 - Net New Trips	**460**	**515**	**975**	**685**	**620**	**1305**

The resultant traffic volumes for Phase 3 development scenarios are set out in Table 3. It is estimated Phase 3 development would generate approximately 270 to 420 net new trip during the weekday afternoon peak hour depending on the land use scenario with Option 2 (with the Office component) being the higher traffic generator. During the Saturday afternoon peak hour, both scenarios would generate 325 to 335 net new trips.

Table 3
Phase 3 Site Trip Generation Considerations – Silvercreek Developments

Development Phases & Land Use	WEEKDAY PM Peak Hour			SATURDAY Peak Hour		
	In	Out	2-Way	In	Out	2-Way
Gross trips for Combined 288,000 ft^2	695	755	1450	950	875	1825
Pass by 22% weekday & 18% Saturday	-160	-160	-320	-165	-165	-330
Net Site Traffic for 288,000 ft^2	535	595	1130	785	710	1495
Net Site Traffic for 243,000 ft^2	460	515	975	685	620	1305
Phase 3 Option 1						
Net Site Traffic for 44,000 ft^2	75	80	155	100	90	190
Interaction	-5	-10	-15	-10	-5	-15
350 Unit Residential Condo	85	50	135	60	75	135
100 Unit Seniors	5	5	10	5	5	10
Interaction	-10	-5	-15	-5	-10	-15
Phase 3 Option 1 – Net New Trips	**150**	**120**	**270**	**150**	**155**	**315**
Phase 3 Option 2						
Net Site Traffic for 45,000 ft^2	75	80	155	100	90	190
Interaction	-20	-15	-35	-10	-5	-15
350 Unit Residential Condo	85	50	135	60	75	135
Interaction	-10	-5	-15	-5	-10	-15
106,000 ft^2 Office	35	165	200	20	20	40
Interaction (Office)	-5	-15	-20	0	0	0
Phase 3 Option 2 – Net New Trips	**160**	**260**	**420**	**165**	**170**	**335**

The weekday a.m. peak hour was not analyzed for the following reasons: (a) During the a.m. peak hour, Phase 1 and 2 development would generate approximately 220 net new trips (approximately 22 percent of the net new p.m. peak hour trips) which would therefore have a marginal impact on the adjacent intersections; and (b) Phase 3 - Option 2 development would generate approximately 585 net new trips two way during the a.m. peak hour (approximately 42% of the net new p.m. peak hour trips) which would also have a marginal impact on the study area intersections.

Therefore, the weekday a.m. peak hour is not a critical time period for analysis purposes.

4.2 Trip Distribution

Retail site traffic distribution was derived based upon a "catchment area" identified in the Retail Centre Market Demand and Impact Analysis report prepared by Tate Economic Research (September 2005) for the subject development.

Figure 5 illustrates the retail site traffic distribution pattern. Phases 1 and 2 gross retail and pass-by site traffic volumes are shown in Figures 6 and 7. The resultant net new site traffic volumes for Phases 1 and 2 are therefore illustrated in Figure 8.

Phase 3

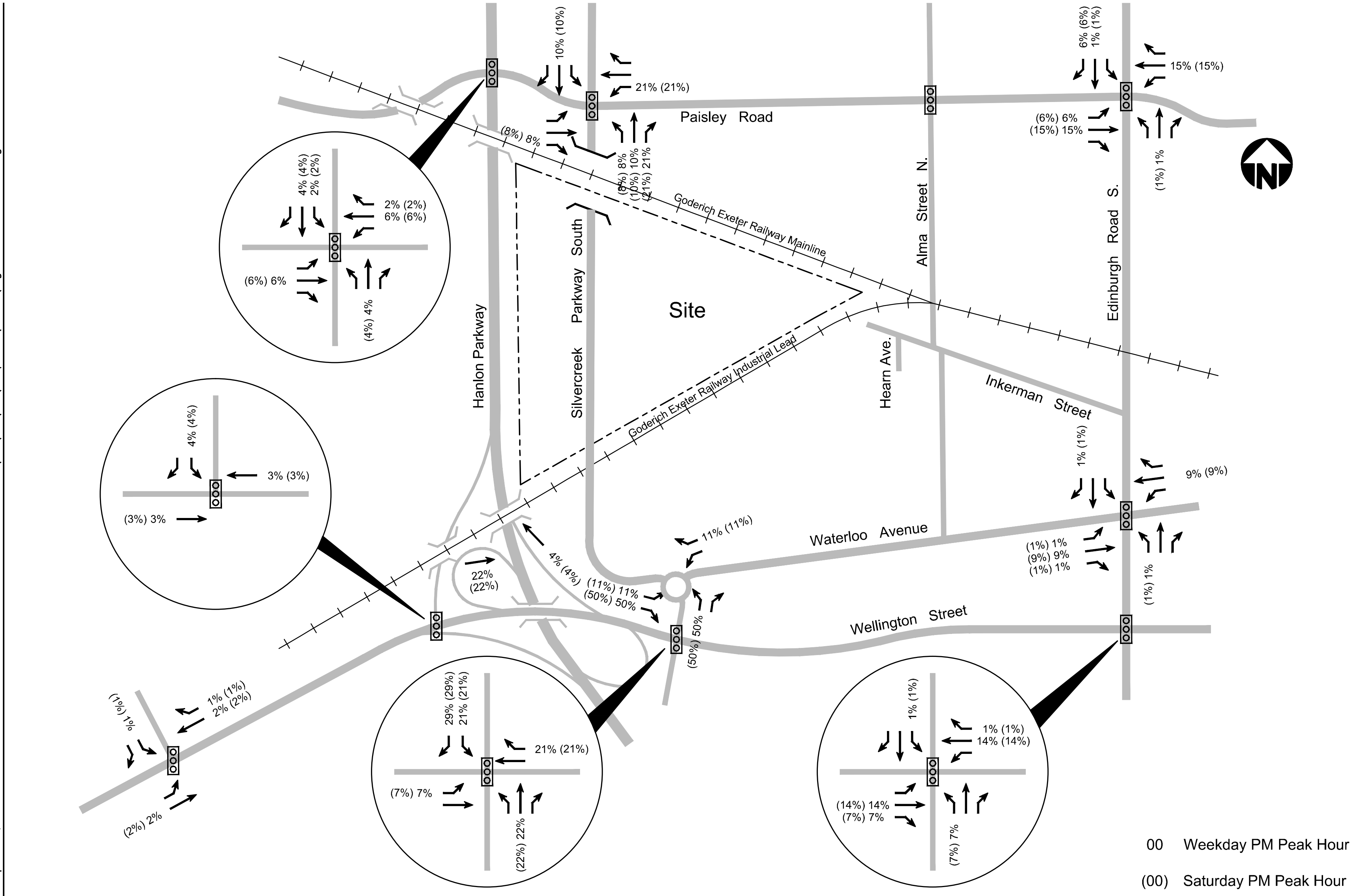
Site trip distribution for residential and office uses were derived based upon a review of the 2006 Transportation Tomorrow Survey (TTS) data.

- Phase 3 residential site traffic distribution is shown in Figure 11.
- Phase 3 office site traffic distribution is shown in Figure 12.
- Phase 3, Option 1 retail, residential and seniors traffic volumes are illustrated in Figure 13 A.
- Phase 3, Option 2 retail, residential and office traffic volumes are illustrated in Figure 13 B.

4.3 Total Traffic Volumes

Future total traffic volumes for the development phases are illustrated in the following Figures:

- Total Traffic Volumes for Phases 1 and 2 are shown in Figure 9.
- Total Traffic Volumes for Phase 3 Option 1 & 2 (Opening Day) are shown in Figures 10A and 10B.
- Total Traffic Volumes 5 Years after opening are shown in Figures 15 and 16.
- Total Traffic Volumes 10 Years after opening are shown in Figures 17 and 18.



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RETAIL SITE TRAFFIC DISTRIBUTION
Phases 1 & 2

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7041-01, April 2012

Figure 5

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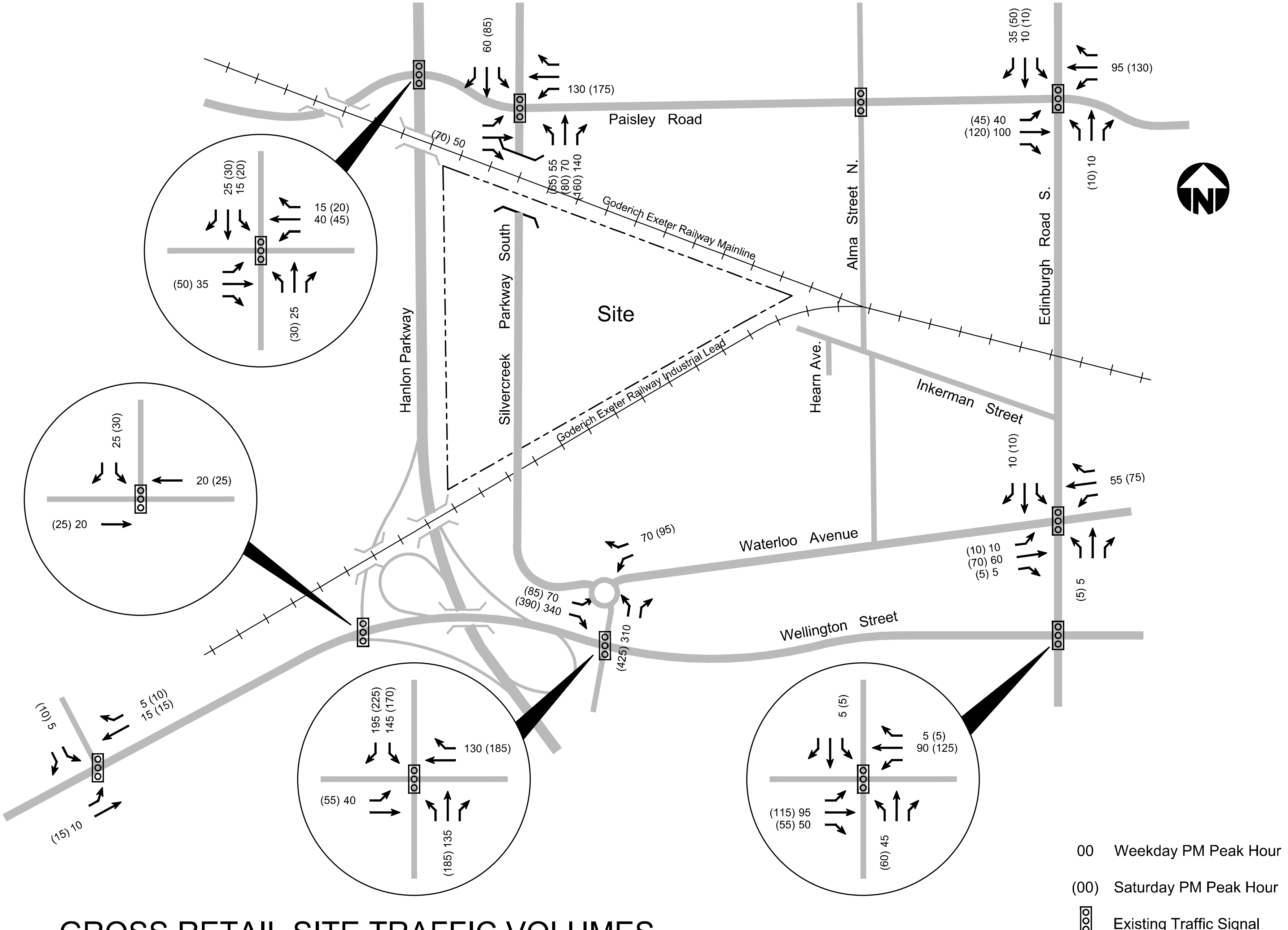

GROSS RETAIL SITE TRAFFIC VOLUMES
Phases 1 & 2

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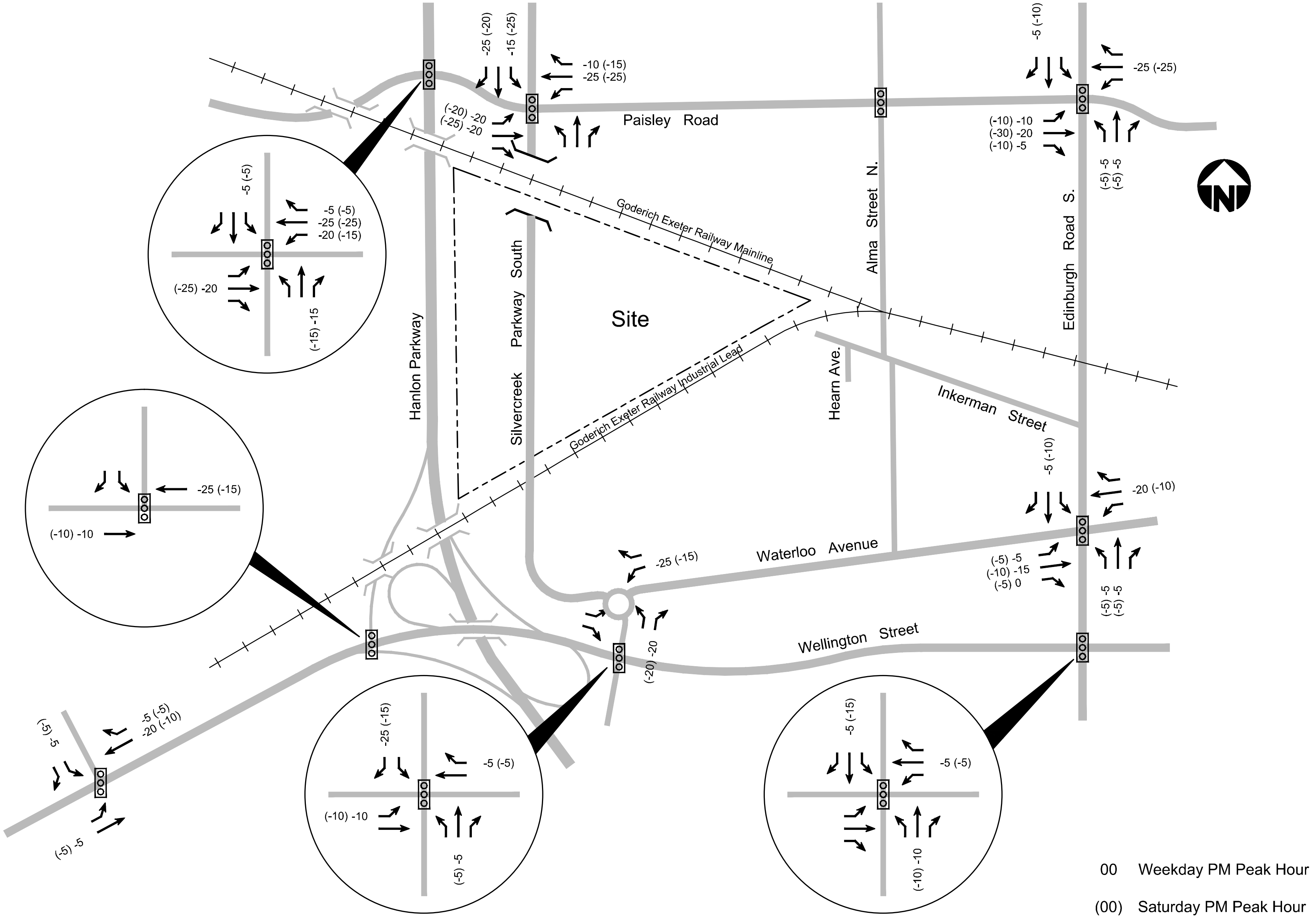
7041-01, April 2012

Figure 6



PASS BY RETAIL TRAFFIC VOLUMES
Phases 1 & 2

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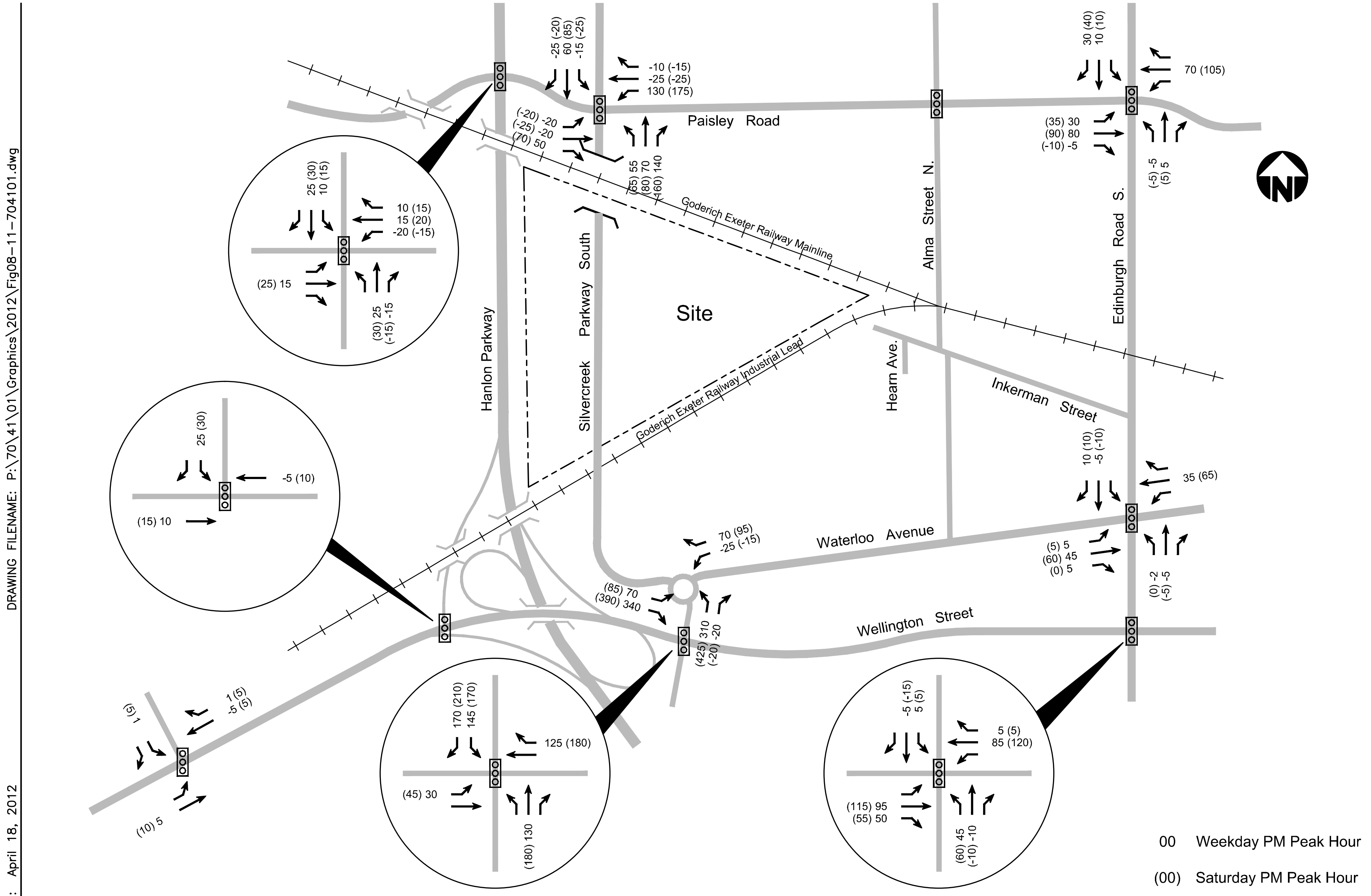


00 Weekday PM Peak Hour

(00) Saturday PM Peak Hour

Existing Traffic Signal

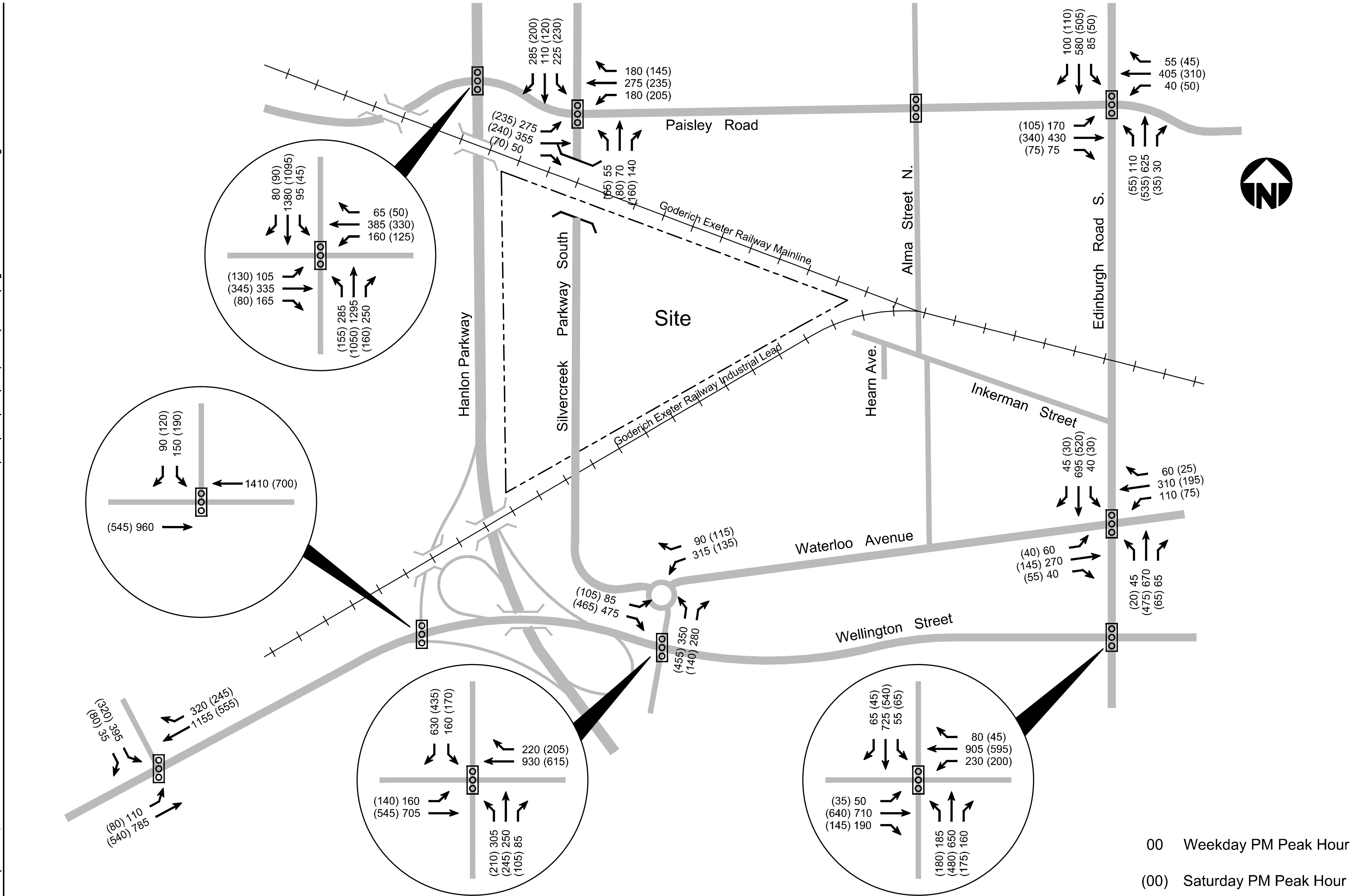
TOTAL NET RETAIL SITE TRAFFIC VOLUMES
Phases 1 & 2

BA GROUP

Silvercreek Guelph Developments

7041-01, April 2012

Figure 8



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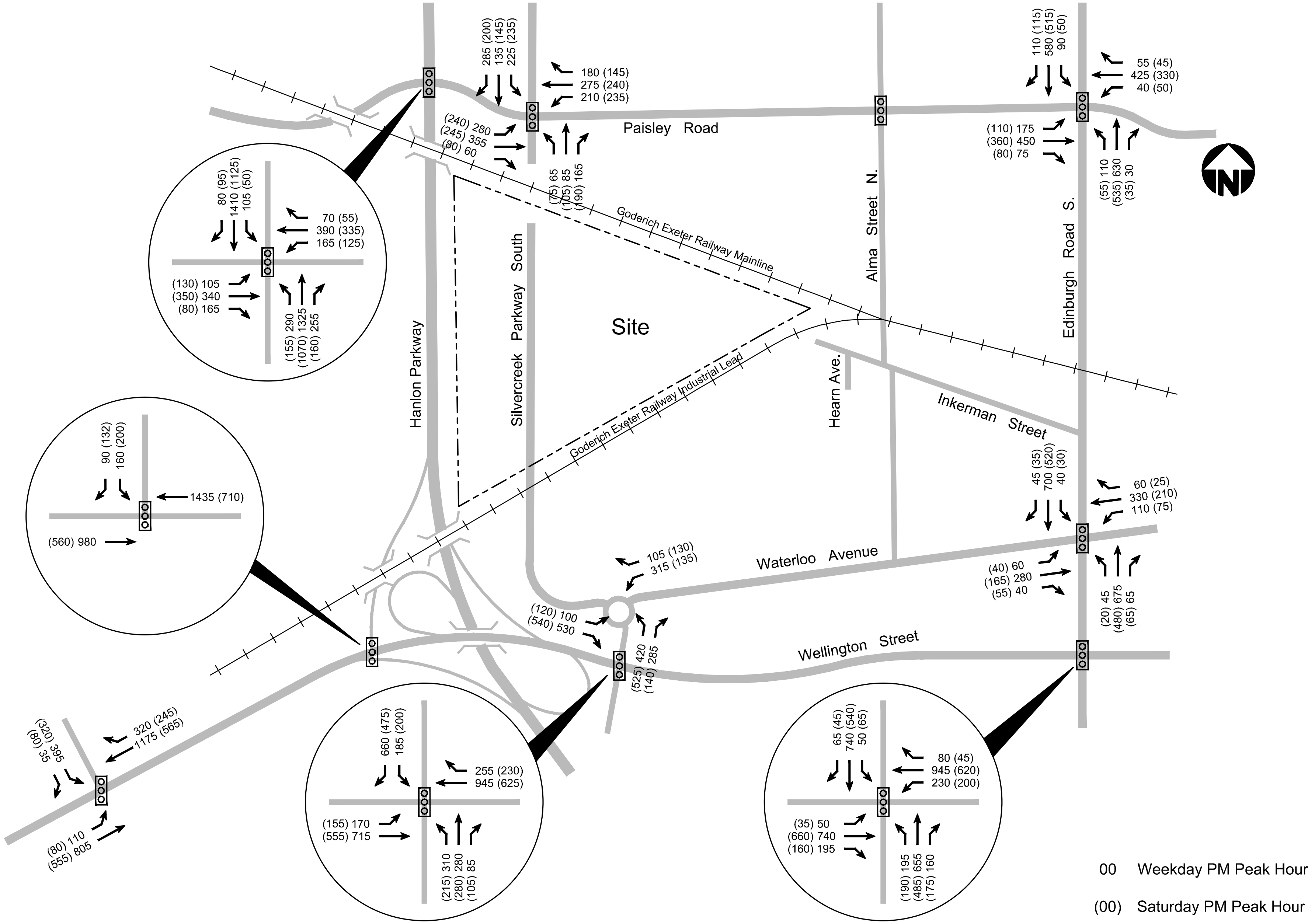
FUTURE TOTAL TRAFFIC VOLUMES
5 Year Traffic Growth + Phases 1 & 2

BA GROUP

Silvercreek Guelph Developments
7041-01, April 2012

Figure 9



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FUTURE TOTAL TRAFFIC VOLUMES

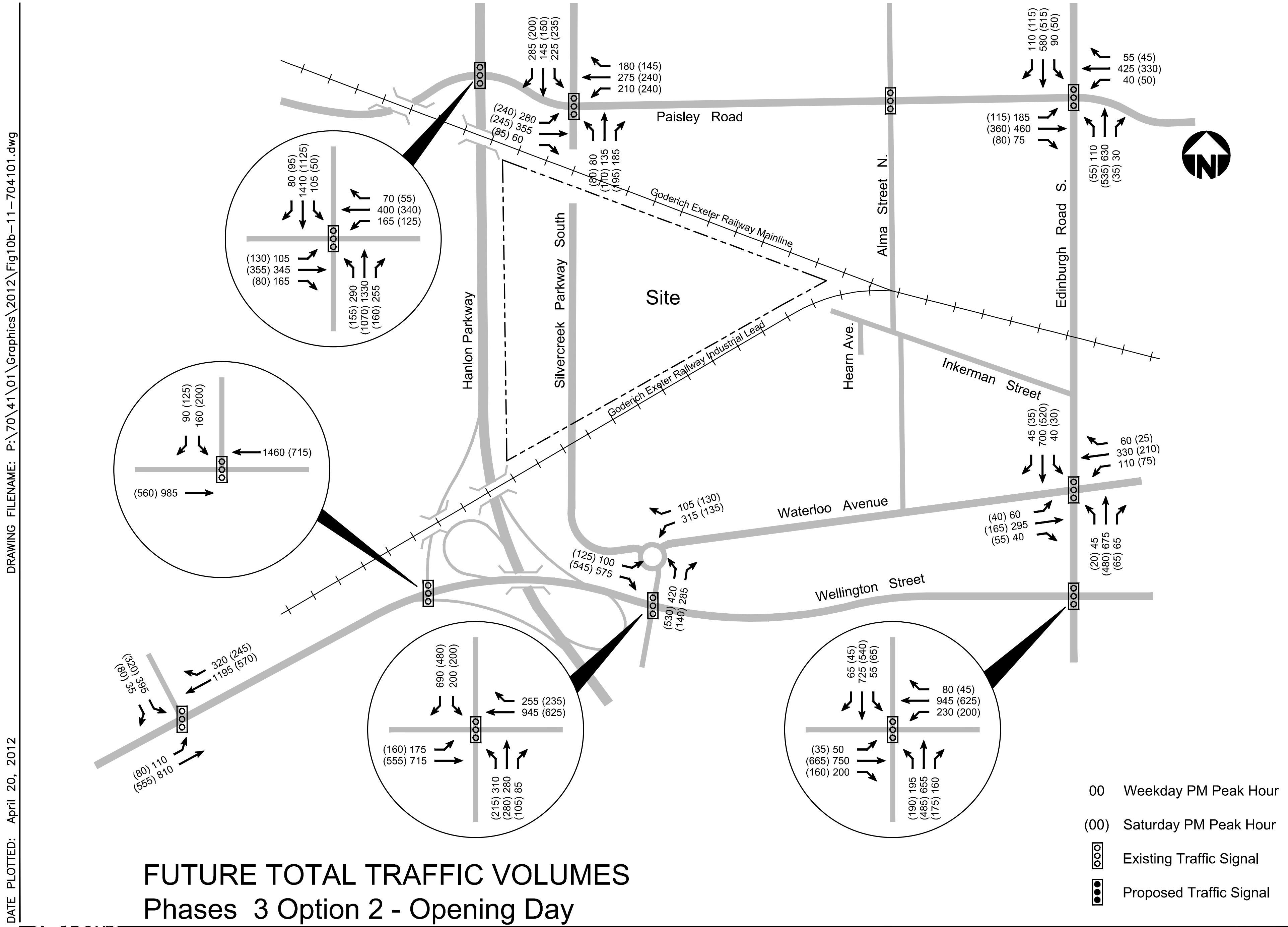
Phases 3 Option 1 - Opening Day

BA GROUP

Silvercreek Guelph Developments

7041-01, April 2012

Figure 10a



FUTURE TOTAL TRAFFIC VOLUMES

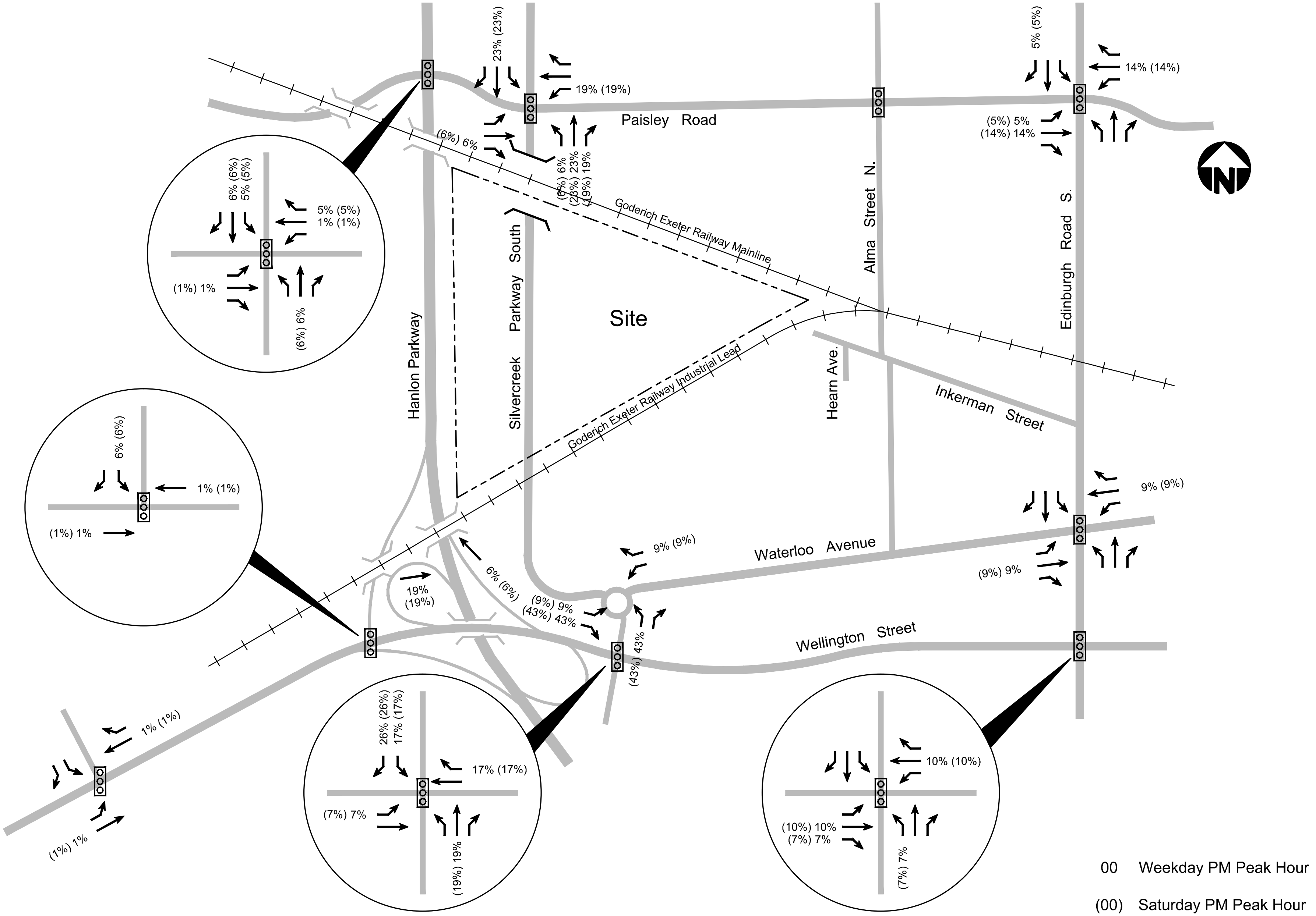
Phases 3 Option 2 - Opening Day

BA GROUP

Silvercreek Guelph Developments

7041-01, April 2012

Figure 10b



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DATE PLOTTED: April 18, 2012

RESIDENTIAL SITE TRAFFIC DISTRIBUTION
Phase 3

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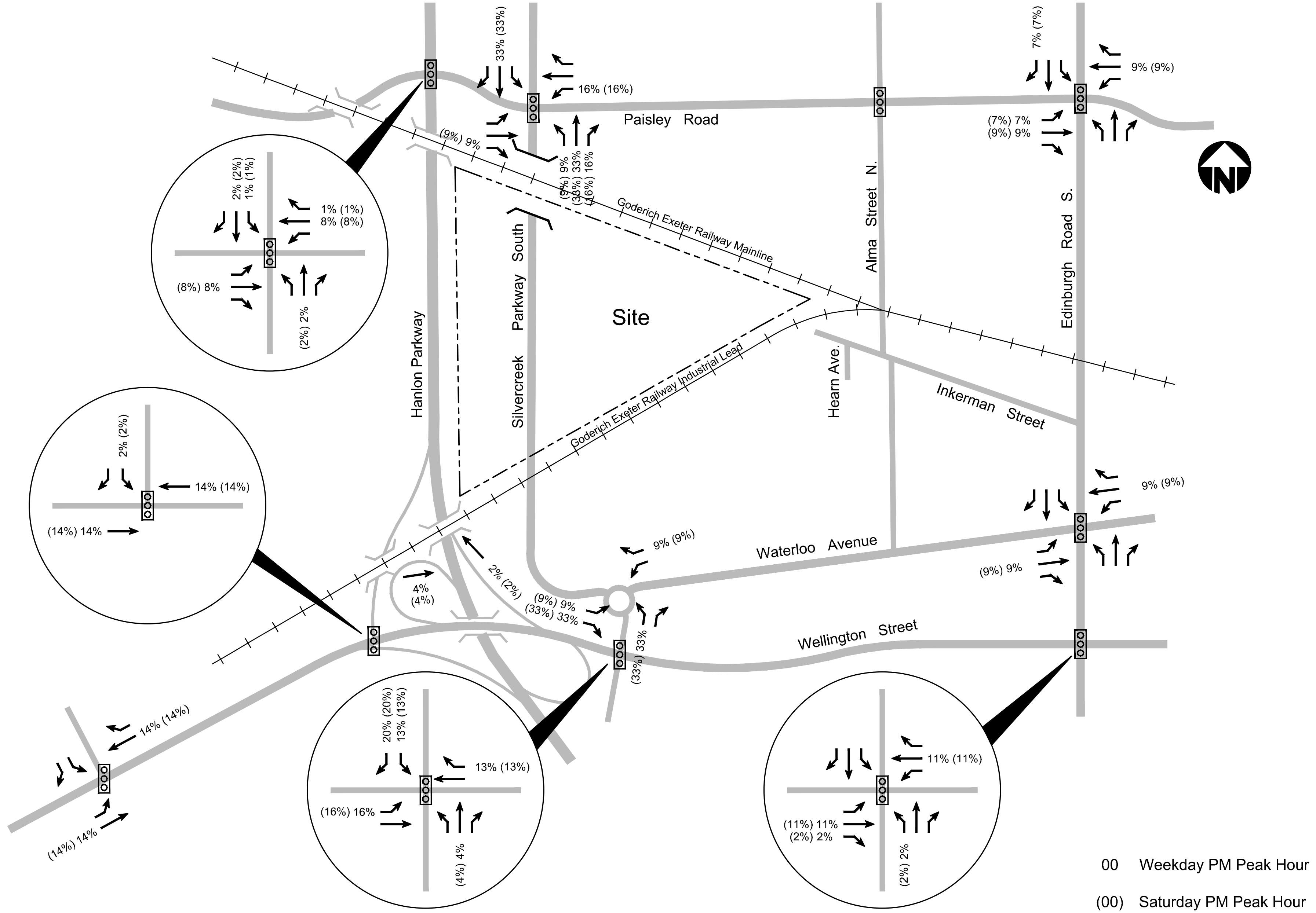
7041-01, April 2012

Figure 11



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DATE PLOTTED: April 18, 2012

OFFICE SITE TRAFFIC DISTRIBUTION
Phase 3

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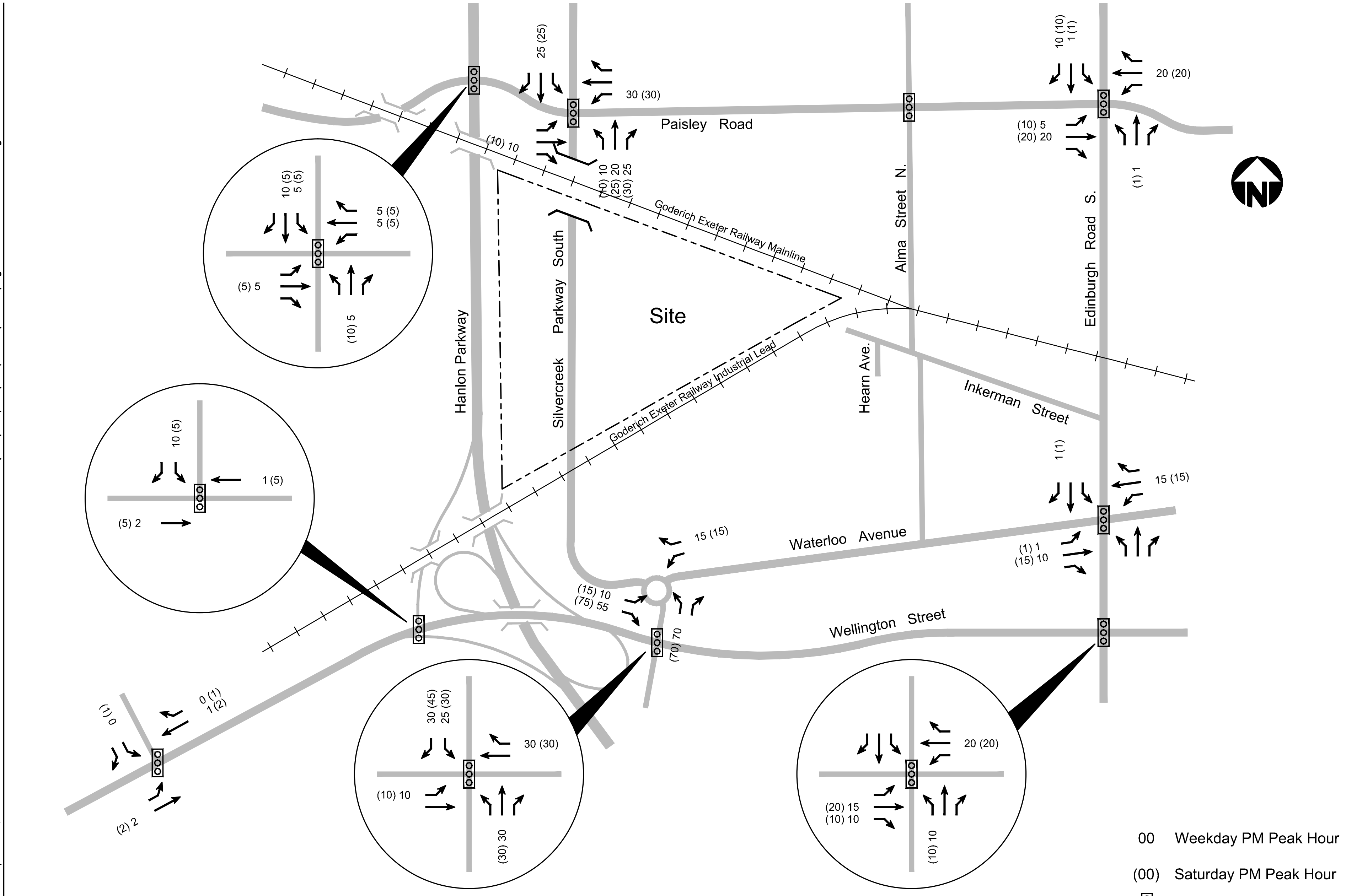
Silvercreek Guelph Developments
7041-01, April 2012

Figure 12



DRAWING FILENAME: P:\70\41\01\Graphics\2012\Fig13a-11-704101.dwg

DATE PLOTTED: April 18, 2012

RETAIL + RESIDENTIAL SITE TRAFFIC VOLUMES
Phase 3 Option 1

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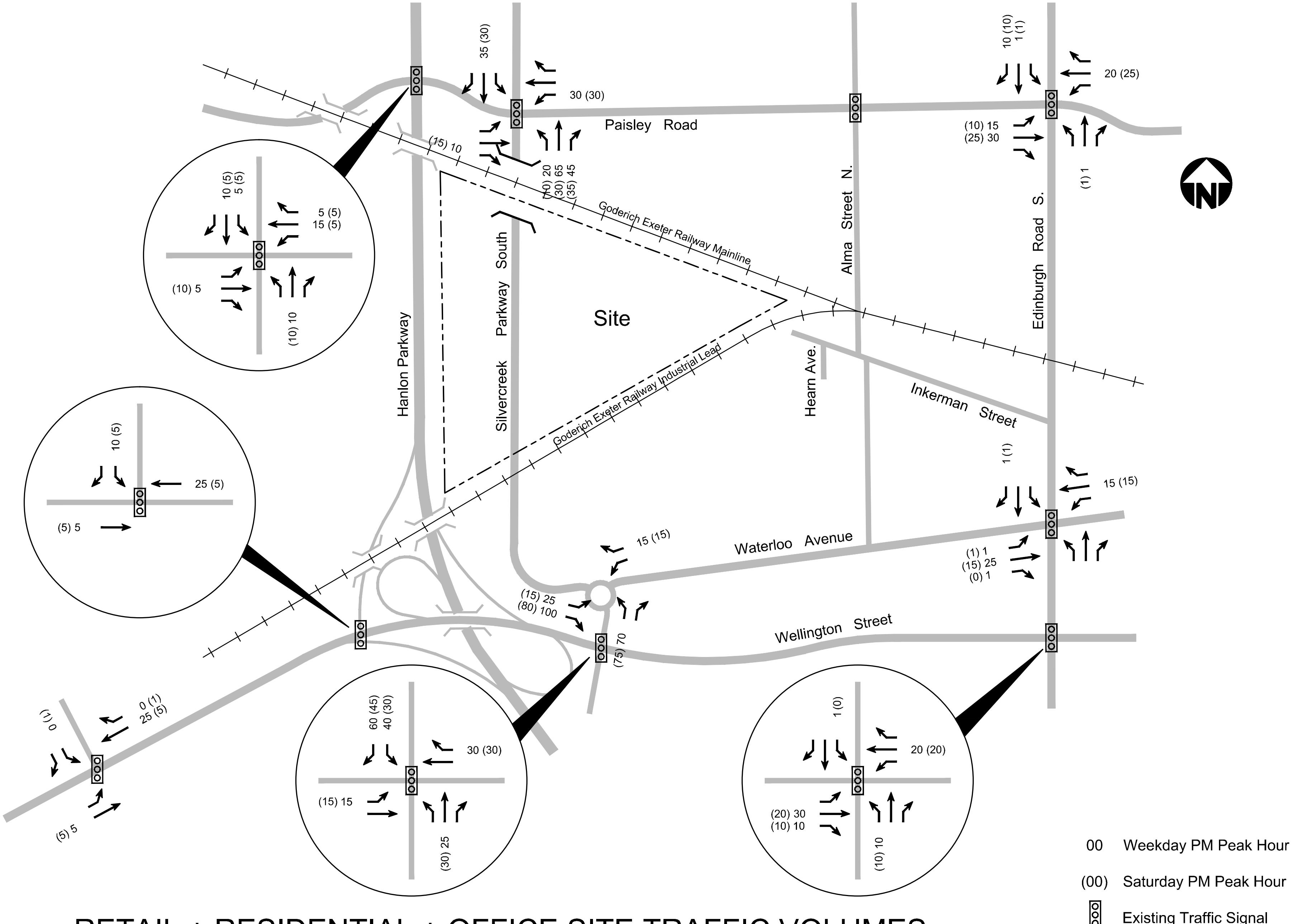
7041-01, April 2012

Figure 13a



RETAIL + RESIDENTIAL + OFFICE SITE TRAFFIC VOLUMES
Phase 3 Option 2

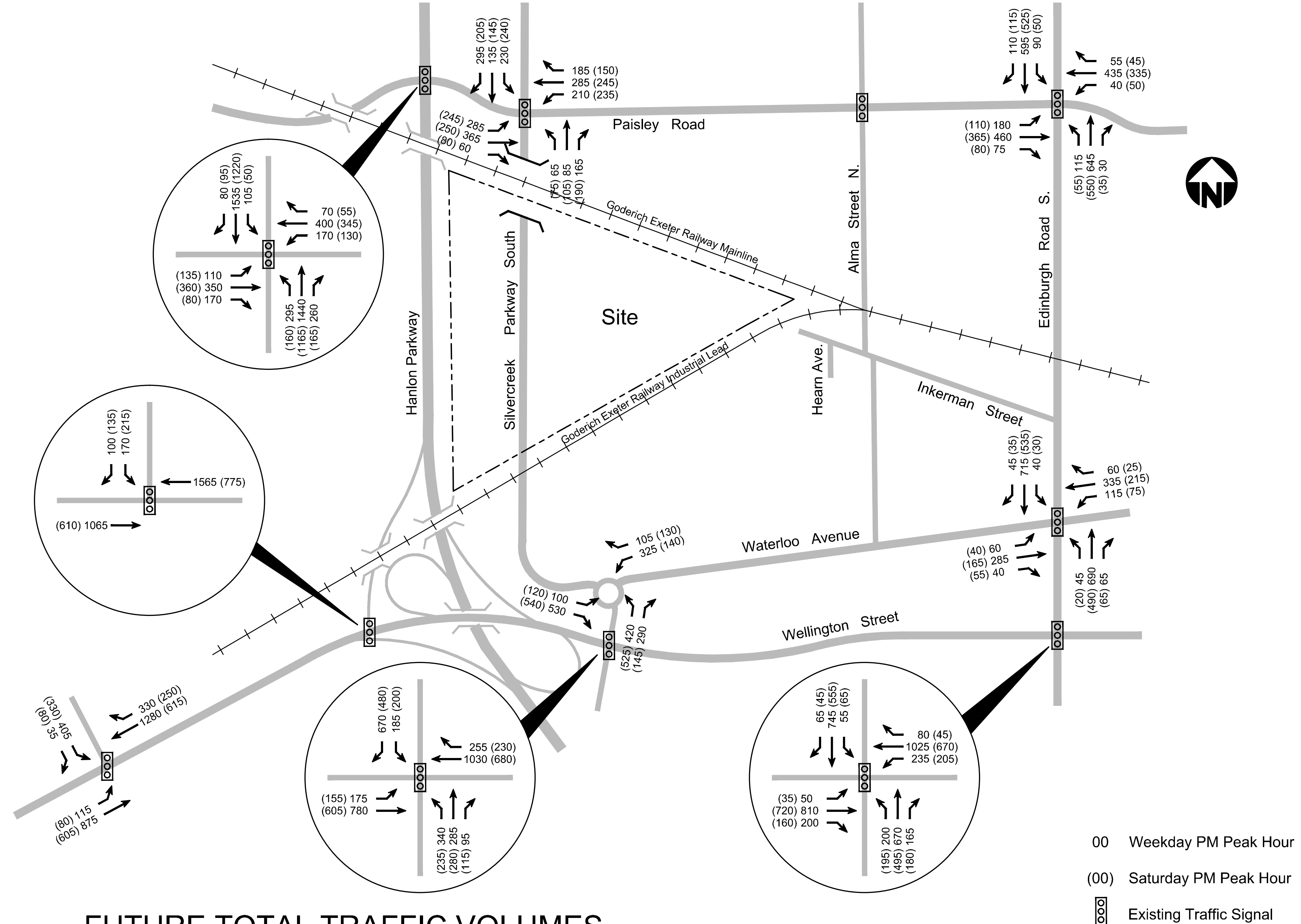
BA GROUP

Silvercreek Guelph Developments
7041-01, April 2012

Figure 13b

DRAWING FILENAME: P:\70\41\01\Graphics\2012\Fig13b-11-704101.dwg

DATE PLOTTED: April 18, 2012



FUTURE TOTAL TRAFFIC VOLUMES
Phase 3 Option 1 - Opening Day + 5 Years

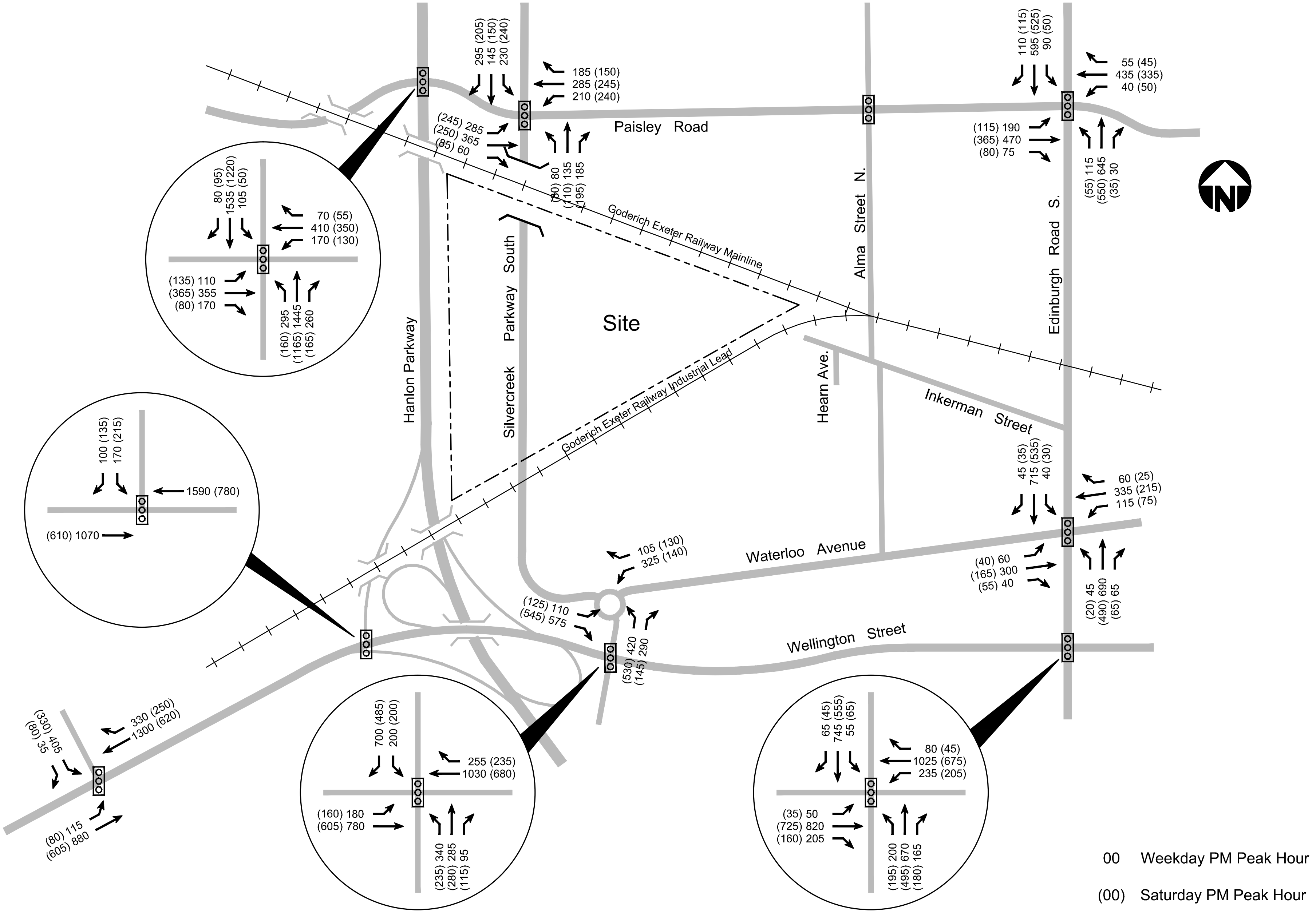
BA GROUP

Silvercreek Guelph Developments
7041-01, April 2012

Figure 14a

DRAWING FILENAME: P:\70\41\01\Graphics\2012\Fig14a-11-704101.dwg

DATE PLOTTED: April 20, 2012



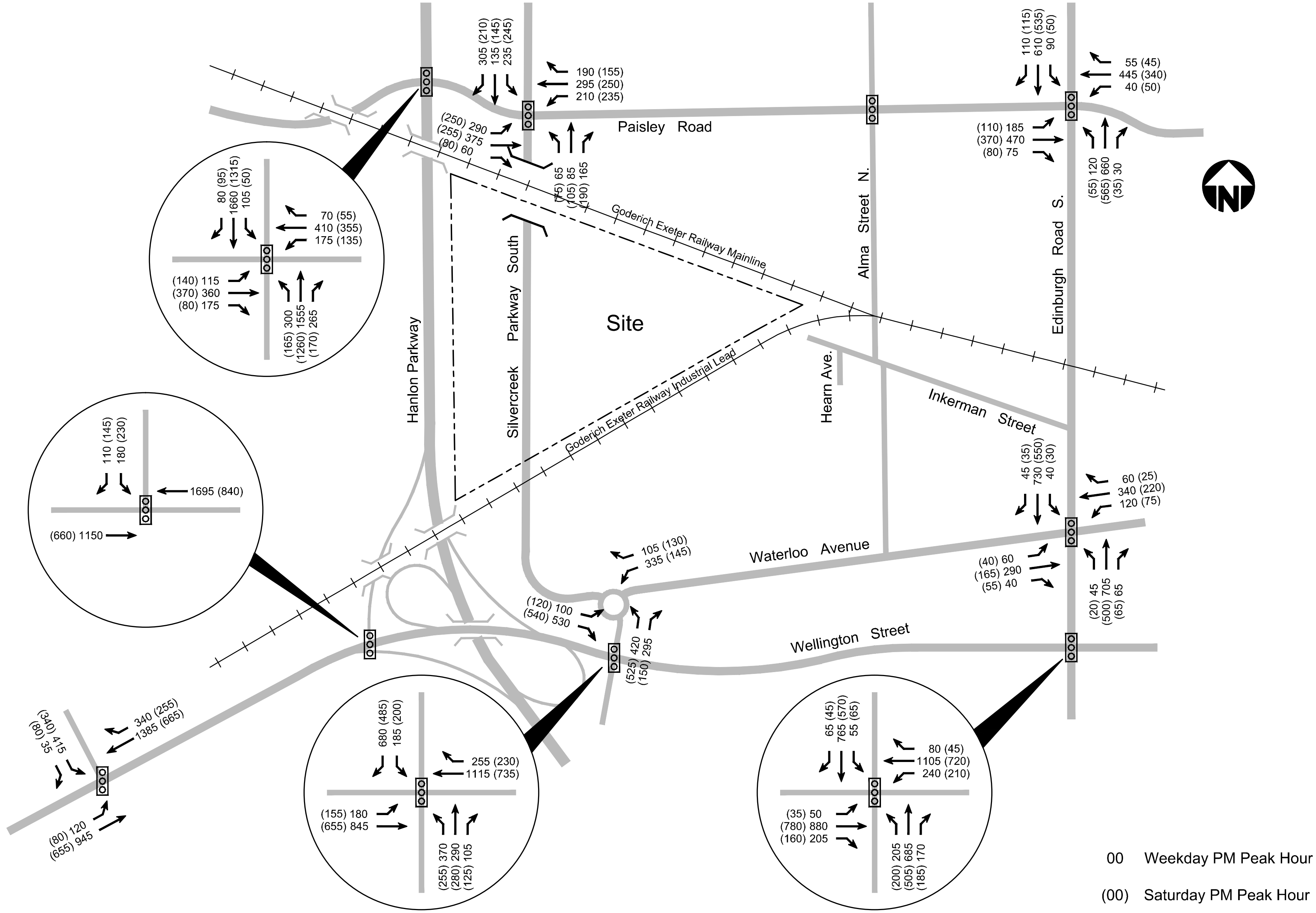
FUTURE TOTAL TRAFFIC VOLUMES
Phase 3 Option 2 - Opening Day + 5 Years

BA GROUP

Silvercreek Guelph Developments
7041-01, April 2012

Figure 14b

DATE PLOTTED: April 20, 2012 DRAWING FILENAME: P:\70\41\01\Graphics\2012\Fig14b-11-704101.dwg



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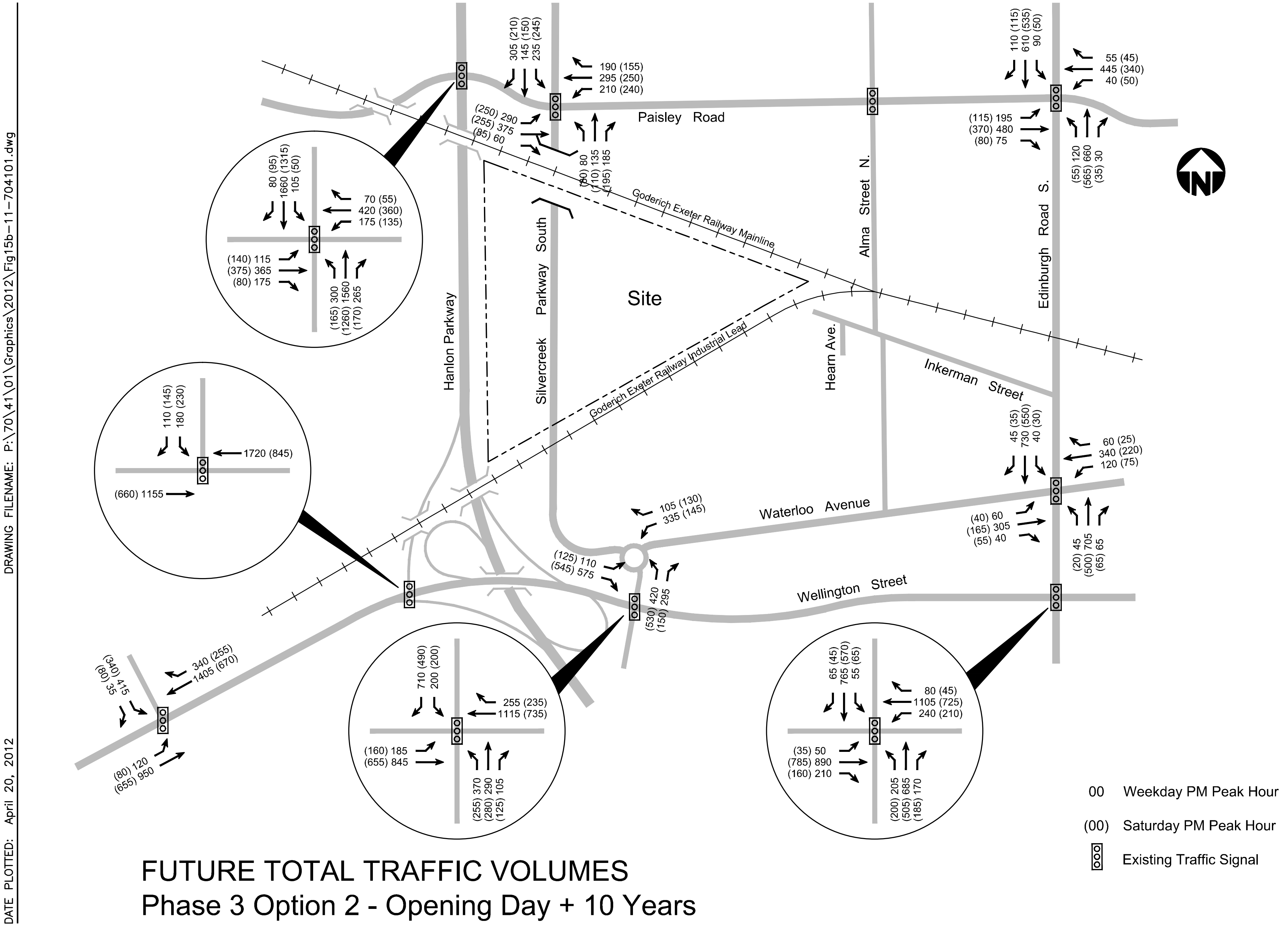
DATE PLOTTED: April 20, 2012

FUTURE TOTAL TRAFFIC VOLUMES
Phase 3 Option 1 - Opening Day + 10 Years

BA GROUP

Silvercreek Guelph Developments
7041-01, April 2012

Figure 15a

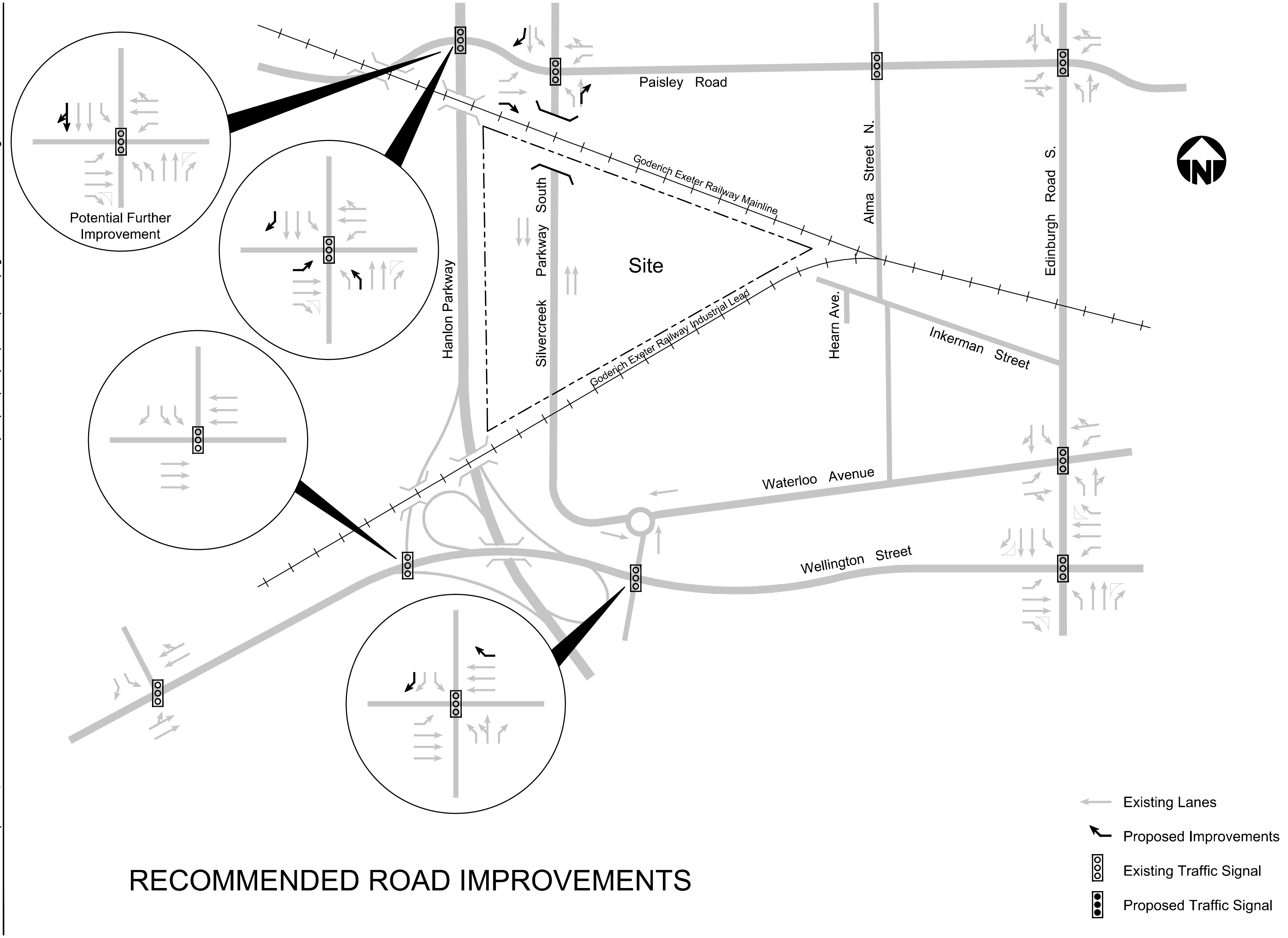


FUTURE TOTAL TRAFFIC VOLUMES
Phase 3 Option 2 - Opening Day + 10 Years

BA GROUP

Silvercreek Guelph Developments
7041-01, April 2012

Figure 15b



RECOMMENDED ROAD IMPROVEMENTS

DRAWING FILENAME: P:\70\41\01\Graphics\2012\Fig16-11-704101.dwg

DATE PLOTTED: April 20, 2012

5.0 Traffic Impact Analysis

5.1 Basis of Analysis

The signalized intersections within the study area were analyzed based on procedures set out in Highway Capacity Manual (2000) with the assistance of Trafficware Traffic Signal Timing software - Synchro Version 7.0, as discussed in section 1.1. Signal cycle lengths and timings currently in effect at the intersections were provided by the City of Guelph Traffic Operations Department. Adjustments were made to reflect future operating conditions as required. The unsignalized intersection of Waterloo Avenue and Silvercreek Parkway was analyzed based on procedures set out in Highway Capacity Manual (2000) with the assistance of Synchro Version 7.0.

5.2 Existing Traffic Conditions

Signalized Intersections

Intersection performance results for existing traffic conditions are summarized in Table 4. Intersection calculation worksheets are provided in Appendix C.

Table 4
Analysis Summary - Baseline Traffic Conditions (Signalized)

Intersection/Critical Movement	Weekday PM Peak Hour[1]			Saturday Peak Hour[1]		
	V/C	Delay (s)	LOS	V/C	Delay (s)	LOS
Existing Traffic						
Hanlon Expressway / Paisley Road	1.06	55.2	E	0.77	33.1	C
WB L	1.38	217.4	F	-	-	-
NB L	1.05	116.4	F	-	-	-
SB TR	0.96	49.4	D	0.96	47.7	D
Paisley Road / Silvercreek Parkway	0.70	16.7	B	0.61	16.4	B
Paisley Road / Edinburgh Road	0.87	24.0	C	0.67	16.8	B
Waterloo Avenue / Edinburgh Road	0.70	19.9	B	0.45	13.0	B
Wellington St. / Edinburgh Road	0.62	25.7	C	0.48	20.0	B
Wellington St. / East Ramp Terminal	0.58	25.1	C	0.36	18.2	B
Wellington St. / West Ramp Terminal	0.38	5.9	A	0.21	7.3	A
Wellington St. / Imperial Road	0.95	21.1	C	0.49	13.6	B

Notes:
1. Existing road network and signal timings.

The analysis results for the study area signalized intersections indicate that all signalized intersections operate at acceptable levels of service LOS ‘D’ or better except for Hanlon / Paisley intersection which operates at LOS ‘E’ overall during the weekday afternoon peak hours. Northbound left and westbound left turn movements at the Hanlon / Paisley intersection are capacity constrained during the weekday peak hours. The southbound shared through-right movement is also operating close to the respective capacity.

Unsignalized Intersection

Table 5 summarizes the overall performance measures of the existing unsignalized intersection.

Table 5
Analysis Summary – Baseline Traffic Conditions (Unsignalized)

Intersection / Approaches	Weekday PM Peak Hour			Saturday Peak Hour		
	V/C	Average Delay (s)	LOS	V/C	Average Delay (s)	LOS
Waterloo Avenue / Silvercreek Pkwy	-	8.6		-	7.4	A
NBL	0.30	11.0	B	0.16	9.5	A
WBL	0.23	8.0	A	0.10	7.5	A

The results indicate that the existing unsignalized intersection operate at an excellent levels of service LOS ‘A’. The stop controlled northbound left turn movement operates at levels of service of ‘B’ or better.

5.3 Phases 1 & 2 Future Background Traffic Conditions

Signalized Intersections

Intersection performance results for Phases 1 and 2 future background traffic conditions with existing lane configurations are summarized above in Table 6. Intersection calculation worksheets are provided in Appendix D.

Results of capacity analysis indicate that the Paisley Road intersections will operate at LOS ‘C’ or better for weekday and Saturday peak hours except for Hanlon / Paisley intersection which will operate at LOS ‘D’ or better overall during the weekday afternoon peak hours. Northbound left and westbound left turn movements at the Hanlon / Paisley intersection are capacity constrained during the weekday peak hours. The southbound shared through-right movement is also operating close to the respective capacity.

Wellington Street and Edinburgh Road intersection will operate at acceptable levels of service with composite LOS ‘C’ or better overall under future background traffic conditions. Detailed signal timing adjustments are provided in Appendix Tables 1 and 2.

Table 6
Analysis Summary – Future Background Traffic – Phases 1 & 2

Intersection	Weekday PM Peak Hour[1, 2, 3]			Saturday Peak Hour[1, 2, 3]		
	V/C	Delay (s)	LOS	V/C	Delay (s)	LOS
Hanlon Expressway / Paisley Road	0.85	43.5	D	0.71	24.5	C
WB L	0.92	72.4	E	-	-	-
NB L	0.69	64.2	E	-	-	-
SB TR	0.90	43.3	D	0.91	38.4	D
Paisley Road / Silvercreek Parkway	0.64	17.2	B	0.54	18.6	B
Paisley Road / Edinburgh Road	0.73	27.6	C	0.53	13.0	B
Waterloo Avenue / Edinburgh Road	0.66	17.6	B	0.41	12.0	B
Wellington St. / Edinburgh Road	0.60	20.3	C	0.48	20.2	C
Wellington St. / East Ramp Terminal	0.73	27.9	C	0.39	19.2	B
Wellington St. / West Ramp Terminal	0.41	6.2	A	0.23	6.9	A
Wellington St. / Imperial Road	0.85	23.3	C	0.45	11.2	B

Notes:
1. Presumed optimized signal timings.
2. Planning analyses – Presumed PHF as 1.0 for planning purposes at Paisley, Edinburg and Wellington Street intersections.
3. Existing road network.

Unsignalized Intersection

Table 7 summarizes the results of the capacity analyses for the unsignalized intersection within the study area. The results of the capacity analyses show that the unsignalized intersection of Waterloo Avenue and Silvercreek Parkway will continue to operate with excellent levels of service under future background traffic conditions.

Table 7
Analysis Summary – Future Background – Phases 1 & 2

Intersection / Approaches	Weekday PM Peak Hour			Saturday Peak Hour		
	V/C	Average Delay (s)	LOS	V/C	Average Delay (s)	LOS
5 Year Horizon						
Waterloo Avenue / Silvercreek Pkwy	-	8.5	A	-	7.4	A
NBL	0.28	10.7	B	0.15	9.4	A
WBL	0.22	8.0	A	0.10	7.5	A

5.4 Phases 1 & 2 Future Total Traffic Conditions

Signalized Intersections

Intersection performance results for Phases 1 and 2 total traffic conditions are summarized in Table 8. Intersection calculation worksheets are provided in Appendix E.

In conjunction with Phase 1 and Phase 2 development scenarios, Silvercreek Parkway will be extended south from Paisley Road intersection. With the extension of Silvercreek Parkway, we have conservatively assumed that approximately one third (approximately 100 vehicles) of the westbound left-turn traffic volumes (weekday p.m.) at the Hanlon / Paisley intersection would travel southbound, i.e., be diverted, through the new underpass. Diverted traffic volumes are illustrated in Appendix Figure 2.

Table 8
Analysis Summary – Phases 1 & 2 Future Total Traffic

Intersection	Weekday PM Peak Hour[1, 2]			Saturday Peak Hour[1, 2]		
	V/C	Delay (s)	LOS	V/C	Delay (s)	LOS
Hanlon Expressway / Paisley Road	0.78	38.0	D	0.70	23.2	C
WB L	0.77	62.9	E	-	-	-
NB L	0.75	68.9	E	-	-	-
SB T	0.82	32.9	C	0.50	40.4	D
Paisley Road / Silvercreek Parkway	0.54	23.5	C	0.58	26.1	C
Paisley Road / Edinburgh Road[3]	0.82	31.4	C	0.61	16.9	B
Waterloo Avenue / Edinburgh Road	0.68	20.2	C	0.45	13.5	B
Wellington St. / Edinburgh Road	0.64	21.5	C	0.57	21.3	C
Wellington St. / East Ramp Terminal[3]	0.75	30.5	C	0.58	25.7	C
Wellington St. / West Ramp Terminal	0.41	6.5	A	0.24	7.3	A
Wellington St. / Imperial Road	0.84	23.3	B	0.46	11.2	B

Notes:
1. Presumed optimized signal timings.
2. Planning analyses – Presumed PHF as 1.0 for planning purpose, except for Hanlon Expressway intersections.
3. Presumed new roundabout at Silvercreek and Waterloo (see Appendix Figure 3).

Specific recommendations for Phases 1 & 2 development are summarized below and illustrated on Appendix Figure 3:

- Extension of Silvercreek Parkway south Paisley Road and provide a grade separated structure for Silvercreek Parkway passing under the main rail line.
- Provision of a new Roundabout at the Waterloo / Silvercreek intersection
- Widening of Silvercreek Parkway, between Waterloo and Wellington, to provide an additional southbound right turn lane, as illustrated in Appendix Figure 3.
- Provision of exclusive westbound, eastbound and northbound left turn lanes and a southbound channelized right turn lane at Paisley Road / Silvercreek Parkway intersection.
- Provision of 90 second signal cycle length at Paisley / Silvercreek, Paisley / Edinburgh and Wellington / Imperial intersections.

With the recommended improvements, Phases 1 & 2 site traffic will have a modest impact on the study area intersections with approximately 2% to 10% increases in the overall v/c ratios at the Paisley Road intersections, 2% to 12% increases in the overall v/c ratios at the Wellington Street intersections and approximately 2%to 4% increases in the v/c ratios at the Waterloo / Edinburgh intersection. The Paisley Road, Wellington Street and Edinburgh Road intersections will continue to operate at acceptable levels of service with LOS ‘C’ or better except for the Hanlon / Paisley intersection which will continue to operate at LOS ‘D’ or better overall. Detailed signal timing adjustments are provided in Appendix Tables 1 and 2.

Therefore, all of the approaches at individual City Road intersections will continue to operate at acceptable levels of service.

Table 9
Analysis Summary – Roundabout – Phases 1 & 2 Future Total

Intersection / Approaches Phases 1 & 2 Development	Weekday PM Peak Hour				Saturday Peak Hour			
	V/C	Delay (s)	Avg. queue	95th % queue	V/C	Delay (s)	Avg. queue	95th % queue
Waterloo Ave / Silvercreek Pkwy		**6.5**				**6.2**		
EB Th/Rt	0.52	6.0	14.9	29.5	0.46	6.2	11.8	28.5
WB Lt	0.39	8.0	23.2	39.8	0.26	6.7	15.5	30.6
NB Lt/Rt	0.49	8.7	8.8	27.7	0.47	6.6	14.1	31.4

Waterloo Avenue / Silvercreek Parkway Roundabout

Summary results of the new roundabout at Waterloo and Silvercreek reflect good operational characteristics with delay of less than 10 seconds per vehicle on any of the three approaches. Northbound queue length, both average and 95th percentile, will not spill back into the Ramp terminal intersection.

5.5 Phase 3 Development Scenarios – Opening Day

Intersection performance results for Opening Day, i.e., Phase 3 total traffic conditions, are summarized in Tables 10, 11 and 12 for Options 1 and 2, respectively. Intersection calculation worksheets are provided in Appendix F.

In addition to the improvements set out in section 5.4 above, Specific recommendations for Phase 3 development are summarized below and illustrated in Appendix Figure 4:

- Provide an exclusive southbound right turn lane on Hanlon Parkway at Paisley Road with approximately 100 m storage.
- Provide an exclusive westbound right turn lane at Wellington and Silvercreek intersection.

Table 10
Analysis Summary – Phase 3 Option 1 Total Traffic – Opening Day

Intersection/Critical Movement	Weekday PM Peak Hour[1,2]			Saturday Peak Hour[1,2]		
	V/C	**Delay (s)**	**LOS**	**V/C**	**Delay (s)**	**LOS**
Hanlon Expressway / Paisley Road	0.80	39.2	D	0.71	24.0	C
WB L	0.79	65.2	E	-	-	-
NB L	0.76	69.1	E	-	-	-
EB LT	0.66	55.1	E	-	-	-
SB T	0.84	34.4	C			
Paisley Road / Silvercreek Parkway	0.50	20.4	C	0.60	22.2	C
Paisley Road / Edinburgh Road	0.84	33.0	C	0.63	17.9	B
WB TR	0.92	53.2	D	-	-	-
Waterloo Avenue / Edinburgh Road	0.69	20.9	C	0.47	14.0	B
Wellington St. / Edinburgh Road	0.66	21.1	C	0.56	21.4	C
Wellington St. / East Ramp Terminal	0.79	33.1	C	0.71	28.3	C
Wellington St. / West Ramp Terminal	0.42	6.6	A	0.25	7.4	A
Wellington St. / Imperial Road	0.85	23.4	C	0.46	11.2	B

Notes:
1. Presumed optimized signal timings. 2. Presumed PHF as 1.0 for planning purpose.

Details of the capacity analysis with Phase 3 development alternatives indicate that both development scenarios can be accommodated at the study area intersections on opening day.

The results indicate that Phase 3 development traffic will have a modest traffic impact with 1% to 3% increases in the composite v/ c ratios at the Paisley Road, Wellington Street and Edinburgh Road intersections. Except for the Hanlon / Paisley intersection, which operates at LOS ‘D’ overall, all other study area intersections will continue to operate at LOS ‘C’ or better. Westbound left turn movements at Hanlon / Paisley will continue to be busy. An exclusive southbound right turn lane may be required at Hanlon and Paisley intersection. Detailed signal timing adjustments are provided in Appendix Tables 1 and 2.

Site traffic generated by each development alternative can be accommodated at the intersections with specific road improvements at the Waterloo / Silvercreek and Wellington / East Ramp Terminal intersections.

We note that the improvements mentioned above assume a worst case development option on the site. Therefore, depending on the mix and density of uses, all of the improvements may not be required.

Table 11
Analysis Summary – Phase 3 Option 2 Total Traffic – Opening Day

Intersection/Critical Movement	Weekday PM Peak Hour[1,2]			Saturday Peak Hour[1,2]		
	V/C	**Delay (s)**	**LOS**	**V/C**	**Delay (s)**	**LOS**
Hanlon Expressway / Paisley Road	0.81	39.2	D	0.71	24.1	C
WB L	0.81	68.0	E	-	-	-
NB L	0.77	69.9	E	-	-	-
EB LT	0.71	62.4	E	-	-	-
SB T	0.83	33.5	C			
Paisley Road / Silvercreek Parkway	0.67	21.9	C	0.60	22.6	C
Paisley Road / Edinburgh Road	0.84	34.1	C	0.63	16.9	B
WB TR	0.92	53.2	D	-	-	-
Waterloo Avenue / Edinburgh Road	0.69	21.0	C	0.47	14.4	B
Wellington St. / Edinburgh Road	0.66	22.1	C	0.57	22.1	C
Wellington St. / East Ramp Terminal	0.82	34.3	C	0.71	28.5	C
Wellington St. / West Ramp Terminal	0.43	6.6	A	0.25	7.4	A
Wellington St. / Imperial Road	0.86	23.7	C	0.46	11.2	B

Notes:
1. Presumed optimized signal timings.
2. Presumed PHF as 1.0 for planning purpose.
3. Presumed improved geometry (see Appendix Figure 4).

Waterloo Avenue / Silvercreek Parkway Roundabout

Summary results of the new roundabout at Waterloo and Silvercreek reflect good operational characteristics with delay of less than 10 seconds per vehicle on any of the three approaches. Northbound queue length, both average and 95th percentile, will not spill back into the Ramp terminal intersection.

Table 12
Analysis Summary – Silvercreek Pkwy. / Waterloo Ave. Roundabout

Intersection / Approaches	Weekday PM Peak Hour				Saturday Peak Hour			
	V/C	Delay (s)	Avg. queue	95th % queue	V/C	Delay (s)	Avg. queue	95th % queue
Phase3 Option 1 – Opening Day								
Waterloo Ave / Silvercreek Pkwy		**7.2**				**6.7**		
EB Th/Rt	0.58	7.1	19.9	38.9	0.53	7.3	14.5	34.0
WB Lt	0.42	7.6	21.5	44.7	0.29	9.6	21.4	41.0
NB Lt/Rt	0.55	9.1	12.8	34.2	0.53	6.2	16.4	35.8
Phase3 Option 2 – Opening Day								
Waterloo Ave / Silvercreek Pkwy		**8.3**				**6.7**		
EB Th/Rt	0.63	9.0	24.3	42.9	0.54	6.9	12.3	24.1
WB Lt	0.42	9.8	28.3	45.5	0.29	10.1	22.0	40.8
NB Lt/Rt	0.55	8.9	13.3	30.2	0.53	8.5	19.8	38.8

5.6 Opening Day + 5 and 10 Years

Intersection performance results for Opening Day plus five and ten years are summarized in Tables 13, 14, 15, 16 and 17 for Options 1 and 2. Intersection calculation worksheets are provided in Appendix G and H.

Table 13 Analysis Summary – Phase 3 Option 1 Total Traffic – Opening + 5 Years

Intersection/Critical Movement	Weekday PM Peak Hour[1,2]			Saturday Peak Hour[1,2]		
	V/C	Delay (s)	LOS	V/C	Delay (s)	LOS
Hanlon Expressway / Paisley Road	0.85 (0.79)	42.5 (38.6)	D	0.77	25.9	C
WB L	0.79 (0.82)	65.2 (70.0)	E	-	-	-
NB L	0.81 (0.71)	74.2 (65.5)	E	-	-	-
EB LT	0.66 (0.70)	53.3 (58.6)	E	-	-	-
SB T	0.92 (0.69)	40.9 (28.3)	C			
Paisley Road / Silvercreek Parkway	0.59	24.6	C	0.61	22.8	C
Paisley Road / Edinburgh Road	0.86	36.0	D	0.64	18.0	B
WB TR	0.93	54.9	D	-	-	-
Waterloo Avenue / Edinburgh Road	0.70	19.8	B	0.48	14.0	B
Wellington St. / Edinburgh Road	0.69	24.1	C	0.60	22.4	C
Wellington St. / East Ramp Terminal	0.83	35.6	D	0.73	28.8	C
Wellington St. / West Ramp Terminal	0.47	6.9	A	0.27	7.6	A
Wellington St. / Imperial Road	0.90	26.0	C	0.49	11.4	B

Table 14 Analysis Summary – Phase 3 Option 2 Total Traffic – Opening + 5 Years

Intersection/Critical Movement	Weekday PM Peak Hour[1,2]			Saturday Peak Hour[1,2]		
	V/C	**Delay (s)**	**LOS**	**V/C**	**Delay (s)**	**LOS**
Hanlon Expressway / Paisley Road	0.87 (0.79)	42.2 (39.0)	D	0.77	26.0	C
WB L	0.84 (0.82)	73.7 (69.7)	E	-	-	-
NB L	0.78 (0.72)	71.4 (65.8)	E	-	-	-
EB LT	0.75 (0.71)	67.2 (58.6)	E	-	-	-
SB T	0.91 (0.69)	39.5 (28.6)	C			
Paisley Road / Silvercreek Parkway	0.68	22.3	C	0.62	23.1	C
Paisley Road / Edinburgh Road	0.86	36.7	D	0.64	16.9	B
WB TR	0.93	54.9	D	-	-	-
Waterloo Avenue / Edinburgh Road	0.70	20.3	C	0.48	14.3	B
Wellington St. / Edinburgh Road	0.69	24.2	C	0.59	22.8	C
Wellington St. / East Ramp Terminal	0.85	36.7	D	0.72	28.9	C
Wellington St. / West Ramp Terminal	0.47	7.0	A	0.27	7.6	A
Wellington St. / Imperial Road	0.91	26.4	C	0.49	11.4	B

Table 15 Analysis Summary – Phase 3 Option 1 Total Traffic – Opening + 10 Years

Intersection/Critical Movement	Weekday PM Peak Hour[1,2]			Saturday Peak Hour[1,2]		
	V/C	**Delay (s)**	**LOS**	**V/C**	**Delay (s)**	**LOS**
Hanlon Expressway / Paisley Road	0.91 (0.83)	48.4 (41.0)	D	0.82	29.2	C
WB L	0.85 (0.83)	74.9 (68.5)	E	-	-	-
NB L	0.82 (0.72)	75.4 (65.4)	E	-	-	-
EB LT	0.74 (0.73)	61.7 (61.3)	E	-	-	-
SB T	0.99 (0.75)	52.5 (30.7)	C			
Paisley Road / Silvercreek Parkway	0.60	25.3	C	0.63	23.7	C
Paisley Road / Edinburgh Road	0.91	38.4	D	0.65	17.0	B
WB TR	0.97	65.3	E	-	-	-
Waterloo Avenue / Edinburgh Road	0.72	21.6	C	0.49	14.3	B
Wellington St. / Edinburgh Road	0.73	24.6	C	0.64	23.5	C
Wellington St. / East Ramp Terminal	0.87	37.9	D	0.72	29.2	C
Wellington St. / West Ramp Terminal	0.51	7.4	A	0.29	7.8	A
Wellington St. / Imperial Road	0.97	31.9	C	0.52	11.6	B

Notes:
1. Presumed optimized signal timings.
2. Planning analyses – Presumed PHF as 1.0 for planning purpose except at Hanlon Expressway/Paisley Road and Ramp Terminals (PHF=0.92).
3. Presumed improved geometry (see MTO' improvements).
4. (00) indicates results with 3-Lane NB widening only.

Table 16 Analysis Summary – Phase 3 Option 2 Total Traffic – Opening + 10 Years

Intersection/Critical Movement	Weekday PM Peak Hour[1,2]			Saturday Peak Hour[1,2]		
	V/C	**Delay (s)**	**LOS**	**V/C**	**Delay (s)**	**LOS**
Hanlon Expressway / Paisley Road	0.91 (0.84)	48.9 (41.6)	D	0.82	29.2	C
WB L	0.85 (0.83)	74.7 (68.7)	E	-	-	-
NB L	0.83 (0.72)	76.6 (65.8)	E	-	-	-
EB LT	0.74 (0.74)	61.9 (62.1)	E	-	-	-
SB T	0.99 (0.75)	52.9 (30.9)	C			
Paisley Road / Silvercreek Parkway	0.69	23.9	C	0.64	23.7	C
Paisley Road / Edinburgh Road	0.91	39.1	D	0.65	17.0	B
WB TR	0.97	65.3	E	-	-	-
Waterloo Avenue / Edinburgh Road	0.72	22.5	C	0.49	14.3	B
Wellington St. / Edinburgh Road	0.73	24.7	C	0.63	23.9	C
Wellington St. / East Ramp Terminal	0.90	39.8	D	0.73	29.4	C
Wellington St. / West Ramp Terminal	0.51	7.4	A	0.29	7.8	A
Wellington St. / Imperial Road	0.98	32.9	C	0.52	11.6	B

Details of the capacity analysis show that, five and ten years after opening day (approximately 2021 and 2026, respectively), the signalized intersections will continue to reflect acceptable operational characteristics with LOS ‘D’ overall or better at Paisley, Edinburg and Wellington Street intersections. Important considerations

1. Significant Near-Term improvements are programmed by MTO at the Hanlon / Paisley intersection.
2. Extended time horizon to year 2026 (from year 2019 in our March 2009 report)
3. Reduced PHF to 0.92 for Year 2026 horizon at Hanlon / Wellington ramp and Hanlon / Paisley intersection.
4. Improved level of service design criteria – with maximum v/c’s = 0.85 at Hanlon / Paisley and 0.75 at the Wellington ramp terminals (overall LOS = C)

Appendix Tables 3 and 4 provide comparable intersection analysis results to Tables 14 and 16 -- for the extended years beyond build-out time horizon. As indicated therein, the desired LOS criteria are not met at the Hanlon / Paisley or Wellington / Silvercreek – East Ramp Terminal signalized intersections.

Appendix Table 3 and 4 illustrate the operational benefits of implementing additional improvements at these two intersections, 10 years after opening day time frame. These are summarized as follows:

<u>Hanlon / Paisley Intersection</u>

- Convert the SB right turn lane to a combination thru/right turn lane

<u>Wellington / Silvercreek – East Ramp Terminal Intersection</u>

- Widen the south approach to provide dual northbound left turn lanes, one thru lane plus one right turn lane
- Widen the north approach to provide dual SB right turn lanes.

The resultant LOS results for the foregoing improvements will substantially meet the more stringent MTO LOS criteria. Given the long-term design context, we believe that the MTO will find the forecast LOS resu1lts to be acceptable.

Waterloo Avenue / Silvercreek Parkway Roundabout

Summary results of the new roundabout at Waterloo and Silvercreek reflect good operational characteristics with delay of less than 10 seconds per vehicle on any of the three approaches. Northbound queue length, both average and 95th percentile, will not spill back into the Ramp terminal intersection.

Table 17 Analysis Summary – Silvercreek Pkwy. / Waterloo Ave. Roundabout

Intersection / Approaches	Weekday PM Peak Hour				Saturday Peak Hour			
	V/C	Delay (s)	Avg. queue	95th % queue	V/C	Delay (s)	Avg. queue	95th % queue
Phase3 Option 1 – Opening +5 Years								
Waterloo Ave / Silvercreek Pkwy		**7.6**				**7.2**		
EB Th/Rt	0.59	8.5	20.2	38.6	0.53	6.6	13.4	31.0
WB Lt	0.43	10.1	28.8	49.4	0.30	7.5	18.2	33.8
NB Lt/Rt	0.55	9.0	11.4	29.4	0.53	8.0	28.9	55.4
Phase3 Option 2 – Opening +5 Years								
Waterloo Ave / Silvercreek Pkwy		**7.9**				**7.0**		
EB Th/Rt	0.64	7.8	19.9	38.8	0.54	6.0	12.0	27.8
WB Lt	0.43	11.8	36.6	63.1	0.30	10.3	24.5	44.6
NB Lt/Rt	0.56	8.1	12.8	26.2	0.54	7.1	19.1	38.8
Phase3 Option 1 Development – Opening + 10 Years								
Waterloo Ave / Silvercreek Pkwy		**7.0**				**7.6**		
EB Th/Rt	0.59	7.7	16.2	30.7	0.53	7.5	11.9	30.9
WB Lt	0.44	10.2	33.0	54.9	0.30	9.1	20.6	37.2
NB Lt/Rt	0.56	7.5	11.2	24.7	0.54	8.2	20.7	40.8
Phase3 Option 2 Development – Opening + 10 Years								
Waterloo Ave / Silvercreek Pkwy		**8.0**				**7.0**		
EB Th/Rt	0.59	8.6	22.7	40.0	0.54	5.6	12.5	32.0
WB Lt	0.44	10.7	29.4	51.4	0.30	10.0	24.3	47.2
NB Lt/Rt	0.56	9.5	12.2	29.1	0.54	8.6	20.9	42.2

5.7 Queue Lengths

Summary results for the 50th and 95th percentile queue lengths are provided below in Tables 18 and 19. The results indicate that the 50th percentile storage lengths are sufficient to accommodate the future traffic conditions. The results also indicate that available storage lengths at Wellington / East Ramp Terminal and Paisley / Silvercreek intersections are also sufficient to accommodate 95th percentile the forecast demand for the two horizon years.

We note that, the 95th percentile queue lengths for the westbound and northbound left turn lanes at the Hanlon / Paisley intersection Phases 1 to 3 are less than the length required under baseline and future background (5 years) traffic conditions. At the Paisley / Edinburgh intersection the 95th percentile queue length is marginally longer (7 m) than the available queue length for the eastbound left turn lane. A minor extension the eastbound storage lane may be required.

Table 18
Signalized Intersection Queue Analysis Summary

Intersection	Peak Hour	Movement	Storage Length Available (M)	Phases 1 & 2 Future Total Traffic (M)		Phase 3 Option 2 Future Total Traffic (M)	
				50th	95th	50th	95th
Hanlon Expressway / Paisley Road	PM	SBL	75.0	26.1	#50.8	28.9	55.6
		NBL	95.0	40.4	#60.4	41.2	65.3
		WBL	45.0	36.8	54.1	38.0	58.3
		WBTR	175.0	63.5	79.1	66.3	82.0
	SAT	SBL	75.0	7.4	16.8	8.2	17.8
		NBL	95.0	12.9	21.2	12.9	21.2
		WBL	45.0	13.0	20.7	12.2	20.9
		WBTR	175.0	22.0	31.0	22.8	31.9
Wellington St. / East Ramp Terminal	PM	SBL	100.0	25.9	53.8	32.5	66.9
		SBR	100.0	54.2	74.3	57.5	78.9
		EBL	120.0	17.7	36.4	20.3	42.6
		NBL	350.0	46.3	82.6	48.6	89.0
		NBTL	350.0	48.3	83.3	54.7	98.3
	SAT	SBL	100.0	26.4	51.7	32.4	66.4
		SBR	100.0	30.7	43.8	34.7	48.9
		EBL	120.0	16.2	28.6	19.2	36.6
		NBL	350.0	30.1	50.6	30.6	51.2
		NBTL	350.0	44.4	70.4	50.7	86.1

Notes:
1. Queue shown is maximum after two cycles reported in Synchro 7.0.
2. # ~95th percentile volume exceeds the capacity, queue may be longer.
3. m – Volume for 95th percentile queue is metered by upstream signal.

Table 19
Signalized Intersection Queue Analysis Summary (Cont'd)

Intersection	Peak Hour	Movement	Storage Length Available (M)	Phases 1 & 2 Future Total Traffic (M)		Phase 3 Option 2 Future Total Traffic (M)	
				50th	95^{th}	50th	95^{th}
Paisley Rd. / Silvercreek Parkway	PM	EBL	60.0	14.2	29.6	21.0	37.8
		NBL	25.0	8.0	16.6	10.7	20.8
		SBL	75.0	30.0	53.6	26.9	51.4
		WBL	65.0	4.6	6.9	8.7	11.7
	SAT	EBL	60.0	3.8	42.3	4.9	45.1
		NBL	25.0	9.2	18.0	10.8	20.5
		SBL	75.0	29.8	57.0	28.6	50.9
		WBL	65.0	12.5	30.9	19.0	41.0
Paisley Rd. / Edinburgh Rd	PM	EBL	40.0	16.1	39.7	18.4	46.5
		NBL	55.0	8.5	15.0	8.6	15.4
		SBL	85.0	6.1	12.2	6.5	12.8
		WBL	105.0	4.9	12.8	4.9	13.2
	SAT	EBL	40.0	11.5	20.8	12.8	24.7
		NBL	55.0	2.3	7.5	1.5	4.0
		SBL	85.0	3.1	9.4	3.2	9.7
		WBL	105.0	6.2	14.6	6.1	14.5

5.8 Level Crossing

The existing level crossing of Silvercreek Parkway with the southern industrial lead line is controlled by a set of flashing lights. With development of the area, it is likely that this crossing would need to be upgraded to feature barrier gates in both directions. As previously noted, because of the light use of this industrial lead line, traffic would be delayed at this crossing on a very infrequent basis.
Given the low volume of train traffic on the southern industrial lead line, it would be of tremendous value to restrict the use of this secondary line during the peak retail periods, i.e., Friday afternoon and Saturdays.

5.9 Silvercreek Parkway / CNR Mainline Underpass

The Silvercreek Parkway / CNR Mainline Underpass Feasibility Study prepared for the City of Guelph in September 1991 concluded that a depressed road alignment on Silvercreek Parkway and subway structure supporting the single CNR track is the only feasible option for grade-separation of the roadway and railway. Taking advantage of the natural topography, the elevated track profile and road grades, the depressed road alignment through the railway underpass will require retaining walls on both sides of the road, but only for a short distance. There are private entrances on the north side of the CNR mainline which presently have access onto Silvercreek Parkway, south of Paisley Road.

A temporary track diversion will be required since continuous use of the CNR mainline is necessary. The offset distance from the existing rail to the track diversion is dependent on the type of subway structure.

5.10 Neighbourhood Traffic Infiltration

The subject lands are separated from adjacent residential neighbourhoods, located immediately to the north, east and south, the existing rail lines along the north-east and south-east site periphery. The rail lines form a natural barrier between the site and the neighbourhoods.

As noted above, vehicular access to the site will be provided via the proposed Silvercreek Parkway / CNR Mainline underpass at the north end and via the existing level crossing of Silvercreerk Parkway with the Goderich Exeter Railway. No vehicular access points are being proposed via the existing residential neighbourhoods.

Therefore, the proposed development will have no discernible adverse impact on the residential streets, i.e., Alma Street and Inkerman Street, abutting the subject site.

We note however, that the proposed Silvercreek Parkway / CNR Mainline underpass and opening of Silvercreek Parkway between Paisley Road and Wellington Street will result in a certain amount of diversionary traffic using the new road connection. We anticipate that some drivers travelling north / south along Alma Street and other neighbourhood streets may use the new underpass to cross the CNR Mainline. As a result, the proposed CNR Mainline underpass may result in a decrease in traffic volumes using some neighbourhood streets.

Also, we anticipate that introduction of the proposed underpass will reduce traffic volumes on Paisley Road between Hanlon Expressway and Silvercreek Parkway.

5.11 Projected Volumes of Truck Traffic

BA Group and others have conducted truck volumes at several commercial, residential and office developments. The results are summarized below:

SUMMARY COUNTS – RETAIL TRUCK TRAFFIC

Land Use	Truck / 1000 ft^3 (1-way)	Truck % Of Daily (est.)	Truck Composition	Source
Highland Farms – Ellesmere (65,000 ft^2)	1.3 / 1000 ft^2	4.4%	14% Type A, 59% B, 27% C	BA Group (6 a.m. -5 p.m.)
Cookstown Outlet Mall (100,000 ft^2)	0.13/ 1000 ft^2	1.6%	27% Type A, 73% B / C	BA Group (6 a.m. -3 p.m.)
Supercentre – Victoria / Eglinton (156,000 ft^2)	0.32/ 1000 ft^2	1.0%		LEA Associates 6 a.m. – 6 p.m.
Costco (126,000 ft^2)	0.53/ 1000 ft^2	1.2%	40% Type A, 29% B, 31% C	BA Group (6 a.m. -3 p.m.)
CBD Retail	0.25 -0.45	-		Transportation and Land Development 2nd Edition
Selected	**0.30 trucks / 1000 ft^2**	**1.0% of daily**	30% Type A, 40% B, 30% C	

SUMMARY COUNTS – OFFICE TRUCK TRAFFIC

Land Use	Truck / 1000 ft^3 (1-way)	Truck % Of Daily (est)	Truck Composition	Source
45 St. Clair Toronto 115,000 ft^2	0.32/ 1000 ft^2		3% Type A, 30% B, 67% C	BA Group (8 a.m. -5 p.m.)
Urban Office	0.20/ 1000 ft^2			Transportation and Land Development 2nd Edition
Offices CBD	0.20/ 1000 ft^2			Transportation and Land Development 2nd Edition
Selected	**0.25 trucks / 1000 ft^2**			

SUMMARY COUNTS – RESIDENTIAL TRUCK TRAFFIC

Land Use	Truck / 1000 ft^3 (1-way)	Truck % Of Daily (est)	Truck Composition	Source
Balmoral Toronto 133 Units	**0.13 trucks / unit**	**8%**	**0% Type A, 28% B, 72% C**	**BA Group (7:30 a.m. -6:30 p.m.)**

Selected truck traffic for retail, office and residential uses are 0.3 trucks / 1000 ft^2, 0.25 / 1000 ft^2 and 0.13 trucks / dwelling unit, respectively. We note, however, that for each use, approximately 70% to 80%of the vehicles at the retail developments can be classified as trucks (medium and large), only 33% of the vehicles at the offices were trucks, and for residential use only 28% of the vehicles were trucks.

Therefore, estimated daily truck traffic volumes for the development would be as follows:

Phase 1 development, 243,000 ft^2 Retail	120 trucks two-way
Phase 2 development 106,000 ft^2 Office	20 trucks two-way
Phase 2 development 45,000 ft^2 Retail	20 trucks two-way
Phase 2 development 350 units	10 trucks two-way

Based on the foregoing, total projected daily trucks for combined development Phases would be of the order of 150 to 170 trucks two-way.

Vehicle classifications are summarized on Appendix Figure 10.

5.12 Total Additional Projected Traffic Volumes

Existing and forecast daily traffic volumes on study area streets are provided in Appendix Figure 5, 6, 7 and 8. Future traffic volumes on area arterial and collector streets such as Paisley Road and Waterloo Avenue, respectively, will increase. However they will continue to function as busy arterial and collector streets, consistent with other similar facilities in the City of Guelph, i.e., Edinburgh Road, Willow Road and London Road.

6.0 Summary and Conclusions

BA Group has completed a traffic impact study update for a proposed multi-phase, mixed use development located on the former Lafarge property. Development phases are as follows:

- **Phase 1** of the development consists of a Warehouse Membership Club or Home Improvement Retail Warehouse establishment with a gross floor area of approximately 145,000 ft^2 and any residential or business park uses.
- **Phase 2** of the development consists of non-food-oriented Retail uses with a GFA of 56,000 ft^2 and 42,000 ft^2 of Service Commercial uses. Building permits for these uses may not be issued until the removal of the holding symbol or September 1, 2012.
- **Phase 3** of the development consists of the remaining GFA, i.e., 44,000 ft^2 of non-food-oriented Retail uses. Occupancy of Phase 3 building to occur no sooner than March 1, 2015.

For analysis purposes, retail uses for Phases 1 and 2 above were combined to form the total GFA for Phase 1. Two scenarios are to be investigated for Phase 3. Each would include of 44,000 ft^2 retail (no food uses) plus, either350 units residential units, 100 unit institutional (nursing home), or 350 residential units and 106,000 square feet of office space.

Weekday afternoon street peak and Saturday afternoon site peak hours were evaluated. Study area intersections included Silvercreek Parkway intersections between Paisley Road and Wellington Street, Wellington Street intersections between Edinburgh Road and Imperial Road, Waterloo Avenue intersections between Edinburg Road and Silvercreek Parkway, Paisley Road intersections between Edinburgh Road and Hanlon Expressway.

Key findings are summarized as follows:

Phases 1 & 2

- The proposed Phase 1 development will add approximately 975 and 1,305 net new two-way trips to the road network during the weekday afternoon and Saturday peak hours, respectively.

- Existing study area intersections operate at acceptable levels with overall LOS ‘D’ or better during the peak hours along Wellington Street and Paisley Road. Key left turn movements at the Hanlon / Paisley intersection are capacity constrained with poor levels of service.

- In conjunction with Phase 1 development, Silvercreek Parkway will be extended south from Paisley Road intersection. With Phase 1 development traffic, all intersections will operate at levels of service, LOS ‘C’ or better, with specific improvements to the Silvercreek / Waterloo, Wellington / East Ramp terminal and Paisley / Silvercreek intersections.

- Specific recommendations for Phase 1 development are summarized below:

  PHASES 1 & 2 IMPROVEMENTS

- Extension of Silvercreek Parkway south Paisley Road and provide a grade separated structure for Silvercreek Parkway passing under the main rail line.

- Provision of a new Roundabout at the Waterloo / Silvercreek intersection
- Widening of Silvercreek Parkway, between Waterloo and Wellington, to provide an additional southbound right turn lane, as illustrated in Appendix Figure 3.
- Provision of exclusive westbound, eastbound and northbound left turn lanes and a southbound channelized right turn lane at Paisley Road / Silvercreek Parkway intersection.
- Provision of 90 second signal cycle length at Paisley / Silvercreek, Paisley / Edinburgh and Wellington / Imperial intersections.

Phase 3 Mixed Use Development Options

- With Phase 2 alternative development scenarios, the Paisley Road intersections will continue to operate at overall LOS 'D' or better. Waterloo Avenue / Edinburgh Road and Wellington Street intersections will operate at LOS 'C' or better during the peak hours. At the Hanlon / Paisley intersection, westbound left turn and northbound left turn movements will continue to be busy; however sufficient capacity will be available to accommodate the movements.

Specific recommendations for Phase 2 development options are summarized below.

PHASE 3 IMPROVEMENTS

In addition to the improvements required for Phase 1 development, specific recommendations for Phase 3 development options are summarized below and illustrated in Appendix Figure 4:

- Provide an exclusive southbound right turn lane on Hanlon Parkway with approximately 100 m storage.
- Provide an exclusive westbound right turn lane at Wellington and Silvercreek intersection.
- We note that the improvements mentioned above assume a worst case development option on the site. Therefore, depending on the mix and density of uses, all of the improvements may not be required.
- New traffic generated by the Silvercreek Guelph Development proposal can be acceptably accommodated on the area street network at Phase 1 and Phase 2 build-out, with construction of the Silvercreek Parkway underpass and other recommended improvements to Silvercreek Parkway intersections at Wellington Street and Waterloo Avenue.

This report concludes that the proposed development traffic can be supported on the existing / improved road network without undue impact. Implementation of the foregoing improvements should ensure maintenance of appropriate levels of accessibility to the proposed development.

APPENDIX A
Appendix Tables and Figures

Appendix Table 1 - Weekday PM Signal Timing Adjustments in Seconds
Silvercreek Junction , Guelph

Intersection	Traffic Conditions								
				Total Ph3 Opening		Total Ph3 (5 Years+Opening)		Total Ph3 (10 Years+Opening)	
Movement	**Existing**	**Bckgrnd, 5 Yrs**	**Total,PH 1/2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**
Weekday PM Peak Hour:									
Hanlon Parkwy and Paisley Road									
EB L	9	9	9	11	10	12	10	11	11
EB T	35	35	35	35	35	35	35	35	35
WB L	9	14	9	12	12	12	12	12	12
WB T	35	40	35	35	37	35	37	36	36
NB L	19	29	19	19	18	18	18	17	17
NB T	60	78	82	81	81	81	81	77	77
SB L	16	17	15	16	16	16	16	20	20
SB T	57	66	78	78	79	79	79	80	80
CYCLE LENGTH	120	144	144	144	144	144	144	144	144
Paisley Road and Silvercreek Parkwy									
EB L	11	20	14	8	13	14	13	14	13
EB T	46	61	41	39	38	41	38	41	38
WB L			11	11	11	11	11	11	11
WB T	35	41	38	42	36	38	36	38	36
NB L									
NB T	29	29	29	29	29	29	29	29	29
SB L			9	11	12	9	12	9	12
SB T	29	29	38	40	41	38	41	38	41
CYCLE LENGTH	75	90	90	90	90	90	90	90	90
Paisley Road and Edinburgh									
EB L			8	8	8	8	8	8	8
EB T	31	38	39	39	39	39	39	38	38
WB L									
WB T	31	38	31	31	31	31	31	30	30
NB L			8	8	8	8	8	8	8
NB T	35	44	43	43	43	43	43	44	44
SB L	9	8	8	8	8	8	8	8	8
SB T	44	52	43	43	43	43	43	44	44
CYCLE LENGTH	75	90	90	90	90	90	90	90	90
Waterloo Avenue and Edinburgh									
EB T	33	33	33	34	34	34	34	33	33
WB T	33	33	33	34	34	34	34	33	33
NB T	57	57	57	56	56	56	56	57	57
SB T	57	57	57	56	56	56	56	57	57
CYCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and Edinburgh Road									
EB L	9	9							
EB T	30	30	30	30	30	30	30	32	32
WB L	13	14	13	13	13	12	12	12	12
WB T	34	35	43	43	43	42	42	44	44
NB L	10	9	8	9	9	9	9	9	9
NB T	37	37	47	47	47	48	48	46	46
SB L	10	9							
SB T	37	37	39	38	38	39	39	37	37
CYCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and East Ramp Terminal									
EB L	14	11	10	9	10	9	9	8	9
EB T	39	41	39	37	37	40	39	38	37
WB L									
WB T	25	30	29	28	27	31	30	30	28
NB L									
NB T	27	24	26	26	25	25	25	27	27
SB L									
SB T	24	25	25	27	28	25	26	25	26
CYCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and West Ramp Terminal									
EB L									
EB T	49	49	54	54	55	55	55	56	56
WB L									
WB T	49	49	54	54	55	55	55	56	56
NB L									
NB T	41	41	36	36	35	35	35	34	34
SB L									
SB T	41	41	38	36	35	35	35	34	34
CYCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and Imperial Road									
EB L			11	11	11	11	11	11	11
EB T	46	63	60	61	61	62	62	63	63
WB L									
WB T	46	63	49	50	50	51	51	52	52
NB L									
NB T									
SB L									
SB T	24	27	30	29	29	28	28	27	27
CYCLE LENGTH	70	90	90	90	90	90	90	90	90

Appendix Table 2 - Saturday Signal Timing Adjustments in Seconds
Silvercreek Junction , Guelph

Intersection	Traffic Conditions								
				Total Ph3 Opening		Total Ph3 (5 Years+Opening)		Total Ph3 (10 Years+Opening)	
Movement	**Existing**	**Bckgrnd, 5 Yrs**	**Total,PH 1/2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**
Saturday PM Peak Hour:									
Hanlon Parkwy and Paisley Road									
EB L	9	9	9	9	9	9	9	9	9
EB T	35	35	35	35	35	35	35	35	35
WB L	9	9	9	9	9	9	9	9	9
WB T	35	35	35	35	35	35	35	35	35
NB L	11	11	9	9	9	9	9	9	9
NB T	37	37	37	37	37	37	37	37	37
SB L	9	9	9	9	9	9	9	9	9
SB T	35	35	37	37	37	37	37	37	37
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Paisley Road and Silvercreek Parkwy									
EB L	11	18	15	13	13	13	13	13	13
EB T	46	58	50	50	50	50	50	50	50
WB L									
WB T	35	40	35	37	37	37	37	37	37
NB L									
NB T	29	32	29	29	29	29	29	29	29
SB L			11	11	11	11	11	11	11
SB T	29	32	40	40	40	40	40	40	40
YCLE LENGTH	75	90	90	90	90	90	90	90	90
Paisley Road and Edinburgh									
EB L									
EB T	31	39	38	39	39	38	38	38	38
WB L									
WB T	31	39	38	39	39	38	38	38	38
NB L									
NB T	35	51	52	51	51	52	52	52	52
SB L	9								
SB T	44	51	52	51	51	52	52	52	52
YCLE LENGTH	75	90	90	90	90	90	90	90	90
Waterloo Avenue and Edinburgh									
EB T	33	29	26	26	26	26	26	26	26
WB T	33	29	26	26	26	26	26	26	26
NB T	57	61	64	64	64	64	64	64	64
SB T	57	61	64	64	64	64	64	64	64
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and Edinburgh Road									
EB L									
EB T	30	30	30	30	30	30	30	30	30
WB L	13	13	13	13	13	12	13	13	12
WB T	43	43	43	43	43	42	43	43	42
NB L	10	9	9	10	10	10	10	10	10
NB T	47	47	47	47	47	48	47	47	48
SB L									
SB T	37	38	38	37	37	38	37	37	38
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and East Ramp Terminal									
EB L	14	12	12	12	12	11	12	12	12
EB T	39	38	38	37	37	37	37	37	38
WB L									
WB T	25	26	26	26	25	26	25	25	26
NB L									
NB T	27	26	25	25	26	25	26	26	25
SB L									
SB T	24	26	27	28	27	28	27	27	27
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and West Ramp Terminal									
EB L									
EB T	49	51	48	48	48	48	48	48	48
WB L									
WB T	49	51	48	48	48	48	48	48	48
NB L									
NB T	41	39	42	42	42	42	42	42	42
SB L									
SB T	41	39	42	42	42	42	42	42	42
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and Imperial Road									
EB L									
EB T	41	41	44	44	44	44	44	45	45
WB L									
WB T	41	41	44	44	44	44	44	45	45
NB L									
NB T									
SB L									
SB T	29	29	26	26	26	26	26	25	25
YCLE LENGTH	70	70	70	70	70	70	70	70	70

APPENDIX TABLE 3 - PHASE 3 OPTION 2 - OPENING DAY + 5 YEARS with IMPROVEMENTS

Wellington Street & East Ramp Connection	Weekday PM Peak Hour						Saturday PM Peak Hour					
	Volume	Delay	V/C	LOS	Q50th	Q95th	Volume	Delay	V/C	LOS	Q50th	Q95th
EBL	175	38.2	0.77	D	16.8	#43.7	180	41.1	0.8	D	17.8	#46.5
EBT	780	17.7	0.4	B	31.7	43.8	780	17.9	0.4	B	32.4	43.8
NBL	340	34.8	0.62	C	27.1	39.4	340	34.8	0.62	C	27.3	39.4
NBT	285	33.1	0.67	C	43.3	67.8	285	34.5	0.69	C	44	69
NBR	95	25.1	0.07	C	0	10.5	95	25.6	0.07	C	0	10.7
SBL	185	44	0.73	D	29.3	#58.1	200	44.3	0.74	D	31.8	#61.1
SBR	670	25.3	0.7	C	56.1	#83.2	700	26.2	0.73	C	59.8	#93.9
WBT	1030	29.4	0.72	C	55.1	72.9	1030	29.6	0.72	C	55.9	72.9
WBR	255	22.4	0.17	C	0	15.4	255	22.5	0.17	C	0	15.4
OVERALL	C= 86.6	27.6	0.72	C			C= 86.9	28.2	0.74	C		
Paisley Road & Hanlon Parkway	**Volume**	**Delay**	**V/C**	**LOS**	**Q50th**	**Q95th**	**Volume**	**Delay**	**V/C**	**LOS**	**Q50th**	**Q95th**
EBL	110	58.6	0.7	E	24.3	38.6	110	58.6	0.71	E	24.2	#39.0
EBT	350	56.2	0.6	E	48.7	62.6	355	55.9	0.6	E	49.3	63.6
EBR	170	0.1	0.12	A	0	0	170	0.1	0.12	A	0	0
NBL	295	65.5	0.71	E	42	56.5	295	65.8	0.72	E	42	56.5
NBT	1440	33.3	0.84	C	182	228.8	1445	33.8	0.85	C	184.6	230.3
NBR	260	18.3	0.22	B	10.9	28	260	18.5	0.22	B	11	28
SBL	105	68.7	0.63	E	29	47.7	105	69.4	0.64	E	29	47.7
SBT	1535	28.3	0.69	C	127	150.8	1535	28.6	0.69	C	128	150.8
SBR	80						80					
WBL	170	70	0.82	E	39	#61.6	170	69.7	0.82	E	38.8	#62.0
WBT	400	63	0.79	E	66.4	82.9	410	62.9	0.8	E	67.8	84.9
WBR	70						70					
OVERALL	C= 144	38.6	0.79	D			C= 144	39	0.79	D		

APPENDIX TABLE 4 - PHASE 3 OPTION 2 - OPENING DAY + 10 YEARS with IMPROVEMENTS

Wellington Street & East Ramp Connection	Weekday PM Peak Hour						Saturday PM Peak Hour					
	Volume	Delay	V/C	LOS	Q50th	Q95th	Volume	Delay	V/C	LOS	Q50th	Q95th
EBL	180	36.4	0.76	D	17.6	#43.3	185	38.1	0.78	D	18.1	#45.4
EBT	845	17.3	0.42	B	35.3	44.8	845	17.4	0.42	B	35.3	44.8
NBL	370	40.8	0.74	D	31.5	45.4	370	40.9	0.74	D	31.5	45.4
NBT	290	38.2	0.73	D	47.1	#80.7	290	39	0.74	D	47.1	#80.7
NBR	105	27.1	0.08	C	0.1	11.9	0					
SBL	185	44.2	0.72	D	30.4	#54.7	200	46.5	0.75	D	33.1	#61.1
SBR	680	25.5	0.7	C	58.9	80.4	710	26.3	0.73	C	62.5	85.1
WBT	1115	30.2	0.75	C	62.7	77.5	1115	30.3	0.75	C	62.7	77.5
WBR	255	22.3	0.17	C	0	14.9	255	22.4	0.17	C	0	14.9
OVERALL	C= 89.4	28.6	0.75	C			C= 89.5	29.1	0.76	C		
Paisley Road & Hanlon Parkway	__Volume	Delay (s)	_V/C	LOS	Q50th	Q95th	Volume	Delay	V/C	LOS	Q50th	Q95th
EBL	115	61.3	0.73	E	25.2	#40.4	115	62.1	0.74	E	25.2	#41.4
EBT	360	57.2	0.63	E	50.5	64.5	365	57	0.63	E	51.2	65.5
EBR	175	0.2	0.12	A	0	0	175	0.2	0.12	A	0	0
NBL	300	65.4	0.72	E	42.6	57.6	300	65.8	0.72	E	42.6	57.6
NBT	1555	37	0.9	D	212.4	#253.4	1560	37.5	0.9	D	214.1	#257.4
NBR	265	17.9	0.23	B	11.7	27.2	265	18	0.23	B	11.8	27.4
SBL	105	76.5	0.7	E	29	#59.0	105	77.6	0.71	E	29.1	#59.0
SBT	1660	30.7	0.75	C	144.5	171.3	1660	30.9	0.75	C	145.4	171.3
SBR	80						80					
WBL	175	68.5	0.83	E	40	#63.1	175	68.7	0.83	E	39.8	#63.6
WBT	410	62.5	0.79	E	67.8	84.1	420	62.6	0.8	E	69.3	86
WBR	70						70					
OVERALL	C= 144	40.4	0.82	D			C= 144	40.7	0.83	D		

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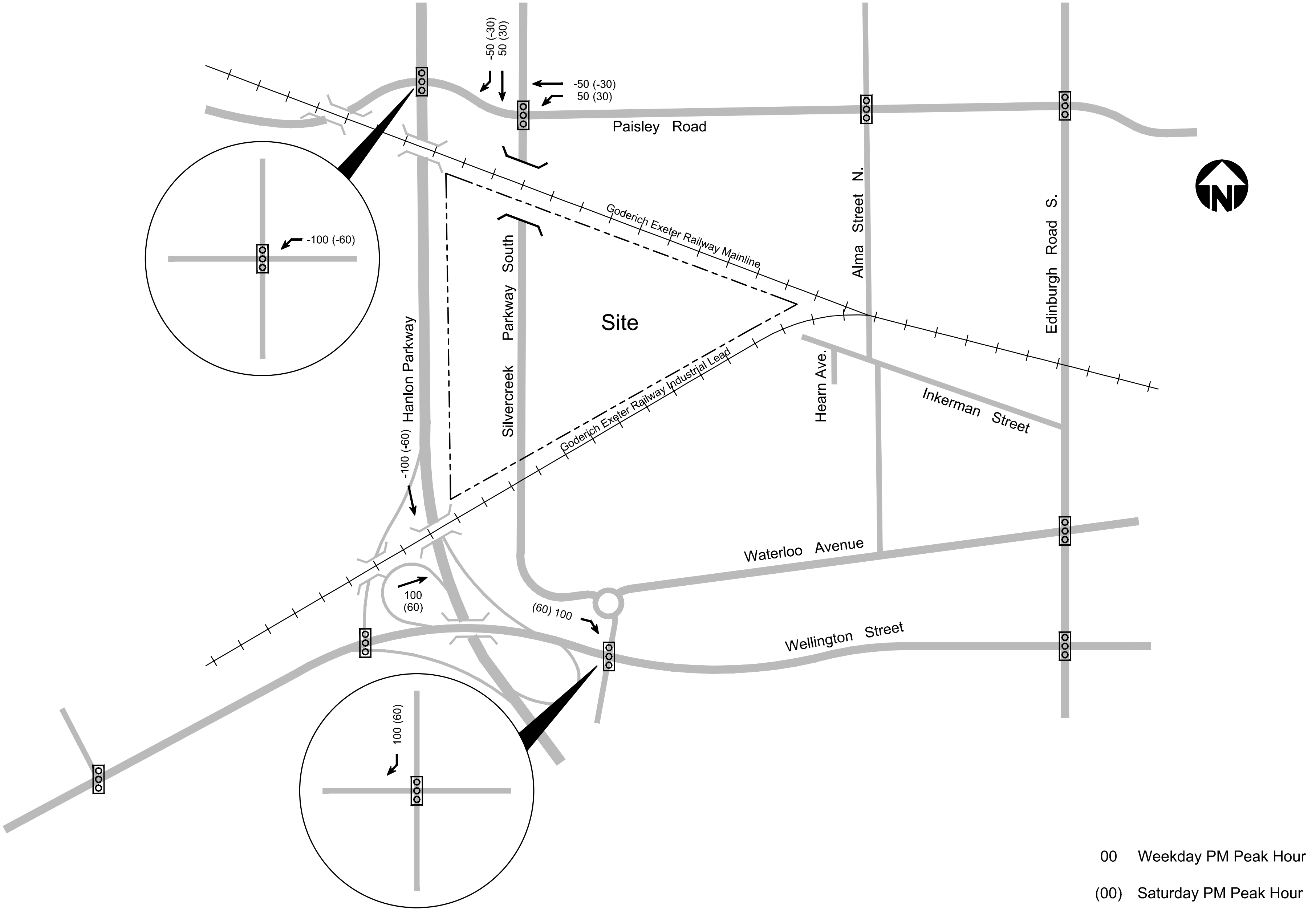
DATE PLOTTED: April 18, 2012

SITE PLAN

Source: Michael Spaziani Architect Inc.



DIVERTED TRAFFIC VOLUMES

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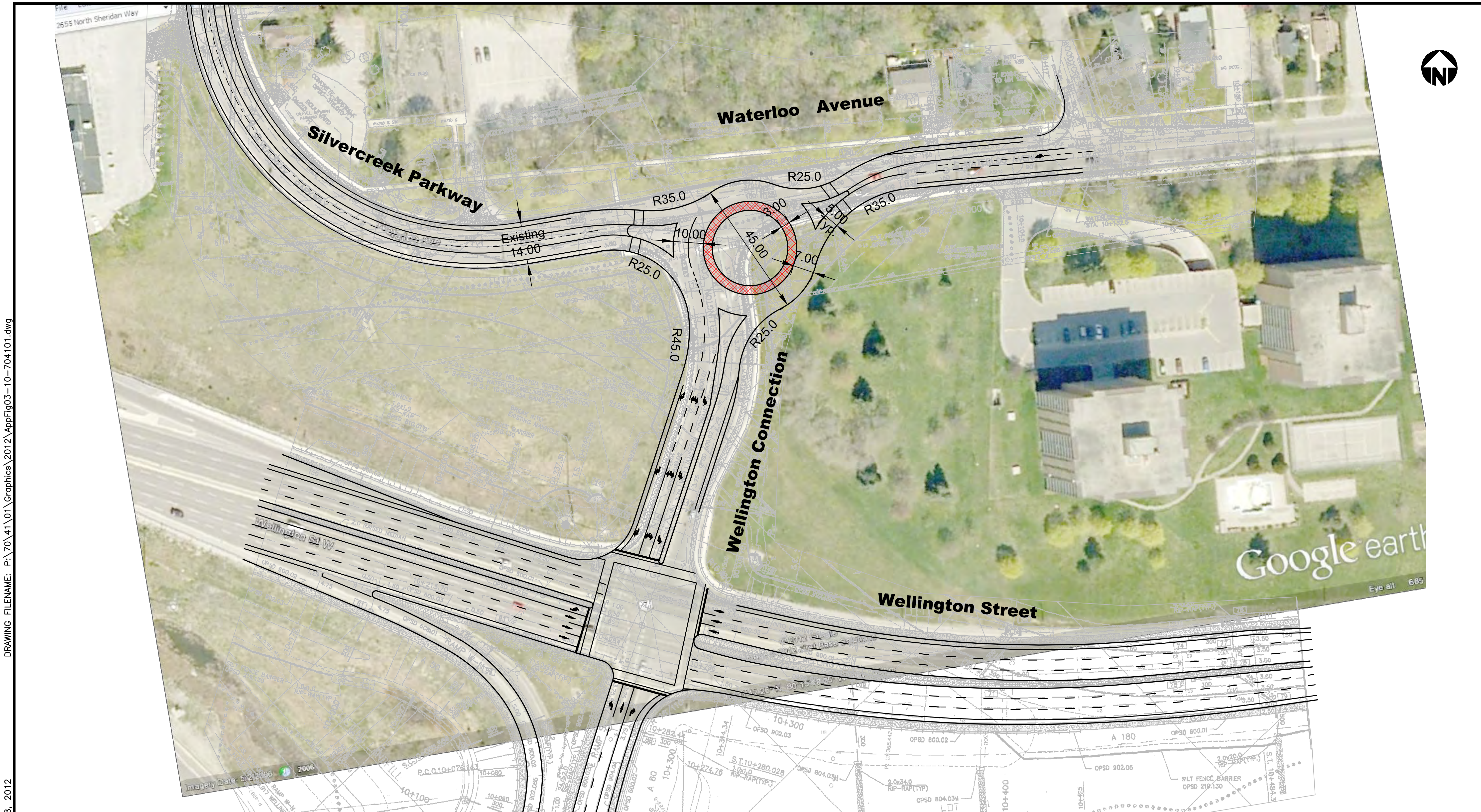
DATE PLOTTED: April 18, 2012



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DATE PLOTTED: April 18, 2012

BA GROUP Transportation Consultants

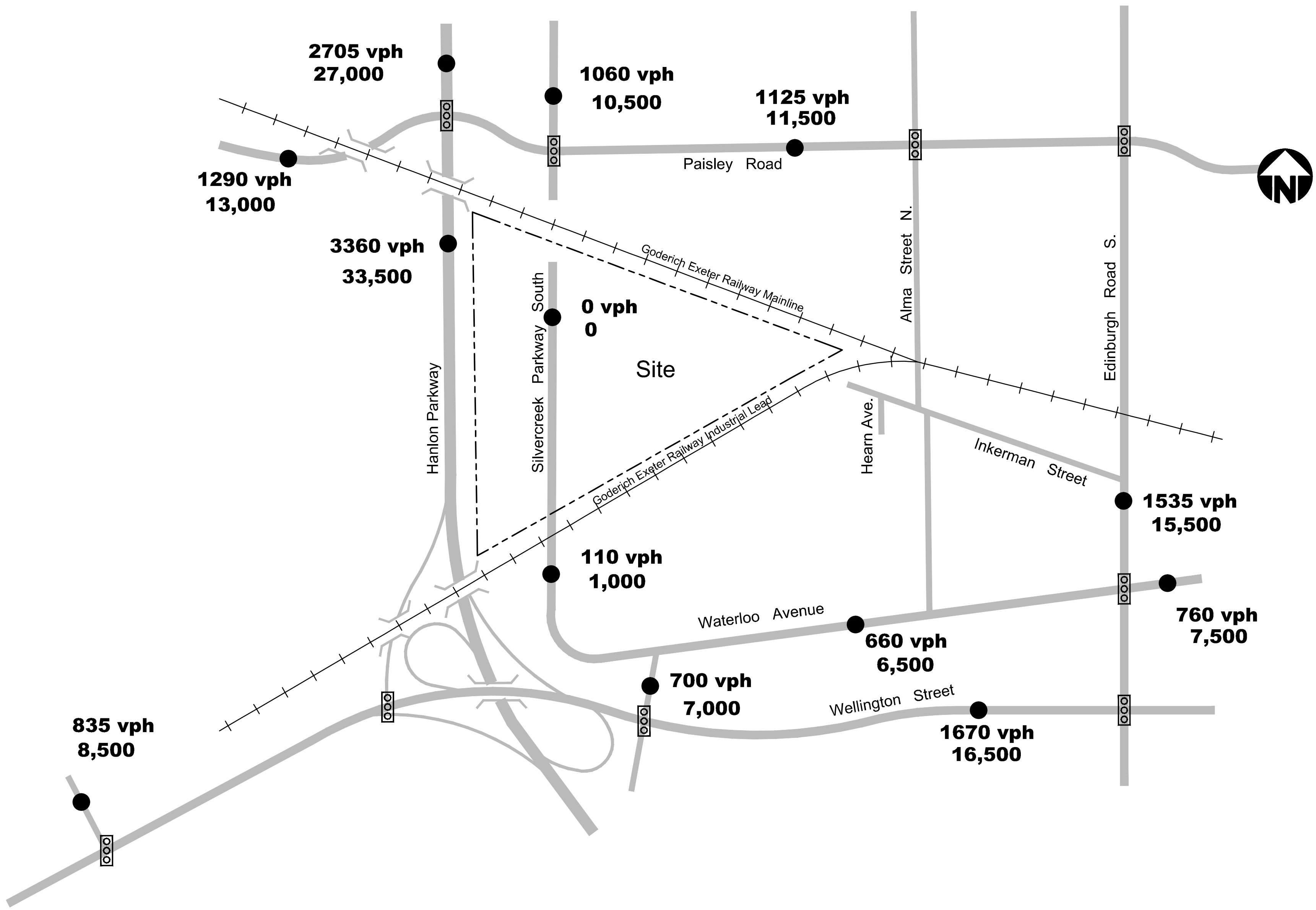
PROJECT:	Lafarge Property
PROJECT NO.	7041-01
DATE:	APRIL 2, 2008
REVISED:	MARCH 26, 2012

Lafarge Property, Guelph

WELLINGTON CONNECTION REALIGNMENT

SCALE 1:1250 (0 25 50m)

DRAWING No. Appendix Figure 3



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DATE PLOTTED: April 18, 2012

EXISTING TRAFFIC VOLUMES
(Two Way) Afternoon Rush Hour and Daily Volumes

1000 vph Two-way Peak Hour Volumes

10000 Daily Volumes

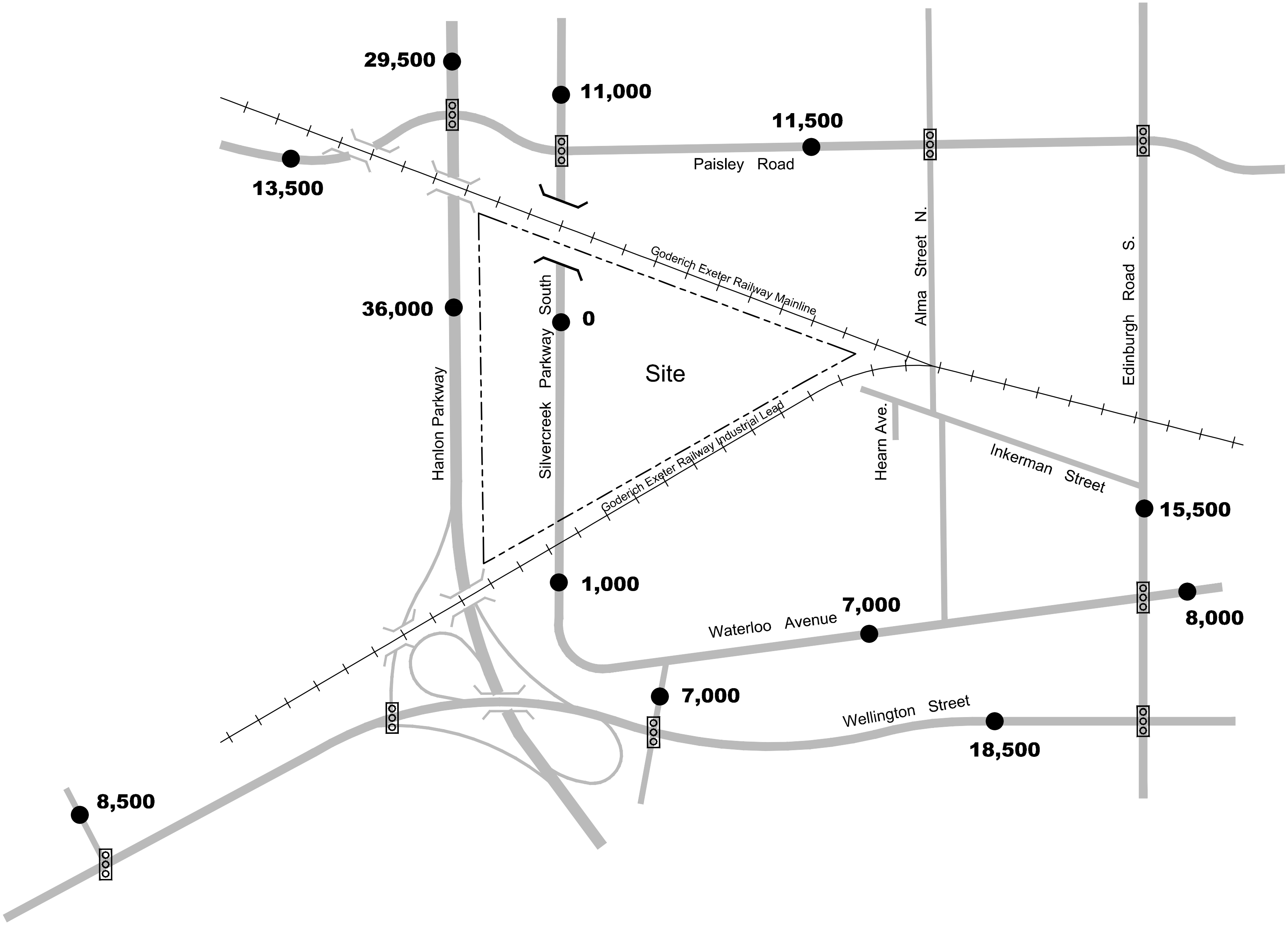
BA GROUP

Silvercreek Guelph Developments

7041-01, April 2012

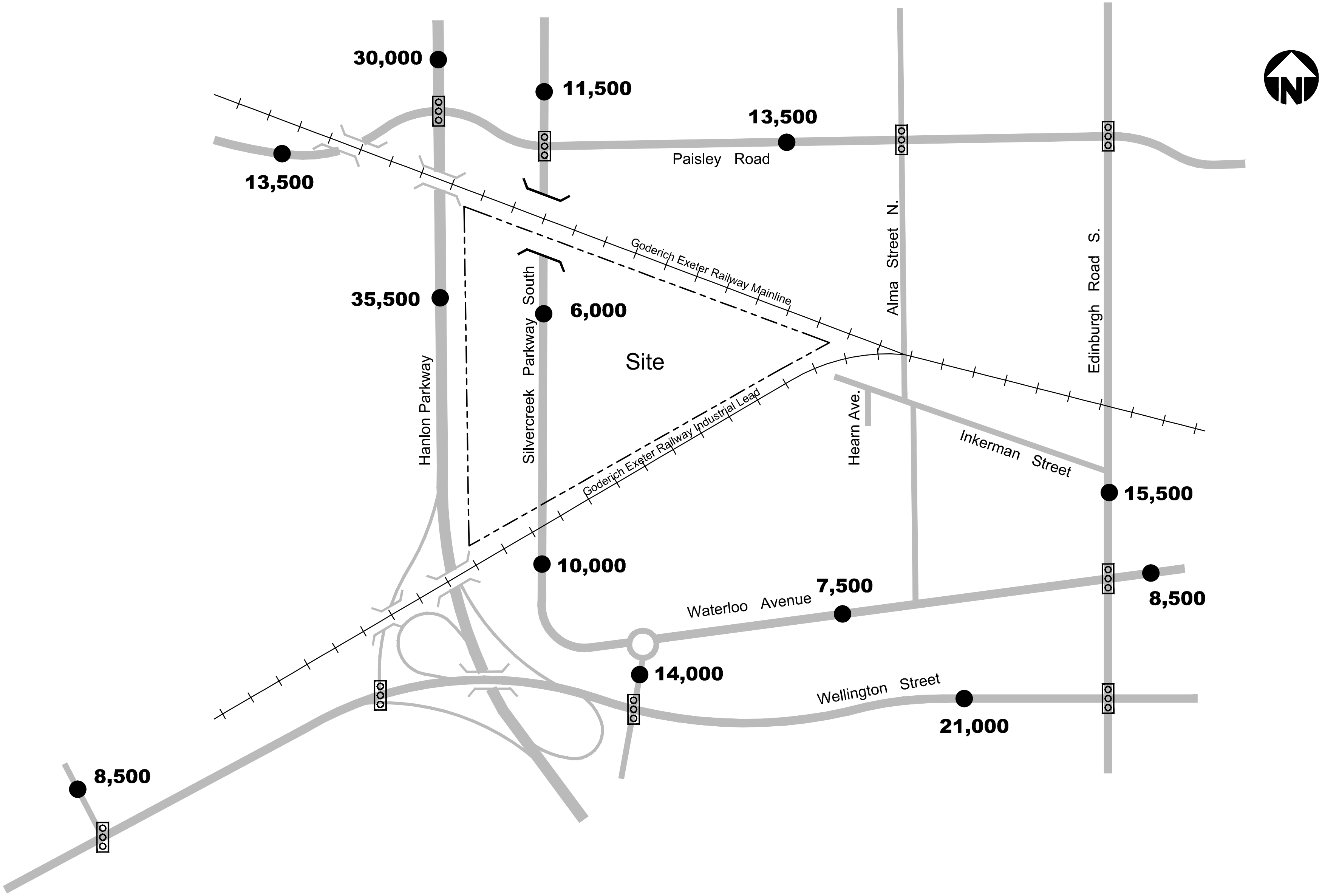
Appendix Figure 4

DRAWING FILENAME: P:\70\41\01\Graphics\2012\AppFig05-11-704101.dwg
DATE PLOTTED: April 18, 2012



FUTURE BACKGROUND TRAFFIC VOLUMES 5 YEAR GROWTH
(Two Way) Daily Volumes

10000 Daily Volumes



FUTURE TOTAL TRAFFIC VOLUMES
Phases 1 & 2 (Two Way) Daily Volumes

10000 Daily Volumes

DRAWING FILENAME: P:\70\41\01\Graphics\2012\AppFig06-11-704101.dwg

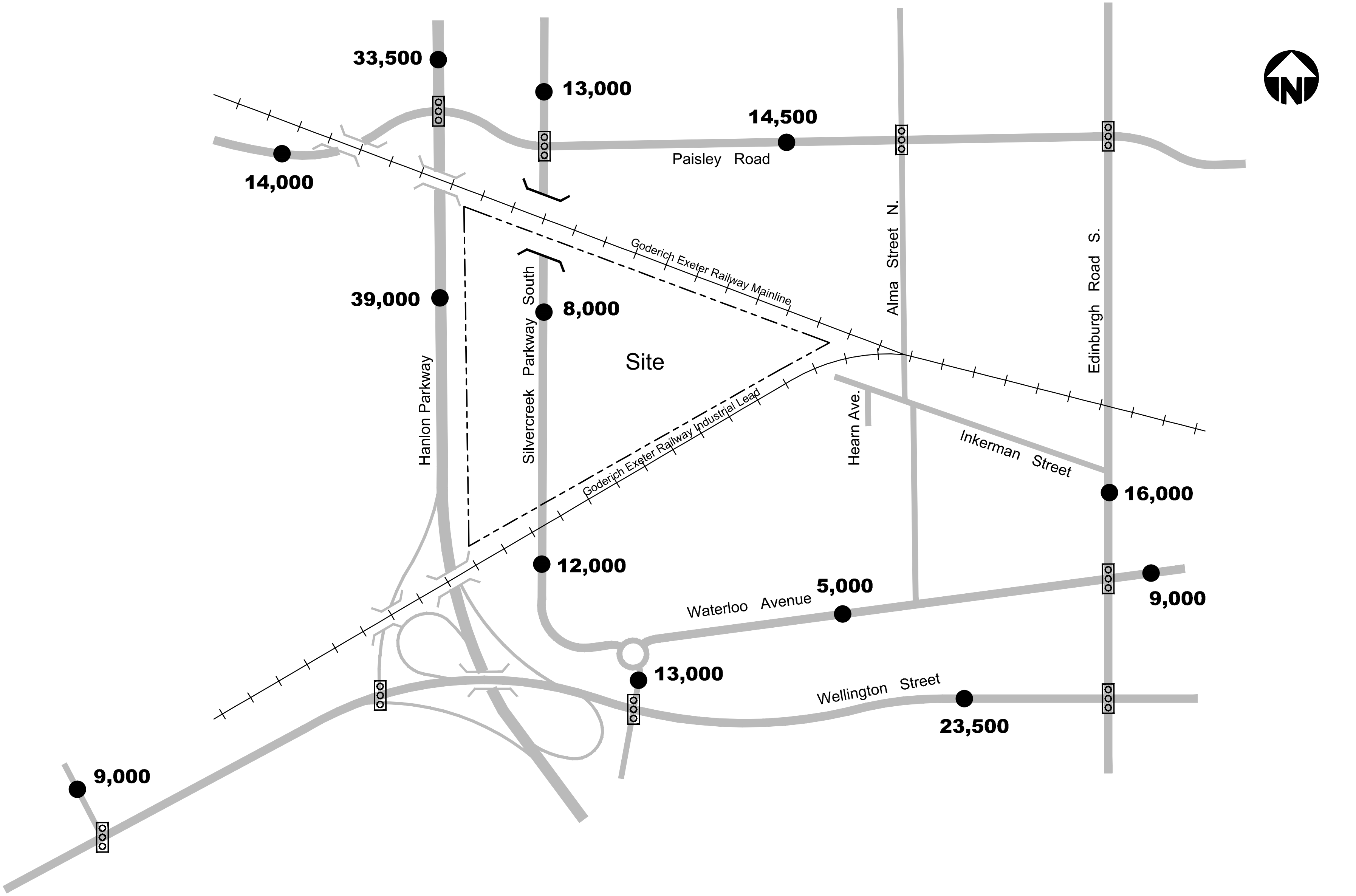
DATE PLOTTED: April 20, 2012

BA GROUP

Silvercreek Guelph Developments

7041-01, April 2012

Appendix Figure 6



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DATE PLOTTED: April 20, 2012

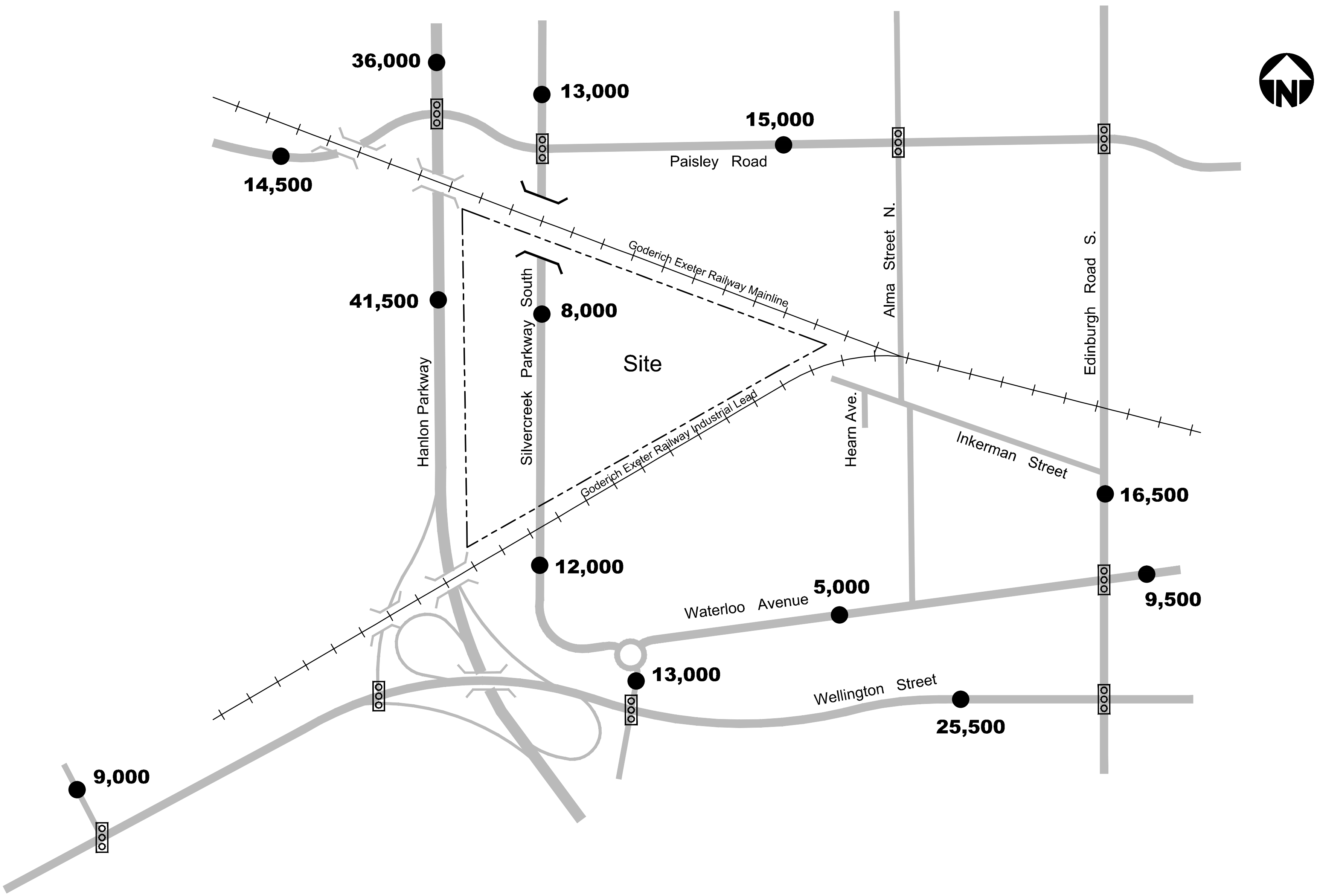
FUTURE TRAFFIC VOLUMES
Phase 3 Option 2 (Two Way) Daily Volumes - Opening Day + 5 Years

10000 Daily Volumes

BA GROUP

Silvercreek Guelph Developments
7041-01, April 2012

Appendix Figure 7



FUTURE TRAFFIC VOLUMES

Phase 3 Option 2 (Two Way) Daily Volumes - Opening Day + 10 Years

10000 Daily Volumes

DRAWING FILENAME: P:\70\41\01\Graphics\2012\AppFig08-11-704101.dwg

DATE PLOTTED: April 20, 2012

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Silvercreek Guelph Developments

7041-01, April 2012

Appendix Figure 8

SILVERCREEK - GUELPH DEVELOPMENT
WEEKDAY PM EXISTING TRAFFIC COMPARISON

HANLON EXPRESSWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	100	90	-10	
	T	310	310	0	
	R	160	165	5	
NB	L	280	215	-65	
	T	1155	895	-260	
	R	260	220	-40	
WB	L	275	185	-90	
	T	360	440	80	
	R	55	35	-20	
SB	L	85	45	-40	
	T	1230	1000	-230	
	R	80	60	-20	
EB	TOTAL	570	565	-5	-0.9%
NB	TOTAL	1695	1330	-365	-27.4%
WB	TOTAL	690	660	-30	-4.5%
SB	TOTAL	1395	1105	-290	-26.2%
GRAND	TOTAL	4350	3660	-690	-18.9%

SILVERCREEK PARKWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	290	265	-25	
	T	365	325	-40	
	R	0	5	5	
NB	L	0	2	2	
	T	0	5	5	
	R	0	0	0	
WB	L	0	1	1	
	T	340	315	-25	
	R	185	175	-10	
SB	L	235	245	10	
	T	0	1	1	
	R	350	340	-10	
EB	TOTAL	655	595	-60	-10.1%
NB	TOTAL	0	7	7	100.0%
WB	TOTAL	525	491	-34	-6.9%
SB	TOTAL	585	586	1	0.2%
GRAND	TOTAL	1765	1679	-86	-5.1%

EDINBURGH RD / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	135	85	-50	
	T	340	270	-70	
	R	80	85	5	
NB	L	110	75	-35	
	T	605	500	-105	
	R	30	35	5	
WB	L	40	40	0	
	T	325	325	0	
	R	55	60	5	
SB	L	85	80	-5	
	T	555	530	-25	
	R	70	70	0	
EB	TOTAL	555	440	-115	-26.1%
NB	TOTAL	745	610	-135	-22.1%
WB	TOTAL	420	425	5	1.2%
SB	TOTAL	710	680	-30	-4.4%
GRAND	TOTAL	2430	2155	-275	-12.8%

EDINBURGH RD / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	55	60	5	
	T	220	155	-65	
	R	35	40	5	
NB	L	45	60	15	
	T	660	710	50	
	R	65	60	-5	
WB	L	105	115	10	
	T	270	235	-35	
	R	60	75	15	
SB	L	40	60	20	
	T	685	685	0	
	R	35	60	25	
EB	TOTAL	310	255	-55	-21.6%
NB	TOTAL	770	830	60	7.2%
WB	TOTAL	435	425	-10	-2.4%
SB	TOTAL	760	805	45	5.6%
GRAND	TOTAL	2275	2315	40	1.7%

EDINBURGH RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	50	35	-15	
	T	545	430	-115	
	R	135	130	-5	
NB	L	135	135	0	
	T	645	765	120	
	R	155	230	75	
WB	L	225	295	70	
	T	740	640	-100	
	R	75	30	-45	
SB	L	50	30	-20	
	T	710	715	5	
	R	65	45	-20	
EB	TOTAL	730	595	-135	-22.7%
NB	TOTAL	935	1130	195	17.3%
WB	TOTAL	1040	965	-75	-7.8%
SB	TOTAL	825	790	-35	-4.4%
GRAND	TOTAL	3530	3480	-50	-1.4%

SILVERCREEK PARKWAY / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	15	10	-5	
	R	35	15	-20	
NB	L	40	25	-15	
	T	0	0	0	
	R	295	260	-35	
WB	L	330	190	-140	
	T	20	10	-10	
	R	0	0	0	
SB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
EB	TOTAL	50	25	-25	-100.0%
NB	TOTAL	335	285	-50	-17.5%
WB	TOTAL	350	200	-150	-75.0%
SB	TOTAL	0	0	0	0.0%
GRAND	TOTAL	735	510	-225	-44.1%

HANLON EXPRESSWAY NB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	125	165	40	
	T	640	585	-55	
	R	0	0	0	
NB	L	275	295	20	
	T	115	85	-30	
	R	75	105	30	
WB	L	0	0	0	
	T	845	760	-85	
	R	95	10	-85	
SB	L	15	5	-10	
	T	0	0	0	
	R	350	200	-150	
EB	TOTAL	765	750	-15	-2.0%
NB	TOTAL	465	485	20	4.1%
WB	TOTAL	940	770	-170	-22.1%
SB	TOTAL	365	205	-160	-78.0%
GRAND	TOTAL	2535	2210	-325	-14.7%

HANLON EXPRESSWAY SB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	865	685	-180	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	1285	965	-320	
	R	0	0	0	
SB	L	115	145	30	
	T	0	0	0	
	R	80	140	60	
EB	TOTAL	865	685	-180	-26.3%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	1285	965	-320	-33.2%
SB	TOTAL	195	285	90	31.6%
GRAND	TOTAL	2345	1935	-410	-21.2%

IMPERIAL RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	105	95	-10	
	T	710	695	-15	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	1055	730	-325	
	R	310	360	50	
SB	L	385	305	-80	
	T	0	0	0	
	R	35	125	90	
EB	TOTAL	815	790	-25	-3.2%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	1365	1090	-275	-25.2%
SB	TOTAL	420	430	10	2.3%
GRAND	TOTAL	2600	2310	-290	-12.6%

	YR 2005	YR 2009	Change	% Change
NETWORK TOTAL	22155	17909	-1901	-10.6%

SILVERCREEK - GUELPH DEVELOPMENT
SATURDAY EXISTING TRAFFIC COMPARISON

HANLON EXPRESSWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	100	125	25	
	T	310	255	-55	
	R	80	70	-10	
NB	L	150	205	55	
	T	925	870	-55	
	R	170	145	-25	
WB	L	195	175	-20	
	T	300	270	-30	
	R	35	30	-5	
SB	L	30	30	0	
	T	970	835	-135	
	R	90	105	15	
EB	TOTAL	490	450	-40	-8.9%
NB	TOTAL	1245	1220	-25	-2.0%
WB	TOTAL	530	475	-55	-11.6%
SB	TOTAL	1090	970	-120	-12.4%
GRAND	TOTAL	3355	3115	-240	-7.7%

SILVERCREEK PARKWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	250	180	-70	
	T	260	235	-25	
	R	0	0	0	
NB	L	0	1	1	
	T	0	1	1	
	R	0	5	5	
WB	L	0	2	2	
	T	285	230	-55	
	R	155	145	-10	
SB	L	250	215	-35	
	T	5	2	-3	
	R	245	230	-15	
EB	TOTAL	510	415	-95	-22.9%
NB	TOTAL	0	7	7	100.0%
WB	TOTAL	440	377	-63	-16.7%
SB	TOTAL	500	447	-53	-11.9%
GRAND	TOTAL	1450	1246	-204	-16.4%

EDINBURGH RD / PAISLEY RD

Direction	Movement	YR 2008	YR 2008	Change	% Change
EB	L	70	70	0	
	T	245	245	0	
	R	85	85	0	
NB	L	60	60	0	
	T	515	515	0	
	R	35	35	0	
WB	L	50	50	0	
	T	200	200	0	
	R	45	45	0	
SB	L	50	50	0	
	T	485	485	0	
	R	70	70	0	
EB	TOTAL	400	400	0	0.0%
NB	TOTAL	610	610	0	0.0%
WB	TOTAL	295	295	0	0.0%
SB	TOTAL	605	605	0	0.0%
GRAND	TOTAL	1910	1910	0	0.0%

EDINBURGH RD / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	35	45	10	
	T	85	85	0	
	R	55	30	-25	
NB	L	20	25	5	
	T	470	470	0	
	R	65	50	-15	
WB	L	75	75	0	
	T	125	75	-50	
	R	25	30	5	
SB	L	30	30	0	
	T	515	510	-5	
	R	20	25	5	
EB	TOTAL	175	160	-15	-9.4%
NB	TOTAL	555	545	-10	-1.8%
WB	TOTAL	225	180	-45	-25.0%
SB	TOTAL	565	565	0	0.0%
GRAND	TOTAL	1520	1450	-70	-4.8%

EDINBURGH RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	35	20	-15	
	T	465	340	-125	
	R	90	75	-15	
NB	L	115	95	-20	
	T	480	530	50	
	R	170	175	5	
WB	L	195	200	5	
	T	425	365	-60	
	R	40	55	15	
SB	L	60	45	-15	
	T	540	585	45	
	R	45	50	5	
EB	TOTAL	590	435	-155	-35.6%
NB	TOTAL	765	800	35	4.4%
WB	TOTAL	660	620	-40	-6.5%
SB	TOTAL	645	680	35	5.1%
GRAND	TOTAL	2660	2535	-125	-4.9%

SILVERCREEK PARKWAY / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	20	10	-10	
	R	15	15	0	
NB	L	30	25	-5	
	T	0	0	0	
	R	155	130	-25	
WB	L	145	145	0	
	T	20	15	-5	
	R	0	0	0	
SB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
EB	TOTAL	35	25	-10	-40.0%
NB	TOTAL	185	155	-30	-19.4%
WB	TOTAL	165	160	-5	-3.1%
SB	TOTAL	0	0	0	0.0%
GRAND	TOTAL	385	340	-45	-13.2%

HANLON EXPRESSWAY NB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	95	95	0	
	T	495	400	-95	
	R	0	0	0	
NB	L	190	225	35	
	T	65	45	-20	
	R	95	65	-30	
WB	L	0	0	0	
	T	560	480	-80	
	R	25	10	-15	
SB	L	0	2	2	
	T	0	0	0	
	R	160	160	0	
EB	TOTAL	590	495	-95	-19.2%
NB	TOTAL	350	335	-15	-4.5%
WB	TOTAL	585	490	-95	-19.4%
SB	TOTAL	160	162	2	1.2%
GRAND	TOTAL	1685	1482	-203	-13.7%

HANLON EXPRESSWAY SB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	480	435	-45	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	625	640	15	
	R	0	0	0	
SB	L	145	100	-45	
	T	0	0	0	
	R	110	80	-30	
EB	TOTAL	480	435	-45	-10.3%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	625	640	15	2.3%
SB	TOTAL	255	180	-75	-41.7%
GRAND	TOTAL	1360	1255	-105	-8.4%

IMPERIAL RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	80	70	-10	
	T	480	355	-125	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	500	420	-80	
	R	235	225	-10	
SB	L	305	285	-20	
	T	0	0	0	
	R	80	80	0	
EB	TOTAL	560	425	-135	-31.8%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	735	645	-90	-14.0%
SB	TOTAL	385	365	-20	-5.5%
GRAND	TOTAL	1680	1435	-245	-17.1%

	YR 2005	YR 2009	Change	% Change
NETWORK TOTAL	15900	13408	-1132	-8.4%

BA Code	Type	City of Toronto Code
	PASSENGER VEHICLES	
1.	CAR	C1
2.	MINI VAN	C1
3.	SUV	C1
4.	VAN	C1
5.	PICKUP	C1
6.	TAXI	C1
	MEDIUM	
7.	CUBE VAN	C2
8.	STEP VAN	C2
9.	SINGLE UNIT	B
10.	SMALL BUS	
11.	WHEEL TRANS BUS	
	HEAVY (More than 2 axels)	
12.	SINGLE UNIT	B
13.	TRACTOR TRAILER	A
14.	ARMOURED TRUCK	
15.	REFUSE TRUCK	G
16.	TRANSIT BUS	
17.	LARGE SCHOOL BUS	
18.	HIGHWAY COACH	

NEW VEHICLE CLASSIFICATIONS

DATE PLOTTED: February 26, 2002 DRAWING FILENAME: P:\Technical Resources\Loading_Demand\Vehicle Classification.dwg

APPENDIX A
Appendix Tables and Figures

Appendix Table 1 - Weekday PM Signal Timing Adjustments in Seconds
Silvercreek Junction , Guelph

Intersection	Traffic Conditions								
				Total Ph3 Opening		Total Ph3 (5 Years+Opening)		Total Ph3 (10 Years+Opening)	
Movement	**Existing**	**Bckgrnd, 5 Yrs**	**Total,PH 1/2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**
Weekday PM Peak Hour:									
Hanlon Parkwy and Paisley Road									
EB L	9	9	9	11	10	12	10	11	11
EB T	35	35	35	35	35	35	35	35	35
WB L	9	14	9	12	12	12	12	12	12
WB T	35	40	35	35	37	35	37	36	36
NB L	19	29	19	19	18	18	18	17	17
NB T	60	78	82	81	81	81	81	77	77
SB L	16	17	15	16	16	16	16	20	20
SB T	57	66	78	78	79	79	79	80	80
YCLE LENGTH	120	144	144	144	144	144	144	144	144
Paisley Road and Silvercreek Parkwy									
EB L	11	20	14	8	13	14	13	14	13
EB T	46	61	41	39	38	41	38	41	38
WB L			11	11	11	11	11	11	11
WB T	35	41	38	42	36	38	36	38	36
NB L									
NB T	29	29	29	29	29	29	29	29	29
SB L			9	11	12	9	12	9	12
SB T	29	29	38	40	41	38	41	38	41
YCLE LENGTH	75	90	90	90	90	90	90	90	90
Paisley Road and Edinburgh									
EB L			8	8	8	8	8	8	8
EB T	31	38	39	39	39	39	39	38	38
WB L									
WB T	31	38	31	31	31	31	31	30	30
NB L			8	8	8	8	8	8	8
NB T	35	44	43	43	43	43	43	44	44
SB L	9	8	8	8	8	8	8	8	8
SB T	44	52	43	43	43	43	43	44	44
YCLE LENGTH	75	90	90	90	90	90	90	90	90
Waterloo Avenue and Edinburgh									
EB T	33	33	33	34	34	34	34	33	33
WB T	33	33	33	34	34	34	34	33	33
NB T	57	57	57	56	56	56	56	57	57
SB T	57	57	57	56	56	56	56	57	57
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and Edinburgh Road									
EB L	9	9							
EB T	30	30	30	30	30	30	30	32	32
WB L	13	14	13	13	13	12	12	12	12
WB T	34	35	43	43	43	42	42	44	44
NB L	10	9	8	9	9	9	9	9	9
NB T	37	37	47	47	47	48	48	46	46
SB L	10	9							
SB T	37	37	39	38	38	39	39	37	37
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and East Ramp Terminal									
EB L	14	11	10	9	10	9	9	8	9
EB T	39	41	39	37	37	40	39	38	37
WB L									
WB T	25	30	29	28	27	31	30	30	28
NB L									
NB T	27	24	26	26	25	25	25	27	27
SB L									
SB T	24	25	25	27	28	25	26	25	26
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and West Ramp Terminal									
EB L									
EB T	49	49	54	54	55	55	55	56	56
WB L									
WB T	49	49	54	54	55	55	55	56	56
NB L									
NB T	41	41	36	36	35	35	35	34	34
SB L									
SB T	41	41	38	36	35	35	35	34	34
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and Imperial Road									
EB L			11	11	11	11	11	11	11
EB T	46	63	60	61	61	62	62	63	63
WB L									
WB T	46	63	49	50	50	51	51	52	52
NB L									
NB T									
SB L									
SB T	24	27	30	29	29	28	28	27	27
YCLE LENGTH	70	90	90	90	90	90	90	90	90

Appendix Table 2 - Saturday Signal Timing Adjustments in Seconds
Silvercreek Junction , Guelph

Intersection	Traffic Conditions								
				Total Ph3 Opening		Total Ph3 (5 Years+Opening)		Total Ph3 (10 Years+Opening)	
Movement	**Existing**	**Bckgrnd, 5 Yrs**	**Total,PH 1/2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**
Saturday PM Peak Hour:									
Hanlon Parkwy and Paisley Road									
EB L	9	9	9	9	9	9	9	9	9
EB T	35	35	35	35	35	35	35	35	35
WB L	9	9	9	9	9	9	9	9	9
WB T	35	35	35	35	35	35	35	35	35
NB L	11	11	9	9	9	9	9	9	9
NB T	37	37	37	37	37	37	37	37	37
SB L	9	9	9	9	9	9	9	9	9
SB T	35	35	37	37	37	37	37	37	37
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Paisley Road and Silvercreek Parkwy									
EB L	11	18	15	13	13	13	13	13	13
EB T	46	58	50	50	50	50	50	50	50
WB L									
WB T	35	40	35	37	37	37	37	37	37
NB L									
NB T	29	32	29	29	29	29	29	29	29
SB L			11	11	11	11	11	11	11
SB T	29	32	40	40	40	40	40	40	40
YCLE LENGTH	75	90	90	90	90	90	90	90	90
Paisley Road and Edinburgh									
EB L									
EB T	31	39	38	39	39	38	38	38	38
WB L									
WB T	31	39	38	39	39	38	38	38	38
NB L									
NB T	35	51	52	51	51	52	52	52	52
SB L	9								
SB T	44	51	52	51	51	52	52	52	52
YCLE LENGTH	75	90	90	90	90	90	90	90	90
Waterloo Avenue and Edinburgh									
EB T	33	29	26	26	26	26	26	26	26
WB T	33	29	26	26	26	26	26	26	26
NB T	57	61	64	64	64	64	64	64	64
SB T	57	61	64	64	64	64	64	64	64
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and Edinburgh Road									
EB L									
EB T	30	30	30	30	30	30	30	30	30
WB L	13	13	13	13	13	12	13	13	12
WB T	43	43	43	43	43	42	43	43	42
NB L	10	9	9	10	10	10	10	10	10
NB T	47	47	47	47	47	48	47	47	48
SB L									
SB T	37	38	38	37	37	38	37	37	38
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and East Ramp Terminal									
EB L	14	12	12	12	12	11	12	12	12
EB T	39	38	38	37	37	37	37	37	38
WB L									
WB T	25	26	26	26	25	26	25	25	26
NB L									
NB T	27	26	25	25	26	25	26	26	25
SB L									
SB T	24	26	27	28	27	28	27	27	27
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and West Ramp Terminal									
EB L									
EB T	49	51	48	48	48	48	48	48	48
WB L									
WB T	49	51	48	48	48	48	48	48	48
NB L									
NB T	41	39	42	42	42	42	42	42	42
SB L									
SB T	41	39	42	42	42	42	42	42	42
YCLE LENGTH	90	90	90	90	90	90	90	90	90
Wellington Street and Imperial Road									
EB L									
EB T	41	41	44	44	44	44	44	45	45
WB L									
WB T	41	41	44	44	44	44	44	45	45
NB L									
NB T									
SB L									
SB T	29	29	26	26	26	26	26	25	25
YCLE LENGTH	70	70	70	70	70	70	70	70	70

APPENDIX TABLE 3 - PHASE 3 OPTION 2 - OPENING DAY + 5 YEARS with IMPROVEMENTS

Wellington Street & East Ramp Connection	Weekday PM Peak Hour						Saturday PM Peak Hour					
	Volume	Delay	V/C	LOS	Q50th	Q95th	Volume	Delay	V/C	LOS	Q50th	Q95th
EBL	175	38.2	0.77	D	16.8	#43.7	180	41.1	0.8	D	17.8	#46.5
EBT	780	17.7	0.4	B	31.7	43.8	780	17.9	0.4	B	32.4	43.8
NBL	340	34.8	0.62	C	27.1	39.4	340	34.8	0.62	C	27.3	39.4
NBT	285	33.1	0.67	C	43.3	67.8	285	34.5	0.69	C	44	69
NBR	95	25.1	0.07	C	0	10.5	95	25.6	0.07	C	0	10.7
SBL	185	44	0.73	D	29.3	#58.1	200	44.3	0.74	D	31.8	#61.1
SBR	670	25.3	0.7	C	56.1	#83.2	700	26.2	0.73	C	59.8	#93.9
WBT	1030	29.4	0.72	C	55.1	72.9	1030	29.6	0.72	C	55.9	72.9
WBR	255	22.4	0.17	C	0	15.4	255	22.5	0.17	C	0	15.4
OVERALL	C= 86.6	27.6	0.72	C			C= 86.9	28.2	0.74	C		
Paisley Road & Hanlon Parkway	**Volume**	**Delay**	**V/C**	**LOS**	**Q50th**	**Q95th**	**Volume**	**Delay**	**V/C**	**LOS**	**Q50th**	**Q95th**
EBL	110	58.6	0.7	E	24.3	38.6	110	58.6	0.71	E	24.2	#39.0
EBT	350	56.2	0.6	E	48.7	62.6	355	55.9	0.6	E	49.3	63.6
EBR	170	0.1	0.12	A	0	0	170	0.1	0.12	A	0	0
NBL	295	65.5	0.71	E	42	56.5	295	65.8	0.72	E	42	56.5
NBT	1440	33.3	0.84	C	182	228.8	1445	33.8	0.85	C	184.6	230.3
NBR	260	18.3	0.22	B	10.9	28	260	18.5	0.22	B	11	28
SBL	105	68.7	0.63	E	29	47.7	105	69.4	0.64	E	29	47.7
SBT	1535	28.3	0.69	C	127	150.8	1535	28.6	0.69	C	128	150.8
SBR	80						80					
WBL	170	70	0.82	E	39	#61.6	170	69.7	0.82	E	38.8	#62.0
WBT	400	63	0.79	E	66.4	82.9	410	62.9	0.8	E	67.8	84.9
WBR	70						70					
OVERALL	C= 144	38.6	0.79	D			C= 144	39	0.79	D		

APPENDIX TABLE 4 - PHASE 3 OPTION 2 - OPENING DAY + 10 YEARS with IMPROVEMENTS

Wellington Street & East Ramp Connection	Weekday PM Peak Hour						Saturday PM Peak Hour					
	Volume	Delay	V/C	LOS	Q50th	Q95th	Volume	Delay	V/C	LOS	Q50th	Q95th
EBL	180	36.4	0.76	D	17.6	#43.3	185	38.1	0.78	D	18.1	#45.4
EBT	845	17.3	0.42	B	35.3	44.8	845	17.4	0.42	B	35.3	44.8
NBL	370	40.8	0.74	D	31.5	45.4	370	40.9	0.74	D	31.5	45.4
NBT	290	38.2	0.73	D	47.1	#80.7	290	39	0.74	D	47.1	#80.7
NBR	105	27.1	0.08	C	0.1	11.9	0					
SBL	185	44.2	0.72	D	30.4	#54.7	200	46.5	0.75	D	33.1	#61.1
SBR	680	25.5	0.7	C	58.9	80.4	710	26.3	0.73	C	62.5	85.1
WBT	1115	30.2	0.75	C	62.7	77.5	1115	30.3	0.75	C	62.7	77.5
WBR	255	22.3	0.17	C	0	14.9	255	22.4	0.17	C	0	14.9
OVERALL	C= 89.4	28.6	0.75	C			C= 89.5	29.1	0.76	C		
Paisley Road & Hanlon Parkway	__Volume	Delay (s)	_V/C	LOS	Q50th	Q95th	Volume	Delay	V/C	LOS	Q50th	Q95th
EBL	115	61.3	0.73	E	25.2	#40.4	115	62.1	0.74	E	25.2	#41.4
EBT	360	57.2	0.63	E	50.5	64.5	365	57	0.63	E	51.2	65.5
EBR	175	0.2	0.12	A	0	0	175	0.2	0.12	A	0	0
NBL	300	65.4	0.72	E	42.6	57.6	300	65.8	0.72	E	42.6	57.6
NBT	1555	37	0.9	D	212.4	#253.4	1560	37.5	0.9	D	214.1	#257.4
NBR	265	17.9	0.23	B	11.7	27.2	265	18	0.23	B	11.8	27.4
SBL	105	76.5	0.7	E	29	#59.0	105	77.6	0.71	E	29.1	#59.0
SBT	1660	30.7	0.75	C	144.5	171.3	1660	30.9	0.75	C	145.4	171.3
SBR	80						80					
WBL	175	68.5	0.83	E	40	#63.1	175	68.7	0.83	E	39.8	#63.6
WBT	410	62.5	0.79	E	67.8	84.1	420	62.6	0.8	E	69.3	86
WBR	70						70					
OVERALL	C= 144	40.4	0.82	D			C= 144	40.7	0.83	D		

SITE PLAN

Source: Michael Spaziani Architect Inc.

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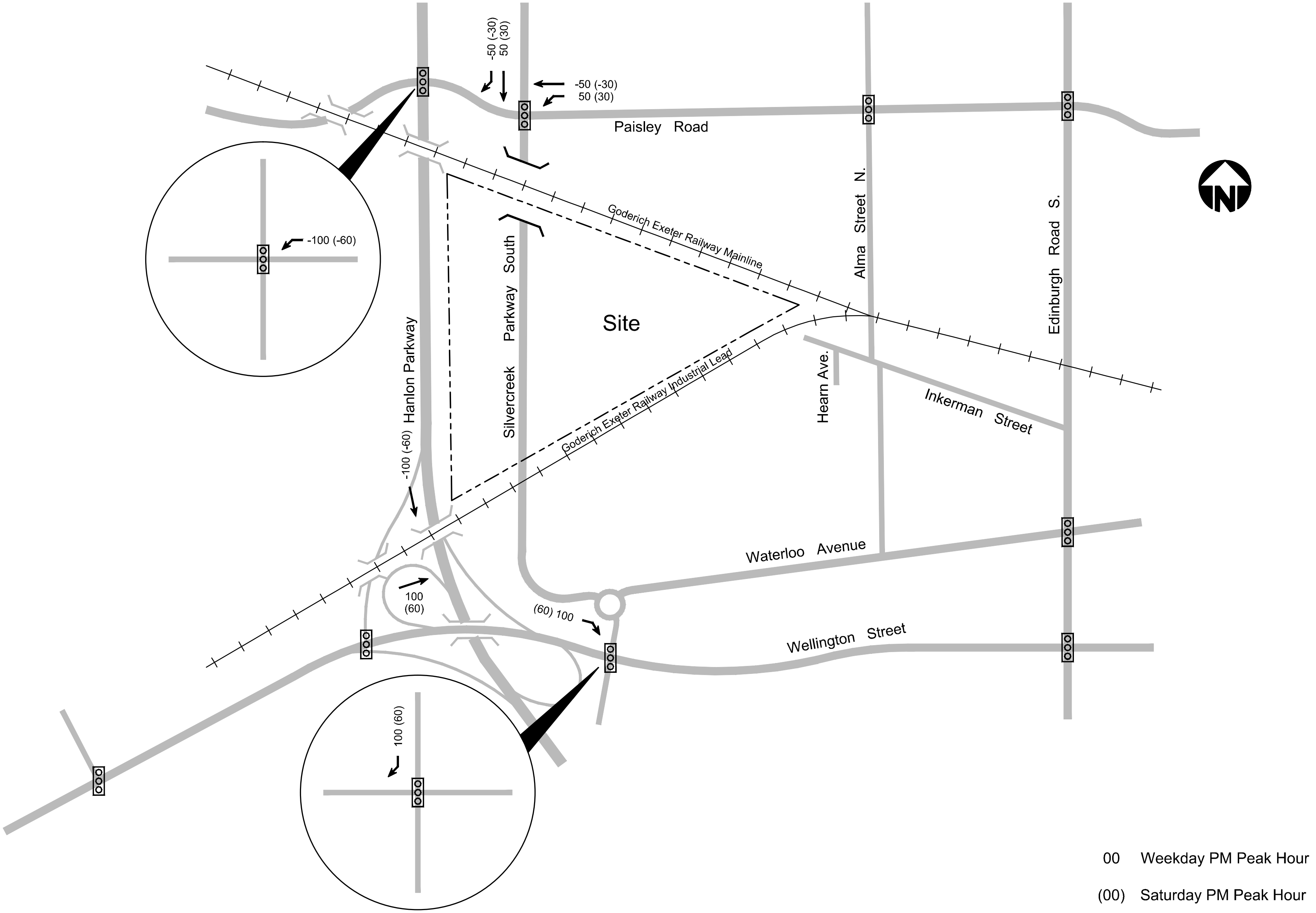
DATE PLOTTED: April 18, 2012



DIVERTED TRAFFIC VOLUMES

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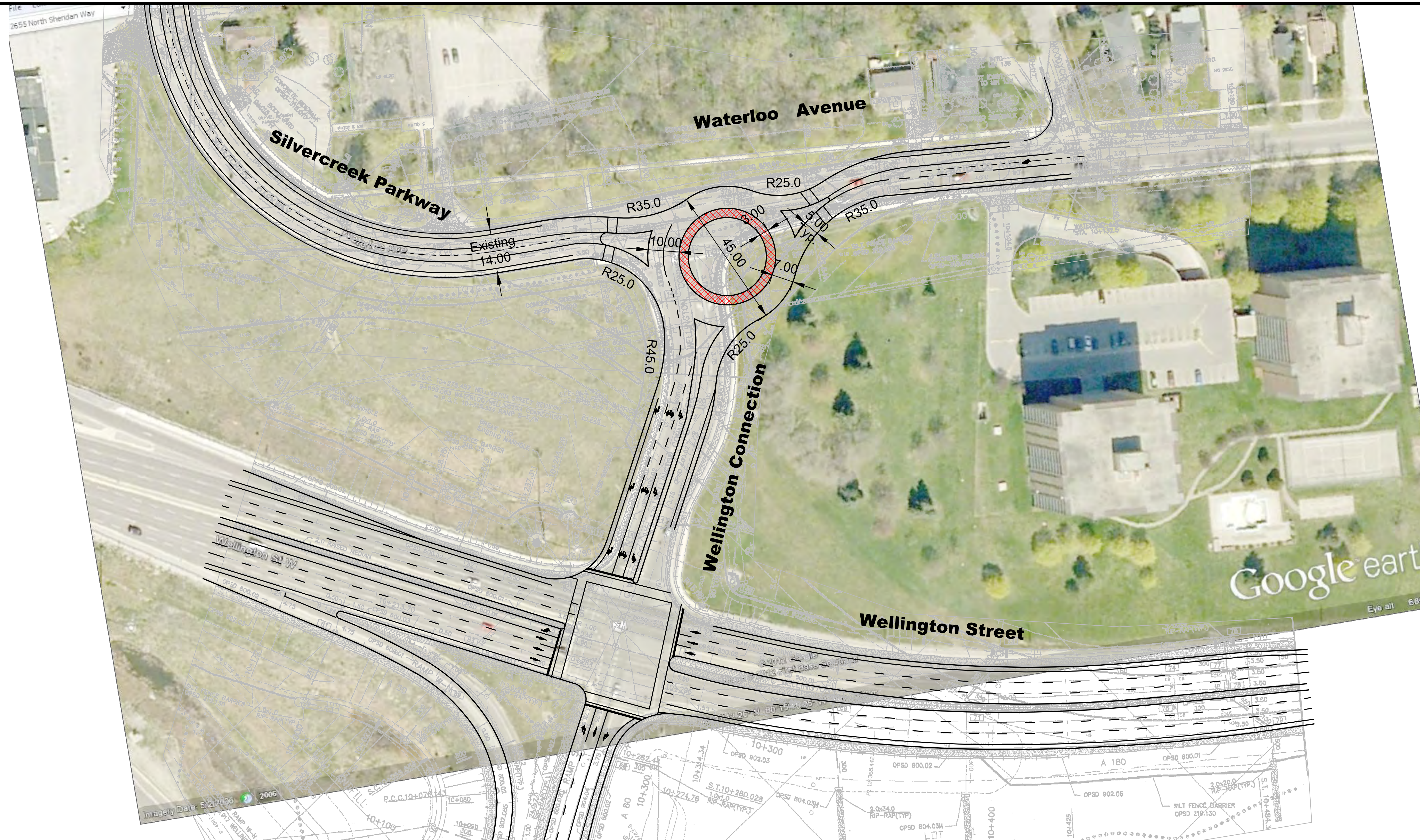
DATE PLOTTED: April 18, 2012

BA GROUP

Silvercreek Guelph Developments

7041-01, April 2012

Appendix Figure 2



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DATE PLOTTED: April 18, 2012

BA GROUP Transportation Consultants

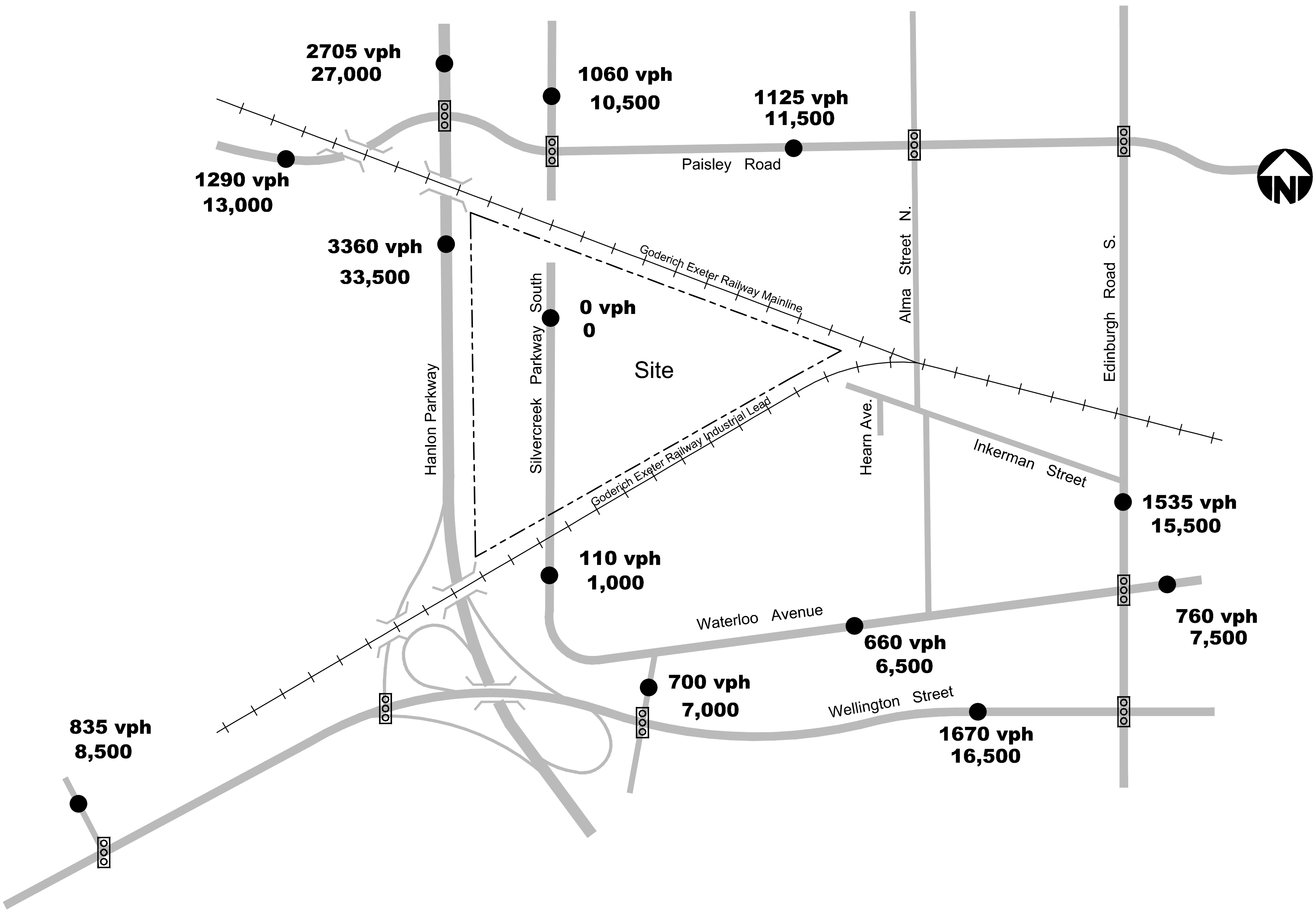
PROJECT:	Lafarge Property
PROJECT NO.	7041-01
DATE:	APRIL 2, 2008
REVISED:	MARCH 26, 2012

Lafarge Property, Guelph

WELLINGTON CONNECTION REALIGNMENT

SCALE 1:1250 0 25 50m

DRAWING No. Appendix Figure 3



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DATE PLOTTED: April 18, 2012

EXISTING TRAFFIC VOLUMES
(Two Way) Afternoon Rush Hour and Daily Volumes

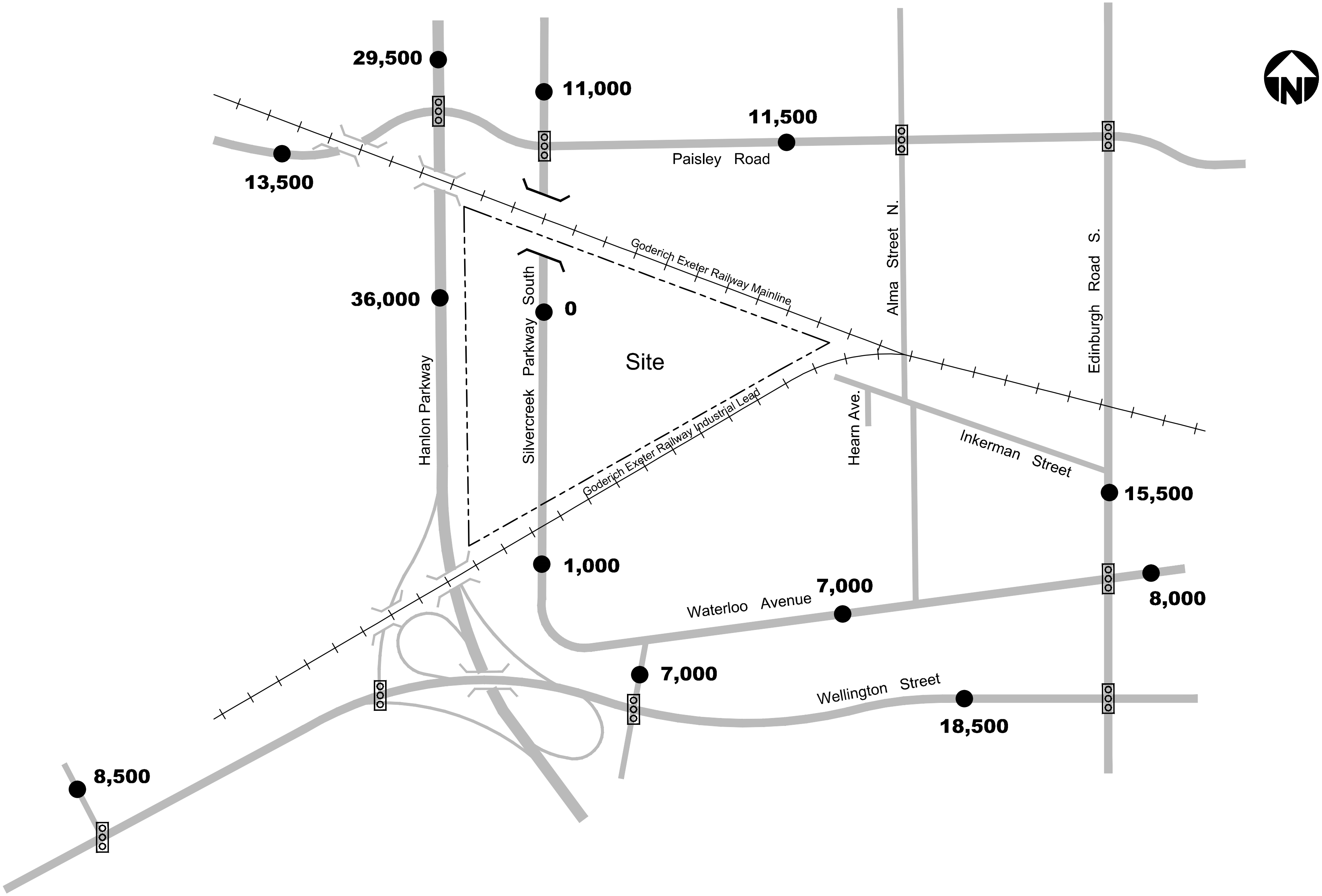
1000 vph Two-way Peak Hour Volumes

10000 Daily Volumes

BA GROUP

Silvercreek Guelph Developments
7041-01, April 2012

Appendix Figure 4



FUTURE BACKGROUND TRAFFIC VOLUMES 5 YEAR GROWTH
(Two Way) Daily Volumes

10000 Daily Volumes

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DATE PLOTTED: April 18, 2012

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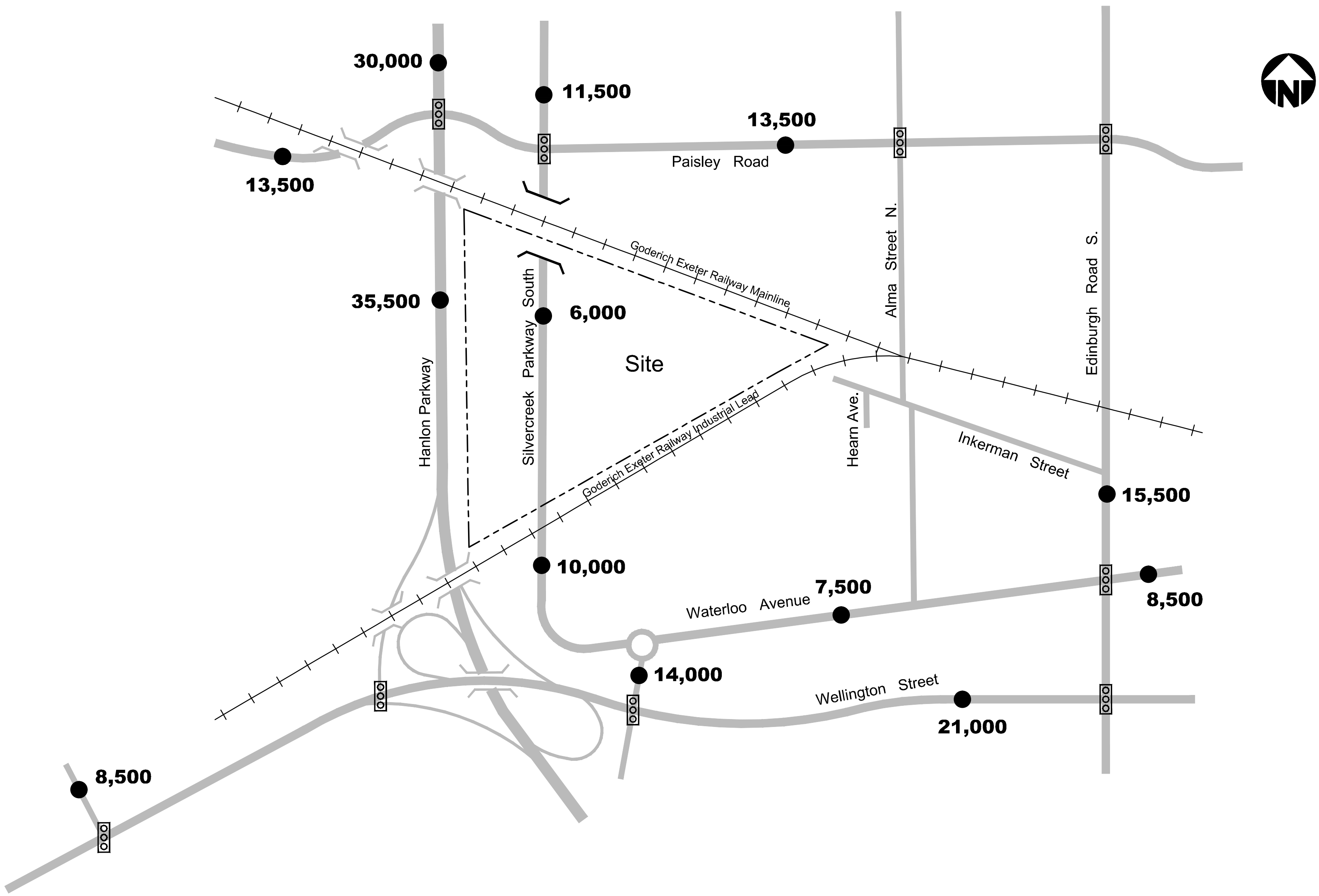


FUTURE TOTAL TRAFFIC VOLUMES
Phases 1 & 2 (Two Way) Daily Volumes

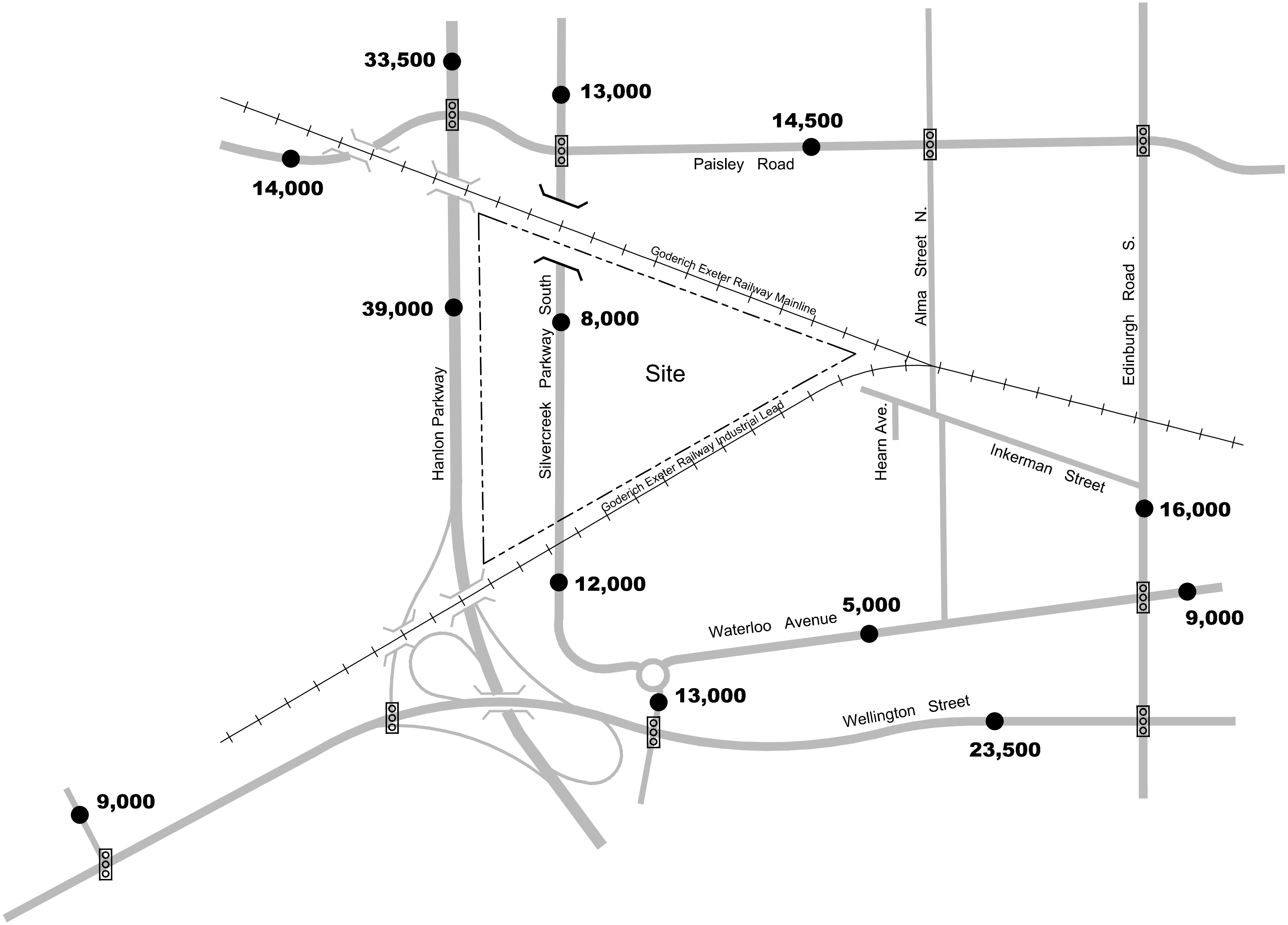
10000 Daily Volumes

BA GROUP

Silvercreek Guelph Developments

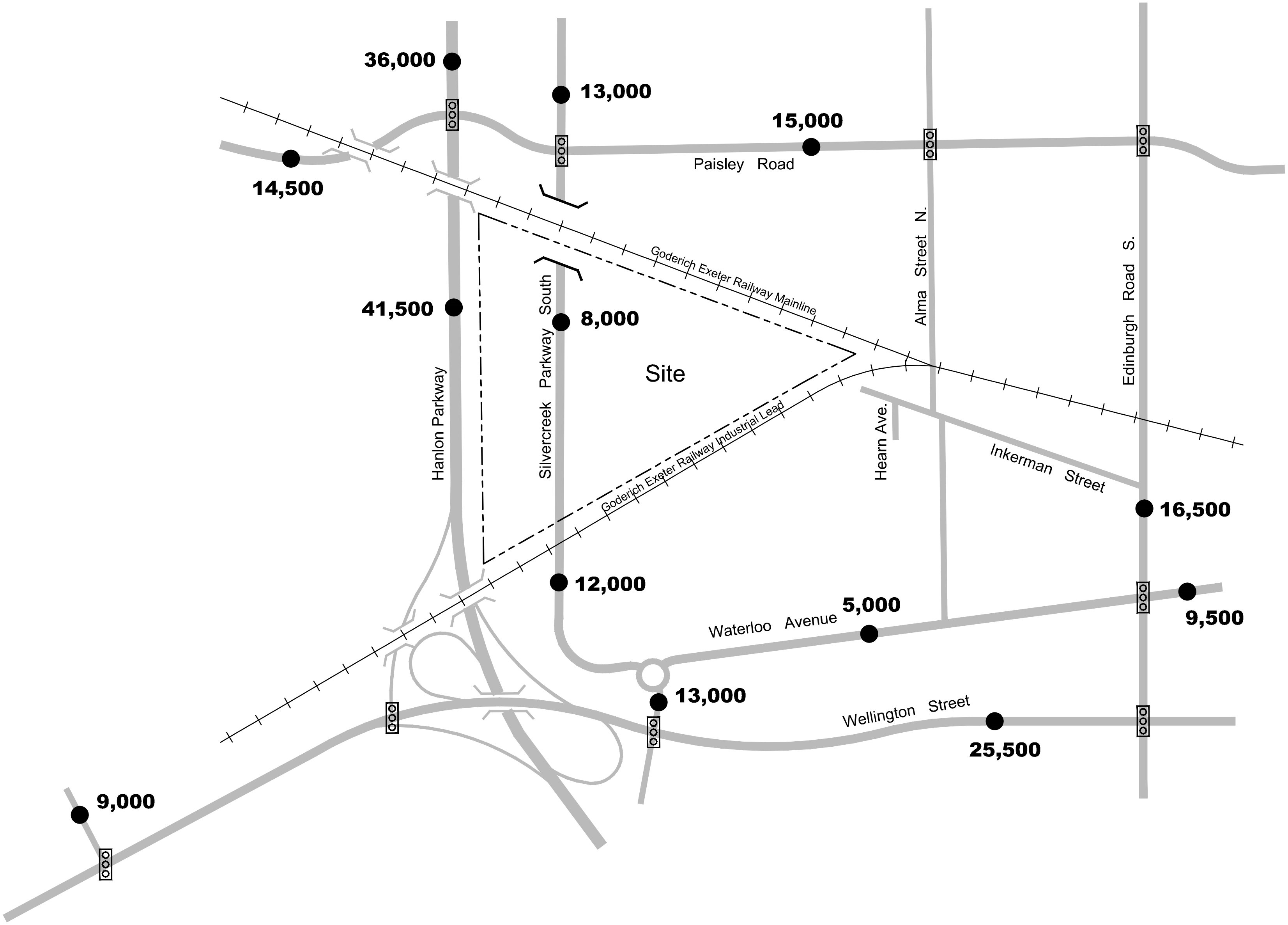
7041-01, April 2012

Appendix Figure 6



FUTURE TRAFFIC VOLUMES
Phase 3 Option 2 (Two Way) Daily Volumes - Opening Day + 5 Years

10000 Daily Volumes



FUTURE TRAFFIC VOLUMES
Phase 3 Option 2 (Two Way) Daily Volumes - Opening Day + 10 Years

10000 Daily Volumes

SILVERCREEK - GUELPH DEVELOPMENT
WEEKDAY PM EXISTING TRAFFIC COMPARISON

HANLON EXPRESSWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	100	90	-10	
	T	310	310	0	
	R	160	165	5	
NB	L	280	215	-65	
	T	1155	895	-260	
	R	260	220	-40	
WB	L	275	185	-90	
	T	360	440	80	
	R	55	35	-20	
SB	L	85	45	-40	
	T	1230	1000	-230	
	R	80	60	-20	
EB	TOTAL	570	565	-5	-0.9%
NB	TOTAL	1695	1330	-365	-27.4%
WB	TOTAL	690	660	-30	-4.5%
SB	TOTAL	1395	1105	-290	-26.2%
GRAND	TOTAL	4350	3660	-690	-18.9%

SILVERCREEK PARKWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	290	265	-25	
	T	365	325	-40	
	R	0	5	5	
NB	L	0	2	2	
	T	0	5	5	
	R	0	0	0	
WB	L	0	1	1	
	T	340	315	-25	
	R	185	175	-10	
SB	L	235	245	10	
	T	0	1	1	
	R	350	340	-10	
EB	TOTAL	655	595	-60	-10.1%
NB	TOTAL	0	7	7	100.0%
WB	TOTAL	525	491	-34	-6.9%
SB	TOTAL	585	586	1	0.2%
GRAND	TOTAL	1765	1679	-86	-5.1%

EDINBURGH RD / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	135	85	-50	
	T	340	270	-70	
	R	80	85	5	
NB	L	110	75	-35	
	T	605	500	-105	
	R	30	35	5	
WB	L	40	40	0	
	T	325	325	0	
	R	55	60	5	
SB	L	85	80	-5	
	T	555	530	-25	
	R	70	70	0	
EB	TOTAL	555	440	-115	-26.1%
NB	TOTAL	745	610	-135	-22.1%
WB	TOTAL	420	425	5	1.2%
SB	TOTAL	710	680	-30	-4.4%
GRAND	TOTAL	2430	2155	-275	-12.8%

EDINBURGH RD / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	55	60	5	
	T	220	155	-65	
	R	35	40	5	
NB	L	45	60	15	
	T	660	710	50	
	R	65	60	-5	
WB	L	105	115	10	
	T	270	235	-35	
	R	60	75	15	
SB	L	40	60	20	
	T	685	685	0	
	R	35	60	25	
EB	TOTAL	310	255	-55	-21.6%
NB	TOTAL	770	830	60	7.2%
WB	TOTAL	435	425	-10	-2.4%
SB	TOTAL	760	805	45	5.6%
GRAND	TOTAL	2275	2315	40	1.7%

EDINBURGH RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	50	35	-15	
	T	545	430	-115	
	R	135	130	-5	
NB	L	135	135	0	
	T	645	765	120	
	R	155	230	75	
WB	L	225	295	70	
	T	740	640	-100	
	R	75	30	-45	
SB	L	50	30	-20	
	T	710	715	5	
	R	65	45	-20	
EB	TOTAL	730	595	-135	-22.7%
NB	TOTAL	935	1130	195	17.3%
WB	TOTAL	1040	965	-75	-7.8%
SB	TOTAL	825	790	-35	-4.4%
GRAND	TOTAL	3530	3480	-50	-1.4%

SILVERCREEK PARKWAY / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	15	10	-5	
	R	35	15	-20	
NB	L	40	25	-15	
	T	0	0	0	
	R	295	260	-35	
WB	L	330	190	-140	
	T	20	10	-10	
	R	0	0	0	
SB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
EB	TOTAL	50	25	-25	-100.0%
NB	TOTAL	335	285	-50	-17.5%
WB	TOTAL	350	200	-150	-75.0%
SB	TOTAL	0	0	0	0.0%
GRAND	TOTAL	735	510	-225	-44.1%

HANLON EXPRESSWAY NB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	125	165	40	
	T	640	585	-55	
	R	0	0	0	
NB	L	275	295	20	
	T	115	85	-30	
	R	75	105	30	
WB	L	0	0	0	
	T	845	760	-85	
	R	95	10	-85	
SB	L	15	5	-10	
	T	0	0	0	
	R	350	200	-150	
EB	TOTAL	765	750	-15	-2.0%
NB	TOTAL	465	485	20	4.1%
WB	TOTAL	940	770	-170	-22.1%
SB	TOTAL	365	205	-160	-78.0%
GRAND	TOTAL	2535	2210	-325	-14.7%

HANLON EXPRESSWAY SB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	865	685	-180	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	1285	965	-320	
	R	0	0	0	
SB	L	115	145	30	
	T	0	0	0	
	R	80	140	60	
EB	TOTAL	865	685	-180	-26.3%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	1285	965	-320	-33.2%
SB	TOTAL	195	285	90	31.6%
GRAND	TOTAL	2345	1935	-410	-21.2%

IMPERIAL RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	105	95	-10	
	T	710	695	-15	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	1055	730	-325	
	R	310	360	50	
SB	L	385	305	-80	
	T	0	0	0	
	R	35	125	90	
EB	TOTAL	815	790	-25	-3.2%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	1365	1090	-275	-25.2%
SB	TOTAL	420	430	10	2.3%
GRAND	TOTAL	2600	2310	-290	-12.6%

	YR 2005	YR 2009	Change	% Change
NETWORK TOTAL	22155	17909	-1901	-10.6%

SILVERCREEK - GUELPH DEVELOPMENT
SATURDAY EXISTING TRAFFIC COMPARISON

HANLON EXPRESSWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	100	125	25	
	T	310	255	-55	
	R	80	70	-10	
NB	L	150	205	55	
	T	925	870	-55	
	R	170	145	-25	
WB	L	195	175	-20	
	T	300	270	-30	
	R	35	30	-5	
SB	L	30	30	0	
	T	970	835	-135	
	R	90	105	15	
EB	TOTAL	490	450	-40	-8.9%
NB	TOTAL	1245	1220	-25	-2.0%
WB	TOTAL	530	475	-55	-11.6%
SB	TOTAL	1090	970	-120	-12.4%
GRAND	TOTAL	3355	3115	-240	-7.7%

SILVERCREEK PARKWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	250	180	-70	
	T	260	235	-25	
	R	0	0	0	
NB	L	0	1	1	
	T	0	1	1	
	R	0	5	5	
WB	L	0	2	2	
	T	285	230	-55	
	R	155	145	-10	
SB	L	250	215	-35	
	T	5	2	-3	
	R	245	230	-15	
EB	TOTAL	510	415	-95	-22.9%
NB	TOTAL	0	7	7	100.0%
WB	TOTAL	440	377	-63	-16.7%
SB	TOTAL	500	447	-53	-11.9%
GRAND	TOTAL	1450	1246	-204	-16.4%

EDINBURGH RD / PAISLEY RD

Direction	Movement	YR 2008	YR 2008	Change	% Change
EB	L	70	70	0	
	T	245	245	0	
	R	85	85	0	
NB	L	60	60	0	
	T	515	515	0	
	R	35	35	0	
WB	L	50	50	0	
	T	200	200	0	
	R	45	45	0	
SB	L	50	50	0	
	T	485	485	0	
	R	70	70	0	
EB	TOTAL	400	400	0	0.0%
NB	TOTAL	610	610	0	0.0%
WB	TOTAL	295	295	0	0.0%
SB	TOTAL	605	605	0	0.0%
GRAND	TOTAL	1910	1910	0	0.0%

EDINBURGH RD / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	35	45	10	
	T	85	85	0	
	R	55	30	-25	
NB	L	20	25	5	
	T	470	470	0	
	R	65	50	-15	
WB	L	75	75	0	
	T	125	75	-50	
	R	25	30	5	
SB	L	30	30	0	
	T	515	510	-5	
	R	20	25	5	
EB	TOTAL	175	160	-15	-9.4%
NB	TOTAL	555	545	-10	-1.8%
WB	TOTAL	225	180	-45	-25.0%
SB	TOTAL	565	565	0	0.0%
GRAND	TOTAL	1520	1450	-70	-4.8%

EDINBURGH RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	35	20	-15	
	T	465	340	-125	
	R	90	75	-15	
NB	L	115	95	-20	
	T	480	530	50	
	R	170	175	5	
WB	L	195	200	5	
	T	425	365	-60	
	R	40	55	15	
SB	L	60	45	-15	
	T	540	585	45	
	R	45	50	5	
EB	TOTAL	590	435	-155	-35.6%
NB	TOTAL	765	800	35	4.4%
WB	TOTAL	660	620	-40	-6.5%
SB	TOTAL	645	680	35	5.1%
GRAND	TOTAL	2660	2535	-125	-4.9%

SILVERCREEK PARKWAY / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	20	10	-10	
	R	15	15	0	
NB	L	30	25	-5	
	T	0	0	0	
	R	155	130	-25	
WB	L	145	145	0	
	T	20	15	-5	
	R	0	0	0	
SB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
EB	TOTAL	35	25	-10	-40.0%
NB	TOTAL	185	155	-30	-19.4%
WB	TOTAL	165	160	-5	-3.1%
SB	TOTAL	0	0	0	0.0%
GRAND	TOTAL	385	340	-45	-13.2%

HANLON EXPRESSWAY NB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	95	95	0	
	T	495	400	-95	
	R	0	0	0	
NB	L	190	225	35	
	T	65	45	-20	
	R	95	65	-30	
WB	L	0	0	0	
	T	560	480	-80	
	R	25	10	-15	
SB	L	0	2	2	
	T	0	0	0	
	R	160	160	0	
EB	TOTAL	590	495	-95	-19.2%
NB	TOTAL	350	335	-15	-4.5%
WB	TOTAL	585	490	-95	-19.4%
SB	TOTAL	160	162	2	1.2%
GRAND	TOTAL	1685	1482	-203	-13.7%

HANLON EXPRESSWAY SB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	480	435	-45	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	625	640	15	
	R	0	0	0	
SB	L	145	100	-45	
	T	0	0	0	
	R	110	80	-30	
EB	TOTAL	480	435	-45	-10.3%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	625	640	15	2.3%
SB	TOTAL	255	180	-75	-41.7%
GRAND	TOTAL	1360	1255	-105	-8.4%

IMPERIAL RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	80	70	-10	
	T	480	355	-125	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	500	420	-80	
	R	235	225	-10	
SB	L	305	285	-20	
	T	0	0	0	
	R	80	80	0	
EB	TOTAL	560	425	-135	-31.8%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	735	645	-90	-14.0%
SB	TOTAL	385	365	-20	-5.5%
GRAND	TOTAL	1680	1435	-245	-17.1%

	YR 2005	YR 2009	Change	% Change
NETWORK TOTAL	15900	13408	-1132	-8.4%

BA Code	Type	City of Toronto Code
	PASSENGER VEHICLES	
1.	CAR	C1
2.	MINI VAN	C1
3.	SUV	C1
4.	VAN	C1
5.	PICKUP	C1
6.	TAXI	C1
	MEDIUM	
7.	CUBE VAN	C2
8.	STEP VAN	C2
9.	SINGLE UNIT	B
10.	SMALL BUS	
11.	WHEEL TRANS BUS	
	HEAVY (More than 2 axels)	
12.	SINGLE UNIT	B
13.	TRACTOR TRAILER	A
14.	ARMOURED TRUCK	
15.	REFUSE TRUCK	G
16.	TRANSIT BUS	
17.	LARGE SCHOOL BUS	
18.	HIGHWAY COACH	

NEW VEHICLE CLASSIFICATIONS

APPENDIX B
Existing Traffic Counts
& Signal Timing Plans

CITY OF Guelph
Making a Difference

January 12, 2009

John E. Barrington
BA Consulting Group
45 St. Clair Avenue West, Suite 300
Toronto, Ontario M4V 1K9

RE: Traffic Signal Timing Request

John, we do not have signal timing information for the following intersections:

- Hanlon Expressway at Paisley Road
- Hanlon Expressway at Wellington Ramp Terminals

The traffic signals on Hanlon Expressway are under the jurisdiction of the Ministry of Transportation of Ontario (MTO).

Here is the traffic signal information for the intersections of:

- Paisley Road at Silvercreek Parkway
- Waterloo Avenue at Edinburgh Road North
- Wellington Street West at Imperial Road
- Wellington Street West at Edinburgh Road

Paisley Road at Silvercreek Parkway

Paisley Road is the main street and is east-west in orientation. There are pedestrian push buttons and vehicle detectors on Silvercreek Parkway to cross Paisley Road. There is a vehicle detector in the eastbound left turn lane and when the detector is occupied, an eastbound flashing advanced green will be displayed. The intersection operates semi-actuated. Unused time from the eastbound flashing advanced green and Silvercreek Parkway phase is displayed as Paisley Road green & walk. The intersection operates in coordination between 07:00-18:00 daily.
The intersection operates in coordination between 07:00 – 18:00 daily.

Movement	07:00-18:00 Daily	18:00-07:00 Daily
EB Flashing Advanced Green (by actuation)	8 seconds	Omit
EB Solid Advanced Green	3	-
EB/WB Green & Walk (Paisley Rd)	15	14seconds

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59 Carden St
Guelph, ON
Canada
N1H 3A1

T 519-822-1260
TTY 519-826-9771

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EB/WB Green & Flashing Don't Walk	14	14
Amber	4	4
All Red	2	2
NB/SB Minimum Green (Silvercreek Parkway) (by actuation)	7	7
NB/SB Maximum Green (by actuation)	23	20
NB/SB Vehicle extension/passage time	3	3
NB/SB Green & Walk	12	9
NB/SB Green & Flashing Don't Walk	11	11
Amber	4	4
All Red	2	2
Cycle Length	75	Free

Edinburgh Road at Waterloo Avenue

Edinburgh Road is the main street and is north-south in orientation. There are pedestrian push buttons and vehicle detectors on Waterloo Avenue to cross Edinburgh Road. The intersection operates semi-actuated. Unused time from the Waterloo Avenue phase is displayed as Edinburgh Road green & walk. The intersection operates in coordination between 07:00-21:00 daily.

Movement	07:00-21:00 Daily	21:00-07:00 Daily
NB/SB Green & Walk (Edinburgh)	37 seconds	16 seconds
NB/SB Green & Flash Don't Walk	14	14
Amber	4	4
All Red	2	2
EB/WB Minimum Green (Waterloo) (by actuation)	7	7
EB/WB Maximum Green (by actuation)	27	18
EB/WB Vehicle extension/passage time	3	3
EB/WB Green & Walk (by actuation)	7	7
EB/WB Green & Flashing Don't Walk	11	11
Amber	4	4
All Red	2	2
Cycle Length	90	Free

Wellington Street West at Imperial Road

Wellington Street is the main street and is east-west in orientation. There are pedestrian push buttons and vehicle detectors on Imperial Road to cross Wellington Street. The intersection operates semi-actuated. Unused time from the Imperial Road phase is displayed as Wellington Street green & walk. The intersection operates in coordination between 07:00-18:00 daily.

Movement	07:00-18:00 Daily	18:00-07:00 Daily
EB/WB Green & Walk (Wellington)	22 seconds	17 seconds
EB/WB Green & Flash Don't Walk	13	13
Amber	4	4
All Red	2	2
SB Minimum Green (Imperial) (by actuation)	7	7
SB Maximum Green (by actuation)	23	18
SB Vehicle extension/passage time	5	3
SB Green & Walk (by actuation)	7	7
SB Green & Flashing Don't Walk	11	11
Amber	4	4
All Red	2	2
Cycle Length	70	Free

Wellington Street West at Edinburgh Road

Edinburgh Road is the main street and is north-south in orientation. There are pedestrian push buttons and stop bar vehicle detectors in all lanes on all approaches. In addition, there are set-back vehicle detectors in all left-turn lanes to detect the third (3^{rd}) vehicle in the queue. The intersection operates in coordination between 07:00 – 21:00 daily. When operating in coordination and the set-back detectors are occupied, the corresponding left arrow will be displayed. Should arrows not be displayed, the unused time is allocated to the corresponding through green & walk time. The pedestrian walk/flashing don't walk phases are displayed every cycle when operating in coordination.

Movement	07:00-21:00 Daily	21:00-07:00 Daily
NB/SB Left Green Arrow (by actuation)	7 seconds	Omit
NB/SB Left Amber Arrow	3	Omit
NB/SB Minimum Green	31	(by actuation) 10 seconds
NB/SB Maximum Green	31	(by actuation) 33
NB/SB Vehicle extension/passage time	-	3
NB/SB Green & Walk	21	(by actuation) 23seconds
NB/SB Green & Flash Don't Walk	10	10
Amber	4	4
All Red	2	2
EB/WB Left Green Arrow (by actuation)	EB 6, WB 10	Omit
EB/WB Left Amber Arrow	3	Omit
EB/WB Minimum Green	24	10 (by actuation)
EB/WB Maximum Green	24	25 (by actuation)
EB/WB Vehicle extension/passage time	-	3
EB/WB Green & Walk (by actuation)	14	15
EB/WB Green & Flashing Don't Walk	10	10
Amber	4	4

All Red	2	2
Cycle Length	90	Free

Regards,

Tony Dam
Traffic Signal Technologist II

Traffic Signals
Operations Department
Location: 45 Municipal Street, Guelph ON

T 519-837-5628 x 2039
F 519-837-5635
E tony.dam@guelph.ca

CITY OF Guelph
Making a Difference

December 16, 2008

Marie Wong
Data Collection Analyst
BA Consulting Group
45 St. Clair Avenue West, Suite 300
Toronto, Ontario M4V 1K9

Marie Wong

RE: City of Guelph - Traffic Signal Timing Request

The following is the traffic signal information for the intersections of:

- Edinburgh Road North at Paisley Road/Paisley Street
- Paisley Road at Alma Street North

Edinburgh Road North at Paisley Road/Paisley Street

Edinburgh Road North is the main street and is north-south in orientation. There are no pedestrian push buttons at this intersection. There is a set-back vehicle detector in the southbound left turn lane to detect the third (3rd) vehicle in the queue. When the southbound detector is occupied, the southbound left arrow will be displayed. Should the arrow not be displayed, the unused time is allocated to the Edinburgh Road through green & walk time.

The intersection operates in coordination between 07:00 – 21:00 daily.

Movement	07:00-21:00 Daily	21:00-07:00 Daily
SB Left Green Arrow (by actuation)	6 seconds	Omit
SB Left Amber Arrow	3	-
NB/SB Green & Walk (Edinburgh Rd)	14	12 seconds
NB/SB Green & Flashing Don't Walk	15	15
Amber	4	4
All Red	2	2
EB/WB Green & Walk (Paisley)	9	9
EB/WB Green & Flashing Don't Walk	16	16
Amber	4	4
All Red	2	2
Cycle Length	75	Free

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59 Carden St
Guelph, ON
Canada
N1H 3A1

T 519-822-1260
TTY 519-826-9771

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Location: Hwy 6(Hanlon) @ Paisley Rd.

Area/District: SWR

Timing Based On T.M. Dated: 2008

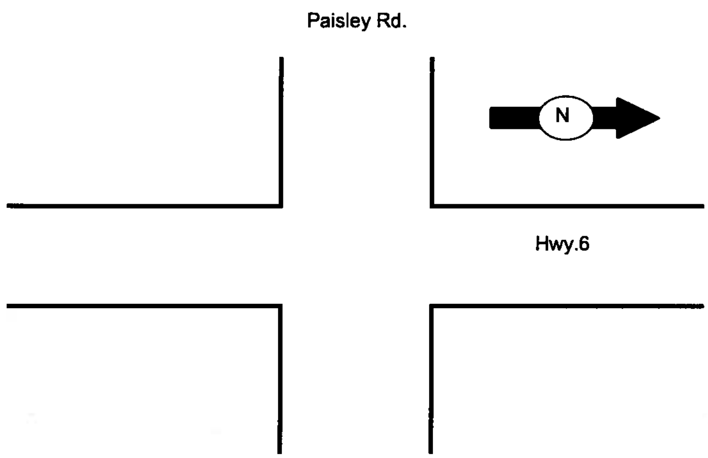
Traffic Signal # 115

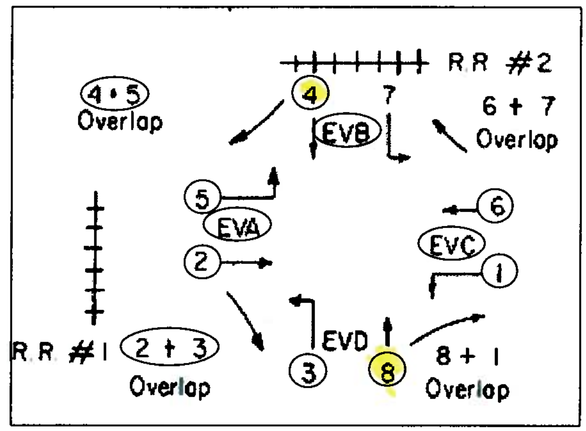
Timing Developed By: WX

Approved By:

Installed By:

Installation Date:





Circle Movements and Operations

Notes: Increased max interval time to 110s,
by increasing F2, F4, F6, F8 time.
Interconnect With Willow & Speedvale.

Dial Out Telephone

	Number	D
0	# OF DIGITS	
1	1st DIGIT	
2	2nd DIGIT	
3	3rd DIGIT	
4	4th DIGIT	
5	5th DIGIT	
6	6th DIGIT	
7	7th DIGIT	
8	8th DIGIT	
9	9th DIGIT	
A	10th DIGIT	
B	11th DIGIT	
C		
D		
E		
F		

< C + 0 + C = 5 >

Redial Time = 10

(C\5 + C + 0)

Default is Report All Alarms (no flags set)

Disable Alarm Reporting

Column F

		1	2	3	4	5	6	7	8
0	OMIT ALARMS					X			

< C + 0 + C = 5 >

1 = STOP TIME
2 = FLASH SENSE
3 = KEYBOARD ENTRY
4 = MANUAL PLAN SELECT
5 = ENABLE POLICE CNTRL (Not Used)
6 = EXTERNAL ALARM (Door Alarm)
7 = DETECTOR FAILURE

COMMUNICATIONS ADDRESSING

COMM ADDRESS
(C/0 + 0 + 0) = 1

ZONE ADDRESS
(C/0 + 0 + 1) = 1

AREA NUMBER
(C/0 + 0 + 2) = 1

AREA ADDRESS
(C/0 + 0 + 3) = 115

NOTE: If Local Controller is part of an Interconnect Ensure Phone Number Is Removed

Observe Redial Timer

(E/2 + D + 6)

Actuated

		1	2	3	4	5	6	7	8
		PHASE							
0	WALK	-	44	-	20	-	44	-	20
1	DON'T WALK	-	6	-	8	-	6	-	8
2	MIN INTIAL	6	50	5	10	6	50		10
3	TYPE 3 LIMIT	-		-	-	-	-	-	-
4	ADD PER VEH	-		-	-	-	-	-	-
5	VEH EXT	3.0		2.0	3.0	3.0			3.0
6	MAX GAP	3.0		2.0	3.0	3.0			3.0
7	MIN GAP	3.0		2.0	3.0	3.0			3.0
8	MAX LIMIT	15		15	30	15			30
9	MAXIMUM 2	-	-	-	-	-	-	-	-
A	ADV /DLY WALK	-	-	-	-	-	-	-	-
B	SEQUENCE TO	-	-	2	-	-	-	-	-
C	COND SRV MIN	-	-	-	-	-	-	-	-
D	REDUCE EVERY	-	-	-	-	-	-	-	-
E	YELLOW	3.0	5.5	2.0	4.5	3.0	5.5		4.5
F	RED CLEAR	1.0	1.5		2.5	1.0	1.5		2.5

PHASE BANK # 1 < C + O + F = 1 >

		9	A	B	C	D
0						
1	PHASE 1	-				
2	PHASE 2	-				
3	PHASE 3	-				
4	PHASE 4	-				
5	PHASE 5	-				
6	PHASE 6	-				
7	PHASE 7	-				
8	PHASE 8	-				
		MAX INT	ALT WALK	ALT FLH D/W	ALT INT	ALT EXT

	E
RR1 DLY	
RR1 CLR	
EVA DLY	
EVA CLR	5
EVB DLY	
EVB CLR	5
EVC DLY	
EVC CLR	
EVD DLY	
EVD CLR	5
RR2 DLY	
RR2 CLR	
EV CLR	
EV DLY	
RR CLR	
RR DLY	

ALL RED START
(F/1 + C +O) = 5.0
RED REVERT
(F/1 + O + F) = 5.0

COLUMN F PHASES

		1	2	3	4	5	6	7	8
0	PERMIT	X	X	X	X	X	X		X
1	RED LOCK								
2	YELLOW LOCK								
3	VEH MIN CALL								
4	PED RECALL		X				X		
5	PEDESTRIANS			View		Only			
6	YIELD AT FL D/W		X				X		
7	RED REST								
8	DOUBLE ENTRY		X		X		X		X
9	VEH MAX CALL								
A	SOFT RECALL								
B	MAXIMUN 2								
C	COND SERVICE								
D	MAN CONT CALL								
E	YELLOW START		X				X		
F	FIRST PHASES			X					X

< C + O + F = 1 >

COMM ADDRESS
(C/ O + O + O) = 1 FM-9
ZONE ADDRESS
(C/ O + O + 1) = 1 - Always
AREA NUMBER
(C/ O + 0 + 2) = 1 - Region/Agcy #
AREA ADDRESS
(C/ O + O + 3) = 115 - Assigned by System Admin

PREEMPT MINIMUMS

		A	B	C
		RR1-2 SPEV1	SP EV2	EMER VEH
A	WLK (DFLT)			
B	D'T WALK			8
C	INITAL			5

< C + O + F = 1 >

Issued Date: Apr-08

Installed Date:

ONTARIO 233 PROGRAM

Hwy 6 (Hanlon) at Paisley

Column E Phases / Bits

		1	2	3	4	5	6	7	8
0	EXCLUSIVE								
1	RR1 CLEAR								
2	RR2 CLEAR								
3	RR2 LTD SRV								
4	PROT/PERM			X					
5	FLH TO PREMT								
6	FLASH ENTRY								
7	DISABL MIN YEL			X					
8	DISABL OVP YEL								
9	OVP FLH YEL								
A	EM VEH A		X			X			
B	EM VEH B				X				X
C	EM VEH C								
D	EM VEH D				X				X
E	EXTRA 1	X		X					
F	IC SELECT		X						

Column F Phases / Bits

		1	2	3	4	5	6	7	8
0									
1	EXT PERMIT 1								
2	EXT PERMIT 2								
3	EXCLU PED								
4									
5	PED 2P OUT		X						
6	PED 6P OUT						X		
7	PED 4P OUT				X				
8	PED 8P OUT				X				
9	FLH YELLOW								
A									
B									
C									
D									
E	RESTRICTED								
F	EXTRA 2								

< C + O + E = 125 >

Column F

		1	2	3	4	5	6	7	8
0	ADV GRN FLH								
1	PHASE FLASH								
2	FLASH WALK								
3	GUAR PASS								
4	SIMUL GAP								
5	SEQ TIMING								
6	ADV WALK								
7	DELAY WALK								
8	EXT RECALL								
9									
A	MAX EXTEN								
B	INH PED RSRV								
C	SEMI ACTUATD								
D									
E	STRT VEH CALL	X		X		X			
F	STRT PED CALL		X		X		X		X

SPECIALS < C + O + F = 2 >

Dial-out Telephone

	Number	D
0	NO. OF DIGITS	
1	1st DIGIT	
2	2nd DIGIT	
3	3rd DIGIT	
4	4th DIGIT	
5	5th DIGIT	
6	6th DIGIT	
7	7th DIGIT	
8	8th DIGIT	
9	9th DIGIT	
A	10th DIGIT	
B	11th DIGIT	
C		
D		
E		
F		

< C + O + C =5 >

REDIAL TIME - 10
(C/5 + C + 0)

DEFAULT IS : REPORT ALL ALARMS (NO FLAGS SET)

DISABLE ALARM REPORTING

Column F

		1	2	3	4	5	6	7	8
0	OMIT ALARMS					X			

< C + O + C = 5 >

1 = STOP TIME
2 = FLASH SENCE
3 = KEYBOARD ENTRY
4 = MANUAL PLAN
5= ENABLE POLICE CONTROL
6 = EXTERNAL ALARM
7 = DETECTOR FAILURE

FLASH TO PREEMPT

1 = EVA 5 = RR1
2 = EVB 6 = RR2
3 = EVC 7 = SE1
4 = EVD 8 = SE2

EXTRA 1

1 = TBC TYPE 1
2 = NEMA EXT. COORD.
3 = DAYLIGHT SAVINGS
4 =
5 = EXPANDED STATUS REPORTING
6 = INTERNATIONAL PED
7 = CLEAR OUTPUTS DURING FLASH
8 = SPLIT RING

EXTRA 2

1 = AWR ON DURING PHASE INITAL
2 = LMU INSTALLED

IC SELECT

2 = 2 WAY MODEM
3 = 7 WIRE SLAVE
4 = FLASH / FREE
5 = SIMPLES MASTER
7 = 7 WIRE MASTER
8 = OFFSET INTURP

PRETIMED ONTARIO 233 PROGRAM

PHASE

	1	2	3	4	5	6	7	8
WALK	-	44	-	20	-	44	-	20
DON'T WALK	-	6	-	8	-	6	-	8
MIN INTIAL	6	50	5	10	6	50		10
TYPE 3 LIMIT	-	-	-	-	-	-	-	-
ADD PER VEH	-	-	-	-	-	-	-	-
VEH EXT	3.0		2.0	3.0	3.0			3.0
MAX GAP	3.0		2.0	3.0	3.0			3.0
MIN GAP	3.0		2.0	3.0	3.0			3.0
MAX LIMIT	15		12	30	15			30
MAXIMUM 2	-	-	-				-	
ADV / DLY WALK	-	-	-	-	-	-	-	-
SEQUENCE TO	-	-	2	-	-	-	-	-
COND SRV MIN	-	-	-	-	-	-	-	-
REDUCE EVERY	-	-	-	-	-	-	-	-
YELLOW	3.0	5.5	2.0	4.5	3.0	5.5		4.5
RED CLEAR	1.0	1.5		2.5	1.0	1.5		2.5

PHASE BANK # < C + O + F = 1 >

Column F

PHASES

		1	2	3	4	5	6	7	8
0	PERMIT	X	X	X	X	X	X		X
1	RED LOCK								
2	YELLOW LOCK								
3	VEH MIN CALL								
4	PED RECALL		X				X		
5	PEDESTRIANS								
6	REST IN WALK		X				X		
7	RED REST								
8	DOUBLE ENTRY		X		X		X		X
9	VEH MAX CALL	X		X	X	X			X
A	SOFT RECALL								
B	MAXIMUM 2								
C	CORD SERVICE								
D	MAN CONT CALL								
E	YELLOW START		X				X		
F	FIRST PHASES			X					X

< C + O + F = 1 >

T.O.D. FUNCTIONS

	TIME HH MM	FUN	DAY OF WEEK S 1	M 2	T 3	W 4	T 5	F 6	S 7	Column 4 PHASES / BITS 1	2	3	4	5	6	7	8
0																	
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
A																	
B																	
C																	
D																	
E																	
F																	

< C + O + 7 = 1 > < C+ O + E = 27 >

Note: Pretimed faze Max Recalls will be restricted by each Control Plan FORCE-OFF

T.O.D. FUNCTIONS

0 = PERMIT PHASES
1 = RED LOCK
2 = YELLOW LOCK
3 = VEH MIN RECALL
4 = PED RECALL
5 -
6 - REST IN WALK
7 = RED REST
8 = DOUBLE ENTRY
9 = VEH MAX RECALL

A = VEH SOFT RECALL
B = MAXIMUM 2
C = CONDITIONAL SERVICE
D = LAG PHASES
E = BIT 1 - LOCAL OVERIDE
BIT 4 - DISABLE DET OFF MONITOR
BIT 7 - DET COUNT MONITOR
BIT 8 - REAL TIME SPLIT MONITOR
F = OUTPUT BITS 1 THRU 4

LOCATION: Hwy 6 (Hanlon) at Paisley

BI Tran Systems, Inc.
510 Bercut Dr., Sacramento, Calif. 95814
916/441-0260
Traffic Signal Program 233 Ontario
Timing Sheet #2
Revised (02/95)

Issued Date: April 2008

Installed Date:

STANDAR D 332 CABINET LOCATION	column	1	3	Column 0		Column 1								Column 2								Column 3							
			carry		C1	ATTRIBUTES								PHASE(S)								ASSIGNMENTS							
		delay	over		pin #	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
I-2 U	0			0	39																								
J-2 U	1			1	40																								
I-6 U	2	5		2	41				X	X		X					X					X	X	X					X
J-6 U	3	10		3	42				X	X		X									X	X	X	X					X
1-2 L	4			4	43																								
J-2 L	5			5	44																								
1-6 L	6	5		6	45				X	X		X					X					X	X	X					X
J-6 L	7	5		7	46				X	X		X									X	X	X	X					X
I-4	8			8	47																								
J-4	9			9	48																								
I-8	A			A	49																								
J-8	B			B	50																								
J-1	C	5		C	55				X	X		X						X				X	X	X					X
I-1	D	5		D	56				X	X		X		X								X	X	X					X
J-5	E			E	57																								
I-5	F	5		F	58				X	X		X				X						X	X	X					X
	< C + O + D = 0 >			DETECTOR ASSIGNMENTS < C + O + E = 126>																									

STANDAR D 332 CABINET LOCATION	column	2	4	Column 4		Column 5								Column 6								Column 7							
			carry		C1	ATTRIBUTES								PHASE(S)								ASSIGNMENTS							
		delay	over		pin #	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
J-9 U	0			0	59																								
I-9 U	1			1	60																								
I-9 L	2			2	61																								
J-9 L	3			3	62																								
I-3 U	4			4	63																								
J-3 U	5			5	64																								
I-7 U	6			6	65				X	X		X					X					X	X	X					X
J-7 U	7			7	66																								
I-12 U	8			8	67																								
I-13 U	9			9	68																								
I-12 L	A			A	69		X										X					X	X	X					X
I-13 L	B			B	70		X										X					X	X	X					X
I-3 L	C			C	76																								
J-3 L	D			D	77																								
I-7 L	E			E																									
J-7 L	F			F																									
	< C + O + D = 0 >			DETECTOR ASSIGNMENTS < C + O + E = 126 >																									

DETECTOR ASSIGNMENT SHEET
ONTARIO 233 PROGRAM

LOCATION:
Hwy 6
at Paisley

Issued Date: April 2008

Installed Date:

DETECTOR ATTRIBUTES

1 = FULL TIME DELAY
2 = PEDESTRIAN CALL
3 =
4 = COUNT
5 = EXTENSION
6 = TYPE 3
7 = CALLING
8 = ALTERNATE

DETECTOR ASSIGNMENTS

1 = DET. SET # 1
2 = DET. SET # 2
3 = DET. SET # 3
4 =
5 =
6 = MIN RECALL ON FAILURE
7 = MAX RECALL ON FAILURE
8 - REPORT ON FAILURE

DETECTOR MONITOR

MAX OFF: D/0+0+1=120
MAX ON: D/0+0+2=60

ADVANCE WARNING BEACONS

SIGN #1 SIGN #2
PHASE NUMBER
(F/1+C+F)= (F/1+D+F)=
TIME BEFORE YELLOW
(F/1+C+E)= (F/1+D+E)=
OUTPUT PIN NUMBER
(E/127+E+8)= (E/127+E+9)=

New Input

Input File Slot No. →	1	2	3	4	5	6	7	8	9	10	1	12	13	14
"I" FILE	1 Ext, Cnt, Call <C1-56>	2 Ext, Cnt <C1-39>	2 Ext, Cnt, Call <C1-63>	2 Type 3, Call <C1-47>	3 Ext, Cnt, Call <C1-58>	4 Ext, Cnt, Call <C1-41>	4 Ext, Cnt, Call <C1-65>	4 Type 3, Call <C1-49>	1 Ext, Cnt, Call <C1-60>	NOT WIRED	Not Assigned <C1-80>	2 Ped Call <C1-67>	6 Ped Call <C1-68>	Flash Sense <C1-81>
		2 Ext, Cnt <C1-43>	2 Ext, Cnt, Call <C1-76>			4 Ext, Cnt, Call <C1-45>	4 Cnt <C1-78>		3 Ext, Cnt, Call <C1-62>		Not Assigned <C1-53>	4 Ped Call, <C1-69>	8 Ped Call <C1-70>	Stop Time <C1-82>
"J" FILE	5 Ext, Cnt, Call <C1-55>	6 Ext, Cnt <C1-40>	6 Ext, Cnt, Call <C1-64>	6 Type 3, Call <C1-48>	7 Ext, Cnt, Call <C1-57>	8 Ext, Cnt, Call <C1-42>	8 Ext, Cnt, Call <C1-66>	8 Type 3, Call <C1-50>	5 Ext, Cnt, Call <C1-59>	NOT WIRED	Not Assigned <C1-54>	EV A Preempt <C1-71>	EV B Preempt <C1-72>	Railroad 1 <C1-51>
		6 Ext, Cnt <C1-44>	6 Ext, Cnt, Call <C1-77>			8 Ext, Cnt, Call <C1-46>	8 Ext, Cnt, Call <C1-79>		7 Ext, Cnt, Call <C1-61>		Not Assigned <C1-75>	EV C Ped Call <C1-73>	EV D Preempt <C1-74>	Railroad 2 <C1-52>

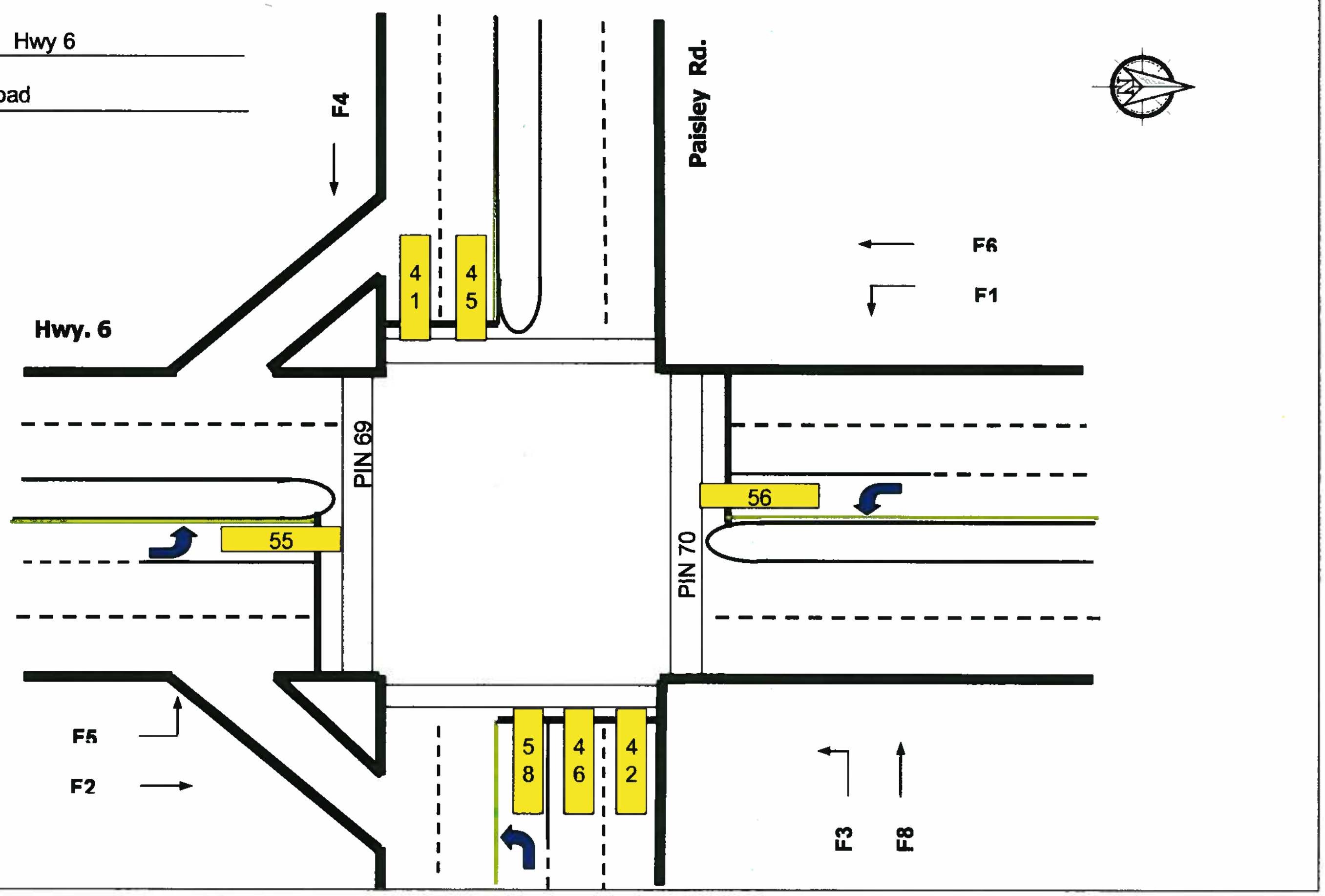
DETECTOR TYPES

Ext = Extension Detector
Detector is only active during the Phase's GREEN Intervals (Ie, will NOT *Call* the Phase)
Cnt = Count Detector
Used in computing "Added Initial"
Call = Calling Detector
Detector is only active during the Phase's NON-GREEN Intervals (Ie, will NOT *Extend* the Phase)
Type 3 = Type 3 Disconnect
Will allow a Calling Detector to Extend its Phase until the Call first drops or the "Type 3 Limit" is reached

BI Tran Systems, Inc.
510 Bercut Dr., Sacramento, Calif. 95814
916/441-0260
Traffic Signal Program 233
Initialized Detector Assignments
(Revised 8/92) 332 Cabinet

Intersection Of: Hwy 6

At: Paisley Road



PROVINCE OF ONTARIO

233 TRAFFIC SIGNAL TIMING SHEET

LOCATION:
Hwy. 6 @ Wellington Rd. West Ramp Term.

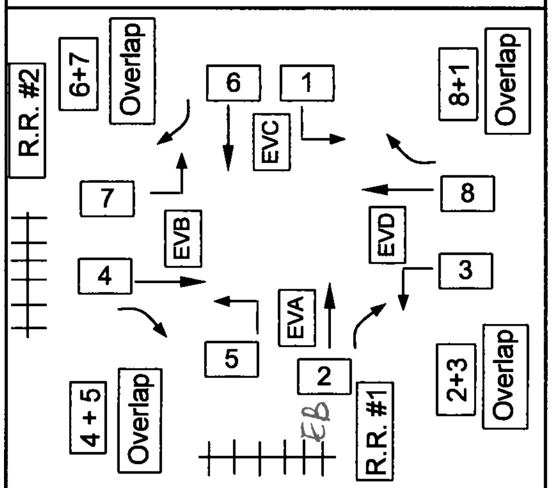
TIMING BASED ON TM DATED :

TIMING PLAN DATE:
June, 2002

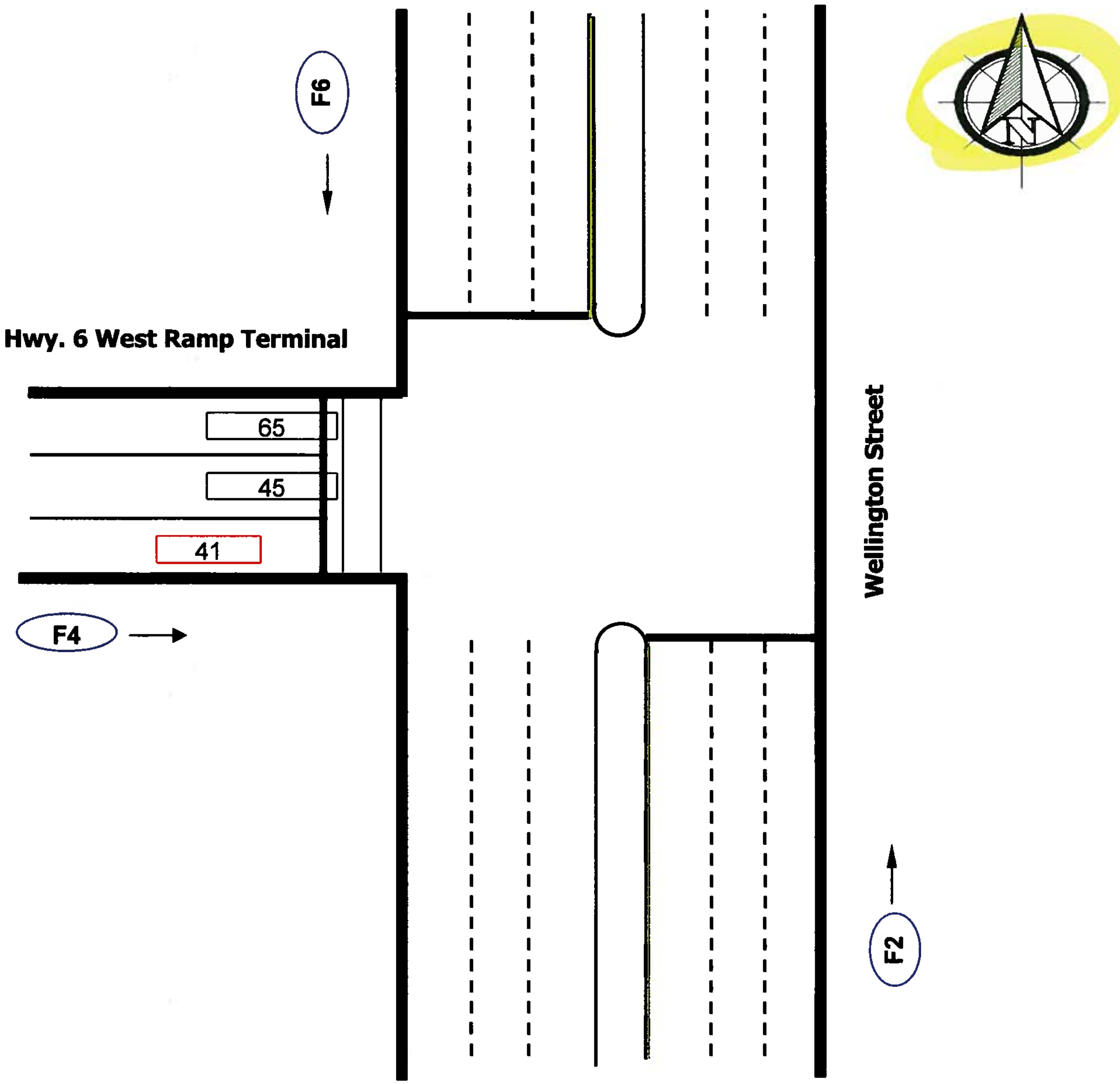
TIMING INSTALLATION DATE :

TIMING INSTALLED BY :

COMMENTS :



Hwy. 6 (Hanlon) @ Wellington Rd. West Ramp Terminal



EB WB

Actuated

		PHASE							
		1	2	3	4	5	6	7	8
0	WALK		20		-		20		
1	DON'T WALK		10		-		10		
2	MIN INTIAL		30		10		30		
3	TYPE 3 LIMIT		-		-		-		
4	ADD PER VEH		-		-		-		
5	VEH EXT		1.0		3.0		1.0		
6	MAX GAP		1.0		3.0		1.0		
7	MIN GAP		1.0		3.0		1.0		
8	MAX LIMIT		-		30		-		
9	MAXIMUM 2		50		-		50		
A	ADV /DLY WALK		-		-		-		
B	SEQUENCE TO		-		-		-		
C	COND SRV MIN		-		-		-		
D	REDUCE EVERY		-		-		-		
E	YELLOW		4.0		4.0		4.0		
F	RED CLEAR		2.0		2.0		2.0		

PHASE BANK # 1 < C + O + F = 1 >

		9	A	B	C	D
0						
1	PHASE 1	-				
2	PHASE 2	-				
3	PHASE 3	-				
4	PHASE 4	-				
5	PHASE 5	-				
6	PHASE 6	-				
7	PHASE 7	-				
8	PHASE 8	-				
		MAX INT	ALT WALK	ALT FLH D/W	ALT INT	ALT EXT

	E
RR1 DLY	
RR1 CLR	
EVA DLY	
EVA CLR	5
EVB DLY	
EVB CLR	
EVC DLY	
EVC CLR	
EVD DLY	
EVD CLR	
RR2 DLY	
RR2 CLR	
EV CLR	
EV DLY	
RR CLR	
RR DLY	

ALL RED START
(F/1 + C +O) = 5.0
RED REVERT
(F/1 + O + F) = 5.0

		COLUMN F PHASES							
		1	2	3	4	5	6	7	8
0	PERMIT		X		X		X		
1	RED LOCK								
2	YELLOW LOCK								
3	VEH MIN CALL								
4	PED RECALL		X				X		
5	PEDESTRIANS			View		Only			
6	YIELD AT FL D/W		X				X		
7	RED REST								
8	DOUBLE ENTRY		X				X		
9	VEH MAX CALL								
A	SOFT RECALL								
B	MAXIMUN 2								
C	COND SERVICE								
D	MAN CONT CALL								
E	YELLOW START		X				X		
F	FIRST PHASES				X				

< C + O + F = 1 >

COMM ADDRESS
(C/ O + O + O) = 1
ZONE ADDRESS
(C/ O + O + 1) = 1 - Always
AREA NUMBER
(C/ O + 0 + 2) = 1 - Region/Agcy #
AREA ADDRESS
(C/ O + O + 3) = 108 - Assigned by System Admin

PREEMPT MINIMUMS		A RR1-2 SPEV1	B SP EV2	C EMER VEH
A	WLK (DFLT)			
B	D`T WALK			9
C	INITAL			5

< C + O + F = 1 >

Issued Date: June, 2002

Installed Date:

ONTARIO 233 PROGRAM

Hwy 6 at Wellington Rd West Ramp Terminal

		Column E Phases / Bits							
		1	2	3	4	5	6	7	8
0	EXCLUSIVE								
1	RR1 CLEAR								
2	RR2 CLEAR								
3	RR2 LTD SRV								
4	PROT/PERM								
5	FLH TO PREMT								
6	FLASH ENTRY								
7	DISABL MIN YEL								
8	DISABL OVP YEL								
9	OVP FLH YEL								
A	EM VEH A		X				X		
B	EM VEH B								
C	EM VEH C								
D	EM VEH D								
E	EXTRA 1	X		X		X			
F	IC SELECT		X						

		Column F Phases / Bits							
		1	2	3	4	5	6	7	8
0									
1	EXT PERMIT 1								
2	EXT PERMIT 2								
3	EXCLU PED								
4									
5	PED 2P OUT								
6	PED 6P OUT		X				X		
7	PED 4P OUT								
8	PED 8P OUT								
9	FLH YELLOW								
A									
B									
C									
D									
E	RESTRICTED								
F	EXTRA 2								

< C + O + E = 125 >

		Column F							
		1	2	3	4	5	6	7	8
0	ADV GRN FLH								
1	PHASE FLASH								
2	FLASH WALK								
3	GUAR PASS								
4	SIMUL GAP								
5	SEQ TIMING								
6	ADV WALK								
7	DELAY WALK								
8	EXT RECALL								
9									
A	MAX EXTEN								
B	INH PED RSRV								
C	SEMI ACTUATD								
D									
E	STRT VEH CALL		X		X		X		
F	STRT PED CALL						X		

SPECIALS < C + O + F = 2 >

Dial-out Telephone Number		D
0	NO. OF DIGITS	11
1	1st DIGIT	1
2	2nd DIGIT	9
3	3rd DIGIT	0
4	4th DIGIT	5
5	5th DIGIT	7
6	6th DIGIT	0
7	7th DIGIT	4
8	8th DIGIT	3
9	9th DIGIT	0
A	10th DIGIT	0
B	11th DIGIT	6
C		
D		
E		
F		

< C + O + C =5 >

REDIAL TIME - 10
(C/5 + C + 0)

DEFAULT IS : REPORT ALL ALARMS (NO FLAGS SET)

DISABLE ALARM REPORTING

		Column F							
		1	2	3	4	5	6	7	8
0	OMIT ALARMS					X			

< C + O + C = 5 >

1 = STOP TIME
2 = FLASH SENCE
3 = KEYBOARD ENTRY
4 = MANUAL PLAN
5= ENABLE POLICE CONTROL
6 = EXTERNAL ALARM
7 = DETECTOR FAILURE

FLASH TO PREEMPT

1 = EVA 5 = RR1
2 = EVB 6 = RR2
3 = EVC 7 = SE1
4 = EVD 8 = SE2

EXTRA 1

1 = TBC TYPE 1
2 = NEMA EXT. COORD.
3 = DAYLIGHT SAVINGS
4 =
5 = EXPANDED STATUS REPORTING
6 = INTERNATIONAL PED
7 = CLEAR OUTPUTS DURING FLASH
8 = SPLIT RING

EXTRA 2

1 = AWR ON DURING PHASE INITAL
2 = LMU INSTALLED

IC SELECT

2 = 2 WAY MODEM
3 = 7 WIRE SLAVE
4 = FLASH / FREE
5 = SIMPLES MASTER
7 = 7 WIRE MASTER
8 = OFFSET INTURP

PRETIMED ONTARIO 233 PROGRAM

PHASE

	1	2	3	4	5	6	7	8
WALK		20		-		20		
DON'T WALK		10		-		10		
MIN INTIAL		30		10		30		
TYPE 3 LIMIT		-		-		-		
ADD PER VEH		-		-		-		
VEH EXT		-		3.0		-		
MAX GAP		-		3.0		-		
MIN GAP		-		3.0		-		
MAX LIMIT		-		20		-		
MAXIMUM 2		50		-		50		
ADV / DLY WALK		-		-		-		
SEQUENCE TO		-		-		-		
COND SRV MIN		-		-		-		
REDUCE EVERY		-		-		-		
YELLOW		4.0		4.0		4.0		
RED CLEAR		2.0		2.0		2.0		

PHASE BANK # < C + O + F = 1 >

Column F

PHASES

		1	2	3	4	5	6	7	8
0	PERMIT		X		X		X		
1	RED LOCK								
2	YELLOW LOCK								
3	VEH MIN CALL								
4	PED RECALL		X						
5	PEDESTRIANS								
6	REST IN WALK		X						
7	RED REST								
8	DOUBLE ENTRY		X				X		
9	VEH MAX CALL				X				
A	SOFT RECALL								
B	MAXIMUM 2		X				X		
C	CORD SERVICE								
D	MAN CONT CALL								
E	YELLOW START		X				X		
F	FIRST PHASES				X				

< C + O + F = 1 >

T.O.D. FUNCTIONS

	TIME		DAY OF WEEK							Column 4 PHASES / BITS							
			S	M	T	W	T	F	S								
	HH MM	FUN	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
0	07:00	B		X	X	X	X	X	X		X				X		
1	21:00	B		X	X	X	X	X	X								
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
A																	
B																	
C																	
D																	
E																	
F																	

< C + O + 7 = 1 > < C+ O + E = 27 >

T.O.D. FUNCTIONS

0 = PERMIT PHASES
1 = RED LOCK
2 = YELLOW LOCK
3 = VEH MIN RECALL
4 = PED RECALL
5 -
6 - REST IN WALK
7 = RED REST
8 = DOUBLE ENTRY
9 = VEH MAX RECALL

A = VEH SOFT RECALL
B = MAXIMUM 2
C = CONDITIONAL SERVICE
D = LAG PHASES
E = BIT 1 - LOCAL OVERIDE
BIT 4 - DISABLE DET OFF MONITOR
BIT 7 - DET COUNT MONITOR
BIT 8 - REAL TIME SPLIT MONITOR
F = OUTPUT BITS 1 THRU 4

LOCATION: <u>Hwy 6 @ Wellington Rd West Ramp Terminal</u>

BI Tran Systems, Inc.
510 Bercut Dr., Sacramento, Calif. 95814
916/441-0260
Traffic Signal Program 233 Ontario
Timing Sheet #2
Revised (02/95)

Issued Date: June 2002

Installed Date:

STANDAR D 332 CABINET LOCATION	column	1	3	Column 0		Column 1								Column 2								Column 3							
			carry	C1		ATTRIBUTES								PHASE(S)								ASSIGNMENTS							
		delay	over		pin #	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
I-2 U	0			0	39																								
J-2 U	1			1	40																								
I-6 U	2	10		2	41				X	X		X					X					X	X	X					X
J-6 U	3			3	42																								
1-2 L	4			4	43																								
J-2 L	5			5	44																								
1-6 L	6	5		6	45				X	X		X					X					X	X	X					X
J-6 L	7			7	46																								
I-4	8			8	47																								
J-4	9			9	48																								
I-8	A			A	49																								
J-8	B			B	50																								
J-1	C			C	55																								
I-1	D			D	56																								
J-5	E			E	57																								
I-5	F			F	58																								
	< C + O + D = 0 >			DETECTOR ASSIGNMENTS < C + O + E = 126>																									

STANDAR D 332 CABINET LOCATION	column	2	4	Column 4		Column 5								Column 6								Column 7							
			carry	C1		ATTRIBUTES								PHASE(S)								ASSIGNMENTS							
		delay	over		pin #	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
J-9 U	0			0	59																								
I-9 U	1			1	60																								
I-9 L	2			2	61																								
J-9 L	3			3	62																								
I-3 U	4			4	63																								
J-3 U	5			5	64																								
I-7 U	6			6	65				X	X		X					X					X	X	X					X
J-7 U	7			7	66																								
I-12 U	8			8	67																								
I-13 U	9			9	68																								
I-12 L	A			A	69																								
I-13 L	B			B	70																								
I-3 L	C			C	76																								
J-3 L	D			D	77																								
I-7 L	E			E																									
J-7 L	F			F																									
	< C + O + D = 0 >			DETECTOR ASSIGNMENTS < C + O + E = 126 >																									

DETECTOR ASSIGNMENT SHEET
ONTARIO 233 PROGRAM

LOCATION:
Hwy 6 at Wellington Rd
West Ramp Terminal

Issued Date: June 2002
Installed Date:

DETECTOR ATTRIBUTES
1 = FULL TIME DELAY
2 = PEDESTRIAN CALL
3 =
4 = COUNT
5 = EXTENSION
6 = TYPE 3
7 = CALLING
8 = ALTERNATE

DETECTOR ASSIGNMENTS
1 = DET. SET # 1
2 = DET. SET # 2
3 = DET. SET # 3
4 =
5 =
6 = MIN RECALL ON FAILURE
7 = MAX RECALL ON FAILURE
8 - REPORT ON FAILURE

DETECTOR MONITOR
MAX OFF: D/0+0+1=120
MAX ON: D/0+0+2=60

ADVANCE WARNING BEACONS

	SIGN #1	SIGN #2
PHASE NUMBER	(F/1+C+F)=	(F/1+D+F)=
TIME BEFORE YELLOW	(F/1+C+E)=	(F/1+D+E)=
OUTPUT PIN NUMBER	(E/127+E+8)=	(E/127+E+9)=

Input File Slot No. →	1	2	3	4	5	6	7	8	9	10	11	12	13	14
"I" FILE	**1** Ext, Cnt, Call <C1-56>	**2** Ext, Cnt, Call <C1-39>	**2** Ext, Cnt, Call <C1-63>	**2** Type 3, Call <C1-47>	**3** Ext, Cnt, Call <C1-58>	**4** Ext, Cnt, Call <C1-41>	**4** Ext, Cnt, Call <C1-65>	**4** Type 3, Call <C1-49>	**1** Ext, Cnt, Call <C1-60>	NOT WIRED	Not Assigned <C1-80>	**2** Ped Call <C1-67>	**6** Ped Call <C1-68>	Flash Sense <C1-81>
		2 Ext, Cnt, Call <C1-43>	**2** Ext, Cnt, Call <C1-76>			**4** Ext, Cnt, Call <C1-45>	**4** Ext, Cnt, Call <C1-78>		**3** Ext, Cnt, Call <C1-62>		Not Assigned <C1-53>	**4** Ped Call <C1-69>	**8** Ped Call <C1-70>	Stop Time <C1-82>
"J" FILE	**5** Ext, Cnt, Call <C1-55>	**6** Ext, Cnt, Call <C1-40>	**6** Ext, Cnt, Call <C1-64>	**6** Type 3, Call <C1-48>	**7** Ext, Cnt, Call <C1-57>	**8** Ext, Cnt, Call <C1-42>	**8** Ext, Cnt, Call <C1-66>	**8** Type 3, Call <C1-50>	**5** Ext, Cnt, Call <C1-59>	NOT WIRED	Not Assigned <C1-54>	EV **A** Preempt <C1-71>	EV **B** Preempt <C1-72>	Railroad 1 <C1-51>
		6 Ext, Cnt, Call <C1-44>	**6** Ext, Cnt, Call <C1-77>			**8** Ext, Cnt, Call <C1-46>	**8** Ext, Cnt, Call <C1-79>		**7** Ext, Cnt, Call <C1-61>		Not Assigned <C1-75>	EV **C** Ped Call <C1-73>	EV **D** Preempt <C1-74>	Railroad 2 <C1-52>

DETECTOR TYPES

Ext = Extension Detector
Detector is only active during the Phase's GREEN Intervals (ie, will NOT *Call* the Phase)

Cnt = Count Detector
Used in computing "Added Initial"

Call = Calling Detector
Detector is only active during the Phase's NON-GREEN Intervals (ie, will NOT *Extend* the Phase)

Type 3 = Type 3 Disconnect
Will allow a Calling Detector to Extend its Phase until the Call first drops or the "Type 3 Limit" is reached

BI Tran Systems, Inc.
510 Bercut Dr., Sacramento, Calif. 95814
916/441-0260
Traffic Signal Program 233
Initialized Detector Assignments
(Revised 8/92) 332 Cabinet

Controller Intervals

0 = Walk	8 = Red Rest
1 = FDW	9 = Preemption
2 = Min. Green	A = Stop Time
3 =	B = Red Revert
4= Var. Initial	C = Yellow-Gap Termination
5 = Extension	D = Yellow-Max. Termination
6 =	E = Yellow-Forceoff Termination
7 = Reduce Gap	F = Red Clearance

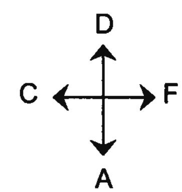
Continuous Memory Error Monitoring

The controller's RAM and EPROM memories are continuously checked for errors. If an erro is found, the intersection will go into FLASH (via Watch Dog Timer), and one of the following will be shown on the controller's display:

bAd A = An error was detected in the CPU's RAM, or a new program has been installed on the memory module. Often caused by a bad controller "gel-cell" battery.

bAd b = An error was detected in the memory module's RAM. Often caused by a bad "lithium" battery on the memory module.

Display Movement Codes



A = Advance ROW
D = Decrement ROW
C = COLUMN Back
F = Forward COLUMN

Special Event Schedules

Special Event #1: C + 0 + E = 27
Special Event #2: C + 0 + E = 28

Current Interval = E + 5 + 0
Current Interval Timer = E + 5 + B
Current Interval Clearance Phases = E + 5 + C

Display Locations

	Plan Select	Offset Select
Manual	= C/0 + A + 1	C/0 + B + 1
Master	= C/0 + A + 2	C/0 + B + 2
Current	= C/0 + A + 3	C/0 + B + 3
Next	= C/0 + A + 4	C/0 + B + 4
TOD	= C/0 + A +5	C/0 + B + 5

Master Cycle = C/0 + A + 0
Ring A Cycle = C/0 + B + 0
Ring B Cycle = C/0 + D + 0

MIN Cycle = C/0 + A + E
MAX Cycle = C/0 + B + E

Phase Hold = C/0 + F + D
Phase Next = C/0 + F + E
Force Off = C/0 + F + F (with Ring A Cycle Timer)

Current Calculated Cycle Length = C/0 + B + F
Current Permitted Phases = E/0 + 7 +8

bAd E = An error was detected in the 233 Program EPROM.
bAd F = An error was detected in the Z-RAM (Dallas chip) on the memory module.

412/C Memory Module
<u>Lithium Battery Condition</u>

To check the condition of the 3.6 volt Lithium Battery on the 412/C Memory Module:

If E/112 + 0 + A = 84 - the battery is BAD
If E/112 + 0 + A = 85 - the battery is O.K.

<u>Monitor "Activate" Flags</u>
(Also Requires T.O.D. Function "E" Flag)
Detector Count Recording:
E/2 + 0 + 9 = Not Zero
Real Time Split Monitor:
E/2 + 0 + E = Not Zero

E Page Enable: F/1 + 9 + E = Not Zero

New Input

<u>Time of Day Function (7 Key)</u>
Current T.O.D. "E Function"
Control Bits = C/0 + E + E
Current T.O.D. "F Function"
Output Bits = C/0 + E + F

Logic DELAY Gate
<u>Delay Timer Display</u>
DELAY A Timer = C/0 + 9 +A
DELAY B Timer = C/0 + 9 + B
thru thru
DELAY F Timer = C/0 + 9 + F

<u>Interval Timer Display</u>
Ring A = F/0 + A + Interval Row
Ring B = F/0 + B + (Interval Row From PHASE BANK data)

Current Phase
Bank = F/0 + C + E

Last Power Failure:
(HR-MIN-DOW) = 8 + 4
(DOW-YR-MONTH) = 8 + 5
Last Cabinet Flash
(HR-MIN-DOW) = 8 + 6
(DOW-YR-MONTH) = 8 + 7
Power Fail Counts:
(Long Failures) = F/1 + 0 + C
(Short Failures) = F/1 + 0 + D
Current Time:
(HR-MIN-DOW) = 8 + 0
(DOW-YR-MONTH) = 8 + 1
(MIN-SEC-1/10SEC) = 8 + F

BI Tran Systems, Inc.
510 Bercut Dr., Sacramento, Calif. 95814
916/441-0260
Traffic Signal Program 233
"View" Locations

PROVINCE OF ONTARIO

233 TRAFFIC SIGNAL TIMING SHEET

LOCATION:
Hwy. 6 @ Wellington Rd. East Ramp Term.

TIMING BASED ON TM DATED :

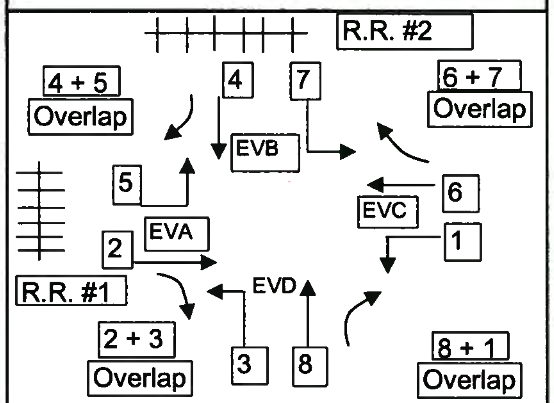
TIMING PLAN DATE:
June, 2002

TIMING INSTALLATION DATE :

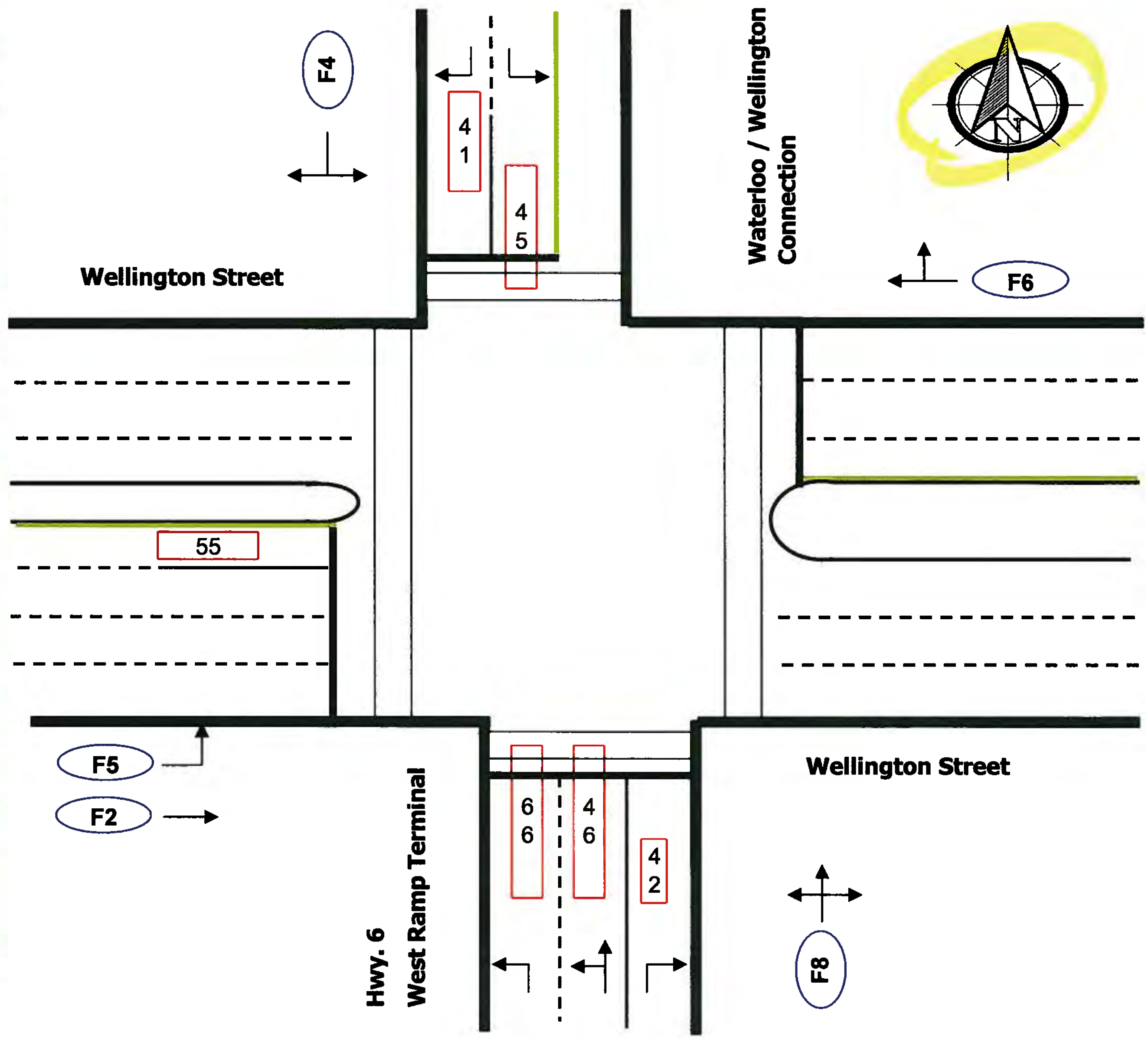
TIMING INSTALLED BY :

COMMENTS :
Check conflict monitor for Diode card

Address info changed



Hwy. 6 (Hanlon) @ Wellington Rd. East Ramp Terminal



Actuated

		PHASE 1	2	3	4	5	6	7	8
0	WALK		20		19	-	20		20
1	DON'T WALK		10		10	-	10		11
2	MIN INTIAL		30		10	5	30		10
3	TYPE 3 LIMIT		-		-	-	-		-
4	ADD PER VEH		-		-	-	-		-
5	VEH EXT		1.0		3.0	2.0	1.0		3.0
6	MAX GAP		1.0		3.0	2.0	1.0		3.0
7	MIN GAP		1.0		3.0	2.0	1.0		3.0
8	MAX LIMIT		-		30	15	-		30
9	MAXIMUM 2		-		-	-	-		-
A	ADV /DLY WALK		-		-	-	-		-
B	SEQUENCE TO		-		-	2	-		-
C	COND SRV MIN		-		-	-	-		-
D	REDUCE EVERY		-		-	-	-		-
E	YELLOW		4.0		4.0	2.0	4.0		4.0
F	RED CLEAR		2.0		2.0	-	2.0		3.0

PHASE BANK # 1 < C + O + F = 1 >

		9	A	B	C	D		E
0							RR1 DLY	
1	PHASE 1	-					RR1 CLR	
2	PHASE 2	-					EVA DLY	
3	PHASE 3	-					EVA CLR	5
4	PHASE 4	-					EVB DLY	
5	PHASE 5	-					EVB CLR	
6	PHASE 6	-					EVC DLY	
7	PHASE 7	-					EVC CLR	
8	PHASE 8	-					EVD DLY	
		MAX INT	ALT WALK	ALT FLH D/W	ALT INT	ALT EXT	EVD CLR	
							RR2 DLY	
							RR2 CLR	
							EV CLR	
							EV DLY	
							RR CLR	
							RR DLY	

ALL RED START
(F/1 + C +O) = 5.0
RED REVERT
(F/1 + O + F) = 5.0

COLUMN F PHASES

		1	2	3	4	5	6	7	8
0	PERMIT		X		X	X	X		X
1	RED LOCK								
2	YELLOW LOCK								
3	VEH MIN CALL								
4	PED RECALL		X				X		
5	PEDESTRIANS			View		Only			
6	YIELD AT FL D/W		X				X		
7	RED REST								
8	DOUBLE ENTRY		X				X		
9	VEH MAX CALL								
A	SOFT RECALL								
B	MAXIMUN 2								
C	COND SERVICE								
D	MAN CONT CALL								
E	YELLOW START		X				X		
F	FIRST PHASES				X				

< C + O + F = 1 >

COMM ADDRESS
(C/ O + O + O) = 1
ZONE ADDRESS
(C/ O + O + 1) = 1 - Always
AREA NUMBER
(C/ O + 0 + 2) = 1 - Region/Agcy #
AREA ADDRESS
(C/ O + O + 3) = 107 - Assigned by System Admin

PREEMPT MINIMUMS

		A	B	C
		RR1-2 SPEV1	SP EV2	EMER VEH
A	WLK (DFLT)			
B	D 'T WALK			9
C	INITAL			5

< C + O + F = 1 >

Issued Date: Jun-02

Installed Date:

ONTARIO 233 PROGRAM

HWY 6 at Wellington Rd East Ramp Terminal

Column E Phases / Bits

		1	2	3	4	5	6	7	8
0	EXCLUSIVE				X				X
1	RR1 CLEAR								
2	RR2 CLEAR								
3	RR2 LTD SRV								
4	PROT/PERM					X			
5	FLH TO PREMT								
6	FLASH ENTRY								
7	DISABL MIN YEL					X			
8	DISABL OVP YEL								
9	OVP FLH YEL								
A	EM VEH A		X				X		
B	EM VEH B								
C	EM VEH C								
D	EM VEH D								
E	EXTRA 1	X		X		X			
F	IC SELECT		X						

Column F Phases / Bits

		1	2	3	4	5	6	7	8
0									
1	EXT PERMIT 1								
2	EXT PERMIT 2								
3	EXCLU PED								
4									
5	PED 2P OUT						X		
6	PED 6P OUT						X		
7	PED 4P OUT				X				
8	PED 8P OUT								X
9	FLH YELLOW								
A									
B									
C									
D									
E	RESTRICTED								
F	EXTRA 2								

< C + O + E = 125 >

Column F

		1	2	3	4	5	6	7	8
0	ADV GRN FLH								
1	PHASE FLASH								
2	FLASH WALK								
3	GUAR PASS								
4	SIMUL GAP								
5	SEQ TIMING								
6	ADV WALK								
7	DELAY WALK								
8	EXT RECALL								
9									
A	MAX EXTEN								
B	INH PED RSRV								
C	SEMI ACTUATD								
D									
E	STRT VEH CALL		X		X	X	X		X
F	STRT PED CALL		X		X		X		X

SPECIALS < C + O + F = 2 >

Dial-out Telephone Number

		D
0	NO. OF DIGITS	11
1	1st DIGIT	1
2	2nd DIGIT	9
3	3rd DIGIT	0
4	4th DIGIT	5
5	5th DIGIT	7
6	6th DIGIT	0
7	7th DIGIT	4
8	8th DIGIT	3
9	9th DIGIT	0
A	10th DIGIT	0
B	11th DIGIT	6
C		
D		
E		
F		

< C + O + C =5 >

REDIAL TIME - 10
(C/5 + C + 0)

DEFAULT IS : REPORT ALL ALARMS (NO FLAGS SET)

DISABLE ALARM REPORTING

	Column F 1	2	3	4	5	6	7	8
0 OMIT ALARMS						X		

< C + O + C = 5 >

1 = STOP TIME
2 = FLASH SENCE
3 = KEYBOARD ENTRY
4 = MANUAL PLAN
5= ENABLE POLICE CONTROL
6 = EXTERNAL ALARM
7 = DETECTOR FAILURE

FLASH TO PREEMPT

1 = EVA 5 = RR1
2 = EVB 6 = RR2
3 = EVC 7 = SE1
4 = EVD 8 = SE2

EXTRA 1

1 = TBC TYPE 1
2 = NEMA EXT. COORD.
3 = DAYLIGHT SAVINGS
4 =
5 = EXPANDED STATUS REPORTING
6 = INTERNATIONAL PED
7 = CLEAR OUTPUTS DURING FLASH
8 = SPLIT RING

EXTRA 2

1 = AWR ON DURING PHASE INITAL
2 = LMU INSTALLED

IC SELECT

2 = 2 WAY MODEM
3 = 7 WIRE SLAVE
4 = FLASH / FREE
5 = SIMPLES MASTER
7 = 7 WIRE MASTER
8 = OFFSET INTURP

PRETIMED ONTARIO 233 PROGRAM

PHASE

	1	2	3	4	5	6	7	8
WALK		20		19	-	20		20
DON'T WALK		10		10	-	10		11
MIN INTIAL		30		10	5	30		10
TYPE 3 LIMIT		-		-	-	-		-
ADD PER VEH		-		-	-	-		-
VEH EXT		-		3.0	2.0	-		3.0
MAX GAP		-		3.0	2.0	-		3.0
MIN GAP		-		3.0	2.0	-		3.0
MAX LIMIT		-		20	10	-		20
MAXIMUM 2		-		-	-	-		-
ADV / DLY WALK		-		-	-	-		-
SEQUENCE TO		-		-	2.0	-		-
COND SRV MIN		-		-	-	-		-
REDUCE EVERY		-		-	-	-		-
YELLOW		4.0		4.0	2.0	4.0		4.0
RED CLEAR		2.0		2.0	-	2.0		3.0

PHASE BANK # < C + O + F = 1 >

Column F

PHASES

		1	2	3	4	5	6	7	8
0	PERMIT		X		X	X	X		X
1	RED LOCK								
2	YELLOW LOCK								
3	VEH MIN CALL								
4	PED RECALL		X				X		
5	PEDESTRIANS								
6	REST IN WALK		X				X		
7	RED REST								
8	DOUBLE ENTRY		X				X		
9	VEH MAX CALL				X	X			X
A	SOFT RECALL								
B	MAXIMUM 2								
C	CORD SERVICE								
D	MAN CONT CALL								
E	YELLOW START		X				X		
F	FIRST PHASES				X				

< C + O + F = 1 >

T.O.D. FUNCTIONS

	TIME HH MM	FUN	DAY OF WEEK S 1	M 2	T 3	W 4	T 5	F 6	S 7	Column 4 PHASES / BITS 1	2	3	4	5	6	7	8
0																	
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
A																	
B																	
C																	
D																	
E																	
F																	

< C + O + 7 = 1 > < C+ O + E = 27 >

T.O.D. FUNCTIONS

0 = PERMIT PHASES
1 = RED LOCK
2 = YELLOW LOCK
3 = VEH MIN RECALL
4 = PED RECALL
5 -
6 - REST IN WALK
7 = RED REST
8 = DOUBLE ENTRY
9 = VEH MAX RECALL

A = VEH SOFT RECALL
B = MAXIMUM 2
C = CONDITIONAL SERVICE
D = LAG PHASES
E = BIT 1 - LOCAL OVERIDE
BIT 4 - DISABLE DET OFF MONITOR
BIT 7 - DET COUNT MONITOR
BIT 8 - REAL TIME SPLIT MONITOR
F = OUTPUT BITS 1 THRU 4

LOCATION: <u>**Hwy 6 @ Wellington Rd East Ramp Terminal**</u>

BI Tran Systems, Inc.
510 Bercut Dr., Sacremento, Calif. 95814
916/441-0260
Traffic Signal Program 233 *Ontario*
Timing Sheet #2
Revised (02/95)

Issued Date: June 2002

Installed Date:

STANDARD D 332 CABINET LOCATION	column	1 delay	3 carry over
I-2 U	0		
J-2 U	1		
I-6 U	2	10	
J-6 U	3	10	
1-2 L	4		
J-2 L	5		
1-6 L	6	5	
J-6 L	7	5	
I-4	8		
J-4	9		
I-8	A		
J-8	B		
J-1	C		
I-1	D		
J-5	E		
I-5	F		
	< C + O + D = 0 >		

Column 0	C1 pin #	Column 1 ATTRIBUTES 1	2	3	4	5	6	7	8	Column 2 PHASE(S) 1	2	3	4	5	6	7	8	Column 3 ASSIGNMENTS 1	2	3	4	5	6	7	8
0	39																								
1	40																								
2	41				X	X		X					X					X	X	X					X
3	42				X	X		X									X	X	X	X					X
4	43																								
5	44																								
6	45				X	X		X					X					X	X	X					X
7	46				X	X		X									X	X	X	X					X
8	47																								
9	48																								
A	49																								
B	50																								
C	55				X	X		X						X				X	X	X					X
D	56																								
E	57																								
F	58																								

DETECTOR ASSIGNMENTS < C + O + E = 126>

STANDARD D 332 CABINET LOCATION	column	2 delay	4 carry over
J-9 U	0		
I-9 U	1		
I-9 L	2		
J-9 L	3		
I-3 U	4		
J-3 U	5		
I-7 U	6		
J-7 U	7		
I-12 U	8		
I-13 U	9		
I-12 L	A		
I-13 L	B		
I-3 L	C		
J-3 L	D		
I-7 L	E		
J-7 L	F		
	< C + O + D = 0 >		

Column 4	C1 pin #	Column 5 ATTRIBUTES 1	2	3	4	5	6	7	8	Column 6 PHASE(S) 1	2	3	4	5	6	7	8	Column 7 ASSIGNMENTS 1	2	3	4	5	6	7	8
0	59																								
1	60																								
2	61																								
3	62																								
4	63																								
5	64																								
6	65																								
7	66				X	X		X									X	X	X	X					X
8	67		X												X			X	X	X					X
9	68		X												X			X	X	X					X
A	69		X										X					X	X	X					X
B	70		X														X	X	X	X					X
C	76																								
D	77																								
E																									
F																									

DETECTOR ASSIGNMENTS < C + O + E = 126 >

DETECTOR ASSIGNMENT SHEET
ONTARIO 233 PROGRAM

LOCATION:
Hwy 6 at Wellington Rd
East Ramp Terminal
Issued Date: June 2002
Installed Date:

DETECTOR ATTRIBUTES
1 = FULL TIME DELAY
2 = PEDESTRIAN CALL
3 =
4 = COUNT
5 = EXTENSION
6 = TYPE 3
7 = CALLING
8 = ALTERNATE

DETECTOR ASSIGNMENTS
1 = DET. SET # 1
2 = DET. SET # 2
3 = DET. SET # 3
4 =
5 =
6 = MIN RECALL ON FAILURE
7 = MAX RECALL ON FAILURE
8 - REPORT ON FAILURE

DETECTOR MONITOR
MAX OFF: D/0+0+1=120
MAX ON: D/0+0+2=60

ADVANCE WARNING BEACONS
SIGN #1 SIGN #2
PHASE NUMBER
(F/1+C+F)= (F/1+D+F)=
TIME BEFORE YELLOW
(F/1+C+E)= (F/1+D+E)=
OUTPUT PIN NUMBER
(E/127+E+8)= (E/127+E+9)=

Input File Slot No. →	1	2	3	4	5	6	7	8	9	10	11	12	13	14
"I" FILE	1 Ext, Cnt, Call <C1-56>	2 Ext, Cnt, Call <C1-39>	2 Ext, Cnt, Call <C1-63>	2 Type 3, Call <C1-47>	3 Ext, Cnt, Call <C1-58>	4 Ext, Cnt, Call <C1-41>	4 Ext, Cnt, Call <C1-65>	4 Type 3, Call <C1-49>	1 Ext, Cnt, Call <C1-60>	NOT WIRED	Not Assigned <C1-80>	2 Ped Call <C1-67>	6 Ped Call <C1-68>	Flash Sense <C1-81>
		2 Ext, Cnt, Call <C1-43>	2 Ext, Cnt, Call <C1-76>			4 Ext, Cnt, Call <C1-45>	4 Ext, Cnt, Call <C1-78>		3 Ext, Cnt, Call <C1-62>		Not Assigned <C1-53>	4 Ped Call <C1-69>	8 Ped Call <C1-70>	Stop Time <C1-82>
"J" FILE	5 Ext, Cnt, Call <C1-55>	6 Ext, Cnt, Call <C1-40>	6 Ext, Cnt, Call <C1-64>	6 Type 3, Call <C1-48>	7 Ext, Cnt, Call <C1-57>	8 Ext, Cnt, Call <C1-42>	8 Ext, Cnt, Call <C1-66>	8 Type 3, Call <C1-50>	5 Ext, Cnt, Call <C1-59>	NOT WIRED	Not Assigned <C1-54>	EV A Preempt <C1-71>	EV B Preempt <C1-72>	Railroad 1 <C1-51>
		6 Ext, Cnt, Call <C1-44>	6 Ext, Cnt, Call <C1-77>			8 Ext, Cnt, Call <C1-46>	8 Ext, Cnt, Call <C1-79>		7 Ext, Cnt, Call <C1-61>		Not Assigned <C1-75>	EV C Ped Call <C1-73>	EV D Preempt <C1-74>	Railroad 2 <C1-52>

DETECTOR TYPES

Ext = Extension Detector
Detector is only active during the Phase's GREEN Intervals (ie, will NOT *Call* the Phase)

Cnt = Count Detector
Used in computing "Added Initial"

Call = Calling Detector
Detector is only active during the Phase's NON-GREEN Intervals (ie, will NOT *Extend* the Phase)

Type 3 = Type 3 Disconnect
Will allow a Calling Detector to Extend its Phase until the Call first drops or the "Type 3 Limit" is reached

BI Tran Systems, Inc.
510 Bercut Dr., Sacramento, Calif. 95814
916/441-0260
Traffic Signal Program 233
Initialized Detector Assignments
(Revised 8/92) 332 Cabinet

Controller Intervals

0 = Walk	8 = Red Rest
1 = FDW	9 = Preemption
2 = Min. Green	A = Stop Time
3 =	B = Red Revert
4= Var. Initial	C = Yellow-Gap Termination
5 = Extension	D = Yellow-Max. Termination
6 =	E = Yellow-Forceoff Termination
7 = Reduce Gap	F = Red Clearance

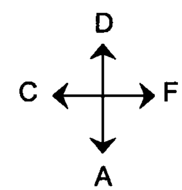
Continuous Memory Error Monitoring

The controller's RAM and EPROM memories are continuously checked for errors. If an erro is found, the intersection will go into FLASH (via Watch Dog Timer), and one of the following will be shown on the controller's display:

bAd A = An error was detected in the CPU's RAM, or a new program has been installed on the memory module. Often caused by a bad controller "gel-cell" battery.

bAd b = An error was detected in the memory module's RAM. Often caused by a bad "lithium" battery on the memory module.

Display Movement Codes



A = Advance ROW
D = Decrement ROW
C = COLUMN Back
F = Forward COLUMN

Special Event Schedules

Special Event #1: C + 0 + E = 27
Special Event #2: C + 0 + E = 28

Current Interval = E + 5 + 0
Current Interval Timer = E + 5 + B
Current Interval Clearance Phases = E + 5 + C

Display Locations

	Plan Select	Offset Select
Manual	= C/0 + A + 1	C/0 + B + 1
Master	= C/0 + A + 2	C/0 + B + 2
Current	= C/0 + A + 3	C/0 + B + 3
Next	= C/0 + A + 4	C/0 + B + 4
TOD	= C/0 + A +5	C/0 + B + 5

Master Cycle = C/0 + A + 0
Ring A Cycle = C/0 + B + 0
Ring B Cycle = C/0 + D + 0

MIN Cycle = C/0 + A + E
MAX Cycle = C/0 + B + E

Phase Hold = C/0 + F + D
Phase Next = C/0 + F + E
Force Off = C/0 + F + F
(with Ring A Cycle Timer)

Current Calculated Cycle Length = C/0 + B + F
Current Permitted Phases = E/0 + 7 +8

bAd E = An error was detected in the 233 Program EPROM.
bAd F = An error was detected in the Z-RAM (Dallas chip) on the memory module.

412/C Memory Module
Lithium Battery Condition

To check the condition of the 3.6 volt Lithium Battery on the 412/C Memory Module:

If E/112 + 0 + A = 84 - the battery is BAD
If E/112 + 0 + A = 85 - the battery is O.K.

Monitor "Activate" Flags
(Also Requires T.O.D. Function "E" Flag)
Detector Count Recording:
E/2 + 0 + 9 = Not Zero
Real Time Split Monitor:
E/2 + 0 + E = Not Zero

E Page Enable: F/1 + 9 + E = Not Zero

New Input

Time of Day Function (7 Key)
Current T.O.D. "E Function"
Control Bits = C/0 + E + E
Current T.O.D. "F Function"
Output Bits = C/0 + E + F

Logic DELAY Gate
Delay Timer Display
DELAY A Timer = C/0 + 9 +A
DELAY B Timer = C/0 + 9 + B
thru thru
DELAY F Timer = C/0 + 9 + F

Interval Timer Display
Ring A = F/0 + A + Interval Row
Ring B = F/0 + B + (Interval Row From PHASE BANK data)

Current Phase
Bank = F/0 + C + E

Last Power Failure:
(HR-MIN-DOW) = 8 + 4
(DOW-YR-MONTH) = 8 + 5
Last Cabinet Flash
(HR-MIN-DOW) = 8 + 6
(DOW-YR-MONTH) = 8 + 7
Power Fail Counts:
(Long Failures) = F/1 + 0 + C
(Short Failures) = F/1 + 0 + D
Current Time:
(HR-MIN-DOW) = 8 + 0
(DOW-YR-MONTH) = 8 + 1
(MIN-SEC-1/10SEC) = 8 + F

BI Tran Systems, Inc.
510 Bercut Dr., Sacramento, Calif. 95814
916/441-0260
Traffic Signal Program 233
"View" Locations

Edinburgh Rd. @ Paisley St.

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:45:00
To: 17:45:00

Municipality: Guelph
Site #: 0000000001
Intersection: Edinburgh Rd. & Paisley St.
TFR File #: 6
Count date: 23-Nov-2004

Weather conditions:
Overcast

Person(s) who counted:
Olga

**** Non-Signalized Intersection ****

Major Road: Edinburgh Rd. runs N/S

North Leg Total: 1511
North Entering: 714
North Peds: 4
Peds Cross: ⋈

Cyclists	0	4	0	4
Trucks	0	7	0	7
Cars	71	545	87	703
Totals	71	556	87	

Cyclists	0
Trucks	6
Cars	791
Totals	797

East Leg Total: 878
East Entering: 422
East Peds: 0
Peds Cross: ⌛

Edinburgh Rd.

Cyclists	Trucks	Cars	Totals
3	6	497	506

Cars	Trucks	Cyclists	Totals
57	0	0	57
315	5	3	323
42	0	0	42
414	5	3	

Paisley St.

N
W E
S

Cyclists	Trucks	Cars	Totals
0	0	133	133
2	4	332	338
0	0	78	78
2	4	543	

Paisley St.

Cars	Trucks	Cyclists	Totals
450	4	2	456

Edinburgh Rd.

Peds Cross: ⌛
West Peds: 0
West Entering: 549
West Leg Total: 1055

Cars	665
Trucks	7
Cyclists	4
Totals	676

Cars	111	601	31	743
Trucks	1	6	0	7
Cyclists	0	0	0	0
Totals	112	607	31	

Peds Cross: ⋈
South Peds: 0
South Entering: 750
South Leg Total: 1426

Comments

TRAFFIC INFORMATION GROUP

e-mail: tig@tigcorporation.com

File Ver: 0

TIG TCS v1.8

NORTH-SOUTH ROAD: *Edinburgh Road N*
EAST-WEST ROAD: *Paisley Street & Paisley Road*
SURVEY DATE: *Saturday December 13, 2008*
MUNICIPALITY: City of Guelph
WEATHER: *Sunny*

TURNING MOVEMENT DIAGRAM

PERIOD	*SATURDAY PEAK HOUR*
TIME	*1315 - 1415*

INTERSECTION TOTALS

Autos	Medium	Heavy	Total Vehicles	Truck & Bus %
1,897	6	8	1,911	0.7%
Peds	**Bicycles**	**U-Turns**	**PHF**	
18	0	0	0.956	

N

Edinburgh Road N (north approach)

Autos	Medium	Heavy	Total
70	0	0	70
483	3	0	486
49	0	0	49

U-Turns	0

Pedestrians	10
Bicyclists	0

Paisley Road

U-Turns	0

Auto	Medium	Heavy	Total
72	0	0	72
241	1	4	246
84	0	0	84

Pedestrians	Bicyclists
0	0

Paisley Street

Auto	Medium	Heavy	Total
43	0	0	43
193	1	4	198
48	0	0	48

U-Turns	0

Pedestrians	Bicyclists
4	0

Pedestrians	4
Bicyclists	0

% MEDIUM & HEAVY VEHICLES			
Direction	Left	Thru	Right
Eastbound	0.0%	2.0%	0.0%
Westbound	0.0%	2.5%	0.0%
Northbound	0.0%	0.2%	0.0%
Southbound	0.0%	0.6%	0.0%

U-Turns	0

Autos	Medium	Heavy	Total
62	0	0	62
516	1	0	517
36	0	0	36

Edinburgh Road N

Comments:

Paisley Rd. @ Silvercreek Pkwy.

Morning Peak Diagram

Specified Period		One Hour Peak	
From:	7:00:00	From:	8:00:00
To:	9:00:00	To:	9:00:00

Municipality: Guelph
Site #: 0000000020
Intersection: Paisley Rd. & Silvercreek Pkwy.
TFR File #: 1
Count date: 7-Apr-2003

Weather conditions:
Overcast

Person(s) who counted:
Tony

**** Signalized Intersection ****

Major Road: Paisley Rd. runs W/E

North Leg Total: 663
North Entering: 333
North Peds: 21
Peds Cross: ⋈

Cyclists	0	0	1	1
Trucks	9	0	10	19
Cars	139	0	174	313
Totals	148	0	185	

Cyclists	1
Trucks	11
Cars	318
Totals	330

East Leg Total: 944
East Entering: 412
East Peds: 11
Peds Cross: ⧗

Silvercreek Pkwy.

Cyclists	Trucks	Cars	Totals
0	16	381	397

Cars	Trucks	Cyclists	Totals
158	4	1	163
242	7	0	249
0	0	0	0
400	11	1	

Paisley Rd.

N
W E
S

Cyclists	Trucks	Cars	Totals
0	7	159	166
0	10	333	343
0	1	0	1
0	18	492	

Paisley Rd.

Cars	Trucks	Cyclists	Totals
511	20	1	532

Silvercreek Pkwy.

Peds Cross: ⧗
West Peds: 19
West Entering: 510
West Leg Total: 907

Cars	0
Trucks	1
Cyclists	0
Totals	1

Cars	0	1	4	5
Trucks	0	0	0	0
Cyclists	0	0	0	0
Totals	0	1	4	

Peds Cross: ⋈
South Peds: 13
South Entering: 5
South Leg Total: 6

Comments

Paisley Rd. @ Silvercreek Pkwy.

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 14:00:00

One Hour Peak
From: 12:15:00
To: 13:15:00

Municipality: Guelph
Site #: 0000000020
Intersection: Paisley Rd. & Silvercreek Pkwy.
TFR File #: 1
Count date: 7-Apr-2003

Weather conditions:
Overcast

Person(s) who counted:
Tony

**** Signalized Intersection ****

Major Road: Paisley Rd. runs W/E

North Leg Total: 589
North Entering: 291
North Peds: 2
Peds Cross: ⋈

Cyclists	0	0	0	0
Trucks	2	0	9	11
Cars	119	0	161	280
Totals	121	0	170	

Cyclists	0
Trucks	7
Cars	291
Totals	298

East Leg Total: 740
East Entering: 349
East Peds: 0
Peds Cross: ⧗

Silvercreek Pkwy.

Cyclists	Trucks	Cars	Totals
0	18	312	330

Paisley Rd.

Cars	Trucks	Cyclists	Totals
135	6	0	141
192	16	0	208
0	0	0	0
327	22	0	

N
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Cyclists	Trucks	Cars	Totals
0	1	155	156
0	7	214	221
0	0	2	2
0	8	371	

Paisley Rd.

Cars	Trucks	Cyclists	Totals
375	16	0	391

Silvercreek Pkwy.

Peds Cross: ⧗
West Peds: 0
West Entering: 379
West Leg Total: 709

Cars	2
Trucks	0
Cyclists	0
Totals	2

Cars	1	1	0	2
Trucks	0	0	0	0
Cyclists	0	0	0	0
Totals	1	1	0	

Peds Cross: ⋈
South Peds: 1
South Entering: 2
South Leg Total: 4

Comments

Paisley Rd. @ Silvercreek Pkwy.

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

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

Municipality: Guelph
Site #: 0000000020
Intersection: Paisley Rd. & Silvercreek Pkwy.
TFR File #: 1
Count date: 7-Apr-2003

Weather conditions:
Overcast
Person(s) who counted:
Tony

**** Signalized Intersection ****

Major Road: Paisley Rd. runs W/E

North Leg Total: 874
North Entering: 511
North Peds: 2
Peds Cross: ⋈

Cyclists	0	0	1	1
Trucks	2	0	4	6
Cars	280	1	223	504
Totals	282	1	228	

Cyclists	0
Trucks	9
Cars	354
Totals	363

East Leg Total: 919
East Entering: 456
East Peds: 2
Peds Cross: ⧗

Silvercreek Pkwy.

Cyclists	Trucks	Cars	Totals
1	8	548	557

Cars	Trucks	Cyclists	Totals
178	2	0	180
268	6	1	275
1	0	0	1
447	8	1	

Paisley Rd.

N
W E
S

Cyclists	Trucks	Cars	Totals
0	7	175	182
0	2	233	235
0	1	1	2
0	10	409	

Paisley Rd.

Cars	Trucks	Cyclists	Totals
456	6	1	463

Silvercreek Pkwy.

Peds Cross: ⧗
West Peds: 0
West Entering: 419
West Leg Total: 976

Cars	3
Trucks	1
Cyclists	0
Totals	4

Cars	0	1	0	1
Trucks	0	0	0	0
Cyclists	0	0	0	0
Totals	0	1	0	

Peds Cross: ⋈
South Peds: 0
South Entering: 1
South Leg Total: 5

Comments

Paisley Rd. @ Silvercreek Pkwy.

Total Count Diagram

Municipality: Guelph
Site #: 0000000020
Intersection: Paisley Rd. & Silvercreek Pkwy.
TFR File #: 1
Count date: 7-Apr-2003

Weather conditions:
Overcast
Person(s) who counted:
Tony

**** Signalized Intersection ****

Major Road: Paisley Rd. runs W/E

North Leg Total: 5161
North Entering: 2833
North Peds: 45
Peds Cross: ⋈

Cyclists	0	0	4	4
Trucks	36	1	64	101
Cars	1297	11	1420	2728
Totals	1333	12	1488	

Cyclists	3
Trucks	60
Cars	2265
Totals	2328

East Leg Total: 6245
East Entering: 2918
East Peds: 24
Peds Cross: ⧗

Silvercreek Pkwy.

Cyclists	Trucks	Cars	Totals
1	106	3028	3135

Cars	Trucks	Cyclists	Totals
1084	25	2	1111
1723	70	1	1794
12	1	0	13
2819	96	3	

Paisley Rd.

N
W E
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Paisley Rd.

Cyclists	Trucks	Cars	Totals
0	35	1171	1206
0	39	1786	1825
0	2	14	16
0	76	2971	

Cars	Trucks	Cyclists	Totals
3218	105	4	3327

Silvercreek Pkwy.

Peds Cross: ⧗
West Peds: 31
West Entering: 3047
West Leg Total: 6182

Cars	37
Trucks	4
Cyclists	0
Totals	41

Cars	8	10	12	30
Trucks	0	0	2	2
Cyclists	0	1	0	1
Totals	8	11	14	

Peds Cross: ⋈
South Peds: 36
South Entering: 33
South Leg Total: 74

Comments

Paisley Rd. @ Silvercreek Pkwy.

Annual Average Daily Traffic Diagram

Total Factor = Monthly Factor(0.95) x Daily Factor(1.11) x 24 Hour Factor(1.91) = 2.014095

Municipality: Guelph
Site #: 0000000020
Intersection: Paisley Rd. & Silvercreek Pkwy.
TFR File #: 1
Count date: 7-Apr-2003

Weather conditions:
Overcast
Person(s) who counted:
Tony

**** Signalized Intersection ****

Major Road: Paisley Rd. runs W/E

North Leg Total: 10395
North Entering: 5706
North Peds: 91
Peds Cross: ⋈

Cyclists	0	0	8	8
Trucks	73	2	129	203
Cars	2612	22	2860	5494
Totals	2685	24	2997	

Cyclists	6
Trucks	121
Cars	4562
Totals	4689

East Leg Total: 12578
East Entering: 5877
East Peds: 48
Peds Cross: ⧗

Silvercreek Pkwy.

Cyclists	Trucks	Cars	Totals
2	213	6099	6314

Paisley Rd.

Cars	Trucks	Cyclists	Totals
2183	50	4	2238
3470	141	2	3613
24	2	0	26
5678	193	6	

N
W E
S

Cyclists	Trucks	Cars	Totals
0	70	2359	2429
0	79	3597	3676
0	4	28	32
0	153	5984	

Paisley Rd.

Cars	Trucks	Cyclists	Totals
6481	211	8	6701

Silvercreek Pkwy.

Peds Cross: ⧗
West Peds: 62
West Entering: 6137
West Leg Total: 12451

Cars	75
Trucks	8
Cyclists	0
Totals	83

Cars	16	20	24	60
Trucks	0	0	4	4
Cyclists	0	2	0	2
Totals	16	22	28	

Peds Cross: ⋈
South Peds: 73
South Entering: 66
South Leg Total: 149

Comments

File: 1
Site: 0539300001
Facing: NORTH

NORTH APPROACH

DATE	TIME	CAR			TRUCK			BUS			Pedestrians
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
*************************** Recording started at:12:56:10											
10/12/2005	13:00:00	6	0	7	0	0	0	0	0	0	0
10/12/2005	13:15:00	70	0	68	1	0	0	0	0	0	0
10/12/2005	13:30:00	60	0	58	0	0	0	0	0	0	0
10/12/2005	13:45:00	49	2	56	1	0	0	0	0	0	0
10/12/2005	14:00:00	65	0	55	0	0	1	0	0	0	0
10/12/2005	14:15:00	57	2	56	1	0	1	0	0	0	0
10/12/2005	14:30:00	63	1	61	0	0	0	0	0	0	0
10/12/2005	14:45:00	63	1	71	1	0	0	0	0	0	0
10/12/2005	15:00:00	69	0	63	0	0	0	0	0	0	0
10/12/2005	15:15:00	0	0	0	0	0	0	0	0	0	0
10/12/2005	15:15:14	0	0	0	0	0	0	0	0	0	0

File: 1
Site: 0539300001
Facing: NORTH

EAST APPROACH

DATE	TIME	CAR			TRUCK			BUS			Pedestrians
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
*************************** Recording started at:12:56:10											
10/12/2005	13:00:00	0	2	7	0	0	0	0	0	0	0
10/12/2005	13:15:00	0	65	43	0	1	0	0	0	0	1
10/12/2005	13:30:00	0	61	37	0	1	0	0	0	0	0
10/12/2005	13:45:00	0	52	41	0	2	1	0	0	0	2
10/12/2005	14:00:00	0	96	33	0	1	0	0	0	0	0
10/12/2005	14:15:00	0	60	43	0	0	0	0	0	0	0
10/12/2005	14:30:00	0	63	37	0	2	0	0	0	0	0
10/12/2005	14:45:00	2	64	40	0	0	0	0	0	0	0
10/12/2005	15:00:00	1	59	50	0	1	0	0	0	0	1
10/12/2005	15:15:00	0	1	0	0	0	0	0	0	0	0
10/12/2005	15:15:14	0	1	0	0	0	0	0	0	0	0

File: 1
Site: 0539300001
Facing: NORTH

SOUTH APPROACH

DATE	TIME	CAR			TRUCK			BUS			Pedestrians
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
*************************** Recording started at:12:56:10											
10/12/2005	13:00:00	1	1	0	0	0	0	0	0	0	0
10/12/2005	13:15:00	0	1	0	0	0	0	0	0	0	2
10/12/2005	13:30:00	0	0	1	0	0	0	0	0	0	1
10/12/2005	13:45:00	0	0	0	0	0	0	0	0	0	0
10/12/2005	14:00:00	0	0	0	0	0	0	0	0	0	0
10/12/2005	14:15:00	1	0	1	0	0	0	0	0	0	1
10/12/2005	14:30:00	1	1	1	0	0	0	0	0	0	3
10/12/2005	14:45:00	0	1	0	0	0	0	0	0	0	0
10/12/2005	15:00:00	0	0	1	0	0	0	0	0	0	5
10/12/2005	15:15:00	0	0	0	0	0	0	0	0	0	0
10/12/2005	15:15:14	0	0	0	0	0	0	0	0	0	0

File: 1
Site: 0539300001
Facing: NORTH

WEST APPROACH

DATE	TIME	CAR			TRUCK			BUS			Pedestrians
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
*************************** Recording started at:12:56:10											
10/12/2005	13:00:00	9	10	0	0	0	0	0	0	0	0
10/12/2005	13:15:00	76	73	1	0	2	0	0	0	0	0
10/12/2005	13:30:00	43	70	0	1	0	0	0	0	0	0
10/12/2005	13:45:00	47	78	0	0	1	0	0	0	0	0
10/12/2005	14:00:00	64	65	0	0	0	0	0	0	0	0
10/12/2005	14:15:00	69	59	1	0	0	0	0	0	0	2
10/12/2005	14:30:00	60	75	0	0	0	0	0	0	0	4
10/12/2005	14:45:00	51	50	1	0	0	0	0	0	0	0
10/12/2005	15:00:00	70	62	1	0	0	0	0	0	0	3
10/12/2005	15:15:00	0	1	0	0	0	0	0	0	0	0
10/12/2005	15:15:14	0	1	0	0	0	0	0	0	0	0

Edinburgh Rd. @ Waterloo Ave.

Afternoon Peak Diagram

Specified Period		One Hour Peak	
From:	15:00:00	**From:**	16:30:00
To:	18:00:00	**To:**	17:30:00

Municipality: Guelph
Site #: 0000000003
Intersection: Edinburgh Rd. & Waterloo Ave.
TFR File #: 1
Count date: 27-Sep-2004

Weather conditions:
Sunny

Person(s) who counted:
Jean

**** Signalized Intersection ****

Major Road: Edinburgh Rd. runs N/S

North Leg Total: 1302
North Entering: 650
North Peds: 10
Peds Cross: ⋈

Cyclists	0	8	0	8
Trucks	0	3	1	4
Cars	34	565	39	638
Totals	34	576	40	

Cyclists	11
Trucks	11
Cars	630
Totals	652

East Leg Total: 702
East Entering: 426
East Peds: 22
Peds Cross: ⌛

Edinburgh Rd.

Cyclists	Trucks	Cars	Totals
11	7	323	341

Waterloo Ave.

Cars	Trucks	Cyclists	Totals
57	0	0	57
247	7	10	264
103	2	0	105
407	9	10	

N
W E
S

Cyclists	Trucks	Cars	Totals
0	1	53	54
3	4	163	170
0	0	35	35
3	5	251	

Waterloo Ave.

Cars	Trucks	Cyclists	Totals
267	6	3	276

Edinburgh Rd.

Peds Cross: ⌛
West Peds: 16
West Entering: 259
West Leg Total: 600

Cars	703
Trucks	5
Cyclists	8
Totals	716

Cars	42	520	65	627
Trucks	0	10	1	11
Cyclists	1	11	0	12
Totals	43	541	66	

Peds Cross: ⋈
South Peds: 25
South Entering: 650
South Leg Total: 1366

Comments

Edinburg Rd. @ Wellington St.

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:15:00
To: 17:15:00

Municipality: Guelph
Site #: 0000000039
Intersection: Edinburg Rd. & Wellington St.
TFR File #: 1
Count date: 28-Apr-2003

Weather conditions:
Sunny

Person(s) who counted:
Donna
Jean

**** Signalized Intersection ****

Major Road: Edinburg Rd. runs N/S

North Leg Total: 1532
North Entering: 791
North Peds: 0
Peds Cross: ⋈

Cyclists	0	13	1	14
Trucks	1	5	1	7
Cars	62	664	44	770
Totals	63	682	46	

Cyclists	8
Trucks	8
Cars	725
Totals	741

East Leg Total: 1710
East Entering: 1003
East Peds: 12
Peds Cross: ⧗

Edinburg Rd.

Cyclists	Trucks	Cars	Totals
3	28	875	906

Wellington St.

Cars	Trucks	Cyclists	Totals
73	1	0	74
688	25	0	713
214	2	0	216
975	28	0	

N
W E
S

Cyclists	Trucks	Cars	Totals
0	0	46	46
1	34	475	510
0	0	129	129
1	34	650	

Wellington St.

Cars	Trucks	Cyclists	Totals
669	36	2	707

Edinburg Rd.

Peds Cross: ⧗
West Peds: 2
West Entering: 685
West Leg Total: 1591

Cars	1007
Trucks	7
Cyclists	13
Totals	1027

Cars	125	606	150	881
Trucks	2	7	1	10
Cyclists	3	8	0	11
Totals	130	621	151	

Peds Cross: ⋈
South Peds: 0
South Entering: 902
South Leg Total: 1929

Comments

Wellington St. @ Hanlon East Ramp

Afternoon Peak Diagram

Specified Period		One Hour Peak	
From:	15:00:00	From:	15:45:00
To:	18:00:00	To:	16:45:00

Municipality: Guelph
Site #: 0000000018
Intersection: Wellington St. & Hanlon East Ramp
TFR File #: 2
Count date: 3-Apr-02

Weather conditions:
Clear

Person(s) who counted:
Olga

**** Signalized Intersection ****

Major Road: Wellington St. runs W/E

North (Waterloo Ave.)

North Leg Total:	586
North Entering:	266
North Peds:	0
Peds Cross:	⋈

Cyclists	0	0	0	0
Trucks	6	0	0	6
Cars	244	0	16	260
Totals	250	0	16	

Cyclists	0
Trucks	5
Cars	315
Totals	320

Waterloo Ave.

East

East Leg Total:	1482
East Entering:	789
East Peds:	0
Peds Cross:	⧗

Cars	Trucks	Cyclists	Totals
91	0	0	91
670	27	0	697
1	0	0	1
762	27	0	

Wellington St.

Cars	Trucks	Cyclists	Totals
657	36	0	693

West

Cyclists	Trucks	Cars	Totals
0	43	1165	1208

Wellington St.

Cyclists	Trucks	Cars	Totals
0	4	117	121
0	33	573	606
0	9	77	86
0	46	767	

N
W E
S

Peds Cross:	⧗
West Peds:	0
West Entering:	813
West Leg Total:	2021

South (Hanlon East Ramp)

Hanlon East Ramp

Cars	78
Trucks	9
Cyclists	0
Totals	87

Cars	251	107	68	426
Trucks	10	1	3	14
Cyclists	0	0	0	0
Totals	261	108	71	

Peds Cross:	⋈
South Peds:	0
South Entering:	440
South Leg Total:	527

Comments

Wellington St. @ Hanlon West Ramp

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

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

Municipality: Guelph
Site #: 0000000019
Intersection: Wellington St. & Hanlon West Ram|
TFR File #: 3
Count date: 4-Apr-02

Weather conditions:
Cloudy

Person(s) who counted:
Olga

**** Signalized Intersection ****

Major Road: Wellington St. runs W/E

North Leg Total: 353
North Entering: 188
North Peds: 0
Peds Cross: ⋈

Cyclists	0	0	0	0
Trucks	9	0	5	14
Cars	69	0	105	174
Totals	78	0	110	

Cyclists	0
Trucks	5
Cars	160
Totals	165

East Leg Total: 2109
East Entering: 1179
East Peds: 0
Peds Cross: ⌛

Hanlon West Ramp

Cyclists	Trucks	Cars	Totals
0	28	1073	1101

Cars	Trucks	Cyclists	Totals
151	5	0	156
1004	19	0	1023
0	0	0	0
1155	24	0	

Wellington St.

N
W E
S

Cyclists	Trucks	Cars	Totals
0	0	9	9
1	26	793	820
0	8	211	219
1	34	1013	

Wellington St.

Cars	Trucks	Cyclists	Totals
898	31	1	930

Hanlon West Ramp

Peds Cross: ⌛
West Peds: 0
West Entering: 1048
West Leg Total: 2149

Cars	211
Trucks	8
Cyclists	0
Totals	219

Cars	0	0	0	0
Trucks	0	0	0	0
Cyclists	0	0	0	0
Totals	0	0	0	

Peds Cross: ⋈
South Peds: 0
South Entering: 0
South Leg Total: 219

Comments

Wellington St. @ Imperial Rd.

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

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

Municipality: Guelph
Site #: 0000000023
Intersection: Wellington St. & Imperial Rd.
TFR File #: 3
Count date: 10-Apr-2003

Weather conditions:
Sunny

Person(s) who counted:
Tony

**** Signalized Intersection ****

Major Road: Wellington St. runs W/E

North Leg Total: 805
North Entering: 404
North Peds: 4
Peds Cross: ⋈

Cyclists	0	1	1
Trucks	5	36	41
Cars	31	331	362
Totals	36	368	

Cyclists	0
Trucks	4
Cars	397
Totals	401

East Leg Total: 1938
East Entering: 901
East Peds: 0
Peds Cross: ⧗

Imperial Rd.

Cyclists	Trucks	Cars	Totals
1	30	607	638

Wellington St.

Cars	Trucks	Cyclists	Totals
295	4	0	299
576	25	1	602
871	29	1	

N
W E
S

Cyclists	Trucks	Cars	Totals
0	0	102	102
3	30	636	669
3	30	738	

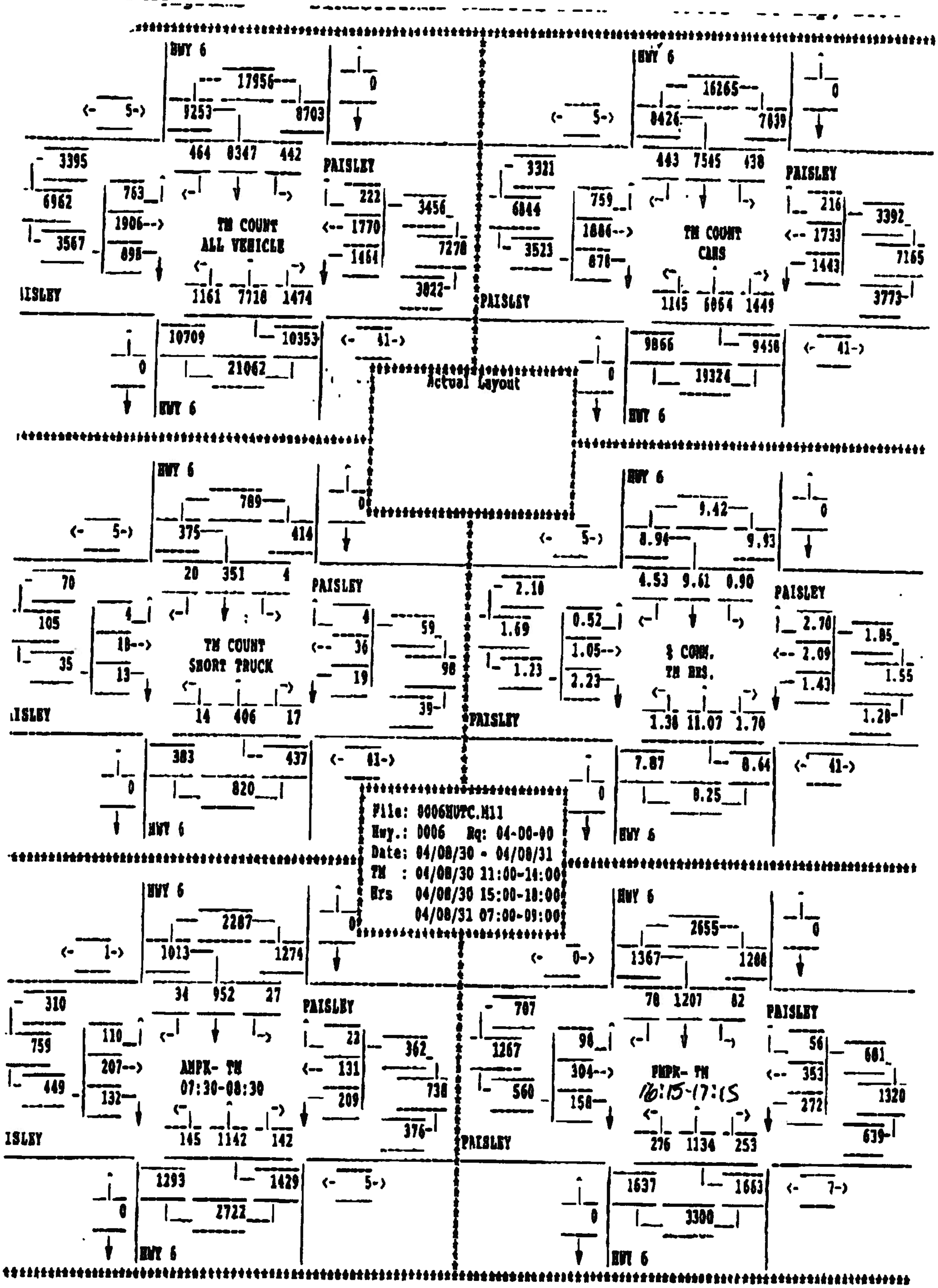
Wellington St.

Cars	Trucks	Cyclists	Totals
967	66	4	1037

Peds Cross: ⧗
West Peds: 0
West Entering: 771
West Leg Total: 1409

Comments

TOTAL P.02



HWY 6
17956
9253
8703
<- 5->
0
464 8347 442
PAISLEY
3395
6962
3567
763
1906-->
898
TM COUNT
ALL VEHICLE
222
<-- 1770
1464
3456
7278
3822
1161 7718 1474
ISLEY
10709
10353
21062
<- 41->
0
HWY 6
HWY 6
16265
8426
7839
<- 5->
0
443 7545 438
PAISLEY
3321
6844
3523
759
1886-->
878
TM COUNT
CARS
216
<-- 1733
1443
3392
7165
3773
1145 6064 1449
PAISLEY
9866
9458
19324
<- 41->
0
HWY 6
Actual Layout
HWY 6
789
375
414
<- 5->
0
20 351 4
PAISLEY
70
105
35
4
18-->
13
TM COUNT
SHORT TRUCK
4
<-- 36
19
59
98
39
14 406 17
ISLEY
383
437
820
<- 41->
0
HWY 6
HWY 6
9.42
8.94
9.93
<- 5->
0
4.53 9.61 0.90
PAISLEY
2.18
1.69
1.23
0.52
1.05-->
2.23
% COMM.
TM HRS.
2.70
<-- 2.09
1.43
1.85
1.55
1.28
1.38 11.07 1.70
PAISLEY
7.87
8.64
8.25
<- 41->
0
HWY 6
File: 0006HUTC.M11
Hwy.: 0006 Rq: 04-00-00
Date: 04/08/30 - 04/08/31
TM : 04/08/30 11:00-14:00
Hrs 04/08/30 15:00-18:00
04/08/31 07:00-09:00
HWY 6
2287
1013
1274
<- 1->
0
34 952 27
PAISLEY
310
759
449
110
207-->
132
AMPK- TM
07:30-08:30
23
<-- 131
209
362
738
376
145 1142 142
ISLEY
1293
1429
2722
<- 5->
0
HWY 6
HWY 6
2655
1367
1288
<- 0->
0
78 1207 82
PAISLEY
707
1267
560
98
304-->
158
PMPK- TM
16:15-17:15
56
<-- 353
272
681
1320
639
276 1134 253
PAISLEY
1637
1663
3300
<- 7->
0
HWY 6

BA Consulting Group Intersection Count Database

Intersection Turning Movement Spreadsheet

Intersection: **WATERLOO AVE, EDINBURGH RD**
Date of Count: **Saturday, June 11, 05**
Source: **BA Group**
Veh & PCU used: **Cars * 1.0 + Medium * 1.0 + Heavy * 1.0**
Comments: **traffic - normal; weather - sunny, hot**

Period	From the North			From the South			From the East			From the West			Approach
Ending	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total
13:15	5	62	9	5	68	4	5	19	5	11	9	11	213
13:30	8	100	5	13	95	7	5	33	10	14	34	6	330
13:45	9	112	3	8	83	4	6	22	13	10	30	6	306
14:00	7	91	6	17	113	8	7	41	17	11	17	11	346
14:15	3	93	10	17	106	6	11	41	18	16	18	5	344
14:30	7	133	7	17	89	5	1	25	16	11	18	7	336
14:45	4	111	9	9	127	3	5	17	10	9	34	11	349
15:00	8	88	5	11	112	3	10	31	12	9	27	10	326
TOTAL	51	790	54	97	793	40	50	229	101	91	187	67	2550
AM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0
MID PEAK	21	428	32	60	435	22	24	124	61	47	87	34	1375
PM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0
FORCED P	27	396	24	55	397	25	29	137	58	51	99	28	1326

Hour Ending	Approach Total
13:15	n/a
13:30	n/a
13:45	n/a
14:00	1195
14:15	1326
14:30	1332
14:45	1375
15:00	1355
15:00	2550
:	0
14:45	1375
:	0
14:15	1326

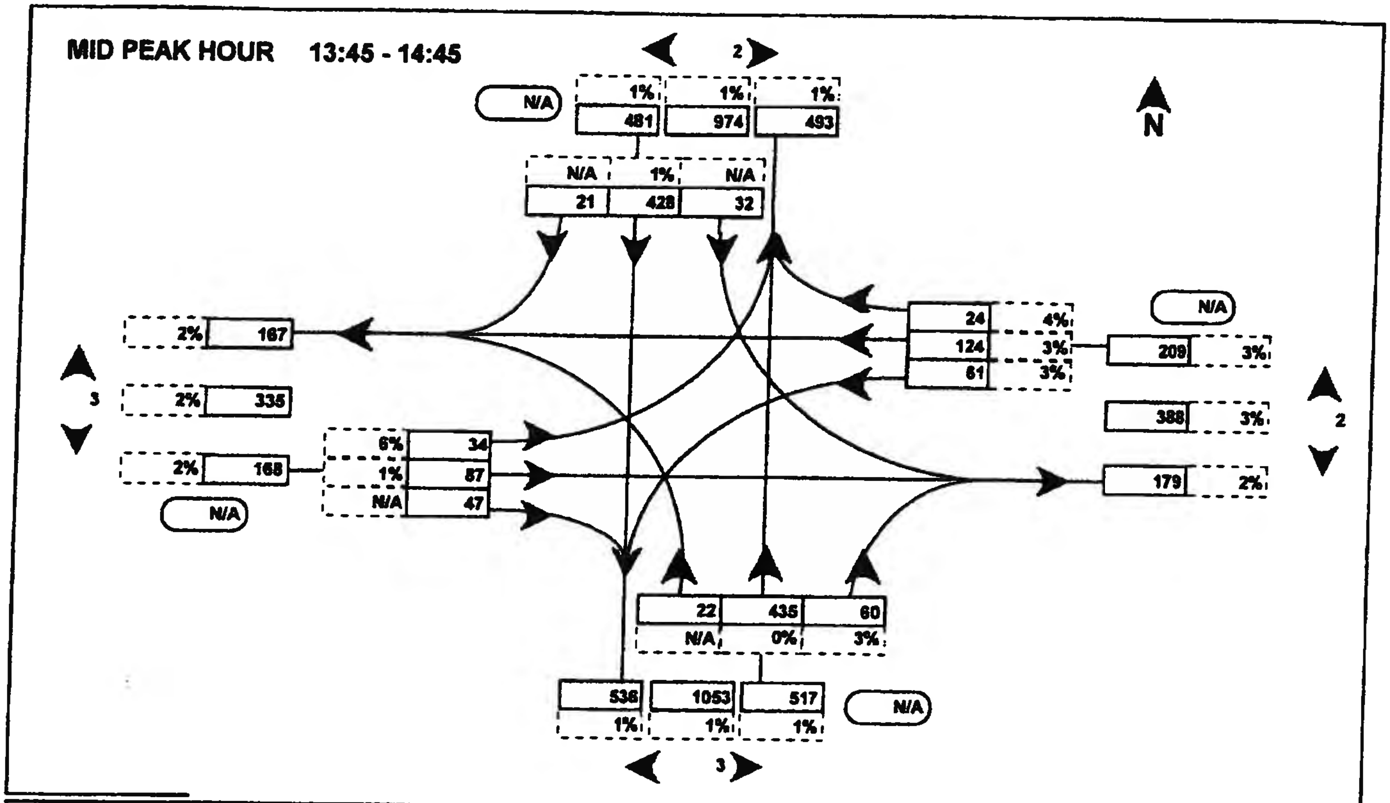
GROUP Transportation Consultants

BA Consulting Group   Intersection Count Database

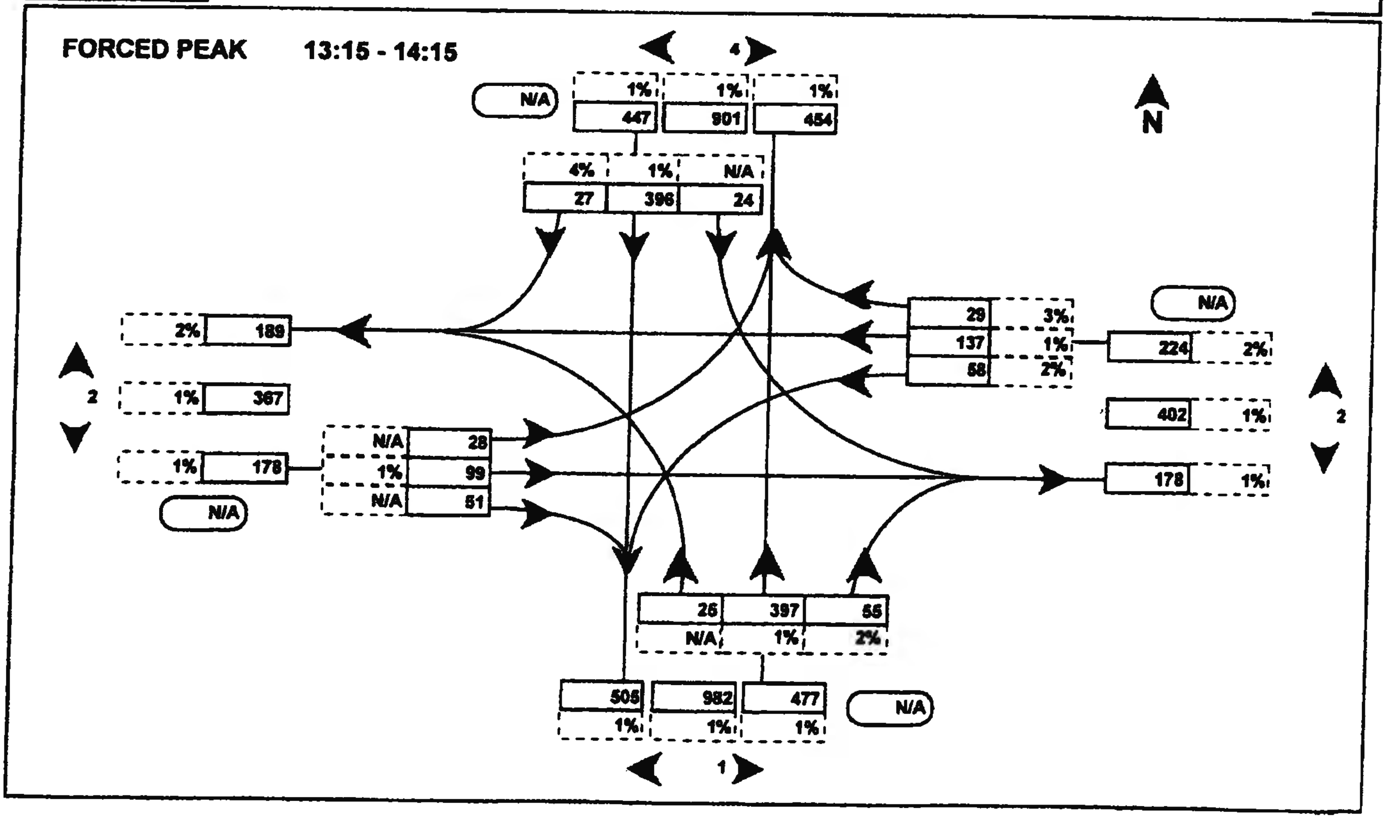
Intersection: **WATERLOO AVE, EDINBURGH RD**
Date of Count: **Saturday, June 11, 05**
Source: **BA Group**
Veh & PCU used: **Cars * 1.0 + Medium * 1.0 + Heavy * 1.0**
Comments: **traffic - normal; weather - sunny, hot**

999 Total vehicles
999 Percent medium and h
999 Bikes and other
999 Pedestrians

MID PEAK HOUR   13:45 - 14:45



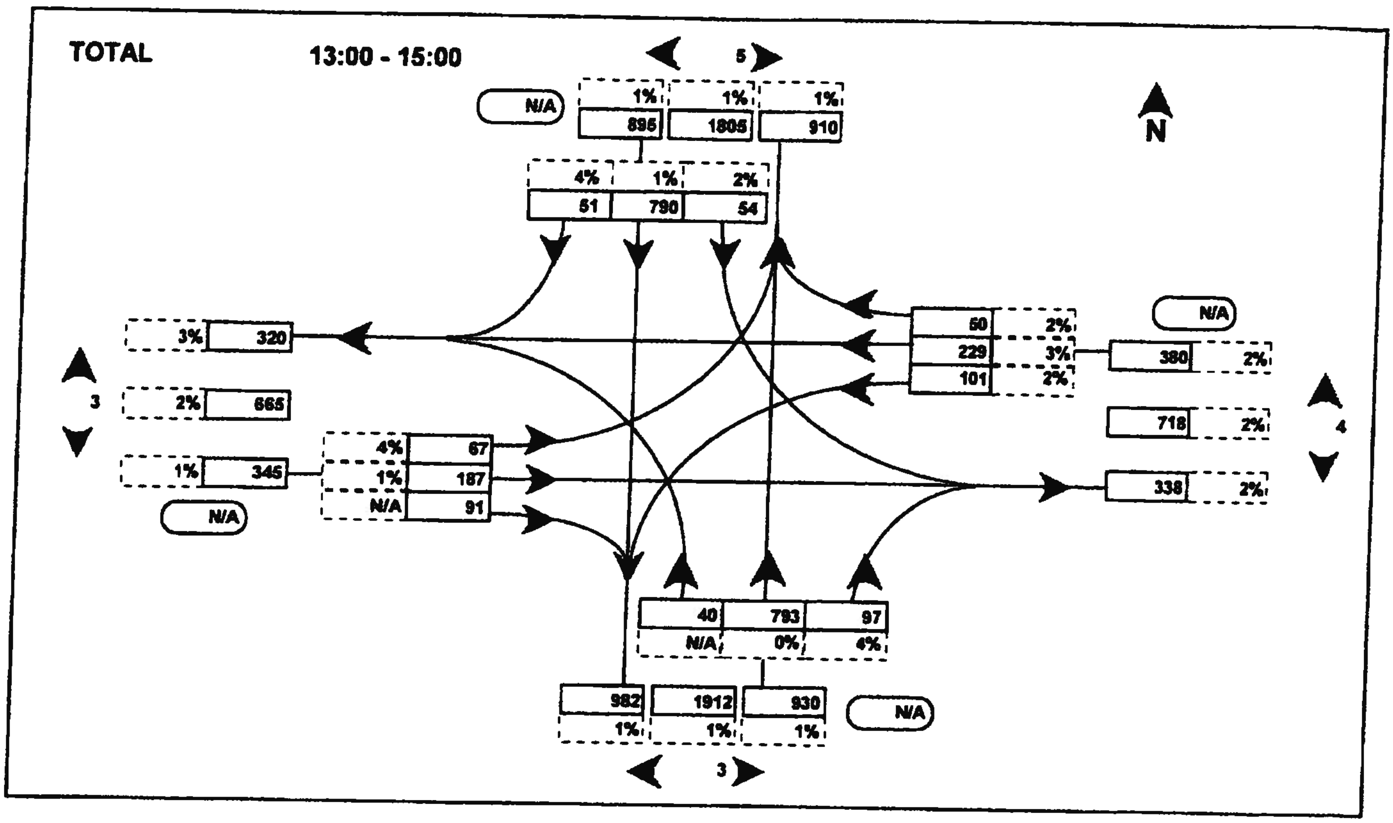
FORCED PEAK   13:15 - 14:15



BA Consulting Group   Intersection Count Database

Intersection: **WATERLOO AVE, EDINBURGH RD**
Date of Count: **Saturday, June 11, 05**
Source: **BA Group**
Veh & PCU used: **Cars * 1.0 + Medium * 1.0 + Heavy * 1.0**
Comments: **traffic - normal; weather - sunny, hot**

999 Total vehicles
999 Percent medium and he
999 Bikes and other
999 Pedestrians



BA Consulting Group Intersection Count Database

Intersection Turning Movement Spreadsheet

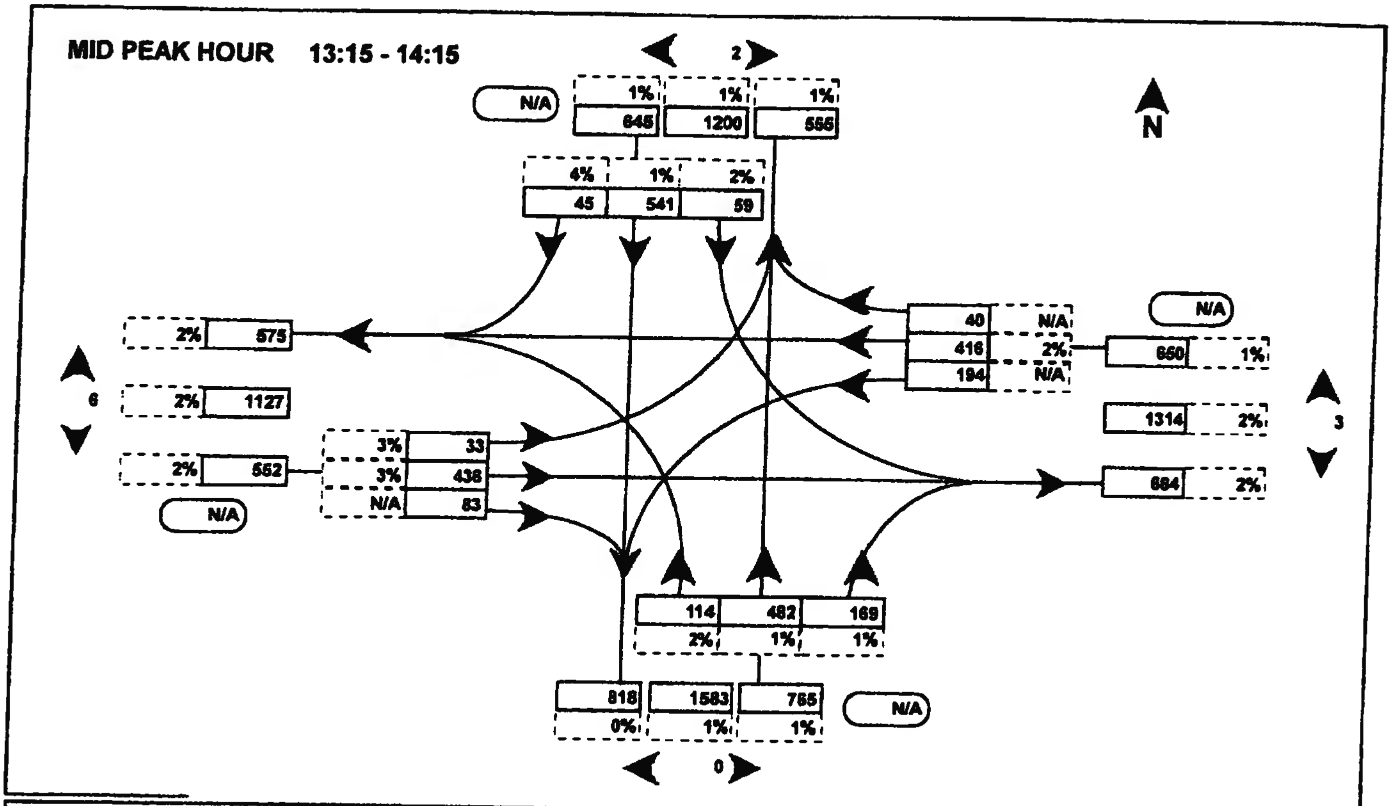
Intersection: **WELLINGTON AVE, EDINBURGH RD**
Date of Count: **Saturday, June 11, 05**
Source: **BA Group**
Veh & PCU used: **Cars * 1.0 + Medium * 1.0 + Heavy * 1.0**
Comments: **traffic - normal; weather - sunny, hot**

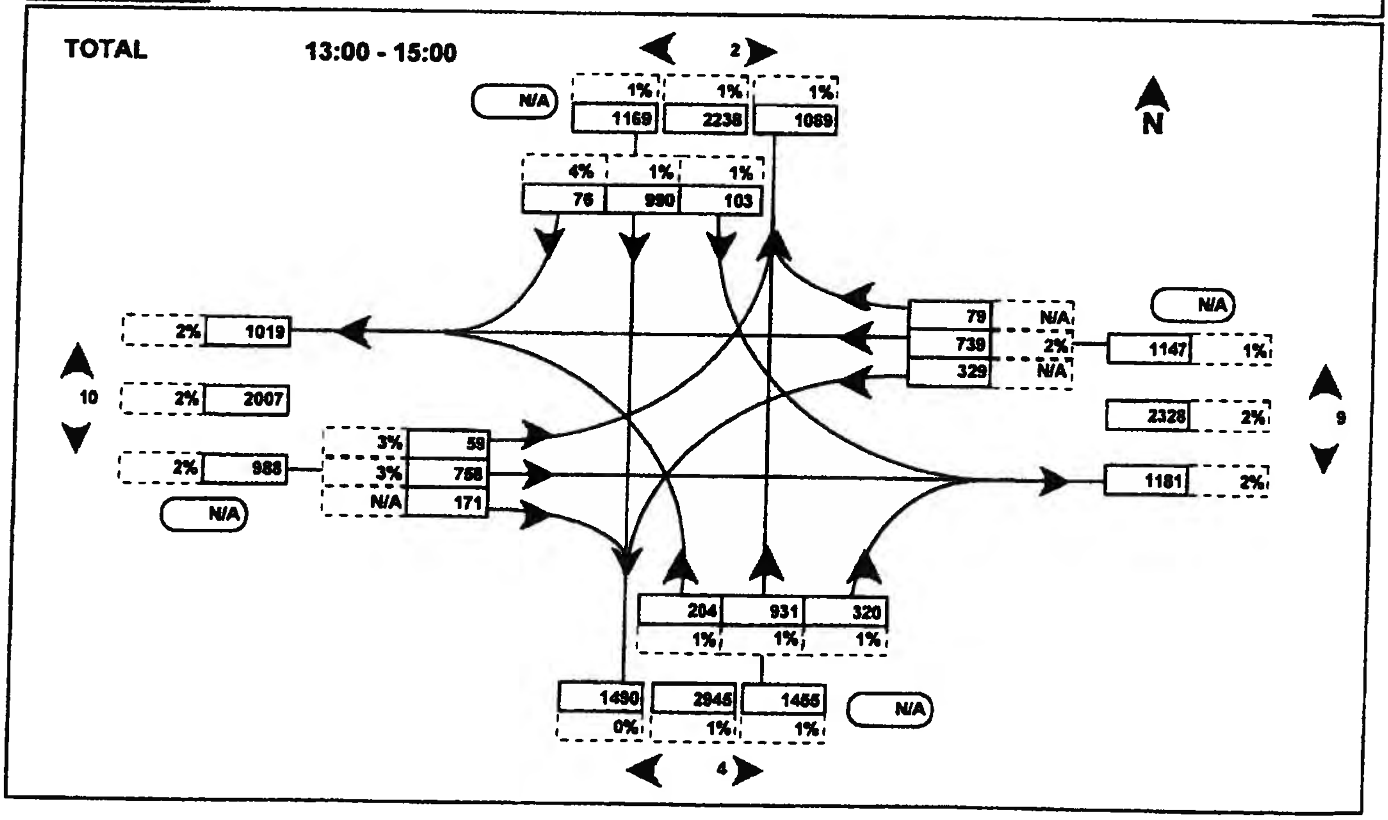
Period	From the North			From the South			From the East			From the West			Approach	Hour	Approach
Ending	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	Ending	Total
13:15	3	48	9	18	61	8	8	40	12	9	45	3	262	13:15	n/a
13:30	8	123	15	50	104	22	10	118	52	18	122	9	651	13:30	n/a
13:45	22	144	16	44	124	30	7	97	52	23	128	10	697	13:45	n/a
14:00	10	130	11	45	135	31	9	92	44	21	98	4	630	14:00	2240
14:15	5	144	17	30	119	31	14	109	46	21	88	10	634	14:15	2612
14:30	12	158	15	29	122	18	11	95	39	29	97	9	634	14:30	2595
14:45	7	115	13	59	139	34	11	92	39	29	79	9	626	14:45	2524
15:00	9	128	7	45	127	30	11	98	45	21	101	5	625	15:00	2519
TOTAL	76	990	103	320	931	204	79	739	329	171	758	59	4759	15:00	4759
AM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0	:	0
MID PEAK	46	541	59	169	482	114	40	416	194	83	436	33	2612	14:15	2612
PM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0	:	0
FORCED P	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0

BA Consulting Group **Intersection Count Database**

Intersection: WELLINGTON AVE, EDINBURGH RD
Date of Count: Saturday, June 11, 05
Source: BA Group
Veh & PCU used: Cars * 1.0 + Medium * 1.0 + Heavy * 1.0
Comments: traffic - normal; weather - sunny, hot

999 Total vehicles
999 Percent medium and h
999 Bikes and other
999 Pedestrians





BA Consulting Group   Intersection Count Database

Intersection Turning Movement Spreadsheet

Intersection: **WELLINGTON AVE, HANLON NB OFF RAMP PKY, SILVERCREEK PKY**
Date of Count: **Saturday, June 11, 05**
Source: **BA Group**
Veh & PCU used: **Cars * 1.0 + Medium * 1.0 + Heavy * 1.0**
Comments: **traffic - normal, weather - sunny, hot**

Period	From the North			From the South			From the East			From the West			Approach
Ending	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total
13:15	49	0	1	21	11	54	2	114	0	0	107	27	386
13:30	40	0	0	30	13	44	8	146	0	0	132	26	437
13:45	40	0	0	28	14	44	9	140	0	0	129	28	432
14:00	34	0	0	21	15	45	3	131	0	0	122	28	399
14:15	47	0	1	17	22	55	2	141	0	0	110	15	410
14:30	37	0	1	22	22	51	2	122	0	0	109	25	391
14:45	38	0	0	15	16	42	4	129	0	0	114	24	384
15:00	41	0	2	27	18	53	3	127	0	0	111	19	401
TOTAL	326	0	5	181	133	388	31	1050	0	0	934	192	3240
AM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0
MID PEAK	161	0	1	96	64	188	20	558	0	0	493	97	1678
PM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0
FORCED P	0	0	0	0	0	0	0	0	0	0	0	0	0

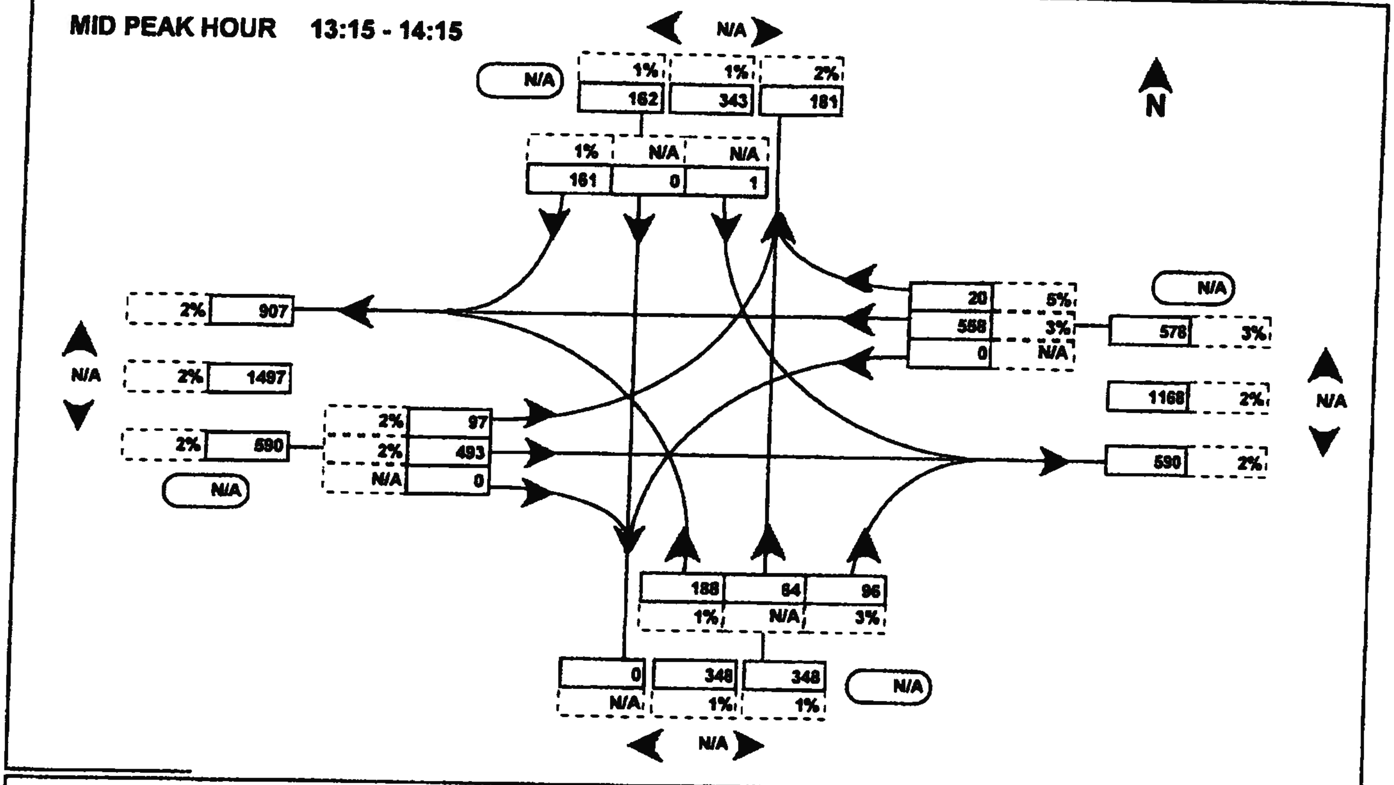
Hour Ending	Approach Total
13:15	n/a
13:30	n/a
13:45	n/a
14:00	1654
14:15	1678
14:30	1632
14:45	1584
15:00	1588
15:00	3240
:	0
14:15	1678
:	0
:	0

BA Consulting Group **Intersection Count Database**

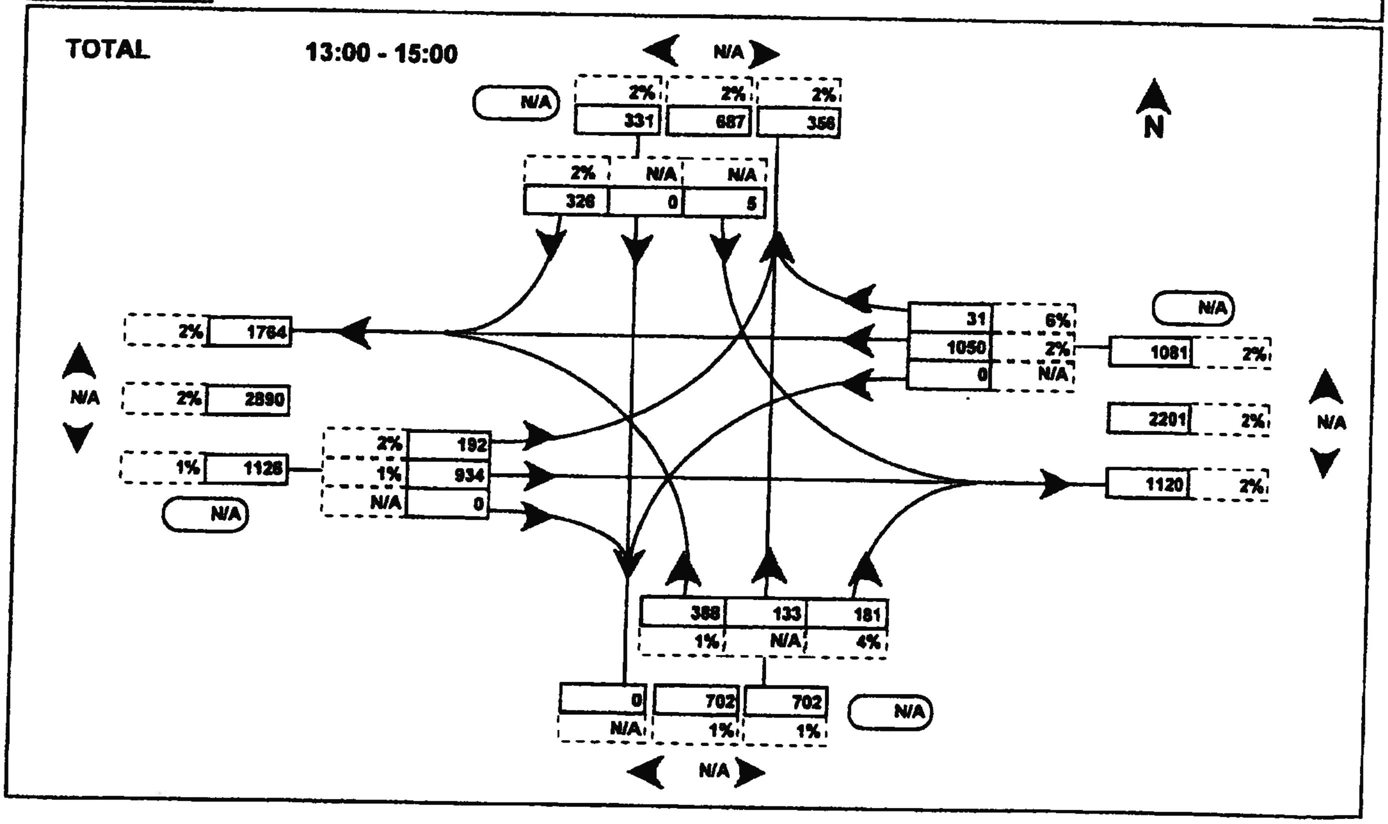
Intersection: **WELLINGTON AVE, HANLON NB OFF RAMP PKY, SILVERCREEK PKY**
Date of Count: **Saturday, June 11, 05**
Source: **BA Group**
Veh & PCU used: **Cars * 1.0 + Medium * 1.0 + Heavy * 1.0**
Comments: **traffic - normal, weather - sunny, hot**

999 Total vehicles
999 Percent medium and h
999 Bikes and other
999 Pedestrians

MID PEAK HOUR 13:15 - 14:15



TOTAL 13:00 - 15:00



BA Consulting Group Intersection Count Database
Intersection Turning Movement Spreadsheet

Intersection: **WATERLOO AVE, SILVERCREEK PKY**
Date of Count: **Saturday, June 11, 05**
Source: **BA Group**
Veh & PCU used: **Cars * 1.0 + Medium * 1.0 + Heavy * 1.0**
Comments: **traffic - normal; weather - sunny, hot**

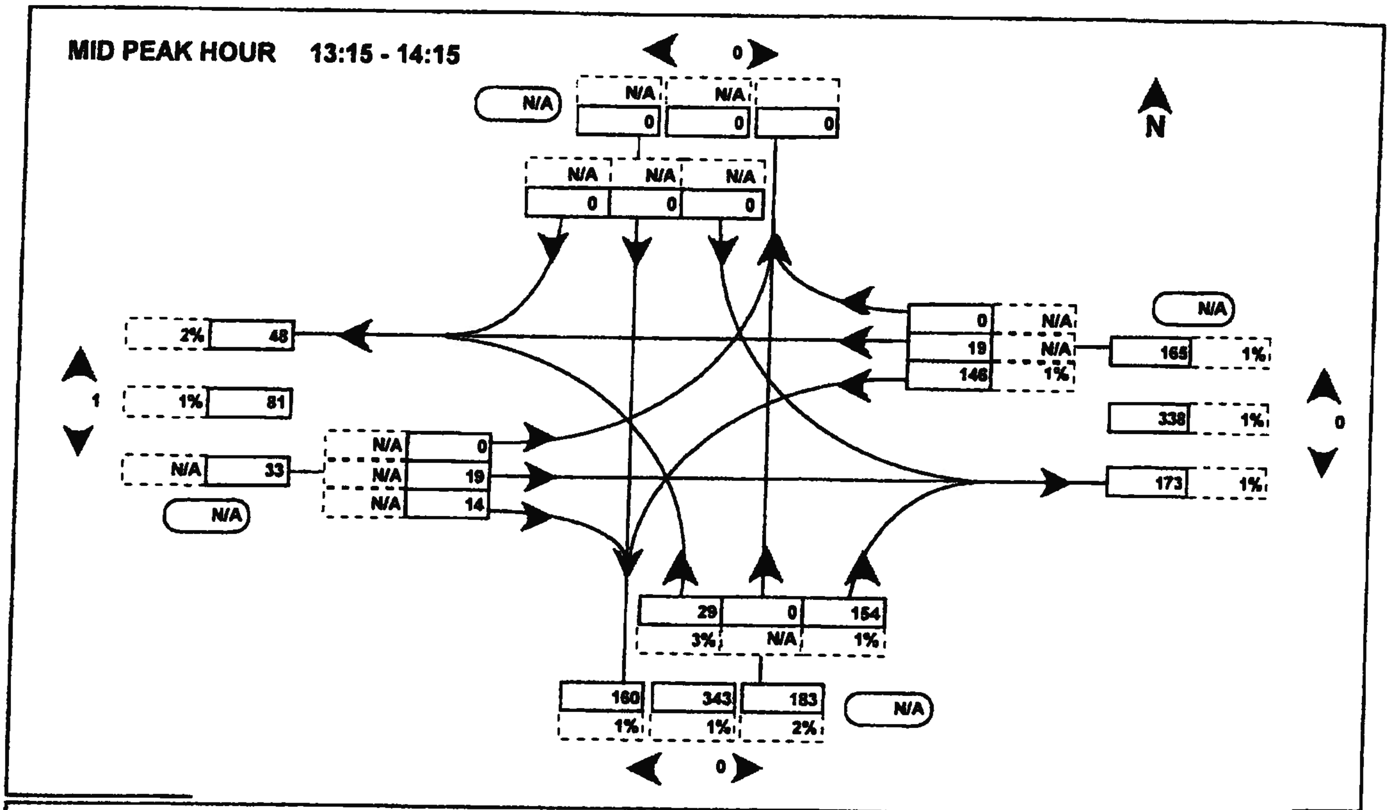
Period	From the North			From the South			From the East			From the West			Approach	Hour	Approach
Ending	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total	Ending	Total
13:15	0	0	0	27	0	8	0	4	34	4	2	0	79	13:15	n/a
13:30	0	0	0	39	0	5	0	7	34	1	6	0	92	13:30	n/a
13:45	0	0	0	40	0	9	0	3	29	5	1	0	87	13:45	n/a
14:00	0	0	0	38	0	8	0	2	33	4	6	0	91	14:00	349
14:15	0	0	0	37	0	7	0	7	50	4	6	0	111	14:15	381
14:30	0	0	0	33	0	11	0	1	31	3	4	0	83	14:30	372
14:45	0	0	0	40	0	7	0	5	33	7	3	0	95	14:45	380
15:00	0	0	0	37	0	4	0	6	30	9	3	0	89	15:00	378
TOTAL	0	0	0	291	0	59	0	35	274	37	31	0	727	15:00	727
AM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0	:	0
MID PEAK	0	0	0	154	0	29	0	19	146	14	19	0	381	14:15	381
PM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0	:	0
FORCED P	0	0	0	0	0	0	0	0	0	0	0	0	0	:	0

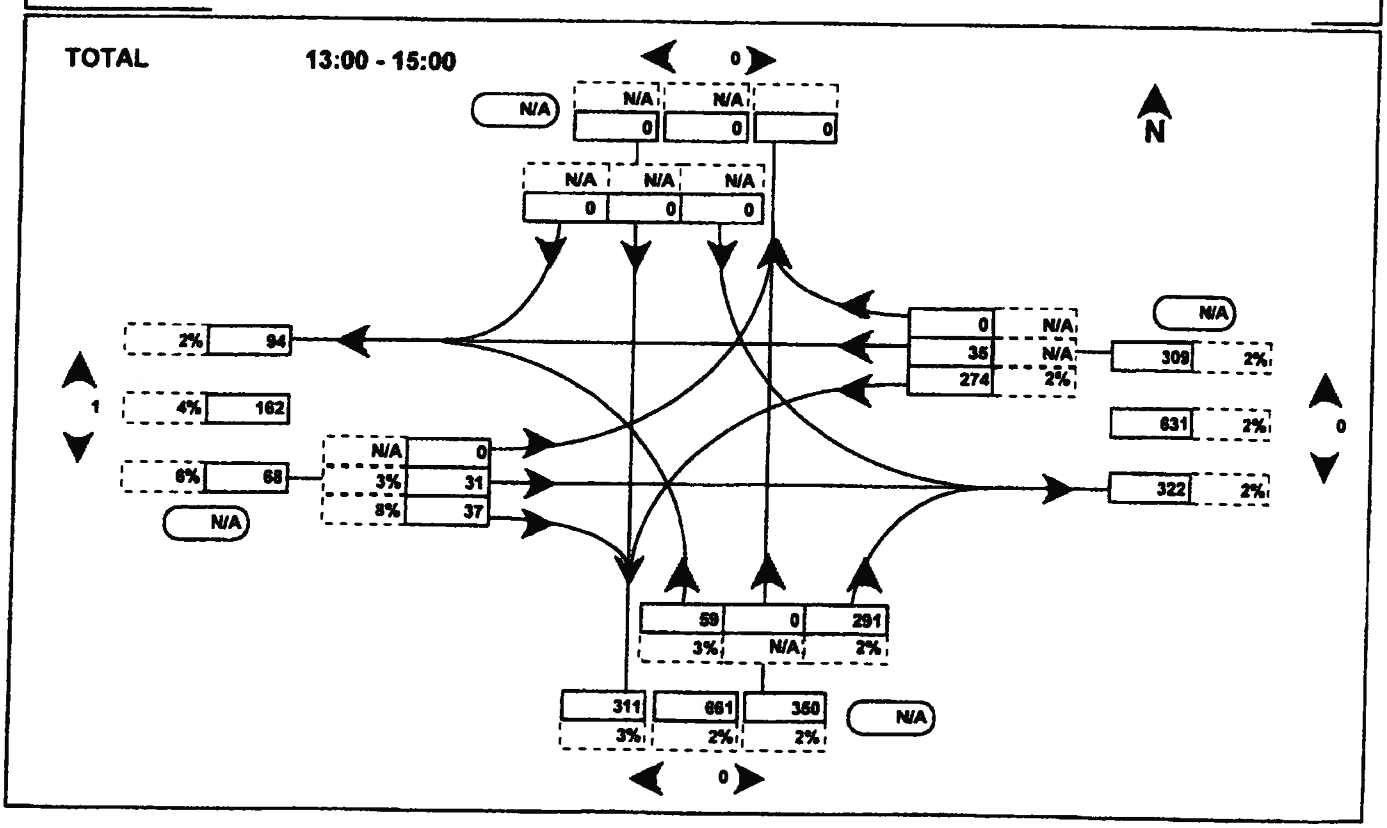
BA GROUP Transportation Consultants

BA Consulting Group **Intersection Count Database**

Intersection:	**WATERLOO AVE, SILVERCREEK PKY**
Date of Count:	**Saturday, June 11, 05**
Source:	**BA Group**
Veh & PCU used:	**Cars * 1.0 + Medium * 1.0 + Heavy * 1.0**
Comments:	**traffic - normal; weather - sunny, hot**

999 Total vehicles
999 Percent medium and he
999 Bikes and other
999 Pedestrians





BA Consulting Group Intersection Count Database

Intersection Turning Movement Spreadsheet

Intersection: **WELLINGTON AVE, HANLON SB OFF RAMP PKY**
Date of Count: **Saturday, June 11, 05**
Source: **BA Group**
Veh & PCU used: **Cars * 1.0 + Medium * 1.0 + Heavy * 1.0**
Comments: **traffic - normal; weather - sunny, hot**

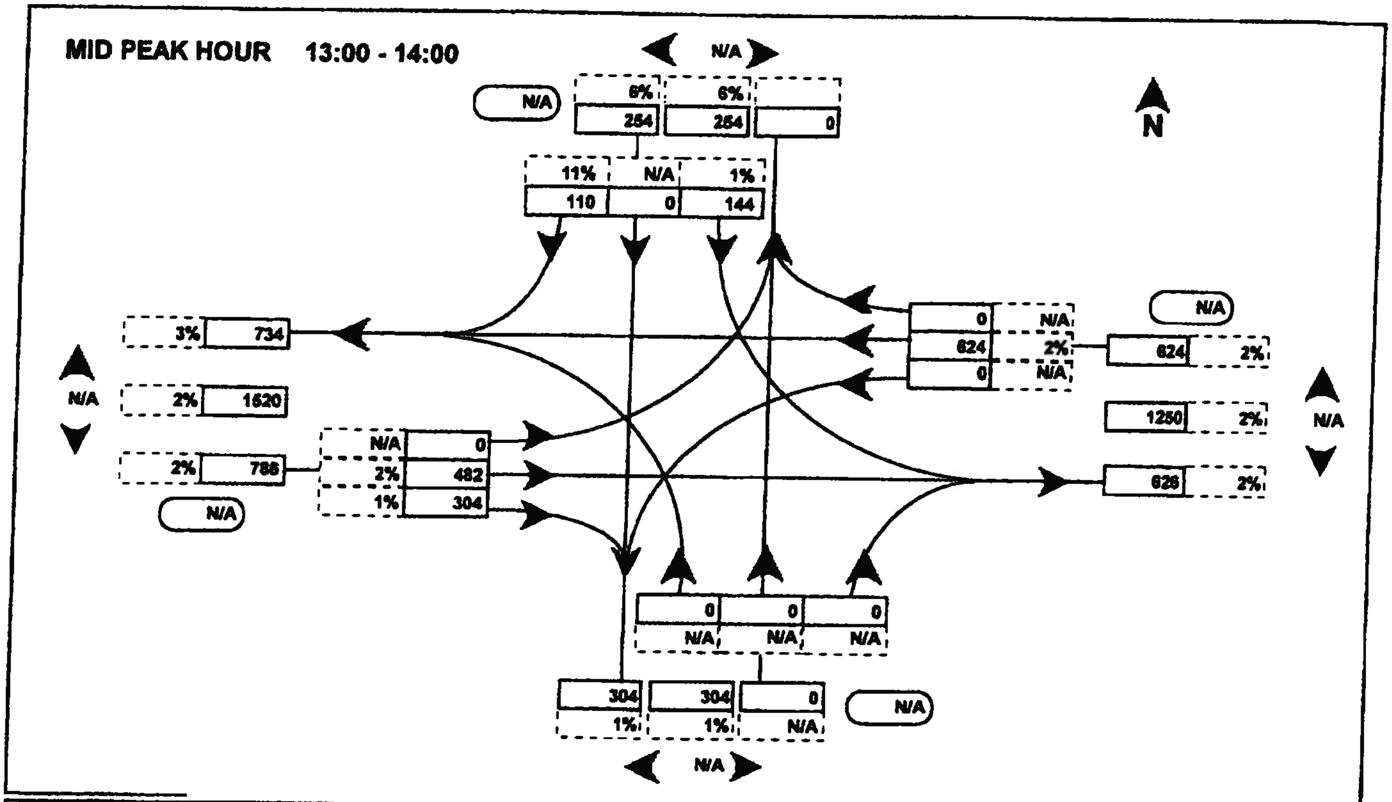
Period	From the North			From the South			From the East			From the West			Approach
Ending	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total
13:15	39	0	27	0	0	0	0	146	0	79	126	0	417
13:30	29	0	37	0	0	0	0	153	0	72	113	0	404
13:45	22	0	43	0	0	0	0	162	0	69	124	0	420
14:00	20	0	37	0	0	0	0	163	0	84	119	0	423
14:15	35	0	32	0	0	0	0	154	0	62	97	0	380
14:30	25	0	27	0	0	0	0	159	0	61	124	0	398
14:45	30	0	31	0	0	0	0	139	0	63	112	0	375
15:00	27	0	31	0	0	0	0	157	0	61	109	0	385
TOTAL	227	0	265	0	0	0	0	1233	0	551	924	0	3200
AM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0
MID PEAK	110	0	144	0	0	0	0	624	0	304	482	0	1664
PM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0
FORCED P	106	0	149	0	0	0	0	632	0	287	453	0	1627

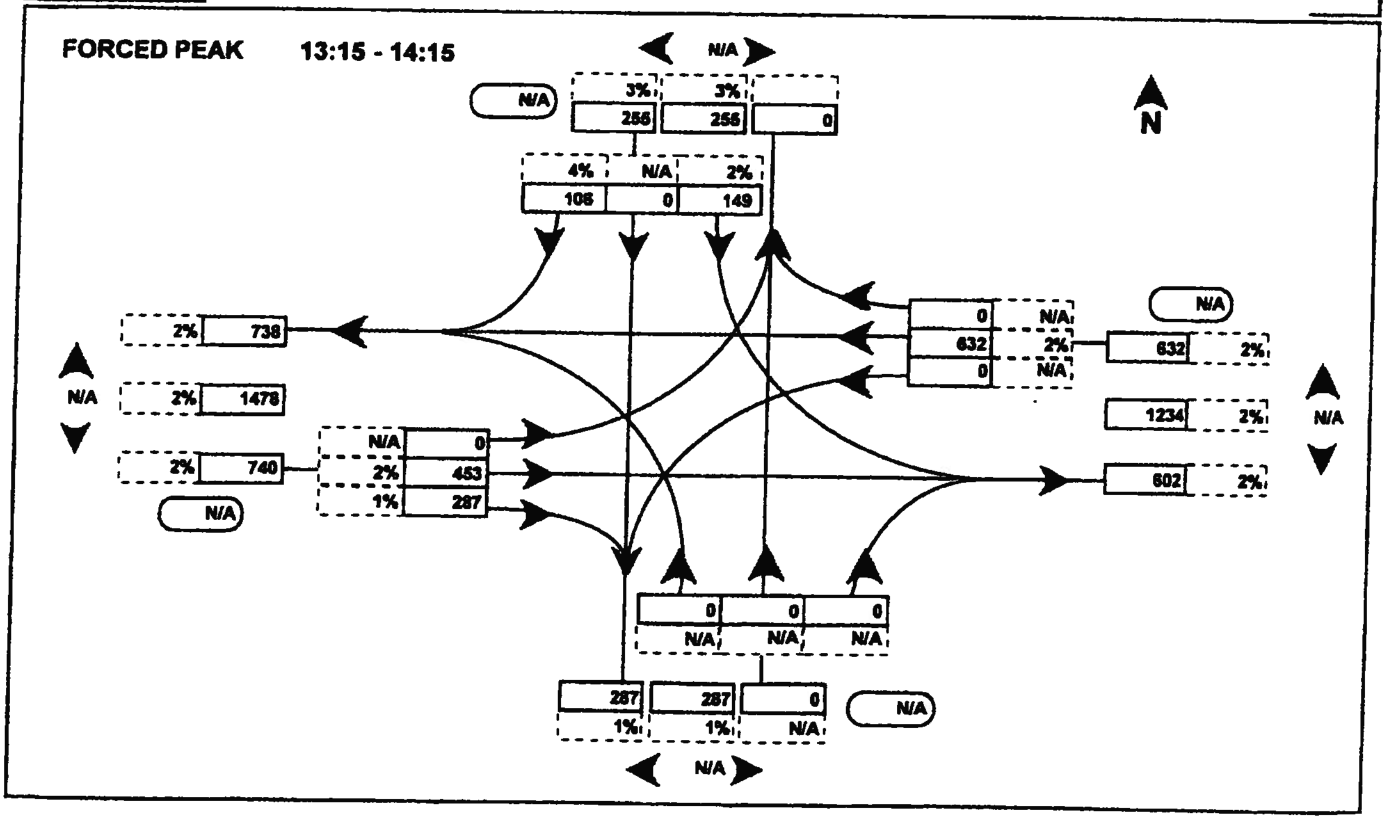
Hour Ending	Approach Total
13:15	n/a
13:30	n/a
13:45	n/a
14:00	1664
14:15	1627
14:30	1619
14:45	1574
15:00	1536
15:00	3200
:	0
14:00	1664
:	0
14:15	1627

BA Consulting Group Intersection Count Database

Intersection: WELLINGTON AVE, HANLON SB OFF RAMP PKY
Date of Count: Saturday, June 11, 05
Source: BA Group
Veh & PCU used: Cars * 1.0 + Medium * 1.0 + Heavy * 1.0
Comments: traffic - normal; weather - sunny, hot

999 Total vehicles
999 Percent medium and h
999 Bikes and other
999 Pedestrians

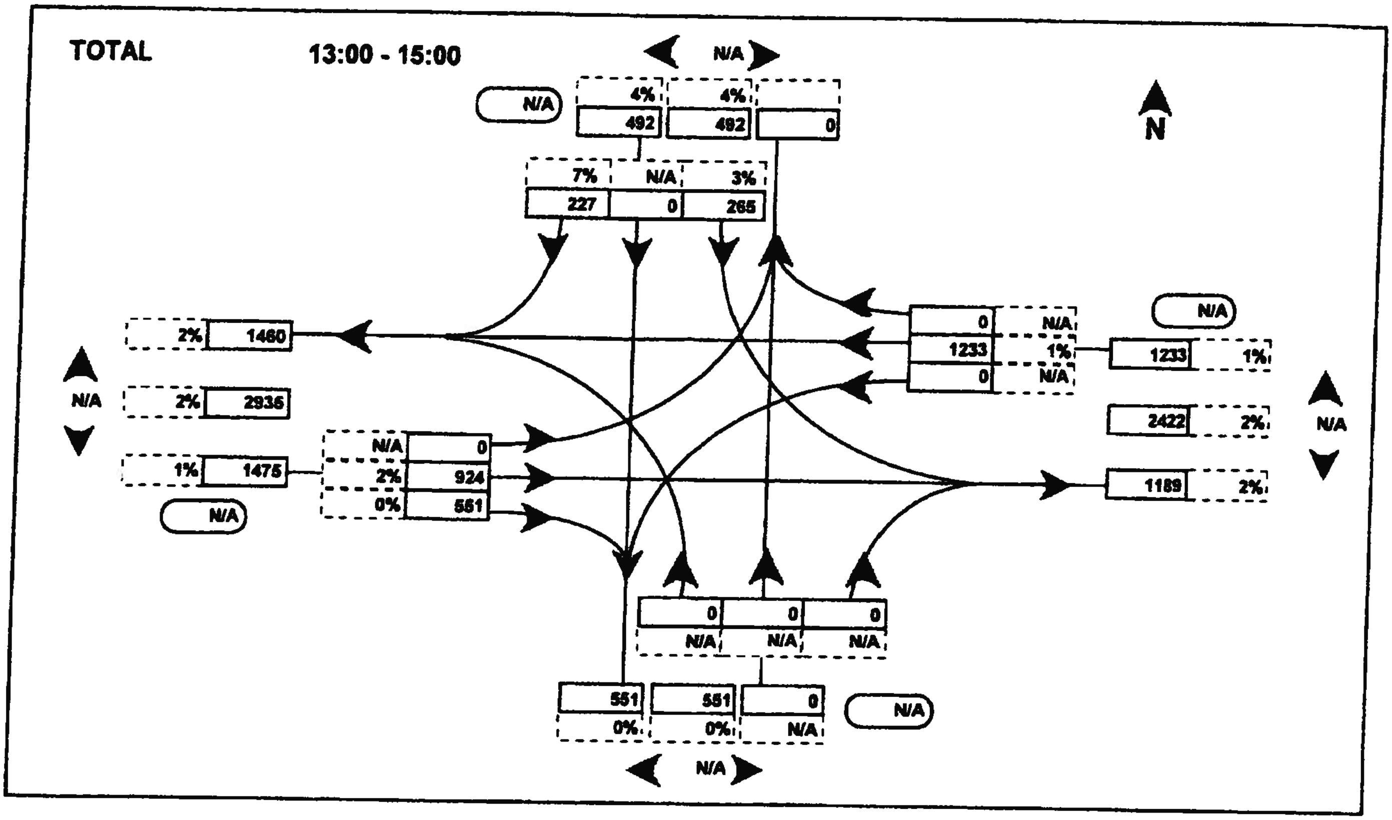




BA Consulting Group   Intersection Count Database

Intersection: WELLINGTON AVE, HANLON SB OFF RAMP PKY
Date of Count: Saturday, June 11, 05
Source: BA Group
Veh & PCU used: Cars * 1.0 + Medium * 1.0 + Heavy * 1.0
Comments: traffic - normal; weather - sunny, hot

999 Total vehicles
999 Percent medium and h
999 Bikes and other
999 Pedestrians



BA Consulting Group   Intersection Count Database
Intersection Turning Movement Spreadsheet

Intersection: **WELLINGTON AVE, IMPERIAL RD**
Date of Count: **Saturday, June 11, 05**
Source: **BA Group**
Veh & PCU used: **Cars * 1.0 + Medium * 1.0 + Heavy * 1.0**
Comments: **traffic - normal; weather - sunny, hot**

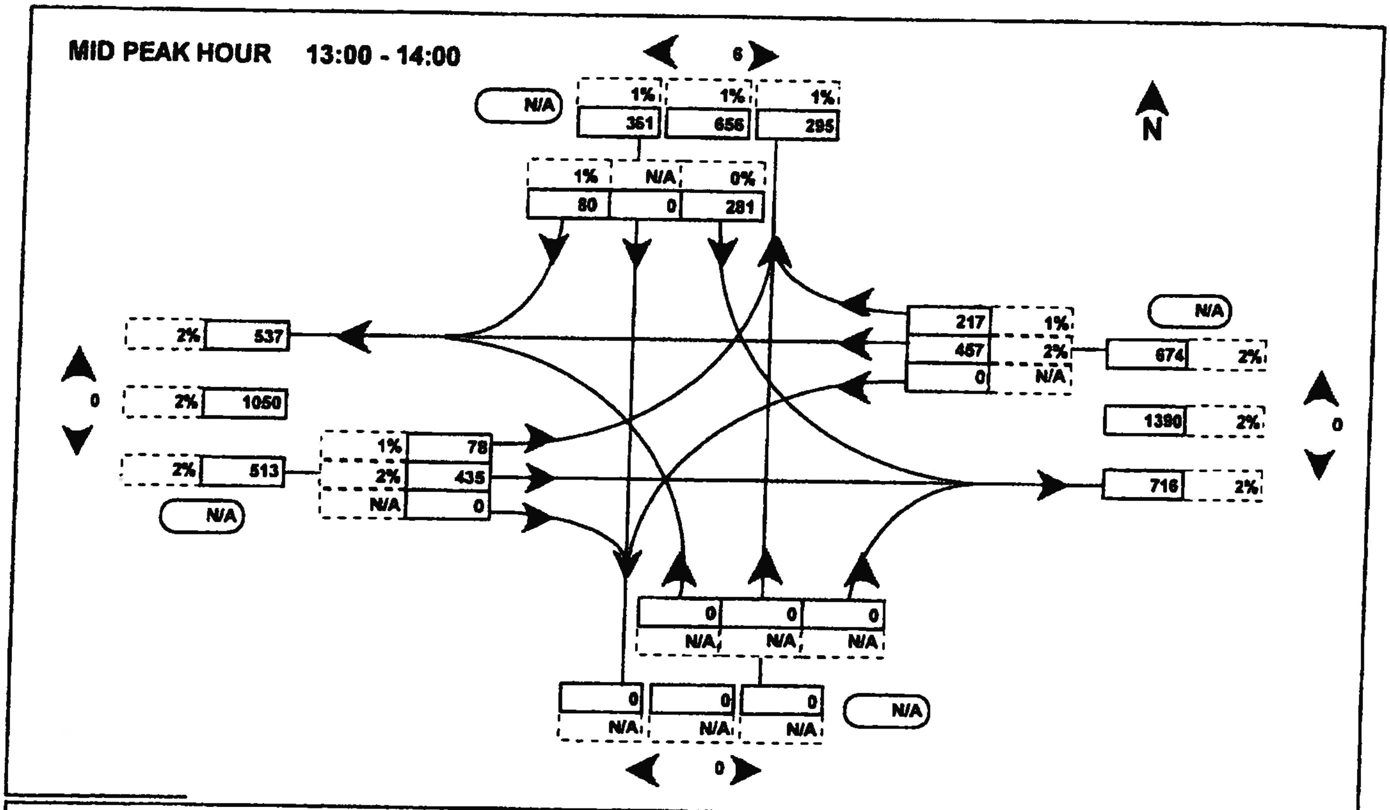
Period	From the North			From the South			From the East			From the West			Approach
Ending	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Total
13:15	22	0	70	0	0	0	57	114	0	0	119	18	400
13:30	21	0	89	0	0	0	48	109	0	0	100	14	361
13:45	18	0	65	0	0	0	54	114	0	0	99	22	372
14:00	19	0	77	0	0	0	58	120	0	0	117	24	415
14:15	15	0	57	0	0	0	53	112	0	0	87	15	339
14:30	26	0	57	0	0	0	58	95	0	0	114	19	369
14:45	24	0	64	0	0	0	57	94	0	0	101	28	368
15:00	17	0	53	0	0	0	65	101	0	0	92	25	353
TOTAL	162	0	512	0	0	0	450	859	0	0	829	165	2977
AM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0
MID PEAK	80	0	281	0	0	0	217	457	0	0	435	78	1548
PM PEAK	0	0	0	0	0	0	0	0	0	0	0	0	0
FORCED P	73	0	268	0	0	0	213	455	0	0	403	75	1487

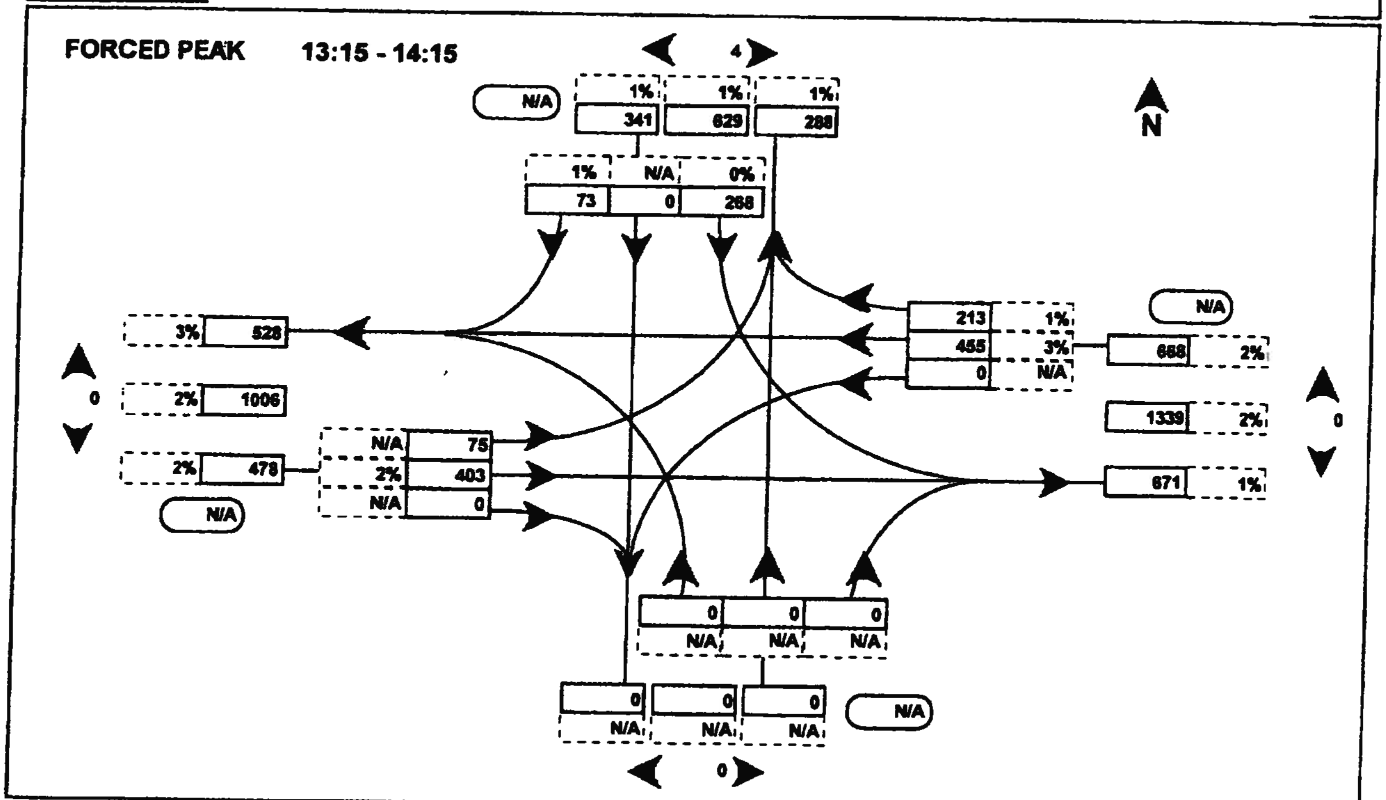
Hour Ending	Approach Total
13:15	n/a
13:30	n/a
13:45	n/a
14:00	1548
14:15	1487
14:30	1495
14:45	1491
15:00	1429
15:00	2977
:	0
14:00	1548
:	0
14:15	1487

BA Consulting Group **Intersection Count Database**

Intersection: **WELLINGTON AVE, IMPERIAL RD**
Date of Count: **Saturday, June 11, 05**
Source: **BA Group**
Veh & PCU used: **Cars * 1.0 + Medium * 1.0 + Heavy * 1.0**
Comments: traffic - normal; weather - sunny, hot

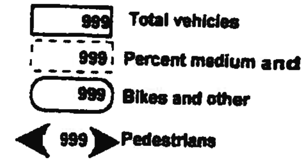
999 Total vehicles
999 Percent medium and h
999 Bikes and other
999 Pedestrians

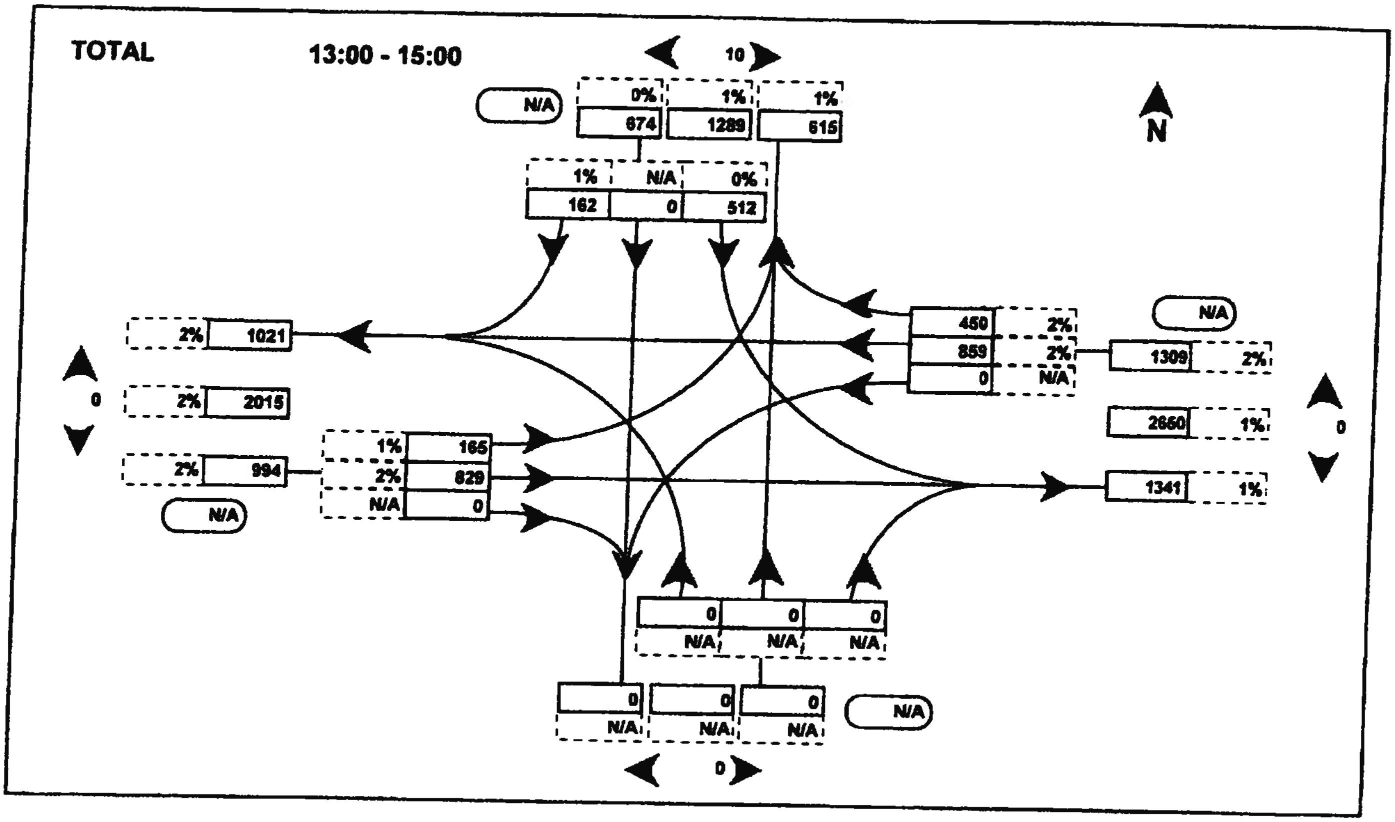




BA Consulting Group **Intersection Count Database**

Intersection: WELLINGTON AVE, IMPERIAL RD
Date of Count: Saturday, June 11, 05
Source: BA Group
Veh & PCU used: Cars * 1.0 + Medium * 1.0 + Heavy * 1.0
Comments: traffic - normal; weather - sunny, hot





SILVERCREEK - GUELPH DEVELOPMENT
WEEKDAY PM EXISTING TRAFFIC COMPARISON

HANLON EXPRESSWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	100	90	-10	
	T	310	310	0	
	R	160	165	5	
NB	L	280	215	-65	
	T	1155	895	-260	
	R	260	220	-40	
WB	L	275	185	-90	
	T	360	440	80	
	R	55	35	-20	
SB	L	85	45	-40	
	T	1230	1000	-230	
	R	80	60	-20	
EB	TOTAL	570	565	-5	-0.9%
NB	TOTAL	1695	1330	-365	-27.4%
WB	TOTAL	690	660	-30	-4.5%
SB	TOTAL	1395	1105	-290	-26.2%
GRAND	TOTAL	4350	3660	-690	-18.9%

SILVERCREEK PARKWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	290	265	-25	
	T	365	325	-40	
	R	0	5	5	
NB	L	0	2	2	
	T	0	5	5	
	R	0	0	0	
WB	L	0	1	1	
	T	340	315	-25	
	R	185	175	-10	
SB	L	235	245	10	
	T	0	1	1	
	R	350	340	-10	
EB	TOTAL	655	595	-60	-10.1%
NB	TOTAL	0	7	7	100.0%
WB	TOTAL	525	491	-34	-6.9%
SB	TOTAL	585	586	1	0.2%
GRAND	TOTAL	1765	1679	-86	-5.1%

EDINBURGH RD / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	135	85	-50	
	T	340	270	-70	
	R	80	85	5	
NB	L	110	75	-35	
	T	605	500	-105	
	R	30	35	5	
WB	L	40	40	0	
	T	325	325	0	
	R	55	60	5	
SB	L	85	80	-5	
	T	555	530	-25	
	R	70	70	0	
EB	TOTAL	555	440	-115	-26.1%
NB	TOTAL	745	610	-135	-22.1%
WB	TOTAL	420	425	5	1.2%
SB	TOTAL	710	680	-30	-4.4%
GRAND	TOTAL	2430	2155	-275	-12.8%

EDINBURGH RD / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	55	60	5	
	T	220	155	-65	
	R	35	40	5	
NB	L	45	60	15	
	T	660	710	50	
	R	65	60	-5	
WB	L	105	115	10	
	T	270	235	-35	
	R	60	75	15	
SB	L	40	60	20	
	T	685	685	0	
	R	35	60	25	
EB	TOTAL	310	255	-55	-21.6%
NB	TOTAL	770	830	60	7.2%
WB	TOTAL	435	425	-10	-2.4%
SB	TOTAL	760	805	45	5.6%
GRAND	TOTAL	2275	2315	40	1.7%

EDINBURGH RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	50	35	-15	
	T	545	430	-115	
	R	135	130	-5	
NB	L	135	135	0	
	T	645	765	120	
	R	155	230	75	
WB	L	225	295	70	
	T	740	640	-100	
	R	75	30	-45	
SB	L	50	30	-20	
	T	710	715	5	
	R	65	45	-20	
EB	TOTAL	730	595	-135	-22.7%
NB	TOTAL	935	1130	195	17.3%
WB	TOTAL	1040	965	-75	-7.8%
SB	TOTAL	825	790	-35	-4.4%
GRAND	TOTAL	3530	3480	-50	-1.4%

SILVERCREEK PARKWAY / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	15	10	-5	
	R	35	15	-20	
NB	L	40	25	-15	
	T	0	0	0	
	R	295	260	-35	
WB	L	330	190	-140	
	T	20	10	-10	
	R	0	0	0	
SB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
EB	TOTAL	50	25	-25	-100.0%
NB	TOTAL	335	285	-50	-17.5%
WB	TOTAL	350	200	-150	-75.0%
SB	TOTAL	0	0	0	0.0%
GRAND	TOTAL	735	510	-225	-44.1%

HANLON EXPRESSWAY NB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	125	165	40	
	T	640	585	-55	
	R	0	0	0	
NB	L	275	295	20	
	T	115	85	-30	
	R	75	105	30	
WB	L	0	0	0	
	T	845	760	-85	
	R	95	10	-85	
SB	L	15	5	-10	
	T	0	0	0	
	R	350	200	-150	
EB	TOTAL	765	750	-15	-2.0%
NB	TOTAL	465	485	20	4.1%
WB	TOTAL	940	770	-170	-22.1%
SB	TOTAL	365	205	-160	-78.0%
GRAND	TOTAL	2535	2210	-325	-14.7%

HANLON EXPRESSWAY SB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	865	685	-180	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	1285	965	-320	
	R	0	0	0	
SB	L	115	145	30	
	T	0	0	0	
	R	80	140	60	
EB	TOTAL	865	685	-180	-26.3%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	1285	965	-320	-33.2%
SB	TOTAL	195	285	90	31.6%
GRAND	TOTAL	2345	1935	-410	-21.2%

IMPERIAL RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	105	95	-10	
	T	710	695	-15	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	1055	730	-325	
	R	310	360	50	
SB	L	385	305	-80	
	T	0	0	0	
	R	35	125	90	
EB	TOTAL	815	790	-25	-3.2%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	1365	1090	-275	-25.2%
SB	TOTAL	420	430	10	2.3%
GRAND	TOTAL	2600	2310	-290	-12.6%

	YR 2005	YR 2009	Change	% Change
NETWORK TOTAL	22155	17909	-1901	-10.6%

SILVERCREEK - GUELPH DEVELOPMENT
SATURDAY EXISTING TRAFFIC COMPARISON

HANLON EXPRESSWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	100	125	25	
	T	310	255	-55	
	R	80	70	-10	
NB	L	150	205	55	
	T	925	870	-55	
	R	170	145	-25	
WB	L	195	175	-20	
	T	300	270	-30	
	R	35	30	-5	
SB	L	30	30	0	
	T	970	835	-135	
	R	90	105	15	
EB	TOTAL	490	450	-40	-8.9%
NB	TOTAL	1245	1220	-25	-2.0%
WB	TOTAL	530	475	-55	-11.6%
SB	TOTAL	1090	970	-120	-12.4%
GRAND	TOTAL	3355	3115	-240	-7.7%

SILVERCREEK PARKWAY / PAISLEY RD

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	250	180	-70	
	T	260	235	-25	
	R	0	0	0	
NB	L	0	1	1	
	T	0	1	1	
	R	0	5	5	
WB	L	0	2	2	
	T	285	230	-55	
	R	155	145	-10	
SB	L	250	215	-35	
	T	5	2	-3	
	R	245	230	-15	
EB	TOTAL	510	415	-95	-22.9%
NB	TOTAL	0	7	7	100.0%
WB	TOTAL	440	377	-63	-16.7%
SB	TOTAL	500	447	-53	-11.9%
GRAND	TOTAL	1450	1246	-204	-16.4%

EDINBURGH RD / PAISLEY RD

Direction	Movement	YR 2008	YR 2008	Change	% Change
EB	L	70	70	0	
	T	245	245	0	
	R	85	85	0	
NB	L	60	60	0	
	T	515	515	0	
	R	35	35	0	
WB	L	50	50	0	
	T	200	200	0	
	R	45	45	0	
SB	L	50	50	0	
	T	485	485	0	
	R	70	70	0	
EB	TOTAL	400	400	0	0.0%
NB	TOTAL	610	610	0	0.0%
WB	TOTAL	295	295	0	0.0%
SB	TOTAL	605	605	0	0.0%
GRAND	TOTAL	1910	1910	0	0.0%

EDINBURGH RD / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	35	45	10	
	T	85	85	0	
	R	55	30	-25	
NB	L	20	25	5	
	T	470	470	0	
	R	65	50	-15	
WB	L	75	75	0	
	T	125	75	-50	
	R	25	30	5	
SB	L	30	30	0	
	T	515	510	-5	
	R	20	25	5	
EB	TOTAL	175	160	-15	-9.4%
NB	TOTAL	555	545	-10	-1.8%
WB	TOTAL	225	180	-45	-25.0%
SB	TOTAL	565	565	0	0.0%
GRAND	TOTAL	1520	1450	-70	-4.8%

EDINBURGH RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	35	20	-15	
	T	465	340	-125	
	R	90	75	-15	
NB	L	115	95	-20	
	T	480	530	50	
	R	170	175	5	
WB	L	195	200	5	
	T	425	365	-60	
	R	40	55	15	
SB	L	60	45	-15	
	T	540	585	45	
	R	45	50	5	
EB	TOTAL	590	435	-155	-35.6%
NB	TOTAL	765	800	35	4.4%
WB	TOTAL	660	620	-40	-6.5%
SB	TOTAL	645	680	35	5.1%
GRAND	TOTAL	2660	2535	-125	-4.9%

SILVERCREEK PARKWAY / WATERLOO AVE

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	20	10	-10	
	R	15	15	0	
NB	L	30	25	-5	
	T	0	0	0	
	R	155	130	-25	
WB	L	145	145	0	
	T	20	15	-5	
	R	0	0	0	
SB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
EB	TOTAL	35	25	-10	-40.0%
NB	TOTAL	185	155	-30	-19.4%
WB	TOTAL	165	160	-5	-3.1%
SB	TOTAL	0	0	0	0.0%
GRAND	TOTAL	385	340	-45	-13.2%

HANLON EXPRESSWAY NB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	95	95	0	
	T	495	400	-95	
	R	0	0	0	
NB	L	190	225	35	
	T	65	45	-20	
	R	95	65	-30	
WB	L	0	0	0	
	T	560	480	-80	
	R	25	10	-15	
SB	L	0	2	2	
	T	0	0	0	
	R	160	160	0	
EB	TOTAL	590	495	-95	-19.2%
NB	TOTAL	350	335	-15	-4.5%
WB	TOTAL	585	490	-95	-19.4%
SB	TOTAL	160	162	2	1.2%
GRAND	TOTAL	1685	1482	-203	-13.7%

HANLON EXPRESSWAY SB OFF RAMP / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	0	0	0	
	T	480	435	-45	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	625	640	15	
	R	0	0	0	
SB	L	145	100	-45	
	T	0	0	0	
	R	110	80	-30	
EB	TOTAL	480	435	-45	-10.3%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	625	640	15	2.3%
SB	TOTAL	255	180	-75	-41.7%
GRAND	TOTAL	1360	1255	-105	-8.4%

IMPERIAL RD / WELLINGTON ST

Direction	Movement	YR 2005	YR 2009	Change	% Change
EB	L	80	70	-10	
	T	480	355	-125	
	R	0	0	0	
NB	L	0	0	0	
	T	0	0	0	
	R	0	0	0	
WB	L	0	0	0	
	T	500	420	-80	
	R	235	225	-10	
SB	L	305	285	-20	
	T	0	0	0	
	R	80	80	0	
EB	TOTAL	560	425	-135	-31.8%
NB	TOTAL	0	0	0	0.0%
WB	TOTAL	735	645	-90	-14.0%
SB	TOTAL	385	365	-20	-5.5%
GRAND	TOTAL	1680	1435	-245	-17.1%

	YR 2005	YR 2009	Change	% Change
NETWORK TOTAL	15900	13408	-1132	-8.4%

APPENDIX C

Capacity Analysis Results

Existing Traffic Conditions

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	15	35	330	20	40	295
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	38	359	22	43	321
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						8
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			54		755	16
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			54		755	16
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			77		85	70
cM capacity (veh/h)			1551		289	1063

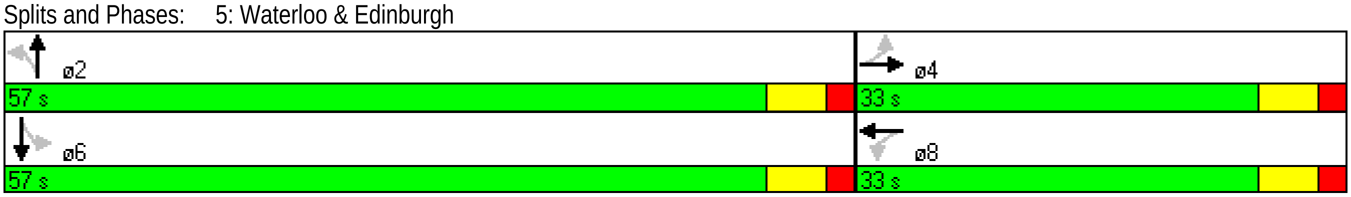
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	16	38	359	22	364
Volume Left	0	0	359	0	43
Volume Right	0	38	0	0	321
cSH	1700	1700	1551	1700	1207
Volume to Capacity	0.01	0.02	0.23	0.01	0.30
Queue Length 95th (m)	0.0	0.0	6.3	0.0	9.0
Control Delay (s)	0.0	0.0	8.0	0.0	11.0
Lane LOS			A		B
Approach Delay (s)	0.0		7.6		11.0
Approach LOS					B

Intersection Summary			
Average Delay	8.6		
Intersection Capacity Utilization	34.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	55	220	105	270	45	660	40	685
Lane Group Flow (vph)	60	277	114	358	49	788	43	783
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	57.0	57.0	57.0	57.0
Total Split (s)	33.0	33.0	33.0	33.0	57.0	57.0	57.0	57.0
Total Split (%)	36.7%	36.7%	36.7%	36.7%	63.3%	63.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.47	0.59	0.61	0.77	0.17	0.68	0.16	0.66
Control Delay	39.9	33.1	43.3	41.0	3.7	14.3	10.0	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.9	33.1	43.3	41.0	3.7	14.3	10.0	14.6
Queue Length 50th (m)	8.0	37.0	15.9	50.4	0.7	58.7	2.6	71.8
Queue Length 95th (m)	18.6	55.4	30.7	73.5	m2.1	75.2	8.1	122.9
Internal Link Dist (m)		993.8		241.7		111.7		775.8
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	155	569	226	564	284	1162	275	1195
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.49	0.50	0.63	0.17	0.68	0.16	0.66

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 6 (7%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh



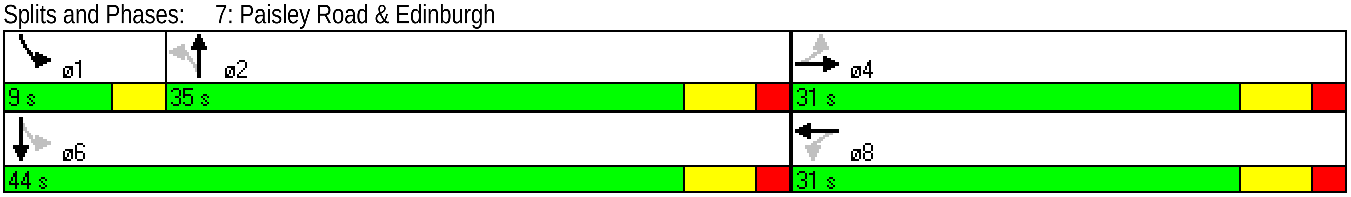
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	220	35	105	270	60	45	660	65	40	685	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.97	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.97		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1751	1809		1709	1783		1798	1831		1760	1883	
Flt Permitted	0.27	1.00		0.41	1.00		0.24	1.00		0.23	1.00	
Satd. Flow (perm)	499	1809		729	1783		449	1831		434	1883	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	239	38	114	293	65	49	717	71	43	745	38
RTOR Reduction (vph)	0	7	0	0	10	0	0	3	0	0	2	0
Lane Group Flow (vph)	60	270	0	114	348	0	49	785	0	43	781	0
Confl. Peds. (#/hr)	10		25	25		10	16		22	22		16
Heavy Vehicles (%)	2%	2%	0%	2%	3%	2%	0%	2%	2%	2%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	22.0	22.0		22.0	22.0		56.0	56.0		56.0	56.0	
Effective Green, g (s)	23.0	23.0		23.0	23.0		57.0	57.0		57.0	57.0	
Actuated g/C Ratio	0.26	0.26		0.26	0.26		0.63	0.63		0.63	0.63	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	128	462		186	456		284	1160		275	1193	
v/s Ratio Prot		0.15			c0.20			c0.43			0.41	
v/s Ratio Perm	0.12			0.16			0.11			0.10		
v/c Ratio	0.47	0.59		0.61	0.76		0.17	0.68		0.16	0.65	
Uniform Delay, d1	28.3	29.3		29.6	31.0		6.8	10.6		6.7	10.3	
Progression Factor	1.00	1.00		1.00	1.00		0.28	0.94		1.00	1.00	
Incremental Delay, d2	2.7	1.9		5.9	7.4		1.2	2.9		1.2	2.8	
Delay (s)	31.0	31.2		35.4	38.4		3.1	12.9		7.9	13.1	
Level of Service	C	C		D	D		A	B		A	B	
Approach Delay (s)		31.2			37.7			12.3			12.9	
Approach LOS		C			D			B			B	

Intersection Summary			
HCM Average Control Delay	19.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	135	340	40	325	110	605	85	555
Lane Group Flow (vph)	147	457	43	413	120	691	92	679
Turn Type	Perm		Perm		Perm		pm+pt	
Protected Phases		4		8		2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	31.0	31.0	31.0	31.0	35.0	35.0	8.0	35.0
Total Split (s)	31.0	31.0	31.0	31.0	35.0	35.0	9.0	44.0
Total Split (%)	41.3%	41.3%	41.3%	41.3%	46.7%	46.7%	12.0%	58.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	2.0	5.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	None	C-Max
v/c Ratio	0.91	0.80	0.33	0.73	0.43	0.80	0.29	0.65
Control Delay	68.5	26.7	26.8	30.4	22.3	28.9	9.7	15.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.5	26.7	26.8	30.4	22.3	28.9	9.7	15.8
Queue Length 50th (m)	13.4	39.8	4.1	44.4	11.3	82.6	4.9	58.7
Queue Length 95th (m)	#44.2	56.9	11.8	69.8	26.3	#143.6	10.5	96.0
Internal Link Dist (m)		1215.6		159.3		775.8		235.3
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	184	646	146	639	281	863	319	1044
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.80	0.71	0.29	0.65	0.43	0.80	0.29	0.65

Intersection Summary
Cycle Length: 75
Actuated Cycle Length: 75
Offset: 71 (95%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7: Paisley Road & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	135	340	80	40	325	55	110	605	30	85	555	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		2.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1800	1831		1805	1820		1787	1869		1805	1852	
Flt Permitted	0.28	1.00		0.22	1.00		0.33	1.00		0.15	1.00	
Satd. Flow (perm)	533	1831		422	1820		612	1869		286	1852	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	147	370	87	43	353	60	120	658	33	92	603	76
RTOR Reduction (vph)	0	12	0	0	8	0	0	2	0	0	6	0
Lane Group Flow (vph)	147	445	0	43	405	0	120	689	0	92	673	0
Confl. Peds. (#/hr)	4					4						
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	1%	1%	0%	0%	1%	0%
Turn Type	Perm			Perm			Perm			pm+pt		
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	21.9	21.9		21.9	21.9		33.0	33.0		41.1	41.1	
Effective Green, g (s)	22.9	22.9		22.9	22.9		34.0	34.0		42.1	42.1	
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.45	0.45		0.56	0.56	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		3.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	163	559		129	556		277	847		284	1040	
v/s Ratio Prot		0.24			0.22			c0.37		0.03	c0.36	
v/s Ratio Perm	c0.28			0.10			0.20			0.16		
v/c Ratio	0.90	0.80		0.33	0.73		0.43	0.81		0.32	0.65	
Uniform Delay, d1	25.0	23.9		20.1	23.3		13.9	17.8		11.5	11.3	
Progression Factor	0.73	0.71		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	40.7	7.1		1.5	4.7		4.9	8.4		0.7	3.1	
Delay (s)	58.8	24.2		21.7	28.0		18.8	26.2		12.1	14.5	
Level of Service	E	C		C	C		B	C		B	B	
Approach Delay (s)		32.6			27.4			25.1			14.2	
Approach LOS		C			C			C			B	

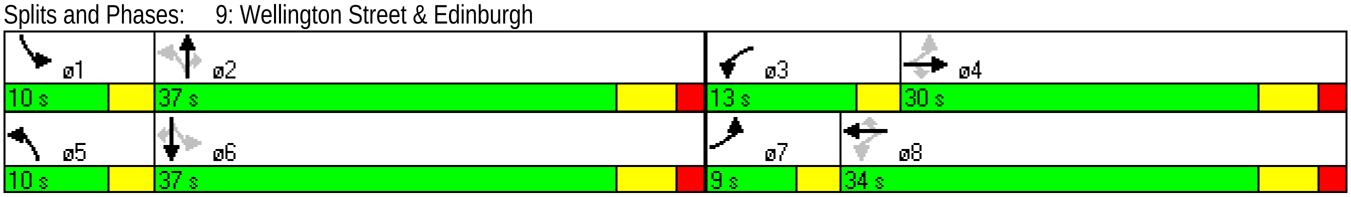
Intersection Summary			
HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	84.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	545	135	225	740	75	135	645	155	50	710	65
Lane Group Flow (vph)	54	592	147	245	804	82	147	701	168	54	772	71
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Minimum Split (s)	9.0	30.0	30.0	9.0	30.0	30.0	9.0	37.0	37.0	9.0	37.0	37.0
Total Split (s)	9.0	30.0	30.0	13.0	34.0	34.0	10.0	37.0	37.0	10.0	37.0	37.0
Total Split (%)	10.0%	33.3%	33.3%	14.4%	37.8%	37.8%	11.1%	41.1%	41.1%	11.1%	41.1%	41.1%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes				Yes	Yes		Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.21	0.70	0.29	0.69	0.74	0.15	0.43	0.48	0.23	0.14	0.57	0.11
Control Delay	16.4	35.4	6.1	27.7	32.5	6.0	15.9	22.3	7.1	13.9	23.9	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.4	35.4	6.1	27.7	32.5	6.0	15.9	22.3	7.1	13.9	23.9	8.8
Queue Length 50th (m)	4.7	43.9	0.0	24.2	59.7	0.0	11.9	45.5	4.0	3.1	38.5	0.2
Queue Length 95th (m)	10.5	59.3	12.1	38.6	77.8	8.5	21.7	61.9	16.0	m8.0	63.4	m5.9
Internal Link Dist (m)		464.5			263.2			253.7			89.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	255	937	555	356	1122	573	343	1461	716	391	1363	639
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.63	0.26	0.69	0.72	0.14	0.43	0.48	0.23	0.14	0.57	0.11

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 8 (9%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	545	135	225	740	75	135	645	155	50	710	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3374	1615	1787	3471	1599	1769	3574	1563	1768	3574	1562
Flt Permitted	0.21	1.00	1.00	0.24	1.00	1.00	0.22	1.00	1.00	0.30	1.00	1.00
Satd. Flow (perm)	407	3374	1615	453	3471	1599	419	3574	1563	565	3574	1562
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	592	147	245	804	82	147	701	168	54	772	71
RTOR Reduction (vph)	0	0	109	0	0	56	0	0	78	0	0	44
Lane Group Flow (vph)	54	592	38	245	804	26	147	701	90	54	772	27
Confl. Peds. (#/hr)							2		12	12		2
Heavy Vehicles (%)	0%	7%	0%	1%	4%	1%	2%	1%	1%	2%	1%	2%
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	26.9	22.1	22.1	35.0	27.2	27.2	41.9	34.6	34.6	38.1	32.7	32.7
Effective Green, g (s)	28.9	23.1	23.1	36.0	28.2	28.2	43.9	35.6	35.6	40.1	33.7	33.7
Actuated g/C Ratio	0.32	0.26	0.26	0.40	0.31	0.31	0.49	0.40	0.40	0.45	0.37	0.37
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	221	866	415	343	1088	501	329	1414	618	337	1338	585
v/s Ratio Prot	0.02	0.18		c0.09	c0.23		c0.04	0.20		0.01	c0.22	
v/s Ratio Perm	0.06		0.02	0.20		0.02	0.18		0.06	0.06		0.02
v/c Ratio	0.24	0.68	0.09	0.71	0.74	0.05	0.45	0.50	0.15	0.16	0.58	0.05
Uniform Delay, d1	21.9	30.2	25.5	19.7	27.6	21.6	14.1	20.5	17.4	14.6	22.5	17.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.15	0.99	1.62
Incremental Delay, d2	0.6	2.2	0.1	6.9	2.7	0.0	1.0	1.2	0.5	0.2	1.4	0.1
Delay (s)	22.4	32.4	25.6	26.6	30.3	21.6	15.1	21.7	17.9	17.0	23.6	29.2
Level of Service	C	C	C	C	C	C	B	C	B	B	C	C
Approach Delay (s)		30.5			28.9			20.1			23.6	
Approach LOS		C			C			C			C	

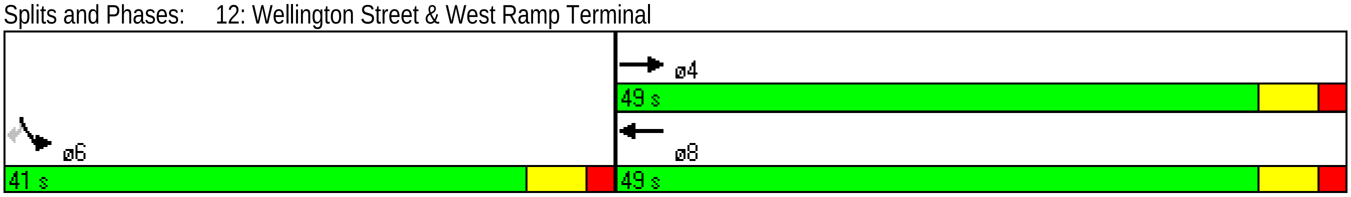
Intersection Summary			
HCM Average Control Delay	25.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	865	1285	115	80
Lane Group Flow (vph)	940	1397	125	87
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	37.0	37.0	24.0	24.0
Total Split (s)	49.0	49.0	41.0	41.0
Total Split (%)	54.4%	54.4%	45.6%	45.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.27	0.39	0.26	0.38
Control Delay	4.0	4.6	25.3	24.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	4.0	4.6	25.3	24.0
Queue Length 50th (m)	10.8	18.1	6.2	6.4
Queue Length 95th (m)	18.6	29.7	12.1	16.6
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3543	3578	1813	787
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.27	0.39	0.07	0.11

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 66.6
Natural Cycle: 65
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	865	1285	0	115	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5036	5085		3335	1429
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5036	5085		3335	1429
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	940	1397	0	125	87
RTOR Reduction (vph)	0	0	0	0	0	19
Lane Group Flow (vph)	0	940	1397	0	125	68
Heavy Vehicles (%)	0%	3%	2%	0%	5%	13%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		45.9	45.9		8.7	8.7
Effective Green, g (s)		46.9	46.9		9.7	9.7
Actuated g/C Ratio		0.70	0.70		0.15	0.15
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3546	3581		486	208
v/s Ratio Prot		0.19	c0.27		0.04	
v/s Ratio Perm						c0.05
v/c Ratio		0.27	0.39		0.26	0.33
Uniform Delay, d1		3.6	4.0		25.3	25.5
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.2	0.3		0.3	0.9
Delay (s)		3.8	4.3		25.5	26.5
Level of Service		A	A		C	C
Approach Delay (s)		3.8	4.3		25.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	5.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	66.6	Sum of lost time (s)	10.0
Intersection Capacity Utilization	38.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBL	NBT	NBR	SBL	SBR
Lane Configurations								
Volume (vph)	125	640	845	275	115	75	15	350
Lane Group Flow (vph)	136	696	1021	209	215	82	16	380
Turn Type	pm+pt			Split		Perm	custom	custom
Protected Phases	7	4	8	2	2			
Permitted Phases	4					2	6	6
Detector Phase	7	4	8	2	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	14.0	39.0	25.0	27.0	27.0	27.0	24.0	24.0
Total Split (%)	15.6%	43.3%	27.8%	30.0%	30.0%	30.0%	26.7%	26.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag					
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	None	None	None	None	None
v/c Ratio	0.35	0.31	0.77	0.61	0.60	0.21	0.10	0.75
Control Delay	15.8	15.3	31.7	36.4	35.4	8.1	30.3	16.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.8	15.3	31.7	36.4	35.4	8.1	30.3	16.7
Queue Length 50th (m)	8.9	19.5	43.1	25.6	26.4	0.0	1.9	6.2
Queue Length 95th (m)	24.3	37.7	#80.4	50.9	51.8	9.6	6.9	31.8
Internal Link Dist (m)		55.6	264.6		261.7			
Turn Bay Length (m)	120.0					170.0		
Base Capacity (vph)	390	2238	1329	483	510	513	297	645
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.31	0.77	0.43	0.42	0.16	0.05	0.59

Intersection Summary

Cycle Length: 90

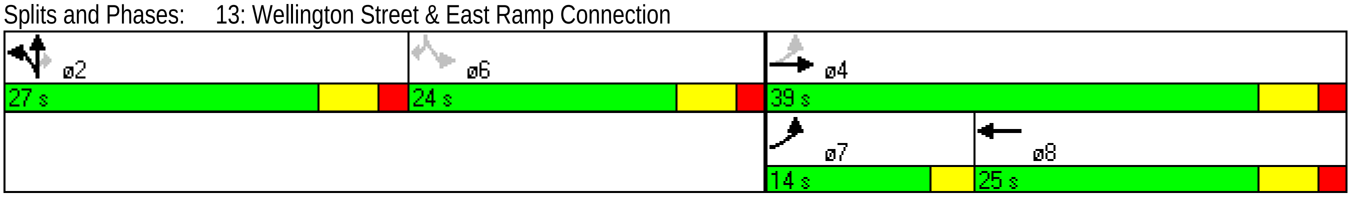
Actuated Cycle Length: 76.1

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

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

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	640	0	0	845	95	275	115	75	15	0	350
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0			5.0		5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.91			0.91		0.95	0.95	1.00	1.00		1.00
Frt	1.00	1.00			0.98		1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	0.98	1.00	0.95		1.00
Satd. Flow (prot)	1752	4940			4931		1649	1739	1553	1805		1583
Flt Permitted	0.18	1.00			1.00		0.95	0.98	1.00	0.62		1.00
Satd. Flow (perm)	331	4940			4931		1649	1739	1553	1173		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	136	696	0	0	918	103	299	125	82	16	0	380
RTOR Reduction (vph)	0	0	0	0	15	0	0	0	65	0	0	281
Lane Group Flow (vph)	136	696	0	0	1006	0	209	215	17	16	0	99
Heavy Vehicles (%)	3%	5%	10%	0%	4%	0%	4%	0%	4%	0%	0%	2%
Turn Type	pm+pt						Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4								2	6		6
Actuated Green, G (s)	33.5	33.5			19.3		14.7	14.7	14.7	9.7		9.7
Effective Green, g (s)	34.5	34.5			20.3		15.7	15.7	15.7	10.7		10.7
Actuated g/C Ratio	0.45	0.45			0.27		0.21	0.21	0.21	0.14		0.14
Clearance Time (s)	3.0	6.0			6.0		6.0	6.0	6.0	6.0		6.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	379	2245			1319		341	360	321	165		223
v/s Ratio Prot	c0.06	0.14			c0.20		c0.13	0.12				
v/s Ratio Perm	0.11								0.01	0.01		c0.06
v/c Ratio	0.36	0.31			0.76		0.61	0.60	0.05	0.10		0.44
Uniform Delay, d1	13.3	13.1			25.6		27.3	27.2	24.1	28.4		29.9
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	2.6	0.4			4.2		3.2	2.7	0.1	0.3		1.4
Delay (s)	16.0	13.5			29.8		30.6	29.9	24.2	28.6		31.3
Level of Service	B	B			C		C	C	C	C		C
Approach Delay (s)		13.9			29.8			29.3			31.2	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM Average Control Delay	25.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	75.9	Sum of lost time (s)	17.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			303							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	6.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	865	230	0	1365	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	940	250	0	1484	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked					0.89	
vC, conflicting volume			940		1560	438
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			940		1210	438
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			725		156	566

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	376	376	438	495	495	495
Volume Left	0	0	0	0	0	0
Volume Right	0	0	250	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.22	0.22	0.26	0.29	0.29	0.29
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	29.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	105	710	1055	385	35
Lane Group Flow (vph)	114	772	1484	418	38
Turn Type	Perm				Perm
Protected Phases		4	8	6	
Permitted Phases	4			6	6
Detector Phase	4	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	7.0	7.0
Minimum Split (s)	41.0	41.0	41.0	24.0	24.0
Total Split (s)	46.0	46.0	46.0	24.0	24.0
Total Split (%)	65.7%	65.7%	65.7%	34.3%	34.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Max	C-Max	C-Max	None	None
v/c Ratio	0.99	0.73	0.74	0.87	0.09
Control Delay	105.6	15.5	12.6	45.1	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	105.6	15.5	12.6	45.1	7.8
Queue Length 50th (m)	12.2	60.3	57.7	47.8	0.0
Queue Length 95th (m)	#27.4	97.9	79.7	#90.0	5.7
Internal Link Dist (m)		188.7	176.0	303.2	
Turn Bay Length (m)	100.0				
Base Capacity (vph)	115	1063	2010	485	412
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.99	0.73	0.74	0.86	0.09

Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 25: Wellington Street & Imperial Road

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	105	710	1055	310	385	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1804	1810	3357		1787	1417
Flt Permitted	0.10	1.00	1.00		0.95	1.00
Satd. Flow (perm)	195	1810	3357		1787	1417
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	772	1147	337	418	38
RTOR Reduction (vph)	0	0	39	0	0	28
Lane Group Flow (vph)	114	772	1445	0	418	10
Confl. Peds. (#/hr)	4			4		
Heavy Vehicles (%)	0%	5%	4%	1%	1%	14%
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)	40.1	40.1	40.1		17.9	17.9
Effective Green, g (s)	41.1	41.1	41.1		18.9	18.9
Actuated g/C Ratio	0.59	0.59	0.59		0.27	0.27
Clearance Time (s)	6.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	114	1063	1971		482	383
v/s Ratio Prot		0.43	0.43		c0.23	
v/s Ratio Perm	c0.58					0.01
v/c Ratio	1.00	0.73	0.73		0.87	0.03
Uniform Delay, d1	14.4	10.4	10.5		24.4	18.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	84.3	4.3	2.5		16.3	0.1
Delay (s)	98.7	14.7	12.9		40.7	18.8
Level of Service	F	B	B		D	B
Approach Delay (s)		25.5	12.9		38.9	
Approach LOS		C	B		D	

Intersection Summary			
HCM Average Control Delay	21.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			80			
pX, platoon unblocked						
vC, conflicting volume	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				1023	1084

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0				0.0		
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	6.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations										
Volume (vph)	100	310	160	275	360	280	1155	260	85	1230
Lane Group Flow (vph)	0	446	174	299	451	304	1255	283	92	1424
Turn Type	Perm		Perm	pm+pt		Prot		Perm	Prot	
Protected Phases		4		3	8	5	2		1	6
Permitted Phases	4		4	8				2		
Detector Phase	4	4	4	3	8	5	2	2	1	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	35.0	35.0	35.0	9.0	35.0	9.0	57.0	57.0	9.0	57.0
Total Split (s)	35.0	35.0	35.0	9.0	35.0	19.0	60.0	60.0	16.0	57.0
Total Split (%)	29.2%	29.2%	29.2%	7.5%	29.2%	15.8%	50.0%	50.0%	13.3%	47.5%
Yellow Time (s)	5.5	5.5	5.5	3.0	5.5	3.0	4.5	4.5	3.0	4.5
All-Red Time (s)	1.5	1.5	1.5	1.0	1.5	1.0	2.5	2.5	1.0	2.5
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	6.0	6.0	6.0	3.0	6.0	3.0	6.0	6.0	3.0	6.0
Lead/Lag	Lag	Lag	Lag	Lead		Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
v/c Ratio		0.79	0.36	1.25	0.44	1.05	0.74	0.33	0.54	0.96
Control Delay		54.8	7.6	175.2	34.6	115.4	28.8	9.9	63.7	49.5
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		54.8	7.6	175.2	34.6	115.4	28.8	9.9	63.7	49.5
Queue Length 50th (m)		47.6	0.0	~65.9	39.7	~76.8	116.0	15.4	19.2	154.7
Queue Length 95th (m)		63.4	15.8	#119.0	52.4	#133.0	147.1	34.0	34.6	#201.1
Internal Link Dist (m)		119.0			60.2		598.1			186.2
Turn Bay Length (m)			40.0	45.0		95.0		40.0	75.0	
Base Capacity (vph)		639	516	239	1109	290	1701	861	192	1482
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		0.70	0.34	1.25	0.41	1.05	0.74	0.33	0.48	0.96

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated

~ 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.

Splits and Phases: 35: Paisley Road & Hanlon Pkwy

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	310	160	275	360	55	280	1155	260	85	1230	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes		1.00	0.98	1.00	1.00		1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt		1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3566	1590	1786	3472		1805	3471	1594	1770	3476	
Flt Permitted		0.73	1.00	0.30	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		2644	1590	568	3472		1805	3471	1594	1770	3476	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	337	174	299	391	60	304	1255	283	92	1337	87
RTOR Reduction (vph)	0	0	137	0	11	0	0	0	80	0	4	0
Lane Group Flow (vph)	0	446	37	299	440	0	304	1255	203	92	1420	0
Confl. Peds. (#/hr)	1		3	3		1	2		1	1		2
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	4%	0%	2%	3%	0%
Turn Type	Perm		Perm	pm+pt			Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8					2			
Actuated Green, G (s)		24.7	24.7	33.7	33.7		18.3	57.8	57.8	10.5	50.0	
Effective Green, g (s)		25.7	25.7	34.7	34.7		19.3	58.8	58.8	11.5	51.0	
Actuated g/C Ratio		0.21	0.21	0.29	0.29		0.16	0.49	0.49	0.10	0.42	
Clearance Time (s)		7.0	7.0	4.0	7.0		4.0	7.0	7.0	4.0	7.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		566	341	225	1004		290	1701	781	170	1477	
v/s Ratio Prot				c0.07	0.13		c0.17	0.36		0.05	c0.41	
v/s Ratio Perm		0.17	0.02	c0.32					0.13			
v/c Ratio		0.79	0.11	1.33	0.44		1.05	0.74	0.26	0.54	0.96	
Uniform Delay, d1		44.6	37.9	42.1	34.7		50.3	24.4	17.9	51.7	33.5	
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		7.2	0.1	175.3	0.3		66.1	2.9	0.8	3.5	15.9	
Delay (s)		51.7	38.1	217.4	35.0		116.4	27.3	18.7	55.2	49.4	
Level of Service		D	D	F	D		F	C	B	E	D	
Approach Delay (s)		47.9			107.7			40.7			49.8	
Approach LOS		D			F			D			D	

Intersection Summary			
HCM Average Control Delay	55.2	HCM Level of Service	E
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	103.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Queues
38: Paisley Road & Silvercreek Parkway

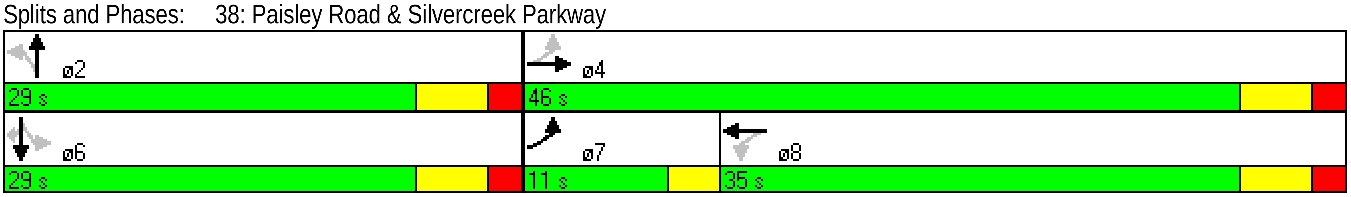
Existing Traffic
Weekday PM Peak Hour

Lane Group	EBL	EBT	WBT	SBL	SBT	SBR	ø2
Lane Configurations							
Volume (vph)	290	365	340	235	0	350	
Lane Group Flow (vph)	315	397	571	0	255	380	
Turn Type	pm+pt			Perm		Perm	
Protected Phases	7	4	8		6		2
Permitted Phases	4			6		6	
Detector Phase	7	4	8	6	6	6	
Switch Phase							
Minimum Initial (s)	8.0	5.0	5.0	7.0	7.0	7.0	7.0
Minimum Split (s)	11.0	35.0	35.0	29.0	29.0	29.0	29.0
Total Split (s)	11.0	46.0	35.0	29.0	29.0	29.0	29.0
Total Split (%)	14.7%	61.3%	46.7%	38.7%	38.7%	38.7%	39%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead		Lag				
Lead-Lag Optimize?							
Recall Mode	None	C-Max	C-Max	None	None	None	None
v/c Ratio	0.67	0.35	0.71		0.70	0.55	
Control Delay	16.4	9.3	14.4		35.4	5.6	
Queue Delay	0.0	0.0	0.0		0.0	0.0	
Total Delay	16.4	9.3	14.4		35.4	5.6	
Queue Length 50th (m)	16.1	24.0	27.8		29.4	0.0	
Queue Length 95th (m)	#39.6	43.7	#59.9		47.8	15.8	
Internal Link Dist (m)		104.3	1215.6		96.7		
Turn Bay Length (m)							
Base Capacity (vph)	467	1144	803		450	770	
Starvation Cap Reductn	0	0	0		0	0	
Spillback Cap Reductn	0	0	0		0	0	
Storage Cap Reductn	0	0	0		0	0	
Reduced v/c Ratio	0.67	0.35	0.71		0.57	0.49	

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 40 (53%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 38: Paisley Road & Silvercreek Parkway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	290	365	0	0	340	185	0	0	0	235	0	350
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	2.0	5.0			5.0						5.0	5.0
Lane Util. Factor	1.00	1.00			1.00						1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00						1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00						1.00	1.00
Frt	1.00	1.00			0.95						1.00	0.85
Flt Protected	0.95	1.00			1.00						0.95	1.00
Satd. Flow (prot)	1735	1881			1772						1764	1599
Flt Permitted	0.24	1.00			1.00						0.76	1.00
Satd. Flow (perm)	434	1881			1772						1406	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	315	397	0	0	370	201	0	0	0	255	0	380
RTOR Reduction (vph)	0	0	0	0	24	0	0	0	0	0	0	282
Lane Group Flow (vph)	315	397	0	0	547	0	0	0	0	0	255	98
Confl. Peds. (#/hr)	2					2			2	2		
Heavy Vehicles (%)	4%	1%	50%	0%	2%	1%	0%	0%	0%	2%	0%	1%
Turn Type	pm+pt			Perm			Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	44.6	44.6			32.0						18.4	18.4
Effective Green, g (s)	45.6	45.6			33.0						19.4	19.4
Actuated g/C Ratio	0.61	0.61			0.44						0.26	0.26
Clearance Time (s)	3.0	6.0			6.0						6.0	6.0
Vehicle Extension (s)	3.0	3.0			3.0						3.0	3.0
Lane Grp Cap (vph)	448	1144			780						364	414
v/s Ratio Prot	c0.10	0.21			c0.31							
v/s Ratio Perm	0.33										c0.18	0.06
v/c Ratio	0.70	0.35			0.70						0.70	0.24
Uniform Delay, d1	10.0	7.3			17.0						25.2	22.0
Progression Factor	1.00	1.00			0.53						1.00	1.00
Incremental Delay, d2	5.0	0.8			4.3						6.0	0.3
Delay (s)	14.9	8.1			13.3						31.2	22.3
Level of Service	B	A			B						C	C
Approach Delay (s)		11.1			13.3			0.0			25.8	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM Average Control Delay	16.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	20	15	145	20	30	155
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	16	158	22	33	168
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						8
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			38		359	22
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			38		359	22
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		94	84
cM capacity (veh/h)			1579		574	1058

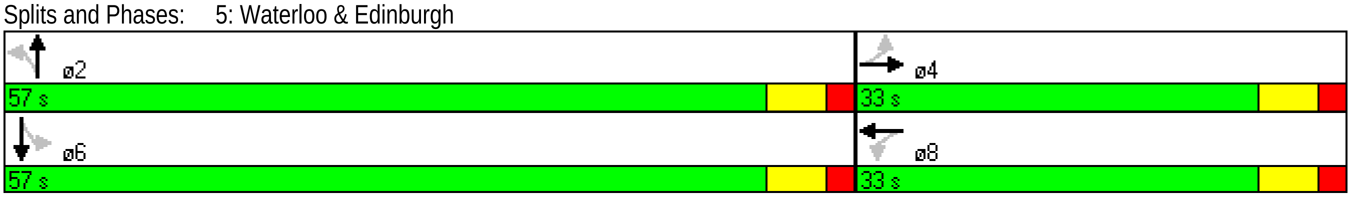
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	22	16	158	22	201
Volume Left	0	0	158	0	33
Volume Right	0	16	0	0	168
cSH	1700	1700	1579	1700	1263
Volume to Capacity	0.01	0.01	0.10	0.01	0.16
Queue Length 95th (m)	0.0	0.0	2.3	0.0	4.0
Control Delay (s)	0.0	0.0	7.5	0.0	9.5
Lane LOS			A		A
Approach Delay (s)	0.0		6.6		9.5
Approach LOS					A

Intersection Summary			
Average Delay	7.4		
Intersection Capacity Utilization	24.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	35	85	75	125	20	470	30	515
Lane Group Flow (vph)	38	152	82	163	22	582	33	582
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	57.0	57.0	57.0	57.0
Total Split (s)	33.0	33.0	33.0	33.0	57.0	57.0	57.0	57.0
Total Split (%)	36.7%	36.7%	36.7%	36.7%	63.3%	63.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.26	0.50	0.51	0.57	0.04	0.43	0.06	0.42
Control Delay	36.1	30.7	45.0	39.5	1.2	4.1	4.6	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.1	30.7	45.0	39.5	1.2	4.1	4.6	6.3
Queue Length 50th (m)	5.4	16.6	12.1	22.5	0.3	24.0	1.2	29.3
Queue Length 95th (m)	12.8	31.0	23.5	37.5	0.9	39.8	4.3	56.1
Internal Link Dist (m)		993.8		241.7		113.7		776.4
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	296	573	323	565	558	1363	558	1372
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.27	0.25	0.29	0.04	0.43	0.06	0.42

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 8 (9%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Splits and Phases: 5: Waterloo & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	85	55	75	125	25	20	470	65	30	515	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.98		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1697	1758		1742	1789		1803	1854		1804	1870	
Flt Permitted	0.53	1.00		0.57	1.00		0.40	1.00		0.40	1.00	
Satd. Flow (perm)	953	1758		1037	1789		762	1854		762	1870	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	92	60	82	136	27	22	511	71	33	560	22
RTOR Reduction (vph)	0	32	0	0	10	0	0	3	0	0	1	0
Lane Group Flow (vph)	38	120	0	82	153	0	22	579	0	33	581	0
Confl. Peds. (#/hr)	2		3	3		2	3		2	2		3
Heavy Vehicles (%)	6%	1%	0%	3%	3%	4%	0%	0%	3%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	13.0	13.0		13.0	13.0		65.0	65.0		65.0	65.0	
Effective Green, g (s)	14.0	14.0		14.0	14.0		66.0	66.0		66.0	66.0	
Actuated g/C Ratio	0.16	0.16		0.16	0.16		0.73	0.73		0.73	0.73	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	148	273		161	278		559	1360		559	1371	
v/s Ratio Prot		0.07			c0.09			c0.31			0.31	
v/s Ratio Perm	0.04			0.08			0.03			0.04		
v/c Ratio	0.26	0.44		0.51	0.55		0.04	0.43		0.06	0.42	
Uniform Delay, d1	33.4	34.4		34.8	35.1		3.3	4.7		3.3	4.6	
Progression Factor	1.00	1.00		1.00	1.00		0.25	0.60		1.00	1.00	
Incremental Delay, d2	0.9	1.1		2.5	2.2		0.1	1.0		0.2	1.0	
Delay (s)	34.3	35.6		37.4	37.3		1.0	3.7		3.5	5.6	
Level of Service	C	D		D	D		A	A		A	A	
Approach Delay (s)		35.3			37.3			3.6			5.5	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	70	245	50	200	60	515	50	485
Lane Group Flow (vph)	76	358	54	266	65	598	54	603
Turn Type	Perm		Perm		Perm		pm+pt	
Protected Phases		4		8		2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	8.0	24.0
Total Split (s)	31.0	31.0	31.0	31.0	35.0	35.0	9.0	44.0
Total Split (%)	41.3%	41.3%	41.3%	41.3%	46.7%	46.7%	12.0%	58.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	2.0	5.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	
Recall Mode	None	None	None	None	C-Max	C-Max	None	C-Max
v/c Ratio	0.33	0.72	0.34	0.54	0.16	0.61	0.12	0.54
Control Delay	18.5	25.2	26.6	25.1	14.5	18.8	7.0	12.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.5	25.2	26.6	25.1	14.5	18.8	7.0	12.1
Queue Length 50th (m)	7.5	32.8	5.6	27.4	4.7	56.9	2.3	41.2
Queue Length 95th (m)	m13.3	47.3	13.1	41.9	13.2	#113.7	7.0	79.8
Internal Link Dist (m)		1198.0		223.8		776.4		313.2
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	301	636	205	637	396	986	453	1113
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.56	0.26	0.42	0.16	0.61	0.12	0.54

Intersection Summary

Cycle Length: 75

Actuated Cycle Length: 75

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

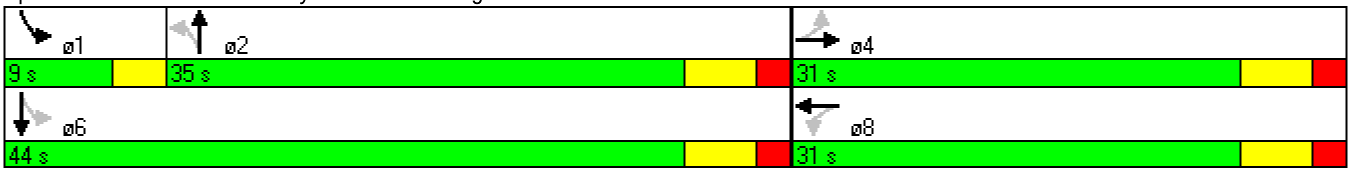
Natural Cycle: 60

Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Paisley Road & Edinburgh



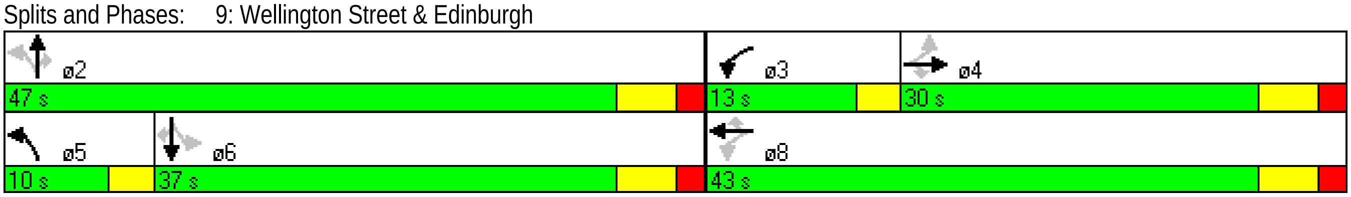
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	245	85	50	200	45	60	515	35	50	485	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		2.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.97		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1784	1787		1799	1805		1805	1879		1804	1848	
Flt Permitted	0.46	1.00		0.31	1.00		0.40	1.00		0.27	1.00	
Satd. Flow (perm)	867	1787		591	1805		756	1879		514	1848	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	266	92	54	217	49	65	560	38	54	527	76
RTOR Reduction (vph)	0	18	0	0	12	0	0	2	0	0	6	0
Lane Group Flow (vph)	76	340	0	54	254	0	65	596	0	54	597	0
Confl. Peds. (#/hr)	10		4	4		10			4	4		
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	1%	0%
Turn Type	Perm			Perm			Perm			pm+pt		
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	19.1	19.1		19.1	19.1		37.1	37.1		43.9	43.9	
Effective Green, g (s)	20.1	20.1		20.1	20.1		38.1	38.1		44.9	44.9	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.51	0.51		0.60	0.60	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		3.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	232	479		158	484		384	955		390	1106	
v/s Ratio Prot		c0.19			0.14			c0.32		0.01	c0.32	
v/s Ratio Perm	0.09			0.09			0.09			0.07		
v/c Ratio	0.33	0.71		0.34	0.52		0.17	0.62		0.14	0.54	
Uniform Delay, d1	22.0	24.8		22.1	23.4		9.9	13.3		7.9	8.9	
Progression Factor	0.73	0.76		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	4.4		1.3	1.0		1.0	3.1		0.2	1.9	
Delay (s)	16.9	23.4		23.4	24.4		10.9	16.4		8.1	10.8	
Level of Service	B	C		C	C		B	B		A	B	
Approach Delay (s)		22.2			24.2			15.8			10.6	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	465	90	195	425	40	115	480	170	60	540	45
Lane Group Flow (vph)	38	505	98	212	462	43	125	522	185	65	587	49
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	13.0	43.0	43.0	10.0	47.0	47.0	37.0	37.0	37.0
Total Split (%)	33.3%	33.3%	33.3%	14.4%	47.8%	47.8%	11.1%	52.2%	52.2%	41.1%	41.1%	41.1%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			Yes			Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.19	0.66	0.23	0.59	0.36	0.07	0.27	0.28	0.20	0.19	0.40	0.08
Control Delay	29.5	35.9	7.0	25.1	21.4	5.6	12.0	13.0	2.7	17.6	17.1	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.5	35.9	7.0	25.1	21.4	5.6	12.0	13.0	2.7	17.6	17.1	4.3
Queue Length 50th (m)	5.0	38.6	0.0	22.4	27.7	0.0	8.9	23.1	0.0	6.0	30.2	0.1
Queue Length 95th (m)	11.8	49.5	10.1	33.4	35.2	5.3	18.8	36.3	9.6	13.7	40.7	3.3
Internal Link Dist (m)		464.5			263.2			253.7			87.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	249	974	519	360	1494	697	469	1886	919	349	1459	652
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.52	0.19	0.59	0.31	0.06	0.27	0.28	0.20	0.19	0.40	0.08

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 4 (4%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Splits and Phases: 9: Wellington Street & Edinburgh



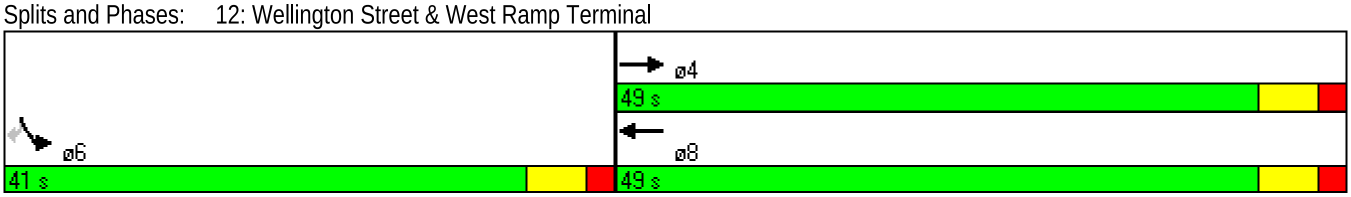
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	465	90	195	425	40	115	480	170	60	540	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1750	3505	1615	1805	3539	1592	1769	3574	1576	1767	3574	1526
Flt Permitted	0.49	1.00	1.00	0.27	1.00	1.00	0.34	1.00	1.00	0.46	1.00	1.00
Satd. Flow (perm)	896	3505	1615	511	3539	1592	636	3574	1576	853	3574	1526
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	505	98	212	462	43	125	522	185	65	587	49
RTOR Reduction (vph)	0	0	77	0	0	27	0	0	87	0	0	29
Lane Group Flow (vph)	38	505	21	212	462	16	125	522	98	65	587	20
Confl. Peds. (#/hr)	2					2	6		3	3		6
Heavy Vehicles (%)	3%	3%	0%	0%	2%	0%	2%	1%	1%	2%	1%	4%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	18.7	18.7	18.7	31.5	31.5	31.5	46.5	46.5	46.5	35.8	35.8	35.8
Effective Green, g (s)	19.7	19.7	19.7	32.5	32.5	32.5	47.5	47.5	47.5	36.8	36.8	36.8
Actuated g/C Ratio	0.22	0.22	0.22	0.36	0.36	0.36	0.53	0.53	0.53	0.41	0.41	0.41
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	196	767	354	340	1278	575	445	1886	832	349	1461	624
v/s Ratio Prot		c0.14		c0.07	0.13		c0.03	0.15			c0.16	
v/s Ratio Perm	0.04		0.01	0.15		0.01	0.12		0.06	0.08		0.01
v/c Ratio	0.19	0.66	0.06	0.62	0.36	0.03	0.28	0.28	0.12	0.19	0.40	0.03
Uniform Delay, d1	28.7	32.1	27.8	21.4	21.1	18.5	11.2	11.8	10.7	17.0	18.8	15.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83	0.81	0.67
Incremental Delay, d2	0.5	2.1	0.1	3.5	0.2	0.0	0.3	0.4	0.3	1.1	0.8	0.1
Delay (s)	29.2	34.1	27.9	25.0	21.3	18.6	11.6	12.1	11.0	15.2	16.1	10.7
Level of Service	C	C	C	C	C	B	B	B	B	B	B	B
Approach Delay (s)		32.9			22.2			11.8			15.6	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	20.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	480	625	145	110
Lane Group Flow (vph)	522	679	158	120
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	37.0	37.0	24.0	24.0
Total Split (s)	49.0	49.0	41.0	41.0
Total Split (%)	54.4%	54.4%	45.6%	45.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.15	0.19	0.31	0.38
Control Delay	3.5	3.6	25.9	9.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	3.5	3.6	25.9	9.4
Queue Length 50th (m)	5.4	7.3	7.9	0.0
Queue Length 95th (m)	9.0	11.7	14.7	11.0
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3547	3547	1966	877
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.15	0.19	0.08	0.14

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 63.5
Natural Cycle: 65
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	480	625	0	145	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	5085		3467	1455
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	5085		3467	1455
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	522	679	0	158	120
RTOR Reduction (vph)	0	0	0	0	0	103
Lane Group Flow (vph)	0	522	679	0	158	17
Heavy Vehicles (%)	0%	2%	2%	0%	1%	11%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		43.3	43.3		8.2	8.2
Effective Green, g (s)		44.3	44.3		9.2	9.2
Actuated g/C Ratio		0.70	0.70		0.14	0.14
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3547	3547		502	211
v/s Ratio Prot		0.10	c0.13		c0.05	
v/s Ratio Perm						0.01
v/c Ratio		0.15	0.19		0.31	0.08
Uniform Delay, d1		3.2	3.4		24.3	23.5
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.1	0.1		0.4	0.2
Delay (s)		3.3	3.5		24.7	23.7
Level of Service		A	A		C	C
Approach Delay (s)		3.3	3.5		24.2	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	7.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.21		
Actuated Cycle Length (s)	63.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	27.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBL	NBT	NBR	SBR
Lane Configurations							
Volume (vph)	95	495	560	190	65	95	160
Lane Group Flow (vph)	103	538	636	137	141	103	174
Turn Type	pm+pt			Split		Perm	custom
Protected Phases	7	4	8	2	2		
Permitted Phases	4					2	6
Detector Phase	7	4	8	2	2	2	6
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	14.0	39.0	25.0	27.0	27.0	27.0	24.0
Total Split (%)	15.6%	43.3%	27.8%	30.0%	30.0%	30.0%	26.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag				
Lead-Lag Optimize?	Yes		Yes				
Recall Mode	Max	Max	Max	None	None	None	None
v/c Ratio	0.19	0.21	0.43	0.46	0.46	0.29	0.34
Control Delay	9.0	9.9	20.4	29.9	29.7	7.9	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.0	9.9	20.4	29.9	29.7	7.9	1.8
Queue Length 50th (m)	5.1	11.6	21.0	15.1	15.5	0.0	0.0
Queue Length 95th (m)	12.8	19.4	32.8	29.1	29.6	9.8	0.0
Internal Link Dist (m)		55.6	264.6		261.7		
Turn Bay Length (m)	120.0					170.0	
Base Capacity (vph)	541	2568	1491	555	573	582	735
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.21	0.43	0.25	0.25	0.18	0.24

Intersection Summary

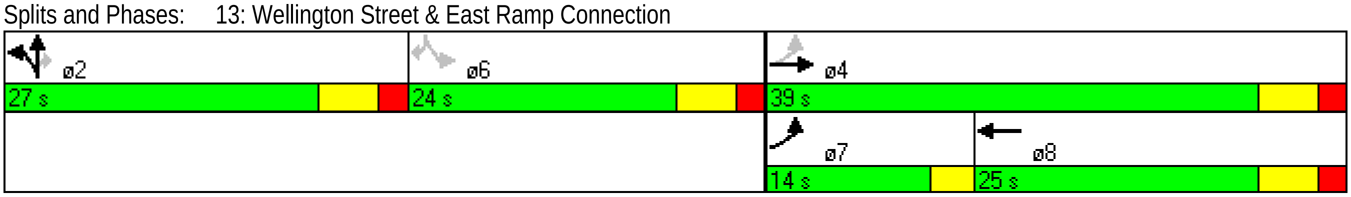
Cycle Length: 90

Actuated Cycle Length: 67.5

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	95	495	0	0	560	25	190	65	95	0	0	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0			5.0		5.0	5.0	5.0			5.0
Lane Util. Factor	1.00	0.91			0.91		0.95	0.95	1.00			1.00
Frt	1.00	1.00			0.99		1.00	1.00	0.85			0.85
Flt Protected	0.95	1.00			1.00		0.95	0.98	1.00			1.00
Satd. Flow (prot)	1770	5085			5000		1698	1753	1568			1599
Flt Permitted	0.33	1.00			1.00		0.95	0.98	1.00			1.00
Satd. Flow (perm)	608	5085			5000		1698	1753	1568			1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	538	0	0	609	27	207	71	103	0	0	174
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	85	0	0	157
Lane Group Flow (vph)	103	538	0	0	631	0	137	141	18	0	0	17
Heavy Vehicles (%)	2%	2%	2%	0%	3%	5%	1%	0%	3%	0%	0%	1%
Turn Type	pm+pt						Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4								2	6		6
Actuated Green, G (s)	33.1	33.1			19.1		10.9	10.9	10.9			5.5
Effective Green, g (s)	34.1	34.1			20.1		11.9	11.9	11.9			6.5
Actuated g/C Ratio	0.51	0.51			0.30		0.18	0.18	0.18			0.10
Clearance Time (s)	3.0	6.0			6.0		6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	514	2569			1489		299	309	276			154
v/s Ratio Prot	0.04	c0.11			c0.13		c0.08	0.08				
v/s Ratio Perm	0.07								0.01			c0.01
v/c Ratio	0.20	0.21			0.42		0.46	0.46	0.07			0.11
Uniform Delay, d1	8.9	9.2			19.0		24.9	24.9	23.2			27.9
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00			1.00
Incremental Delay, d2	0.9	0.2			0.9		1.1	1.1	0.1			0.3
Delay (s)	9.8	9.4			19.9		26.0	26.0	23.3			28.2
Level of Service	A	A			B		C	C	C			C
Approach Delay (s)		9.5			19.9			25.3			28.2	
Approach LOS		A			B			C			C	

Intersection Summary			
HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	67.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	40.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			303							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1636			1636			1029	900	1091	1029	900	1091

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	6.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	735	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	799	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked					0.98	
vC, conflicting volume			0		266	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		195	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1636		769	1091

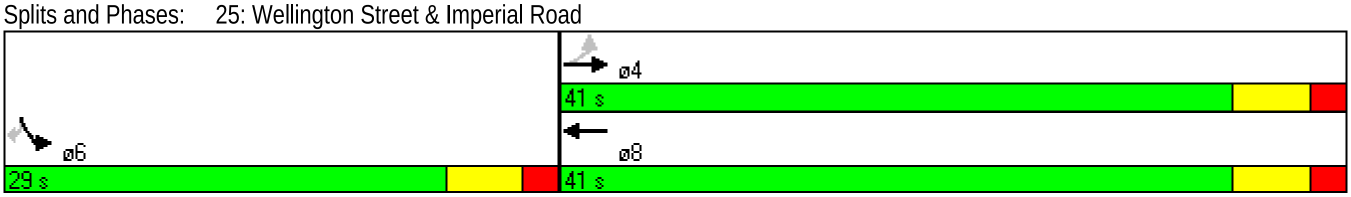
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	266	266	266
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.16	0.16	0.16
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	80	480	500	305	80
Lane Group Flow (vph)	0	609	798	332	87
Turn Type	Perm				Perm
Protected Phases		4	8	6	
Permitted Phases	4			6	6
Detector Phase	4	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	41.0	41.0	41.0	24.0	24.0
Total Split (s)	41.0	41.0	41.0	29.0	29.0
Total Split (%)	58.6%	58.6%	58.6%	41.4%	41.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	Max	Max	Max	C-Max	C-Max
v/c Ratio		0.45	0.44	0.54	0.14
Control Delay		12.1	9.2	22.4	4.9
Queue Delay		0.0	0.0	0.0	0.0
Total Delay		12.1	9.2	22.4	4.9
Queue Length 50th (m)		22.7	22.5	31.7	0.0
Queue Length 95th (m)		33.5	33.7	52.7	7.4
Internal Link Dist (m)		188.7	176.8	303.2	
Turn Bay Length (m)					
Base Capacity (vph)		1351	1804	619	605
Starvation Cap Reductn		0	0	0	0
Spillback Cap Reductn		0	0	0	0
Storage Cap Reductn		0	0	0	0
Reduced v/c Ratio		0.45	0.44	0.54	0.14

Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2: and 6:SBL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	80	480	500	235	305	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.95		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3518	3352		1805	1599
Flt Permitted		0.74	1.00		0.95	1.00
Satd. Flow (perm)		2625	3352		1805	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	522	543	255	332	87
RTOR Reduction (vph)	0	0	80	0	0	57
Lane Group Flow (vph)	0	609	718	0	332	30
Confl. Peds. (#/hr)	6			6		
Heavy Vehicles (%)	1%	2%	2%	1%	0%	1%
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)		35.0	35.0		23.0	23.0
Effective Green, g (s)		36.0	36.0		24.0	24.0
Actuated g/C Ratio		0.51	0.51		0.34	0.34
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		5.0	5.0
Lane Grp Cap (vph)		1350	1724		619	548
v/s Ratio Prot			0.21		c0.18	
v/s Ratio Perm		c0.23				0.02
v/c Ratio		0.45	0.42		0.54	0.05
Uniform Delay, d1		10.8	10.5		18.5	15.4
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		1.1	0.7		3.3	0.2
Delay (s)		11.8	11.3		21.8	15.6
Level of Service		B	B		C	B
Approach Delay (s)		11.8	11.3		20.5	
Approach LOS		B	B		C	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			80			
pX, platoon unblocked						
vC, conflicting volume	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				1023	1084

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS							
Approach Delay (s)	0.0				0.0		
Approach LOS							

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	6.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations										
Volume (vph)	125	310	80	195	300	150	925	170	30	970
Lane Group Flow (vph)	0	473	87	212	364	163	1005	185	33	1152
Turn Type	Perm		Perm	pm+pt		Prot		Perm	Prot	
Protected Phases		4		3	8	5	2		1	6
Permitted Phases	4		4	8				2		
Detector Phase	4	4	4	3	8	5	2	2	1	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	35.0	35.0	35.0	9.0	35.0	9.0	35.0	35.0	9.0	35.0
Total Split (s)	35.0	35.0	35.0	9.0	44.0	11.0	37.0	37.0	9.0	35.0
Total Split (%)	38.9%	38.9%	38.9%	10.0%	48.9%	12.2%	41.1%	41.1%	10.0%	38.9%
Yellow Time (s)	5.5	5.5	5.5	3.0	5.5	3.0	4.5	4.5	3.0	4.5
All-Red Time (s)	1.5	1.5	1.5	1.0	1.5	1.0	2.5	2.5	1.0	2.5
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	6.0	6.0	6.0	3.0	6.0	3.0	6.0	6.0	3.0	6.0
Lead/Lag	Lag	Lag	Lag	Lead		Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
v/c Ratio		0.71	0.19	0.66	0.29	0.64	0.64	0.23	0.22	0.96
Control Delay		36.5	6.5	30.0	20.1	51.1	24.0	6.9	42.5	49.4
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		36.5	6.5	30.0	20.1	51.1	24.0	6.9	42.5	49.4
Queue Length 50th (m)		36.3	0.0	23.2	20.7	24.2	69.4	4.1	5.0	~98.3
Queue Length 95th (m)		46.6	9.0	33.7	27.0	#61.1	98.8	17.2	13.3	#139.0
Internal Link Dist (m)		119.0			60.0		595.4			186.2
Turn Bay Length (m)			40.0	45.0		95.0		40.0	75.0	
Base Capacity (vph)		859	566	320	1488	256	1573	788	148	1195
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		0.55	0.15	0.66	0.24	0.64	0.64	0.23	0.22	0.96

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

~ 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.

Splits and Phases: 35: Paisley Road & Hanlon Pkwy

ø1	ø2	ø3	ø4
9 s	37 s	9 s	35 s

ø5	ø6	ø8
11 s	35 s	44 s

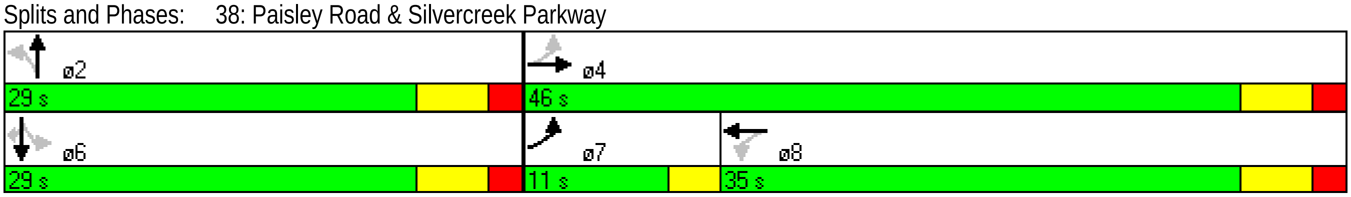
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	310	80	195	300	35	150	925	170	30	970	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes		1.00	0.98	1.00	1.00		1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt		1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3546	1572	1804	3502		1787	3539	1594	1805	3497	
Flt Permitted		0.74	1.00	0.33	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		2667	1572	633	3502		1787	3539	1594	1805	3497	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	136	337	87	212	326	38	163	1005	185	33	1054	98
RTOR Reduction (vph)	0	0	65	0	11	0	0	0	82	0	7	0
Lane Group Flow (vph)	0	473	22	212	353	0	163	1005	103	33	1145	0
Confl. Peds. (#/hr)	4		5	5		4			1	1		
Heavy Vehicles (%)	1%	0%	1%	0%	1%	4%	1%	2%	0%	0%	2%	1%
Turn Type	Perm		Perm	pm+pt			Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		4	8					2			
Actuated Green, G (s)		21.5	21.5	30.5	30.5		11.9	37.4	37.4	4.1	29.6	
Effective Green, g (s)		22.5	22.5	31.5	31.5		12.9	38.4	38.4	5.1	30.6	
Actuated g/C Ratio		0.25	0.25	0.35	0.35		0.14	0.43	0.43	0.06	0.34	
Clearance Time (s)		7.0	7.0	4.0	7.0		4.0	7.0	7.0	4.0	7.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0		2.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		667	393	300	1226		256	1510	680	102	1189	
v/s Ratio Prot				c0.05	0.10		c0.09	0.28		0.02	c0.33	
v/s Ratio Perm		0.18	0.01	c0.20					0.06			
v/c Ratio		0.71	0.06	0.71	0.29		0.64	0.67	0.15	0.32	0.96	
Uniform Delay, d1		30.8	25.7	23.7	21.1		36.3	20.7	15.8	40.8	29.1	
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		3.5	0.1	7.4	0.1		3.8	2.3	0.5	1.8	18.6	
Delay (s)		34.2	25.7	31.1	21.3		40.1	23.0	16.3	42.6	47.7	
Level of Service		C	C	C	C		D	C	B	D	D	
Approach Delay (s)		32.9			24.9			24.1			47.6	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	33.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	SBL	SBT	SBR	ø2
Lane Configurations							
Volume (vph)	250	260	285	250	0	245	
Lane Group Flow (vph)	272	283	478	0	272	266	
Turn Type	pm+pt			Perm		Perm	
Protected Phases	7	4	8		6		2
Permitted Phases	4			6		6	
Detector Phase	7	4	8	6	6	6	
Switch Phase							
Minimum Initial (s)	8.0	5.0	5.0	7.0	7.0	7.0	7.0
Minimum Split (s)	11.0	35.0	35.0	29.0	29.0	29.0	29.0
Total Split (s)	11.0	46.0	35.0	29.0	29.0	29.0	29.0
Total Split (%)	14.7%	61.3%	46.7%	38.7%	38.7%	38.7%	39%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	
Lead/Lag	Lead		Lag				
Lead-Lag Optimize?							
Recall Mode	None	C-Max	C-Max	None	None	None	None
v/c Ratio	0.50	0.25	0.58		0.73	0.43	
Control Delay	10.0	8.6	14.2		36.4	5.1	
Queue Delay	0.0	0.0	0.0		0.0	0.0	
Total Delay	10.0	8.6	14.2		36.4	5.1	
Queue Length 50th (m)	13.4	15.9	28.3		31.8	0.0	
Queue Length 95th (m)	26.3	30.3	44.2		51.3	13.5	
Internal Link Dist (m)		117.2	1198.0		77.1		
Turn Bay Length (m)							
Base Capacity (vph)	539	1123	819		453	698	
Starvation Cap Reductn	0	0	0		0	0	
Spillback Cap Reductn	0	0	0		0	0	
Storage Cap Reductn	0	0	0		0	0	
Reduced v/c Ratio	0.50	0.25	0.58		0.60	0.38	

Intersection Summary
Cycle Length: 75
Actuated Cycle Length: 75
Offset: 40 (53%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated

Splits and Phases: 38: Paisley Road & Silvercreek Parkway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	260	0	0	285	155	0	0	0	250	0	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	2.0	5.0			5.0						5.0	5.0
Lane Util. Factor	1.00	1.00			1.00						1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00						1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00						1.00	1.00
Frt	1.00	1.00			0.95						1.00	0.85
Flt Protected	0.95	1.00			1.00						0.95	1.00
Satd. Flow (prot)	1770	1863			1774						1778	1615
Flt Permitted	0.33	1.00			1.00						0.76	1.00
Satd. Flow (perm)	606	1863			1774						1417	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	283	0	0	310	168	0	0	0	272	0	266
RTOR Reduction (vph)	0	0	0	0	24	0	0	0	0	0	0	196
Lane Group Flow (vph)	272	283	0	0	454	0	0	0	0	0	272	70
Confl. Peds. (#/hr)			3	3					3	3		
Heavy Vehicles (%)	2%	2%	0%	0%	2%	2%	0%	0%	0%	1%	0%	0%
Turn Type	pm+pt			Perm			Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	44.2	44.2			32.6						18.8	18.8
Effective Green, g (s)	45.2	45.2			33.6						19.8	19.8
Actuated g/C Ratio	0.60	0.60			0.45						0.26	0.26
Clearance Time (s)	3.0	6.0			6.0						6.0	6.0
Vehicle Extension (s)	3.0	3.0			3.0						3.0	3.0
Lane Grp Cap (vph)	514	1123			795						374	426
v/s Ratio Prot	c0.07	0.15			c0.26							
v/s Ratio Perm	0.25										c0.19	0.04
v/c Ratio	0.53	0.25			0.57						0.73	0.16
Uniform Delay, d1	8.4	7.0			15.4						25.1	21.2
Progression Factor	1.00	1.00			0.72						1.00	1.00
Incremental Delay, d2	1.0	0.5			2.9						6.9	0.2
Delay (s)	9.3	7.5			13.9						32.0	21.4
Level of Service	A	A			B						C	C
Approach Delay (s)		8.4			13.9			0.0			26.8	
Approach LOS		A			B			A			C	

Intersection Summary			
HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX D

Capacity Analysis Results

Phases 1 & 2

Future Background Traffic Conditions

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	15	35	340	20	40	300
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	15	35	340	20	40	300
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						9
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			50		715	15
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			50		715	15
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			78		87	72
cM capacity (veh/h)			1557		311	1065

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	15	35	340	20	340
Volume Left	0	0	340	0	40
Volume Right	0	35	0	0	300
cSH	1700	1700	1557	1700	1206
Volume to Capacity	0.01	0.02	0.22	0.01	0.28
Queue Length 95th (m)	0.0	0.0	5.8	0.0	8.2
Control Delay (s)	0.0	0.0	8.0	0.0	10.7
Lane LOS			A		B
Approach Delay (s)	0.0		7.5		10.7
Approach LOS					B

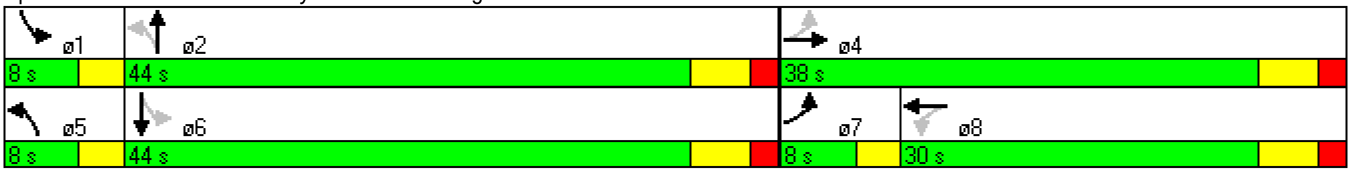
Intersection Summary			
Average Delay	8.5		
Intersection Capacity Utilization	35.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	140	350	40	335	115	620	85	570
Lane Group Flow (vph)	140	430	40	390	115	650	85	640
Turn Type	pm+pt		Perm		pm+pt		pm+pt	
Protected Phases	7	4		8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	29.0	29.0	29.0	8.0	28.0	8.0	28.0
Total Split (s)	8.0	38.0	30.0	30.0	8.0	44.0	8.0	44.0
Total Split (%)	8.9%	42.2%	33.3%	33.3%	8.9%	48.9%	8.9%	48.9%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	2.0	5.0	2.0	5.0
Lead/Lag	Lead		Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.59	0.67	0.21	0.83	0.36	0.74	0.27	0.73
Control Delay	28.0	27.4	28.6	46.4	13.4	27.2	11.5	26.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.0	27.4	28.6	46.4	13.4	27.2	11.5	26.7
Queue Length 50th (m)	12.9	43.6	4.9	55.5	10.5	76.7	5.9	84.3
Queue Length 95th (m)	25.4	73.4	12.5	#92.7	m16.9	#105.5	11.9	#126.8
Internal Link Dist (m)		1213.0		222.3		775.1		164.8
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	238	681	205	513	316	880	310	873
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.63	0.20	0.76	0.36	0.74	0.27	0.73

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 10 (11%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	350	80	40	335	55	115	620	30	85	570	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0		5.0	5.0		2.0	5.0		2.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1804	1832		1805	1821		1787	1869		1805	1852	
Flt Permitted	0.20	1.00		0.39	1.00		0.20	1.00		0.19	1.00	
Satd. Flow (perm)	382	1832		740	1821		379	1869		370	1852	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	140	350	80	40	335	55	115	620	30	85	570	70
RTOR Reduction (vph)	0	9	0	0	7	0	0	2	0	0	5	0
Lane Group Flow (vph)	140	421	0	40	383	0	115	648	0	85	635	0
Confl. Peds. (#/hr)	4					4						
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	1%	1%	0%	0%	1%	0%
Turn Type	pm+pt			Perm			pm+pt			pm+pt		
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	30.0	30.0		22.0	22.0		45.1	40.7		44.9	40.6	
Effective Green, g (s)	31.0	31.0		23.0	23.0		47.1	41.7		46.9	41.6	
Actuated g/C Ratio	0.34	0.34		0.26	0.26		0.52	0.46		0.52	0.46	
Clearance Time (s)	3.0	6.0		6.0	6.0		3.0	6.0		3.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	226	631		189	465		283	866		277	856	
v/s Ratio Prot	0.04	c0.23			c0.21		c0.02	c0.35		0.02	0.34	
v/s Ratio Perm	0.17			0.05			0.19			0.14		
v/c Ratio	0.62	0.67		0.21	0.82		0.41	0.75		0.31	0.74	
Uniform Delay, d1	22.5	25.1		26.4	31.6		14.0	19.8		13.9	19.8	
Progression Factor	0.97	0.91		1.00	1.00		1.15	1.06		1.00	1.00	
Incremental Delay, d2	4.7	2.5		0.6	11.3		0.8	4.8		0.6	5.8	
Delay (s)	26.4	25.4		26.9	42.9		16.9	25.7		14.5	25.6	
Level of Service	C	C		C	D		B	C		B	C	
Approach Delay (s)		25.7			41.4			24.4			24.3	
Approach LOS		C			D			C			C	

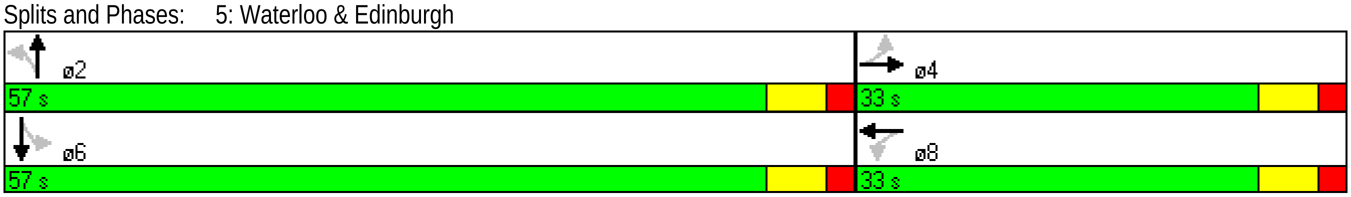
Intersection Summary			
HCM Average Control Delay	27.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	55	225	110	275	45	675	40	700
Lane Group Flow (vph)	55	260	110	335	45	740	40	735
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	55.0	55.0	55.0	55.0
Total Split (s)	33.0	33.0	33.0	33.0	57.0	57.0	57.0	57.0
Total Split (%)	36.7%	36.7%	36.7%	36.7%	63.3%	63.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.41	0.58	0.59	0.75	0.14	0.63	0.13	0.61
Control Delay	36.7	33.1	41.9	40.2	6.9	14.5	5.0	7.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.7	33.1	41.9	40.2	6.9	14.5	5.0	7.1
Queue Length 50th (m)	7.3	34.9	15.4	47.1	2.1	36.9	1.1	20.8
Queue Length 95th (m)	16.6	51.9	29.0	67.9	5.5	86.3	m2.0	38.2
Internal Link Dist (m)		842.2		241.7		111.7		775.1
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	168	569	237	564	330	1181	319	1213
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.46	0.46	0.59	0.14	0.63	0.13	0.61

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 66 (73%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	225	35	110	275	60	45	675	65	40	700	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.96	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.97		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1750	1810		1706	1784		1800	1832		1759	1885	
Flt Permitted	0.29	1.00		0.42	1.00		0.27	1.00		0.27	1.00	
Satd. Flow (perm)	542	1810		763	1784		514	1832		496	1885	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	55	225	35	110	275	60	45	675	65	40	700	35
RTOR Reduction (vph)	0	7	0	0	10	0	0	3	0	0	2	0
Lane Group Flow (vph)	55	253	0	110	325	0	45	737	0	40	733	0
Confl. Peds. (#/hr)	10		25	25		10	16		22	22		16
Heavy Vehicles (%)	2%	2%	0%	2%	3%	2%	0%	2%	2%	2%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	21.2	21.2		21.2	21.2		56.8	56.8		56.8	56.8	
Effective Green, g (s)	22.2	22.2		22.2	22.2		57.8	57.8		57.8	57.8	
Actuated g/C Ratio	0.25	0.25		0.25	0.25		0.64	0.64		0.64	0.64	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	134	446		188	440		330	1177		319	1211	
v/s Ratio Prot		0.14			c0.18			c0.40			0.39	
v/s Ratio Perm	0.10			0.14			0.09			0.08		
v/c Ratio	0.41	0.57		0.59	0.74		0.14	0.63		0.13	0.61	
Uniform Delay, d1	28.4	29.7		29.8	31.2		6.3	9.6		6.3	9.4	
Progression Factor	1.00	1.00		1.00	1.00		0.73	1.09		0.53	0.49	
Incremental Delay, d2	2.0	1.7		4.6	6.4		0.8	2.4		0.6	1.8	
Delay (s)	30.5	31.4		34.4	37.6		5.5	12.9		3.9	6.4	
Level of Service	C	C		C	D		A	B		A	A	
Approach Delay (s)		31.2			36.8			12.5			6.3	
Approach LOS		C			D			B			A	

Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	615	140	230	820	230	140	660	160	50	730	65
Lane Group Flow (vph)	50	615	140	230	820	230	140	660	160	50	730	65
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	15.0	45.0	45.0	8.0	45.0	45.0	37.0	37.0	37.0
Total Split (%)	33.3%	33.3%	33.3%	16.7%	50.0%	50.0%	8.9%	50.0%	50.0%	41.1%	41.1%	41.1%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.31	0.73	0.28	0.62	0.58	0.31	0.41	0.38	0.19	0.18	0.54	0.10
Control Delay	32.2	36.6	6.1	23.5	22.1	7.6	16.4	16.3	3.6	13.0	14.8	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.2	36.6	6.1	23.5	22.1	7.6	16.4	16.3	3.6	13.0	14.8	2.1
Queue Length 50th (m)	6.4	46.7	0.0	22.0	50.4	8.2	11.6	35.0	0.7	3.3	36.1	0.3
Queue Length 95th (m)	15.5	61.8	11.8	34.7	63.8	20.4	21.8	49.0	10.2	m5.7	44.3	m0.6
Internal Link Dist (m)		464.5			263.2			253.7			89.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	181	937	550	378	1543	790	343	1721	831	282	1354	632
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.66	0.25	0.61	0.53	0.29	0.41	0.38	0.19	0.18	0.54	0.10

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

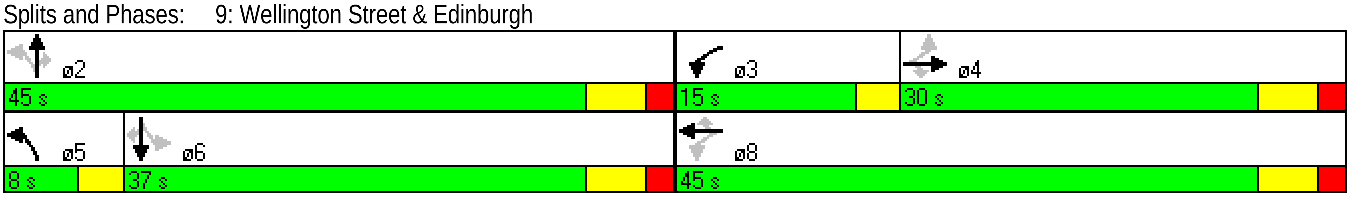
Offset: 89 (99%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



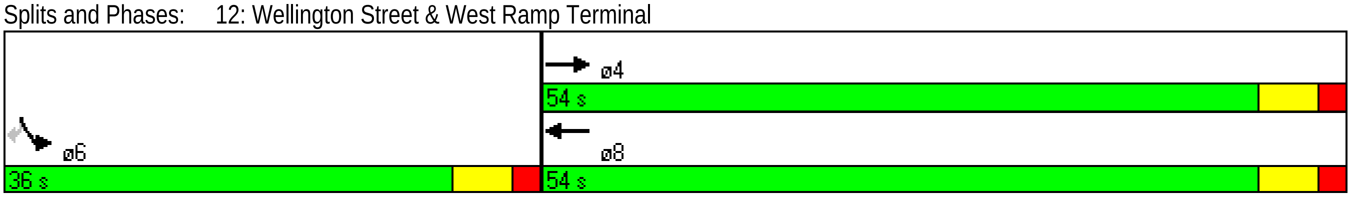
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	615	140	230	820	230	140	660	160	50	730	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3374	1615	1787	3471	1599	1769	3574	1563	1762	3574	1562
Flt Permitted	0.34	1.00	1.00	0.22	1.00	1.00	0.25	1.00	1.00	0.40	1.00	1.00
Satd. Flow (perm)	651	3374	1615	406	3471	1599	462	3574	1563	744	3574	1562
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	50	615	140	230	820	230	140	660	160	50	730	65
RTOR Reduction (vph)	0	0	105	0	0	85	0	0	79	0	0	40
Lane Group Flow (vph)	50	615	35	230	820	145	140	660	81	50	730	25
Confl. Peds. (#/hr)							2		12	12		2
Heavy Vehicles (%)	0%	7%	0%	1%	4%	1%	2%	1%	1%	2%	1%	2%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	21.4	21.4	21.4	35.7	35.7	35.7	42.3	42.3	42.3	33.1	33.1	33.1
Effective Green, g (s)	22.4	22.4	22.4	36.7	36.7	36.7	43.3	43.3	43.3	34.1	34.1	34.1
Actuated g/C Ratio	0.25	0.25	0.25	0.41	0.41	0.41	0.48	0.48	0.48	0.38	0.38	0.38
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	162	840	402	354	1415	652	327	1719	752	282	1354	592
v/s Ratio Prot		c0.18		c0.09	0.24		c0.03	0.18			c0.20	
v/s Ratio Perm	0.08		0.02	0.18		0.09	0.17		0.05	0.07		0.02
v/c Ratio	0.31	0.73	0.09	0.65	0.58	0.22	0.43	0.38	0.11	0.18	0.54	0.04
Uniform Delay, d1	27.5	31.0	25.9	19.2	20.7	17.4	14.2	14.9	12.8	18.6	21.8	17.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.57	0.60	0.34
Incremental Delay, d2	1.1	3.3	0.1	4.1	0.6	0.2	0.9	0.7	0.3	1.1	1.3	0.1
Delay (s)	28.6	34.4	26.0	23.3	21.2	17.5	15.1	15.5	13.1	11.7	14.3	6.0
Level of Service	C	C	C	C	C	B	B	B	B	B	B	A
Approach Delay (s)		32.6			20.9			15.0			13.5	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	950	1415	125	90
Lane Group Flow (vph)	1033	1538	136	98
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	38.0	38.0	33.0	33.0
Total Split (s)	54.0	54.0	36.0	36.0
Total Split (%)	60.0%	60.0%	40.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.29	0.42	0.29	0.43
Control Delay	4.1	4.8	28.0	26.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	4.1	4.8	28.0	26.7
Queue Length 50th (m)	12.9	21.8	7.5	8.0
Queue Length 95th (m)	21.7	35.8	13.9	19.5
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3616	3651	1437	635
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.29	0.42	0.09	0.15

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 72.3
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	950	1415	0	125	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5036	5085		3335	1442
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5036	5085		3335	1442
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1033	1538	0	136	98
RTOR Reduction (vph)	0	0	0	0	0	21
Lane Group Flow (vph)	0	1033	1538	0	136	77
Heavy Vehicles (%)	0%	3%	2%	0%	5%	12%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		50.9	50.9		9.3	9.3
Effective Green, g (s)		51.9	51.9		10.3	10.3
Actuated g/C Ratio		0.72	0.72		0.14	0.14
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3620	3655		476	206
v/s Ratio Prot		0.21	c0.30		0.04	
v/s Ratio Perm						c0.05
v/c Ratio		0.29	0.42		0.29	0.38
Uniform Delay, d1		3.6	4.1		27.7	28.0
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.2	0.4		0.3	1.2
Delay (s)		3.8	4.4		28.0	29.2
Level of Service		A	A		C	C
Approach Delay (s)		3.8	4.4		28.5	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	6.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	72.2	Sum of lost time (s)	10.0
Intersection Capacity Utilization	41.2%	ICU Level of Service	A
Analysis Period (min)	15		

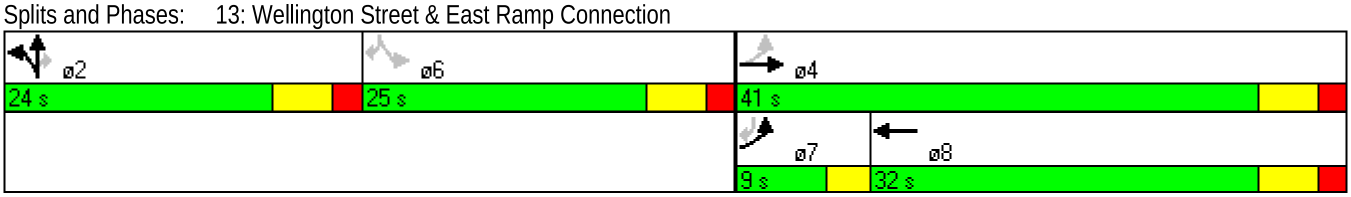
c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBL	NBT	NBR	SBL	SBR
Lane Configurations								
Volume (vph)	130	705	930	305	120	85	15	360
Lane Group Flow (vph)	141	766	1114	229	233	92	16	391
Turn Type	pm+pt			Split		Perm	custom	custom
Protected Phases	7	4	8	2	2			
Permitted Phases	4					2	6	6 7
Detector Phase	7	4	8	2	2	2	6	6 7
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	9.0	41.0	32.0	24.0	24.0	24.0	25.0	34.0
Total Split (%)	10.0%	45.6%	35.6%	26.7%	26.7%	26.7%	27.8%	37.8%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag					
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	None	None	None	None	
v/c Ratio	0.60	0.37	0.72	0.73	0.71	0.25	0.06	0.76
Control Delay	27.3	18.8	29.8	47.4	45.6	8.7	28.5	38.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.3	18.8	29.8	47.4	45.6	8.7	28.5	38.1
Queue Length 50th (m)	13.3	30.6	56.8	35.4	35.8	0.0	2.0	55.0
Queue Length 95th (m)	#26.4	40.1	71.6	58.5	59.0	10.8	6.8	#94.4
Internal Link Dist (m)		150.3	264.6		261.7			
Turn Bay Length (m)	120.0					170.0		
Base Capacity (vph)	235	2051	1550	361	378	412	266	509
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.37	0.72	0.63	0.62	0.22	0.06	0.77

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 87
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	705	0	0	930	95	305	120	85	15	0	360
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0			5.0		5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.91			0.91		0.95	0.95	1.00	1.00		1.00
Frt	1.00	1.00			0.99		1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00		0.95	0.98	1.00	0.95		1.00
Satd. Flow (prot)	1752	4940			4936		1649	1726	1553	1805		1583
Flt Permitted	0.14	1.00			1.00		0.95	0.98	1.00	0.61		1.00
Satd. Flow (perm)	254	4940			4936		1649	1726	1553	1153		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	766	0	0	1011	103	332	130	92	16	0	391
RTOR Reduction (vph)	0	0	0	0	13	0	0	0	74	0	0	0
Lane Group Flow (vph)	141	766	0	0	1101	0	229	233	18	16	0	391
Heavy Vehicles (%)	3%	5%	0%	0%	4%	0%	4%	1%	4%	0%	0%	2%
Turn Type	pm+pt						Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4								2	6		6 7
Actuated Green, G (s)	35.1	35.1			26.1		15.6	15.6	15.6	18.2		30.2
Effective Green, g (s)	36.1	36.1			27.1		16.6	16.6	16.6	19.2		31.2
Actuated g/C Ratio	0.42	0.42			0.31		0.19	0.19	0.19	0.22		0.36
Clearance Time (s)	3.0	6.0			6.0		6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	226	2052			1539		315	330	297	255		568
v/s Ratio Prot	0.05	0.16			c0.22		c0.14	0.14				
v/s Ratio Perm	0.21								0.01	0.01		c0.25
v/c Ratio	0.62	0.37			0.72		0.73	0.71	0.06	0.06		0.69
Uniform Delay, d1	17.8	17.6			26.5		33.0	32.9	28.8	26.7		23.7
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	12.3	0.5			2.9		8.1	6.7	0.1	0.1		3.5
Delay (s)	30.1	18.1			29.4		41.1	39.6	28.8	26.8		27.2
Level of Service	C	B			C		D	D	C	C		C
Approach Delay (s)		20.0			29.4			38.4			27.2	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM Average Control Delay	27.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	86.9	Sum of lost time (s)	15.0
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			303							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

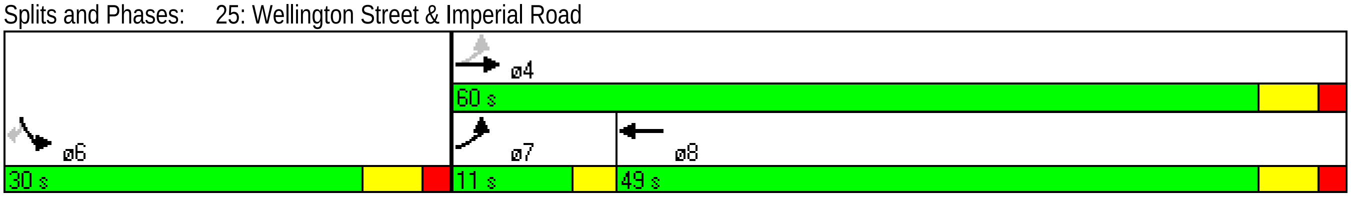
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	110	780	1160	395	35
Lane Group Flow (vph)	110	780	1480	395	35
Turn Type	pm+pt				Perm
Protected Phases	7	4	8	6	
Permitted Phases	4			6	6
Detector Phase	7	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	41.0	41.0	24.0	24.0
Total Split (s)	11.0	60.0	49.0	30.0	30.0
Total Split (%)	12.2%	66.7%	54.4%	33.3%	33.3%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	C-Max	C-Max	None	None
v/c Ratio	0.43	0.69	0.82	0.83	0.09
Control Delay	13.8	15.8	23.3	46.9	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.8	15.8	23.3	46.9	9.2
Queue Length 50th (m)	5.9	77.4	102.3	58.2	0.0
Queue Length 95th (m)	15.6	116.5	#138.0	#98.3	6.2
Internal Link Dist (m)		188.7	176.5	303.2	
Turn Bay Length (m)	100.0				
Base Capacity (vph)	267	1125	1799	496	419
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.41	0.69	0.82	0.80	0.08

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	110	780	1160	320	395	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1810	3361		1787	1417
Flt Permitted	0.08	1.00	1.00		0.95	1.00
Satd. Flow (perm)	156	1810	3361		1787	1417
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	780	1160	320	395	35
RTOR Reduction (vph)	0	0	26	0	0	26
Lane Group Flow (vph)	110	780	1454	0	395	9
Confl. Peds. (#/hr)	4			4		
Heavy Vehicles (%)	0%	5%	4%	1%	1%	14%
Turn Type	pm+pt					Perm
Protected Phases	7	4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)	54.9	54.9	45.8		23.1	23.1
Effective Green, g (s)	55.9	55.9	46.8		24.1	24.1
Actuated g/C Ratio	0.62	0.62	0.52		0.27	0.27
Clearance Time (s)	3.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	227	1124	1748		479	379
v/s Ratio Prot	0.04	c0.43	c0.43		c0.22	
v/s Ratio Perm	0.26					0.01
v/c Ratio	0.48	0.69	0.83		0.82	0.02
Uniform Delay, d1	13.7	11.4	18.3		31.0	24.3
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.6	3.5	4.8		12.3	0.1
Delay (s)	15.4	14.9	23.0		43.3	24.3
Level of Service	B	B	C		D	C
Approach Delay (s)		15.0	23.0		41.7	
Approach LOS		B	C		D	

Intersection Summary			
HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	82.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	935	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	935	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		327	174			
pX, platoon unblocked						
vC, conflicting volume	0				312	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				312	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				656	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	312	312	312	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.18	0.18	0.18	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

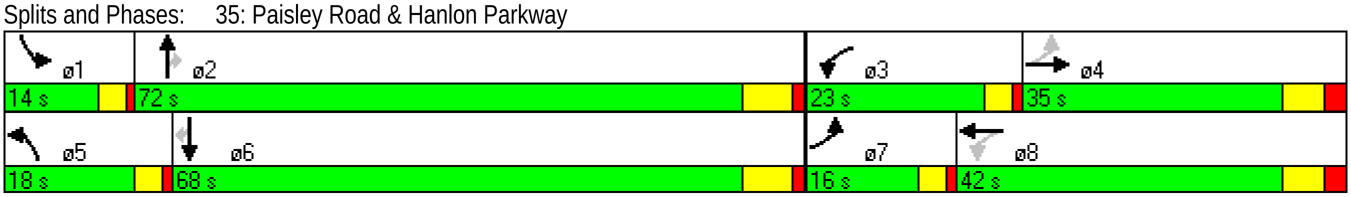
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	320	165	280	370	285	1270	265	85	1355	80
Lane Group Flow (vph)	114	348	179	304	473	310	1380	288	92	1473	87
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	59.0	59.0	9.0	57.0	57.0
Total Split (s)	16.0	35.0	0.0	23.0	42.0	18.0	72.0	72.0	14.0	68.0	68.0
Total Split (%)	11.1%	24.3%	0.0%	16.0%	29.2%	12.5%	50.0%	50.0%	9.7%	47.2%	47.2%
Yellow Time (s)	3.0	4.5		3.0	4.5	3.0	5.5	5.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	2.5	1.0	1.5	1.5	1.0	1.5	1.5
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.0	6.0	3.0	3.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.43	0.69	0.11	0.89	0.69	0.69	0.79	0.32	0.56	0.90	0.11
Control Delay	40.6	66.1	0.1	67.7	57.9	68.1	34.5	7.1	75.3	44.2	15.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.6	66.1	0.1	67.7	57.9	68.1	34.5	7.1	75.3	44.2	15.3
Queue Length 50th (m)	21.7	46.5	0.0	65.5	60.3	40.3	155.2	10.0	23.4	186.5	7.8
Queue Length 95th (m)	34.3	59.7	0.0	#88.6	75.0	55.3	198.6	28.3	40.3	#245.2	18.3
Internal Link Dist (m)		119.3			60.9		653.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	276	727	1594	344	875	452	1751	910	169	1642	764
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.48	0.11	0.88	0.54	0.69	0.79	0.32	0.54	0.90	0.11

Intersection Summary

Cycle Length: 144
Actuated Cycle Length: 144
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 35: Paisley Road & Hanlon Parkway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	320	165	280	370	65	285	1270	265	85	1355	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1594	1786	3463		3502	3471	1594	1770	3505	1593
Flt Permitted	0.37	1.00	1.00	0.28	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	705	3610	1594	533	3463		3502	3471	1594	1770	3505	1593
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	348	179	304	402	71	310	1380	288	92	1473	87
RTOR Reduction (vph)	0	0	0	0	10	0	0	0	106	0	0	18
Lane Group Flow (vph)	114	348	179	304	463	0	310	1380	182	92	1473	69
Confl. Peds. (#/hr)	1		3	3		1	2		1	1		2
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	4%	0%	2%	3%	0%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	30.0	19.1	144.0	42.0	27.1		17.6	71.6	71.6	12.4	66.4	66.4
Effective Green, g (s)	32.0	20.1	144.0	43.0	28.1		18.6	72.6	72.6	13.4	67.4	67.4
Actuated g/C Ratio	0.22	0.14	1.00	0.30	0.20		0.13	0.50	0.50	0.09	0.47	0.47
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	248	504	1594	332	676		452	1750	804	165	1641	746
v/s Ratio Prot	0.04	0.10		c0.13	0.13		c0.09	0.40		0.05	c0.42	
v/s Ratio Perm	0.06		0.11	c0.15					0.11			0.04
v/c Ratio	0.46	0.69	0.11	0.92	0.68		0.69	0.79	0.23	0.56	0.90	0.09
Uniform Delay, d1	46.6	59.0	0.0	43.7	53.8		59.9	29.4	20.0	62.5	35.1	21.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	4.1	0.1	28.7	2.9		4.3	3.7	0.7	4.0	8.2	0.2
Delay (s)	47.9	63.0	0.1	72.4	56.7		64.2	33.1	20.6	66.5	43.3	21.5
Level of Service	D	E	A	E	E		E	C	C	E	D	C
Approach Delay (s)		42.8			62.9			36.1			43.5	
Approach LOS		D			E			D			D	

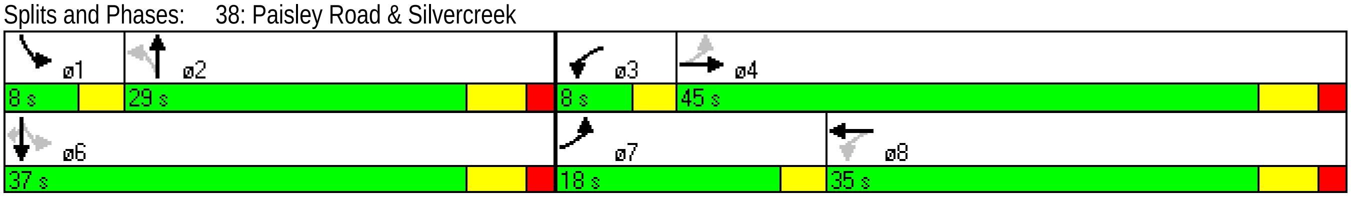
Intersection Summary			
HCM Average Control Delay	43.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	92.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	SBL	SBT	SBR	ø2	ø3
Lane Configurations								
Volume (vph)	295	375	350	240	0	360		
Lane Group Flow (vph)	295	375	540	0	240	360		
Turn Type	pm+pt			pm+pt		Perm		
Protected Phases	7	4	8	1	6		2	3
Permitted Phases	4			6		6		
Detector Phase	7	4	8	1	6	6		
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	8.0	29.0	29.0	29.0	8.0
Total Split (s)	18.0	45.0	35.0	8.0	37.0	37.0	29.0	8.0
Total Split (%)	20.0%	50.0%	38.9%	8.9%	41.1%	41.1%	32%	9%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0	3.0
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0	2.0	2.0	0.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0		
Total Lost Time (s)	2.0	5.0	5.0	2.0	5.0	5.0		
Lead/Lag	Lead	Lag	Lag	Lead			Lag	Lead
Lead-Lag Optimize?								
Recall Mode	None	C-Max	C-Max	None	None	None	None	None
v/c Ratio	0.57	0.32	0.66		0.66	0.53		
Control Delay	12.0	9.8	15.0		37.9	5.6		
Queue Delay	0.0	0.0	0.0		0.0	0.0		
Total Delay	12.0	9.8	15.0		37.9	5.6		
Queue Length 50th (m)	16.6	24.6	19.6		34.4	0.0		
Queue Length 95th (m)	36.4	50.0	#124.8		49.1	15.6		
Internal Link Dist (m)		120.8	1213.0		126.1			
Turn Bay Length (m)								
Base Capacity (vph)	555	1187	822		500	801		
Starvation Cap Reductn	0	0	0		0	0		
Spillback Cap Reductn	0	0	0		0	0		
Storage Cap Reductn	0	0	0		0	0		
Reduced v/c Ratio	0.53	0.32	0.66		0.48	0.45		

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 52 (58%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	295	375	0	0	350	190	0	0	0	240	0	360
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	2.0	5.0			5.0						5.0	5.0
Lane Util. Factor	1.00	1.00			1.00						1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00						1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00						1.00	1.00
Frt	1.00	1.00			0.95						1.00	0.85
Flt Protected	0.95	1.00			1.00						0.95	1.00
Satd. Flow (prot)	1735	1881			1772						1763	1599
Flt Permitted	0.27	1.00			1.00						0.76	1.00
Satd. Flow (perm)	490	1881			1772						1405	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	295	375	0	0	350	190	0	0	0	240	0	360
RTOR Reduction (vph)	0	0	0	0	18	0	0	0	0	0	0	267
Lane Group Flow (vph)	295	375	0	0	522	0	0	0	0	0	240	93
Confl. Peds. (#/hr)	2					2			2	2		
Heavy Vehicles (%)	4%	1%	2%	2%	2%	1%	0%	0%	0%	2%	2%	1%
Turn Type	pm+pt			pm+pt			Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	55.8	55.8			39.9						22.2	22.2
Effective Green, g (s)	56.8	56.8			40.9						23.2	23.2
Actuated g/C Ratio	0.63	0.63			0.45						0.26	0.26
Clearance Time (s)	3.0	6.0			6.0						6.0	6.0
Vehicle Extension (s)	3.0	3.0			3.0						3.0	3.0
Lane Grp Cap (vph)	502	1187			805						362	412
v/s Ratio Prot	c0.09	0.20			c0.29							
v/s Ratio Perm	0.28										c0.17	0.06
v/c Ratio	0.59	0.32			0.65						0.66	0.23
Uniform Delay, d1	10.2	7.6			19.0						29.9	26.3
Progression Factor	1.00	1.00			0.48						1.00	1.00
Incremental Delay, d2	1.8	0.7			3.1						4.5	0.3
Delay (s)	11.9	8.3			12.2						34.4	26.6
Level of Service	B	A			B						C	C
Approach Delay (s)		9.9			12.2			0.0			29.7	
Approach LOS		A			B			A			C	

Intersection Summary			
HCM Average Control Delay	17.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	20	15	150	20	30	160
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	20	15	150	20	30	160
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						9
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			35		340	20
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			35		340	20
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		95	85
cM capacity (veh/h)			1576		593	1058

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	20	15	150	20	190
Volume Left	0	0	150	0	30
Volume Right	0	15	0	0	160
cSH	1700	1700	1576	1700	1256
Volume to Capacity	0.01	0.01	0.10	0.01	0.15
Queue Length 95th (m)	0.0	0.0	2.2	0.0	3.7
Control Delay (s)	0.0	0.0	7.5	0.0	9.4
Lane LOS			A		A
Approach Delay (s)	0.0		6.6		9.4
Approach LOS					A

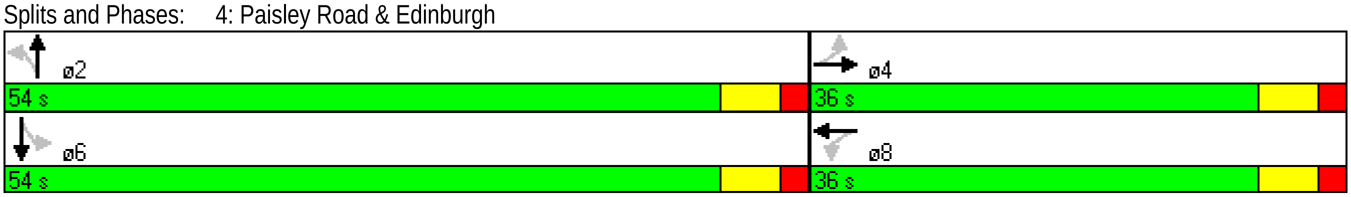
Intersection Summary			
Average Delay	7.4		
Intersection Capacity Utilization	25.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	70	250	50	205	60	530	50	495
Lane Group Flow (vph)	70	335	50	250	60	565	50	565
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.0	29.0	29.0	29.0	28.0	28.0	28.0	28.0
Total Split (s)	36.0	36.0	36.0	36.0	54.0	54.0	54.0	54.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.34	0.70	0.36	0.52	0.13	0.47	0.11	0.47
Control Delay	18.7	21.7	32.8	30.1	5.6	6.3	8.2	10.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.7	21.7	32.8	30.1	5.6	6.3	8.2	10.2
Queue Length 50th (m)	6.4	29.6	6.5	32.2	1.8	17.5	2.7	38.9
Queue Length 95th (m)	m15.2	54.9	14.7	47.0	5.1	37.3	8.4	74.6
Internal Link Dist (m)		1197.0		206.3		775.8		167.4
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	286	649	193	651	463	1207	462	1211
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.52	0.26	0.38	0.13	0.47	0.11	0.47

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 29 (32%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	250	85	50	205	45	60	530	35	50	495	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.97		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1784	1788		1798	1806		1805	1846		1802	1848	
Flt Permitted	0.43	1.00		0.29	1.00		0.37	1.00		0.37	1.00	
Satd. Flow (perm)	803	1788		544	1806		709	1846		708	1848	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	70	250	85	50	205	45	60	530	35	50	495	70
RTOR Reduction (vph)	0	16	0	0	10	0	0	2	0	0	5	0
Lane Group Flow (vph)	70	319	0	50	240	0	60	563	0	50	560	0
Confl. Peds. (#/hr)	10		4	4		10			4	4		
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	2%	0%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	21.2	21.2		21.2	21.2		56.8	56.8		56.8	56.8	
Effective Green, g (s)	23.2	23.2		23.2	23.2		58.8	58.8		58.8	58.8	
Actuated g/C Ratio	0.26	0.26		0.26	0.26		0.65	0.65		0.65	0.65	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	207	461		140	466		463	1206		463	1207	
v/s Ratio Prot		c0.18			0.13			c0.30			0.30	
v/s Ratio Perm	0.09			0.09			0.08			0.07		
v/c Ratio	0.34	0.69		0.36	0.51		0.13	0.47		0.11	0.46	
Uniform Delay, d1	27.2	30.2		27.3	28.6		5.9	7.8		5.8	7.8	
Progression Factor	0.57	0.50		1.00	1.00		0.64	0.56		1.00	1.00	
Incremental Delay, d2	0.9	4.2		1.6	1.0		0.6	1.3		0.5	1.3	
Delay (s)	16.5	19.3		28.9	29.5		4.3	5.6		6.3	9.0	
Level of Service	B	B		C	C		A	A		A	A	
Approach Delay (s)		18.8			29.4			5.5			8.8	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	35	85	75	130	20	480	30	530
Lane Group Flow (vph)	35	150	75	155	20	545	30	550
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	57.0	57.0	57.0	57.0
Total Split (s)	30.0	30.0	30.0	30.0	60.0	60.0	60.0	60.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Min	C-Min
v/c Ratio	0.23	0.47	0.47	0.52	0.03	0.39	0.05	0.39
Control Delay	34.7	27.8	43.2	37.5	1.3	4.0	3.4	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.7	27.8	43.2	37.5	1.3	4.0	3.4	4.2
Queue Length 50th (m)	4.8	15.1	11.0	21.1	0.2	22.8	0.9	19.2
Queue Length 95th (m)	m11.9	29.1	22.0	35.8	0.8	37.5	m2.0	25.4
Internal Link Dist (m)		218.2		241.7		109.7		775.8
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	268	535	282	525	594	1392	599	1403
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.28	0.27	0.30	0.03	0.39	0.05	0.39

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 85 (94%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh

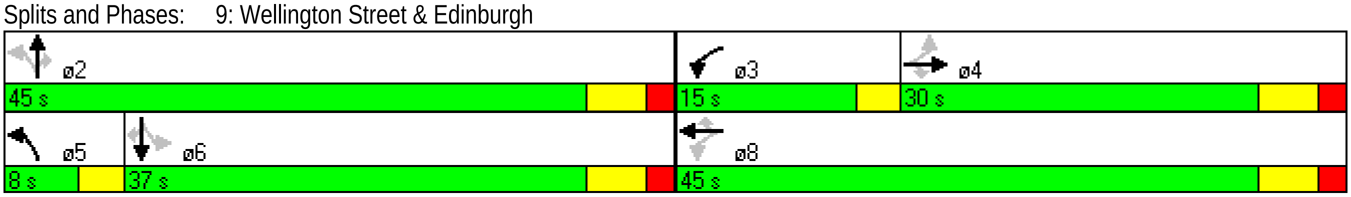
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	85	65	75	130	25	20	480	65	30	530	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.98		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1697	1746		1743	1790		1803	1855		1804	1870	
Flt Permitted	0.52	1.00		0.53	1.00		0.42	1.00		0.42	1.00	
Satd. Flow (perm)	926	1746		976	1790		793	1855		799	1870	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	85	65	75	130	25	20	480	65	30	530	20
RTOR Reduction (vph)	0	36	0	0	9	0	0	4	0	0	1	0
Lane Group Flow (vph)	35	114	0	75	146	0	20	541	0	30	549	0
Confl. Peds. (#/hr)	2		3	3		2	3		2	2		3
Heavy Vehicles (%)	6%	1%	0%	3%	3%	4%	0%	0%	3%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	12.6	12.6		12.6	12.6		65.4	65.4		65.4	65.4	
Effective Green, g (s)	14.6	14.6		14.6	14.6		67.4	67.4		67.4	67.4	
Actuated g/C Ratio	0.16	0.16		0.16	0.16		0.75	0.75		0.75	0.75	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	150	283		158	290		594	1389		598	1400	
v/s Ratio Prot		0.07			c0.08			0.29			c0.29	
v/s Ratio Perm	0.04			0.08			0.03			0.04		
v/c Ratio	0.23	0.40		0.47	0.50		0.03	0.39		0.05	0.39	
Uniform Delay, d1	32.8	33.8		34.2	34.4		2.9	4.0		2.9	4.0	
Progression Factor	0.99	0.98		1.00	1.00		0.32	0.71		0.85	0.76	
Incremental Delay, d2	0.8	0.9		2.2	1.4		0.1	0.8		0.1	0.7	
Delay (s)	33.3	34.2		36.5	35.8		1.0	3.7		2.6	3.8	
Level of Service	C	C		D	D		A	A		A	A	
Approach Delay (s)		34.0			36.0			3.6			3.7	
Approach LOS		C			D			A			A	

Intersection Summary			
HCM Average Control Delay	12.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	525	90	200	475	40	120	490	175	60	555	45
Lane Group Flow (vph)	35	525	90	200	475	40	120	490	175	60	555	45
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	15.0	45.0	45.0	8.0	45.0	45.0	37.0	37.0	37.0
Total Split (%)	33.3%	33.3%	33.3%	16.7%	50.0%	50.0%	8.9%	50.0%	50.0%	41.1%	41.1%	41.1%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	1.0	-2.0	-2.0	1.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.17	0.64	0.20	0.65	0.34	0.06	0.31	0.26	0.19	0.17	0.38	0.07
Control Delay	27.9	34.3	6.8	28.0	19.3	5.0	15.1	13.4	2.9	19.1	17.5	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.9	34.3	6.8	28.0	19.3	5.0	15.1	13.4	2.9	19.1	17.5	6.9
Queue Length 50th (m)	4.4	39.5	0.0	20.8	26.6	0.0	9.7	22.4	0.0	3.7	20.3	0.0
Queue Length 95th (m)	10.9	50.7	9.5	31.6	33.8	4.8	20.0	34.8	9.6	13.5	45.4	5.4
Internal Link Dist (m)		464.5			263.2			253.7			91.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	255	1013	531	322	1612	747	390	1857	903	359	1460	650
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.52	0.17	0.62	0.29	0.05	0.31	0.26	0.19	0.17	0.38	0.07

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 76 (84%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Splits and Phases: 9: Wellington Street & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	525	90	200	475	40	120	490	175	60	555	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1750	3505	1615	1805	3539	1592	1769	3574	1576	1767	3574	1526
Flt Permitted	0.48	1.00	1.00	0.20	1.00	1.00	0.32	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)	885	3505	1615	378	3539	1592	601	3574	1576	880	3574	1526
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	525	90	200	475	40	120	490	175	60	555	45
RTOR Reduction (vph)	0	0	69	0	0	24	0	0	84	0	0	27
Lane Group Flow (vph)	35	525	21	200	475	16	120	490	91	60	555	18
Confl. Peds. (#/hr)	2					2	6		3	3		6
Heavy Vehicles (%)	3%	3%	0%	0%	2%	0%	2%	1%	1%	2%	1%	4%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	19.1	19.1	19.1	33.2	33.2	33.2	44.8	44.8	44.8	34.8	34.8	34.8
Effective Green, g (s)	21.1	21.1	21.1	32.2	35.2	35.2	43.8	46.8	46.8	36.8	36.8	36.8
Actuated g/C Ratio	0.23	0.23	0.23	0.36	0.39	0.39	0.49	0.52	0.52	0.41	0.41	0.41
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	207	822	379	295	1384	623	370	1858	820	360	1461	624
v/s Ratio Prot		0.15		c0.08	0.13		c0.02	0.14			c0.16	
v/s Ratio Perm	0.04		0.01	c0.17		0.01	0.14		0.06	0.07		0.01
v/c Ratio	0.17	0.64	0.06	0.68	0.34	0.03	0.32	0.26	0.11	0.17	0.38	0.03
Uniform Delay, d1	27.5	31.0	26.7	22.0	19.3	16.8	13.4	12.0	11.0	16.9	18.6	15.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.85	1.11
Incremental Delay, d2	0.4	1.6	0.1	6.1	0.1	0.0	0.5	0.3	0.3	0.9	0.7	0.1
Delay (s)	27.9	32.7	26.8	28.1	19.4	16.9	13.9	12.4	11.3	16.6	16.5	17.8
Level of Service	C	C	C	C	B	B	B	B	B	B	B	B
Approach Delay (s)		31.6			21.7			12.4			16.6	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	20.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	530	690	160	120
Lane Group Flow (vph)	576	750	174	130
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	37.0	37.0	37.0	37.0
Total Split (s)	48.0	48.0	42.0	42.0
Total Split (%)	53.3%	53.3%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.16	0.21	0.30	0.37
Control Delay	3.3	3.5	24.2	8.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	3.3	3.5	24.2	8.4
Queue Length 50th (m)	5.7	7.7	8.4	0.0
Queue Length 95th (m)	9.5	12.4	15.2	11.0
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3584	3584	2110	937
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.16	0.21	0.08	0.14

Intersection Summary

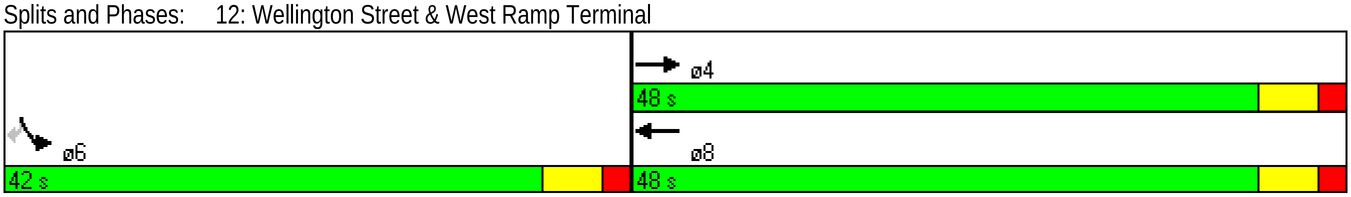
Cycle Length: 90

Actuated Cycle Length: 62.5

Natural Cycle: 75

Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	530	690	0	160	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	5085		3467	1455
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	5085		3467	1455
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	576	750	0	174	130
RTOR Reduction (vph)	0	0	0	0	0	108
Lane Group Flow (vph)	0	576	750	0	174	22
Heavy Vehicles (%)	0%	2%	2%	0%	1%	11%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		42.0	42.0		8.4	8.4
Effective Green, g (s)		44.0	44.0		10.4	10.4
Actuated g/C Ratio		0.71	0.71		0.17	0.17
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3586	3586		578	243
v/s Ratio Prot		0.11	c0.15		c0.05	
v/s Ratio Perm						0.01
v/c Ratio		0.16	0.21		0.30	0.09
Uniform Delay, d1		3.1	3.2		22.8	22.0
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.1	0.1		0.3	0.2
Delay (s)		3.2	3.3		23.1	22.2
Level of Service		A	A		C	C
Approach Delay (s)		3.2	3.3		22.7	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	6.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	62.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	27.4%	ICU Level of Service	A
Analysis Period (min)	15		

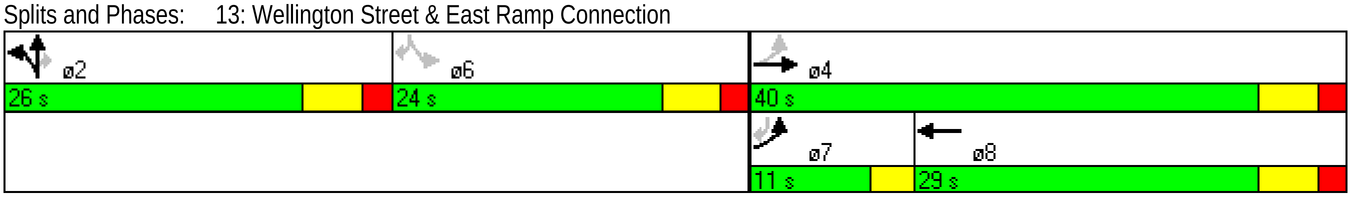
c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBL	NBT	NBR	SBR	ø6
Lane Configurations								
Volume (vph)	95	545	615	210	65	105	165	
Lane Group Flow (vph)	103	592	695	148	151	114	179	
Turn Type	pm+pt			Split		Perm	custom	
Protected Phases	7	4	8	2	2			6
Permitted Phases	4					2	6 7	
Detector Phase	7	4	8	2	2	2	6 7	
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0		24.0
Total Split (s)	11.0	40.0	29.0	26.0	26.0	26.0	35.0	24.0
Total Split (%)	12.2%	44.4%	32.2%	28.9%	28.9%	28.9%	38.9%	27%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0		4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0		2.0
Lost Time Adjust (s)	1.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag	Lead		Lag					
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	None	None	None		None
v/c Ratio	0.30	0.25	0.42	0.47	0.47	0.30	0.34	
Control Delay	15.9	13.5	22.0	33.8	33.5	8.1	22.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	15.9	13.5	22.0	33.8	33.5	8.1	22.2	
Queue Length 50th (m)	7.2	16.0	25.4	18.5	18.9	0.0	17.6	
Queue Length 95th (m)	19.1	29.9	43.2	36.8	37.3	11.4	35.2	
Internal Link Dist (m)		163.9	264.6		261.7			
Turn Bay Length (m)	120.0					170.0		
Base Capacity (vph)	345	2411	1652	492	507	535	526	
Starvation Cap Reductn	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.30	0.25	0.42	0.30	0.30	0.21	0.34	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 76.6
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	95	545	0	0	615	25	210	65	105	0	0	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0	4.0			4.0
Lane Util. Factor	1.00	0.91			0.91		0.95	0.95	1.00			1.00
Frt	1.00	1.00			0.99		1.00	1.00	0.85			0.85
Flt Protected	0.95	1.00			1.00		0.95	0.97	1.00			1.00
Satd. Flow (prot)	1770	5085			5003		1698	1749	1568			1599
Flt Permitted	0.25	1.00			1.00		0.95	0.97	1.00			1.00
Satd. Flow (perm)	474	5085			5003		1698	1749	1568			1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	592	0	0	668	27	228	71	114	0	0	179
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	93	0	0	0
Lane Group Flow (vph)	103	592	0	0	690	0	148	151	21	0	0	179
Heavy Vehicles (%)	2%	2%	0%	0%	3%	5%	1%	0%	3%	0%	0%	1%
Turn Type	pm+pt						Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4								2	6		6 7
Actuated Green, G (s)	34.3	34.3			23.2		12.1	12.1	12.1			26.2
Effective Green, g (s)	33.3	36.3			25.2		14.1	14.1	14.1			28.2
Actuated g/C Ratio	0.44	0.47			0.33		0.18	0.18	0.18			0.37
Clearance Time (s)	3.0	6.0			6.0		6.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	327	2413			1648		313	322	289			589
v/s Ratio Prot	0.03	0.12			c0.14		c0.09	0.09				
v/s Ratio Perm	0.11								0.01			c0.11
v/c Ratio	0.31	0.25			0.42		0.47	0.47	0.07			0.30
Uniform Delay, d1	13.5	12.0			20.0		27.9	27.9	25.8			17.2
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00			1.00
Incremental Delay, d2	2.5	0.2			0.8		1.1	1.1	0.1			0.3
Delay (s)	16.0	12.2			20.7		29.0	28.9	25.9			17.5
Level of Service	B	B			C		C	C	C			B
Approach Delay (s)		12.8			20.7			28.1			17.5	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	76.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			305							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

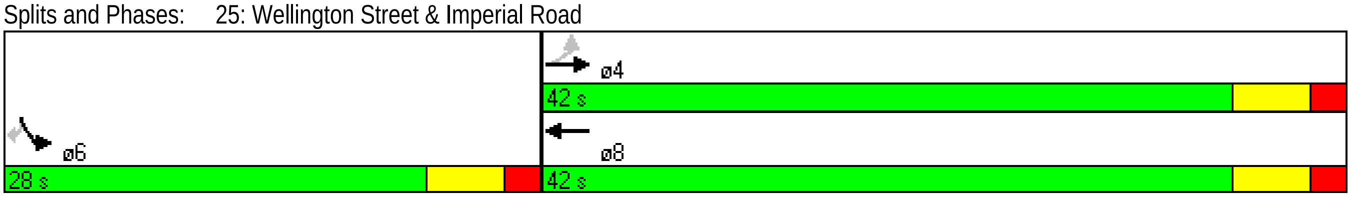
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	80	530	550	315	80
Lane Group Flow (vph)	0	610	790	315	80
Turn Type	Perm				Perm
Protected Phases		4	8	6	
Permitted Phases	4			6	6
Detector Phase	4	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	41.0	41.0	41.0	24.0	24.0
Total Split (s)	42.0	42.0	42.0	28.0	28.0
Total Split (%)	60.0%	60.0%	60.0%	40.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Max	C-Max	C-Max	None	None
v/c Ratio		0.38	0.38	0.60	0.15
Control Delay		9.0	7.1	25.6	5.2
Queue Delay		0.0	0.0	0.0	0.0
Total Delay		9.0	7.1	25.6	5.2
Queue Length 50th (m)		18.5	18.4	31.9	0.0
Queue Length 95th (m)		30.6	31.3	49.7	7.2
Internal Link Dist (m)		188.7	176.3	303.2	
Turn Bay Length (m)					
Base Capacity (vph)		1624	2054	619	601
Starvation Cap Reductn		0	0	0	0
Spillback Cap Reductn		0	0	0	0
Storage Cap Reductn		0	0	0	0
Reduced v/c Ratio		0.38	0.38	0.51	0.13

Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	80	530	550	240	315	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.95		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3520	3361		1805	1599
Flt Permitted		0.77	1.00		0.95	1.00
Satd. Flow (perm)		2740	3361		1805	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	530	550	240	315	80
RTOR Reduction (vph)	0	0	62	0	0	57
Lane Group Flow (vph)	0	610	728	0	315	23
Confl. Peds. (#/hr)	6			6		
Heavy Vehicles (%)	1%	2%	2%	1%	0%	1%
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)		39.5	39.5		18.5	18.5
Effective Green, g (s)		41.5	41.5		20.5	20.5
Actuated g/C Ratio		0.59	0.59		0.29	0.29
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		5.0	5.0
Lane Grp Cap (vph)		1624	1993		529	468
v/s Ratio Prot			0.22		c0.17	
v/s Ratio Perm		c0.22				0.01
v/c Ratio		0.38	0.37		0.60	0.05
Uniform Delay, d1		7.5	7.4		21.2	17.8
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.7	0.5		2.7	0.1
Delay (s)		8.1	7.9		23.9	17.9
Level of Service		A	A		C	B
Approach Delay (s)		8.1	7.9		22.7	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	11.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	735	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	735	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		314	188			
pX, platoon unblocked						
vC, conflicting volume	0				245	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				245	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				722	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	245	245	245	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.14	0.14	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

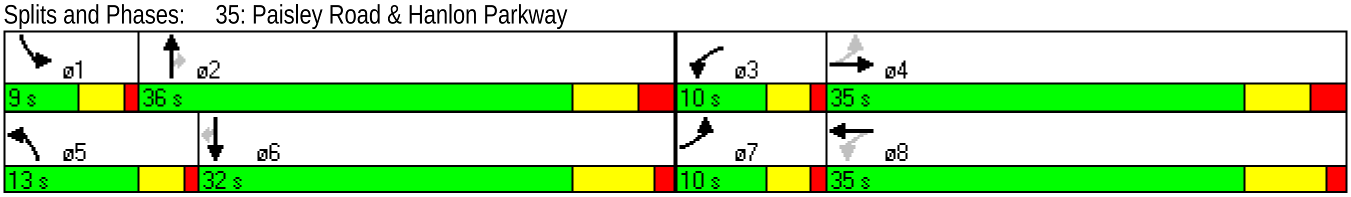
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	130	320	80	200	310	155	1020	175	30	1065	90
Lane Group Flow (vph)	141	348	87	217	375	168	1109	190	33	1158	98
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	33.0	33.0	9.0	33.0	33.0
Total Split (s)	10.0	35.0	0.0	10.0	35.0	13.0	36.0	36.0	9.0	32.0	32.0
Total Split (%)	11.1%	38.9%	0.0%	11.1%	38.9%	14.4%	40.0%	40.0%	10.0%	35.6%	35.6%
Yellow Time (s)	3.0	4.5		3.0	5.5	3.0	4.5	4.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	1.5	1.0	2.5	2.5	1.0	1.5	1.5
Lost Time Adjust (s)	0.0	-3.0	0.0	0.0	-3.0	0.0	-3.0	-3.0	0.0	-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	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.57	0.49	0.06	0.82	0.54	0.45	0.60	0.21	0.23	0.72	0.13
Control Delay	33.1	34.2	0.1	44.2	26.7	41.2	18.5	3.2	42.0	24.6	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.1	34.2	0.1	44.2	26.7	41.2	18.5	3.2	42.0	24.6	8.0
Queue Length 50th (m)	16.8	26.2	0.0	24.0	27.9	13.1	67.1	0.0	5.1	76.2	3.0
Queue Length 95th (m)	28.2	36.0	0.0	#43.9	35.9	21.2	99.8	10.8	12.8	#115.8	12.4
Internal Link Dist (m)		119.3			60.6		643.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	248	1243	1577	264	1217	391	1853	925	144	1601	758
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.28	0.06	0.82	0.31	0.43	0.60	0.21	0.23	0.72	0.13

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 44 (49%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 35: Paisley Road & Hanlon Parkway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	320	80	200	310	35	155	1020	175	30	1065	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1786	3610	1577	1803	3504		3467	3539	1594	1805	3539	1599
Flt Permitted	0.35	1.00	1.00	0.39	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	660	3610	1577	734	3504		3467	3539	1594	1805	3539	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	348	87	217	337	38	168	1109	190	33	1158	98
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	94	0	0	35
Lane Group Flow (vph)	141	348	87	217	363	0	168	1109	96	33	1158	63
Confl. Peds. (#/hr)	4		5	5		4			1	1		
Heavy Vehicles (%)	1%	0%	1%	0%	1%	4%	1%	2%	0%	0%	2%	1%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	20.6	14.6	90.0	20.6	14.6		9.7	42.5	42.5	4.9	37.7	37.7
Effective Green, g (s)	20.6	17.6	90.0	20.6	17.6		9.7	45.5	45.5	4.9	40.7	40.7
Actuated g/C Ratio	0.23	0.20	1.00	0.23	0.20		0.11	0.51	0.51	0.05	0.45	0.45
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	226	706	1577	239	685		374	1789	806	98	1600	723
v/s Ratio Prot	0.04	0.10		c0.06	0.10		c0.05	0.31		0.02	c0.33	
v/s Ratio Perm	0.10		0.06	c0.15					0.06			0.04
v/c Ratio	0.62	0.49	0.06	0.91	0.53		0.45	0.62	0.12	0.34	0.72	0.09
Uniform Delay, d1	29.2	32.2	0.0	32.5	32.5		37.6	16.0	11.7	41.0	20.1	14.1
Progression Factor	1.00	1.00	1.00	0.74	0.78		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.3	0.5	0.1	32.7	0.7		0.9	1.6	0.3	2.0	2.9	0.2
Delay (s)	34.5	32.8	0.1	56.8	26.0		38.5	17.6	12.0	43.0	23.0	14.3
Level of Service	C	C	A	E	C		D	B	B	D	C	B
Approach Delay (s)		28.3			37.3			19.3			22.8	
Approach LOS		C			D			B			C	

Intersection Summary			
HCM Average Control Delay	24.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	SBL	SBT	SBR	ø2
Lane Configurations							
Volume (vph)	255	265	290	255	5	250	
Lane Group Flow (vph)	255	265	450	0	260	250	
Turn Type	pm+pt			pm+pt		Perm	
Protected Phases	7	4	8	1	6		2
Permitted Phases	4			6		6	
Detector Phase	7	4	8	1	6	6	
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	8.0	29.0	29.0	29.0
Total Split (s)	16.0	53.0	37.0	8.0	37.0	37.0	29.0
Total Split (%)	17.8%	58.9%	41.1%	8.9%	41.1%	41.1%	32%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	-2.0	1.0	-2.0	-2.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag	Lead		Lag	Lead			Lag
Lead-Lag Optimize?							
Recall Mode	None	C-Max	C-Max	None	None	None	None
v/c Ratio	0.49	0.22	0.52		0.68	0.40	
Control Delay	15.0	11.8	14.4		37.5	4.8	
Queue Delay	0.0	0.0	0.0		0.0	0.0	
Total Delay	15.0	11.8	14.4		37.5	4.8	
Queue Length 50th (m)	32.6	33.8	27.5		36.7	0.0	
Queue Length 95th (m)	51.8	53.1	59.9		53.2	13.2	
Internal Link Dist (m)		125.5	1197.0		126.1		
Turn Bay Length (m)							
Base Capacity (vph)	550	1190	873		501	751	
Starvation Cap Reductn	0	0	0		0	0	
Spillback Cap Reductn	0	0	0		0	0	
Storage Cap Reductn	0	0	0		0	0	
Reduced v/c Ratio	0.46	0.22	0.52		0.52	0.33	

Intersection Summary

Cycle Length: 90

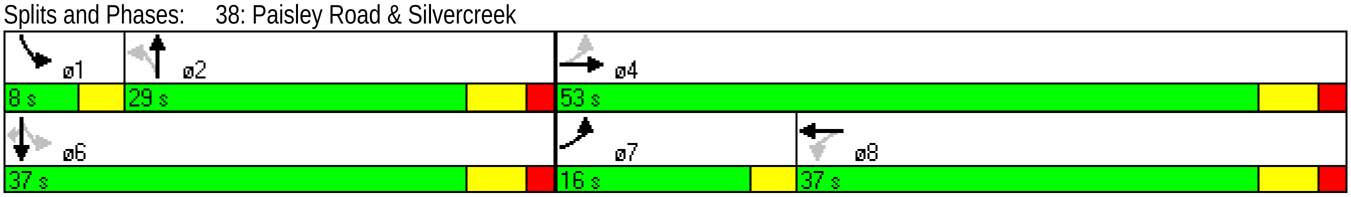
Actuated Cycle Length: 90

Offset: 46 (51%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	255	265	0	0	290	160	0	0	0	255	5	250
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	4.0	4.0			4.0						4.0	4.0
Lane Util. Factor	1.00	1.00			1.00						1.00	1.00
Frpb, ped/bikes	1.00	1.00			1.00						1.00	1.00
Flpb, ped/bikes	1.00	1.00			1.00						0.99	1.00
Frt	1.00	1.00			0.95						1.00	0.85
Flt Protected	0.95	1.00			1.00						0.95	1.00
Satd. Flow (prot)	1805	1881			1780						1783	1615
Flt Permitted	0.33	1.00			1.00						0.73	1.00
Satd. Flow (perm)	618	1881			1780						1366	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	255	265	0	0	290	160	0	0	0	255	5	250
RTOR Reduction (vph)	0	0	0	0	18	0	0	0	0	0	0	180
Lane Group Flow (vph)	255	265	0	0	432	0	0	0	0	0	260	70
Confl. Peds. (#/hr)			3	3					3	3		
Heavy Vehicles (%)	0%	1%	2%	2%	2%	1%	0%	0%	0%	1%	2%	0%
Turn Type	pm+pt			Perm			Perm			pm+pt		Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	54.9	54.9			41.2						23.1	23.1
Effective Green, g (s)	53.9	56.9			43.2						25.1	25.1
Actuated g/C Ratio	0.60	0.63			0.48						0.28	0.28
Clearance Time (s)	3.0	6.0			6.0						6.0	6.0
Vehicle Extension (s)	3.0	3.0			3.0						3.0	3.0
Lane Grp Cap (vph)	498	1189			854						381	450
v/s Ratio Prot	c0.06	0.14			0.24							
v/s Ratio Perm	c0.25										c0.19	0.04
v/c Ratio	0.51	0.22			0.51						0.68	0.15
Uniform Delay, d1	10.3	7.1			16.1						28.9	24.5
Progression Factor	1.39	1.35			0.71						1.00	1.00
Incremental Delay, d2	0.9	0.4			2.1						5.0	0.2
Delay (s)	15.1	10.0			13.4						33.9	24.6
Level of Service	B	A			B						C	C
Approach Delay (s)		12.5			13.4			0.0			29.3	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM Average Control Delay	18.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX E
Capacity Analysis Results
Phases 1 & 2
Future Total Traffic Conditions

APPENDIX E

Capacity Analysis Results

Phases 1 & 2

Future Total Traffic Conditions

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	85	475	315	90	350	280
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	85	475	315	90	350	280
Approach Volume (veh/h)	560			405	630	
Crossing Volume (veh/h)	315			350	85	
High Capacity (veh/h)	1081			1052	1296	
High v/c (veh/h)	0.52			0.39	0.49	
Low Capacity (veh/h)	887			860	1080	
Low v/c (veh/h)	0.63			0.47	0.58	

Intersection Summary			
Maximum v/c High	0.52		
Maximum v/c Low	0.63		
Intersection Capacity Utilization	102.5%	ICU Level of Service	G

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	170	430	40	405	110	625	85	580
Lane Group Flow (vph)	170	505	40	460	110	655	85	680
Turn Type	pm+pt		Perm		pm+pt		pm+pt	
Protected Phases	7	4		8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	29.0	29.0	29.0	8.0	28.0	8.0	28.0
Total Split (s)	8.0	39.0	31.0	31.0	8.0	43.0	8.0	43.0
Total Split (%)	8.9%	43.3%	34.4%	34.4%	8.9%	47.8%	8.9%	47.8%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	2.0	5.0	2.0	5.0
Lead/Lag	Lead		Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.79	0.74	0.25	0.89	0.43	0.78	0.31	0.81
Control Delay	43.9	25.7	29.4	52.1	15.6	27.1	12.9	31.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.9	25.7	29.4	52.1	15.6	27.1	12.9	31.9
Queue Length 50th (m)	15.3	49.5	4.9	68.0	7.8	60.9	6.1	94.5
Queue Length 95th (m)	m#30.8	m71.7	12.8	#116.2	m14.6	#141.1	12.2	#154.5
Internal Link Dist (m)		1213.0		222.3		775.1		164.8
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	214	703	166	533	253	843	274	836
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.72	0.24	0.86	0.43	0.78	0.31	0.81

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 23 (26%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

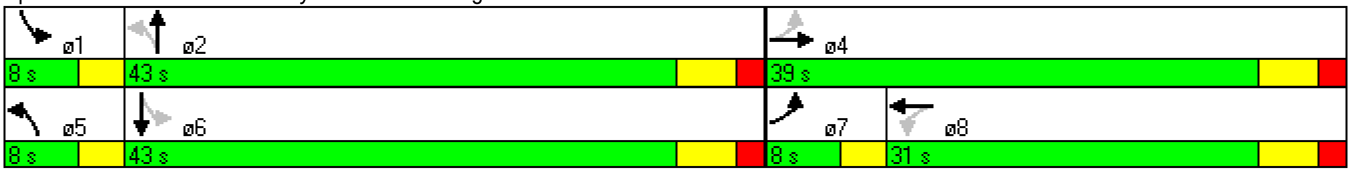
Natural Cycle: 80

Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	430	75	40	405	55	110	625	30	85	580	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0		5.0	5.0		2.0	5.0		2.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1842		1805	1828		1787	1869		1805	1842	
Flt Permitted	0.15	1.00		0.30	1.00		0.15	1.00		0.17	1.00	
Satd. Flow (perm)	280	1842		576	1828		278	1869		322	1842	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	170	430	75	40	405	55	110	625	30	85	580	100
RTOR Reduction (vph)	0	7	0	0	6	0	0	2	0	0	7	0
Lane Group Flow (vph)	170	498	0	40	454	0	110	653	0	85	673	0
Confl. Peds. (#/hr)	4					4						
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	1%	1%	0%	0%	1%	0%
Turn Type	pm+pt			Perm			pm+pt			pm+pt		
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	32.1	32.1		24.1	24.1		42.9	38.9		42.9	38.9	
Effective Green, g (s)	33.1	33.1		25.1	25.1		44.9	39.9		44.9	39.9	
Actuated g/C Ratio	0.37	0.37		0.28	0.28		0.50	0.44		0.50	0.44	
Clearance Time (s)	3.0	6.0		6.0	6.0		3.0	6.0		3.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	205	677		161	510		223	829		243	817	
v/s Ratio Prot	c0.06	0.27			c0.25		c0.03	0.35		0.02	c0.37	
v/s Ratio Perm	0.25			0.07			0.22			0.16		
v/c Ratio	0.83	0.74		0.25	0.89		0.49	0.79		0.35	0.82	
Uniform Delay, d1	22.4	24.7		25.1	31.1		16.2	21.4		15.3	22.0	
Progression Factor	1.03	0.80		1.00	1.00		1.13	0.93		1.00	1.00	
Incremental Delay, d2	20.5	3.6		0.8	17.5		1.3	6.0		0.9	9.2	
Delay (s)	43.5	23.4		26.0	48.6		19.6	25.9		16.2	31.2	
Level of Service	D	C		C	D		B	C		B	C	
Approach Delay (s)		28.5			46.8			25.0			29.6	
Approach LOS		C			D			C			C	

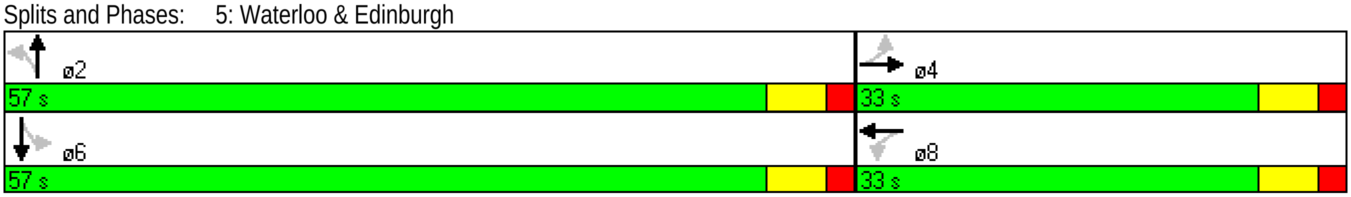
Intersection Summary			
HCM Average Control Delay	31.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	91.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	60	270	110	310	45	670	40	695
Lane Group Flow (vph)	60	310	110	370	45	735	40	740
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	55.0	55.0	55.0	55.0
Total Split (s)	33.0	33.0	33.0	33.0	57.0	57.0	57.0	57.0
Total Split (%)	36.7%	36.7%	36.7%	36.7%	63.3%	63.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.48	0.65	0.65	0.78	0.15	0.64	0.13	0.63
Control Delay	40.5	34.7	47.7	41.5	7.9	21.8	5.0	6.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.5	34.7	47.7	41.5	7.9	21.8	5.0	6.4
Queue Length 50th (m)	8.0	42.1	15.4	52.5	2.3	62.7	1.2	23.3
Queue Length 95th (m)	18.8	62.7	30.9	76.4	5.6	102.4	m1.9	m30.5
Internal Link Dist (m)		842.2		241.7		111.7		775.1
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	149	570	200	564	308	1154	305	1183
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.54	0.55	0.66	0.15	0.64	0.13	0.63

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 74 (82%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	270	40	110	310	60	45	670	65	40	695	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.97	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1752	1812		1715	1790		1797	1832		1759	1879	
Flt Permitted	0.26	1.00		0.36	1.00		0.26	1.00		0.26	1.00	
Satd. Flow (perm)	480	1812		644	1790		490	1832		486	1879	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	270	40	110	310	60	45	670	65	40	695	45
RTOR Reduction (vph)	0	7	0	0	8	0	0	3	0	0	2	0
Lane Group Flow (vph)	60	303	0	110	362	0	45	732	0	40	738	0
Confl. Peds. (#/hr)	10		25	25		10	16		22	22		16
Heavy Vehicles (%)	2%	2%	0%	2%	3%	2%	0%	2%	2%	2%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	22.5	22.5		22.5	22.5		55.5	55.5		55.5	55.5	
Effective Green, g (s)	23.5	23.5		23.5	23.5		56.5	56.5		56.5	56.5	
Actuated g/C Ratio	0.26	0.26		0.26	0.26		0.63	0.63		0.63	0.63	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	125	473		168	467		308	1150		305	1180	
v/s Ratio Prot		0.17			c0.20			c0.40			0.39	
v/s Ratio Perm	0.13			0.17			0.09			0.08		
v/c Ratio	0.48	0.64		0.65	0.77		0.15	0.64		0.13	0.63	
Uniform Delay, d1	28.1	29.5		29.6	30.8		6.9	10.4		6.8	10.3	
Progression Factor	1.00	1.00		1.00	1.00		0.80	1.64		0.50	0.40	
Incremental Delay, d2	2.9	3.0		8.8	7.9		1.0	2.6		0.6	1.8	
Delay (s)	31.0	32.5		38.5	38.7		6.4	19.6		4.1	5.9	
Level of Service	C	C		D	D		A	B		A	A	
Approach Delay (s)		32.2			38.6			18.9			5.8	
Approach LOS		C			D			B			A	

Intersection Summary			
HCM Average Control Delay	20.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	710	190	230	905	80	185	650	160	55	725	65
Lane Group Flow (vph)	50	710	190	230	905	80	185	650	160	55	725	65
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	13.0	43.0	43.0	8.0	47.0	47.0	39.0	39.0	39.0
Total Split (%)	33.3%	33.3%	33.3%	14.4%	47.8%	47.8%	8.9%	52.2%	52.2%	43.3%	43.3%	43.3%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.34	0.80	0.34	0.73	0.64	0.12	0.54	0.38	0.19	0.19	0.52	0.10
Control Delay	33.5	38.8	5.8	31.2	23.8	4.4	19.1	15.8	3.0	10.8	13.1	1.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.5	38.8	5.8	31.2	23.8	4.4	19.1	15.8	3.0	10.8	13.1	1.2
Queue Length 50th (m)	6.3	54.3	0.0	22.1	57.6	0.0	15.7	34.1	0.0	3.5	30.9	0.1
Queue Length 95th (m)	16.0	72.8	13.6	#44.6	75.4	7.2	26.7	46.0	9.0	m5.5	40.0	m0.7
Internal Link Dist (m)		464.5			263.2			253.7			89.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	157	937	586	317	1466	721	342	1731	840	291	1383	645
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.76	0.32	0.73	0.62	0.11	0.54	0.38	0.19	0.19	0.52	0.10

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 11 (12%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

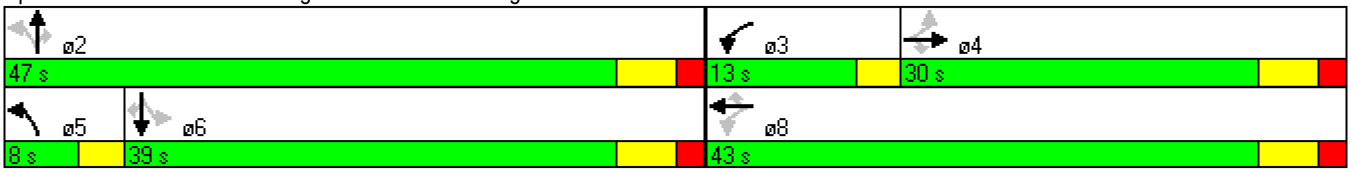
Natural Cycle: 85

Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



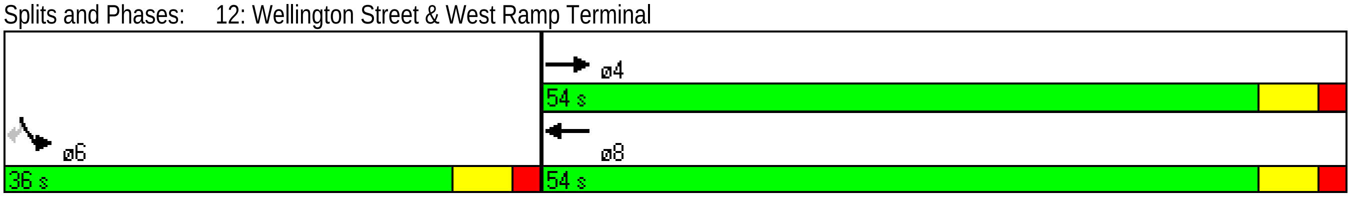
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	710	190	230	905	80	185	650	160	55	725	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3374	1615	1787	3471	1599	1769	3574	1563	1762	3574	1562
Flt Permitted	0.30	1.00	1.00	0.17	1.00	1.00	0.25	1.00	1.00	0.40	1.00	1.00
Satd. Flow (perm)	564	3374	1615	314	3471	1599	474	3574	1563	751	3574	1562
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	50	710	190	230	905	80	185	650	160	55	725	65
RTOR Reduction (vph)	0	0	140	0	0	48	0	0	83	0	0	40
Lane Group Flow (vph)	50	710	50	230	905	32	185	650	77	55	725	25
Confl. Peds. (#/hr)							2		12	12		2
Heavy Vehicles (%)	0%	7%	0%	1%	4%	1%	2%	1%	1%	2%	1%	2%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	22.6	22.6	22.6	35.5	35.5	35.5	42.5	42.5	42.5	33.7	33.7	33.7
Effective Green, g (s)	23.6	23.6	23.6	36.5	36.5	36.5	43.5	43.5	43.5	34.7	34.7	34.7
Actuated g/C Ratio	0.26	0.26	0.26	0.41	0.41	0.41	0.48	0.48	0.48	0.39	0.39	0.39
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	148	885	423	306	1408	648	327	1727	755	290	1378	602
v/s Ratio Prot		c0.21		c0.09	0.26		c0.04	0.18			c0.20	
v/s Ratio Perm	0.09		0.03	0.21		0.02	0.23		0.05	0.07		0.02
v/c Ratio	0.34	0.80	0.12	0.75	0.64	0.05	0.57	0.38	0.10	0.19	0.53	0.04
Uniform Delay, d1	26.9	31.0	25.3	19.9	21.5	16.2	14.5	14.7	12.6	18.3	21.3	17.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.49	0.55	0.18
Incremental Delay, d2	1.4	5.3	0.1	10.0	1.0	0.0	2.2	0.6	0.3	1.1	1.1	0.1
Delay (s)	28.2	36.3	25.4	29.9	22.5	16.3	16.7	15.3	12.9	10.1	12.9	3.2
Level of Service	C	D	C	C	C	B	B	B	B	B	B	A
Approach Delay (s)		33.7			23.5			15.2			11.9	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	21.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	960	1410	150	90
Lane Group Flow (vph)	1043	1533	163	98
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	38.0	38.0	33.0	33.0
Total Split (s)	54.0	54.0	36.0	36.0
Total Split (%)	60.0%	60.0%	40.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.29	0.42	0.33	0.42
Control Delay	4.2	4.9	28.2	26.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	4.2	4.9	28.2	26.5
Queue Length 50th (m)	13.0	21.7	9.1	8.0
Queue Length 95th (m)	22.0	35.5	16.1	19.5
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3577	3612	1469	648
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.29	0.42	0.11	0.15

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 70.4
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	960	1410	0	150	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5036	5085		3335	1442
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5036	5085		3335	1442
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1043	1533	0	163	98
RTOR Reduction (vph)	0	0	0	0	0	20
Lane Group Flow (vph)	0	1043	1533	0	163	78
Heavy Vehicles (%)	0%	3%	2%	0%	5%	12%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		49.0	49.0		9.4	9.4
Effective Green, g (s)		50.0	50.0		10.4	10.4
Actuated g/C Ratio		0.71	0.71		0.15	0.15
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3577	3612		493	213
v/s Ratio Prot		0.21	c0.30		0.05	
v/s Ratio Perm						c0.05
v/c Ratio		0.29	0.42		0.33	0.36
Uniform Delay, d1		3.7	4.2		26.9	27.0
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.2	0.4		0.4	1.1
Delay (s)		3.9	4.6		27.3	28.1
Level of Service		A	A		C	C
Approach Delay (s)		3.9	4.6		27.6	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	6.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	70.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	160	705	930	220	305	250	85	160	630
Lane Group Flow (vph)	174	766	1011	239	295	309	92	174	685
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	10.0	39.0	29.0	29.0	26.0	26.0	26.0	25.0	35.0
Total Split (%)	11.1%	43.3%	32.2%	32.2%	28.9%	28.9%	28.9%	27.8%	38.9%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.69	0.40	0.74	0.39	0.81	0.79	0.22	0.73	0.73
Control Delay	33.2	20.7	33.4	5.7	51.5	48.7	7.9	52.3	31.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.2	20.7	33.4	5.7	51.5	48.7	7.9	52.3	31.5
Queue Length 50th (m)	17.7	32.2	54.1	0.0	46.3	48.3	0.0	25.9	54.2
Queue Length 95th (m)	#36.4	41.8	68.0	15.3	#82.6	#83.3	10.5	#53.8	74.3
Internal Link Dist (m)		150.3	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	253	1914	1365	615	395	424	442	244	919
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	0.69	0.40	0.74	0.39	0.75	0.73	0.21	0.71	0.75

Intersection Summary

Cycle Length: 90

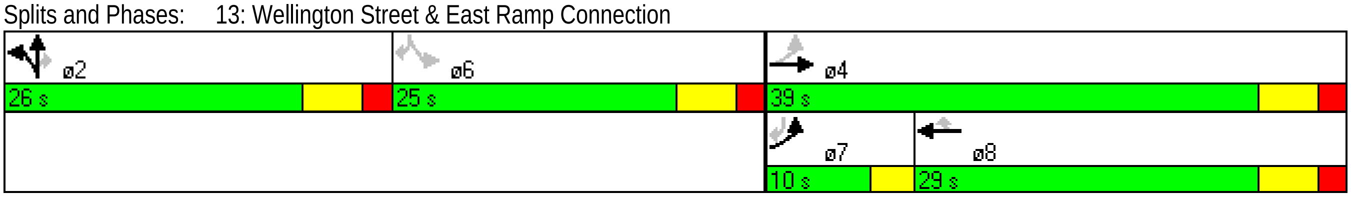
Actuated Cycle Length: 87.9

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

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

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	705	0	0	930	220	305	250	85	160	0	630
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.99	1.00	0.95		1.00
Satd. Flow (prot)	1752	4940			4988	1615	1649	1770	1553	1805		2787
Flt Permitted	0.15	1.00			1.00	1.00	0.95	0.99	1.00	0.56		1.00
Satd. Flow (perm)	283	4940			4988	1615	1649	1770	1553	1071		2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	766	0	0	1011	239	332	272	92	174	0	685
RTOR Reduction (vph)	0	0	0	0	0	173	0	0	72	0	0	0
Lane Group Flow (vph)	174	766	0	0	1011	66	295	309	20	174	0	685
Heavy Vehicles (%)	3%	5%	0%	0%	4%	0%	4%	1%	4%	0%	0%	2%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	33.1	33.1			23.1	23.1	18.3	18.3	18.3	18.5		31.5
Effective Green, g (s)	34.1	34.1			24.1	24.1	19.3	19.3	19.3	19.5		32.5
Actuated g/C Ratio	0.39	0.39			0.27	0.27	0.22	0.22	0.22	0.22		0.37
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	243	1916			1368	443	362	389	341	238		1030
v/s Ratio Prot	0.07	0.16			c0.20		c0.18	0.17				
v/s Ratio Perm	0.21					0.04			0.01	0.16		c0.25
v/c Ratio	0.72	0.40			0.74	0.15	0.81	0.79	0.06	0.73		0.67
Uniform Delay, d1	19.8	19.5			29.0	24.1	32.6	32.4	27.1	31.8		23.2
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	16.5	0.6			3.6	0.7	13.2	10.7	0.1	11.0		1.6
Delay (s)	36.3	20.1			32.7	24.8	45.8	43.1	27.2	42.7		24.8
Level of Service	D	C			C	C	D	D	C	D		C
Approach Delay (s)		23.1			31.2			42.1			28.4	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM Average Control Delay	30.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	87.9	Sum of lost time (s)	15.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			303							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	110	785	1155	395	35
Lane Group Flow (vph)	110	785	1475	395	35
Turn Type	pm+pt				Perm
Protected Phases	7	4	8	6	
Permitted Phases	4			6	6
Detector Phase	7	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	41.0	41.0	24.0	24.0
Total Split (s)	11.0	60.0	49.0	30.0	30.0
Total Split (%)	12.2%	66.7%	54.4%	33.3%	33.3%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	C-Max	C-Max	None	None
v/c Ratio	0.43	0.70	0.82	0.83	0.09
Control Delay	13.8	15.9	23.2	46.9	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.8	15.9	23.2	46.9	9.2
Queue Length 50th (m)	5.9	78.2	101.8	58.2	0.0
Queue Length 95th (m)	15.6	117.5	#137.1	#98.3	6.2
Internal Link Dist (m)		188.7	176.5	303.2	
Turn Bay Length (m)	100.0				
Base Capacity (vph)	267	1125	1797	496	419
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.41	0.70	0.82	0.80	0.08

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

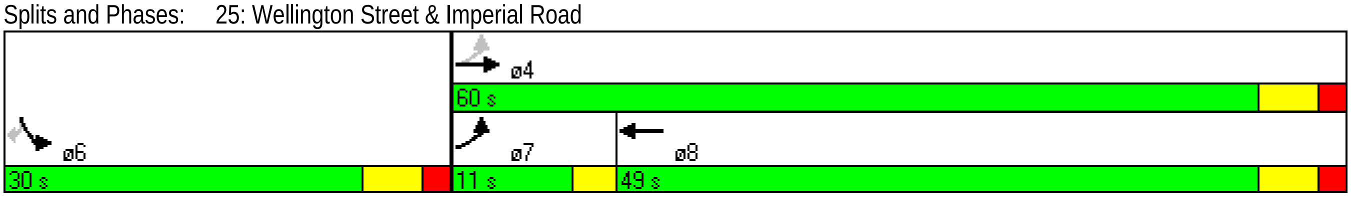
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

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

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	110	785	1155	320	395	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1810	3361		1787	1417
Flt Permitted	0.08	1.00	1.00		0.95	1.00
Satd. Flow (perm)	156	1810	3361		1787	1417
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	785	1155	320	395	35
RTOR Reduction (vph)	0	0	26	0	0	26
Lane Group Flow (vph)	110	785	1449	0	395	9
Confl. Peds. (#/hr)	4			4		
Heavy Vehicles (%)	0%	5%	4%	1%	1%	14%
Turn Type	pm+pt					Perm
Protected Phases	7	4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)	54.9	54.9	45.8		23.1	23.1
Effective Green, g (s)	55.9	55.9	46.8		24.1	24.1
Actuated g/C Ratio	0.62	0.62	0.52		0.27	0.27
Clearance Time (s)	3.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	227	1124	1748		479	379
v/s Ratio Prot	0.04	c0.43	c0.43		c0.22	
v/s Ratio Perm	0.26					0.01
v/c Ratio	0.48	0.70	0.83		0.82	0.02
Uniform Delay, d1	13.7	11.4	18.2		31.0	24.3
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.6	3.6	4.7		12.3	0.1
Delay (s)	15.3	15.0	22.9		43.3	24.3
Level of Service	B	B	C		D	C
Approach Delay (s)		15.1	22.9		41.7	
Approach LOS		B	C		D	

Intersection Summary			
HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑↑↑	↑↑↑→			
Volume (veh/h)	0	935	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	935	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		327	174			
pX, platoon unblocked						
vC, conflicting volume	0				312	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				312	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				656	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	312	312	312	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.18	0.18	0.18	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	335	165	160	385	285	1295	250	95	1380	80
Lane Group Flow (vph)	114	364	179	174	489	310	1408	272	103	1500	87
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	59.0	59.0	9.0	57.0	57.0
Total Split (s)	11.0	35.0	0.0	12.0	36.0	19.0	82.0	82.0	15.0	78.0	78.0
Total Split (%)	7.6%	24.3%	0.0%	8.3%	25.0%	13.2%	56.9%	56.9%	10.4%	54.2%	54.2%
Yellow Time (s)	3.0	4.5		3.0	4.5	3.0	5.5	5.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	2.5	1.0	1.5	1.5	1.0	1.5	1.5
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.0	6.0	3.0	3.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.62	0.59	0.11	0.72	0.78	0.75	0.73	0.28	0.66	0.82	0.10
Control Delay	55.6	58.7	0.1	61.0	64.1	73.3	27.8	4.3	83.2	34.0	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.6	58.7	0.1	61.0	64.1	73.3	27.8	4.3	83.2	34.0	11.4
Queue Length 50th (m)	23.2	46.7	0.0	36.8	63.5	40.4	148.2	5.4	26.1	175.3	6.6
Queue Length 95th (m)	37.0	60.1	0.0	54.1	79.1	#60.4	176.6	18.4	#50.8	207.4	15.3
Internal Link Dist (m)		119.3			205.7		653.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	184	727	1594	240	731	420	1920	983	162	1834	851
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.62	0.50	0.11	0.73	0.67	0.74	0.73	0.28	0.64	0.82	0.10

Intersection Summary

Cycle Length: 144
Actuated Cycle Length: 144
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 35: Paisley Road & Hanlon Parkway

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	335	165	160	385	65	285	1295	250	95	1380	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1594	1786	3465		3502	3471	1594	1770	3505	1593
Flt Permitted	0.23	1.00	1.00	0.34	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	436	3610	1594	645	3465		3502	3471	1594	1770	3505	1593
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	364	179	174	418	71	310	1408	272	103	1500	87
RTOR Reduction (vph)	0	0	0	0	10	0	0	0	102	0	0	18
Lane Group Flow (vph)	114	364	179	174	479	0	310	1408	170	103	1500	69
Confl. Peds. (#/hr)	1		3	3		1	2		1	1		2
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	4%	0%	2%	3%	0%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	30.7	23.7	144.0	32.7	24.7		16.0	78.6	78.6	11.7	74.3	74.3
Effective Green, g (s)	32.7	24.7	144.0	34.7	25.7		17.0	79.6	79.6	12.7	75.3	75.3
Actuated g/C Ratio	0.23	0.17	1.00	0.24	0.18		0.12	0.55	0.55	0.09	0.52	0.52
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	175	619	1594	227	618		413	1919	881	156	1833	833
v/s Ratio Prot	0.04	0.10		c0.05	c0.14		c0.09	0.41		0.06	c0.43	
v/s Ratio Perm	0.11		0.11	0.14					0.11			0.04
v/c Ratio	0.65	0.59	0.11	0.77	0.78		0.75	0.73	0.19	0.66	0.82	0.08
Uniform Delay, d1	46.6	55.0	0.0	48.6	56.4		61.4	24.2	16.1	63.6	28.6	17.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.4	1.4	0.1	14.3	6.1		7.5	2.5	0.5	10.0	4.2	0.2
Delay (s)	55.0	56.4	0.1	62.9	62.4		68.9	26.8	16.6	73.6	32.9	17.3
Level of Service	D	E	A	E	E		E	C	B	E	C	B
Approach Delay (s)		40.8			62.6			31.9			34.5	
Approach LOS		D			E			C			C	

Intersection Summary			
HCM Average Control Delay	38.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	275	355	50	180	275	55	70	225	110	285
Lane Group Flow (vph)	275	355	50	180	455	55	210	225	110	285
Turn Type	pm+pt		Perm	pm+pt		Perm		pm+pt		Perm
Protected Phases	7	4		3	8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	3	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	8.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	14.0	44.0	44.0	8.0	38.0	29.0	29.0	9.0	38.0	38.0
Total Split (%)	15.6%	48.9%	48.9%	8.9%	42.2%	32.2%	32.2%	10.0%	42.2%	42.2%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	2.0	5.0	5.0	5.0	2.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None
v/c Ratio	0.46	0.36	0.06	0.26	0.52	0.31	0.66	0.90	0.25	0.48
Control Delay	8.8	15.5	4.6	3.3	9.1	37.6	27.1	64.9	27.7	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.8	15.5	4.6	3.3	9.1	37.6	27.1	64.9	27.7	6.0
Queue Length 50th (m)	14.2	31.5	0.0	4.6	17.6	8.0	15.0	30.0	14.3	0.0
Queue Length 95th (m)	29.6	59.0	5.7	m6.9	m41.7	16.6	32.5	#53.6	24.0	15.4
Internal Link Dist (m)		205.7			1213.0		75.2		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	615	982	850	690	879	337	515	251	683	767
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.36	0.06	0.26	0.52	0.16	0.41	0.90	0.16	0.37

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 59 (66%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green

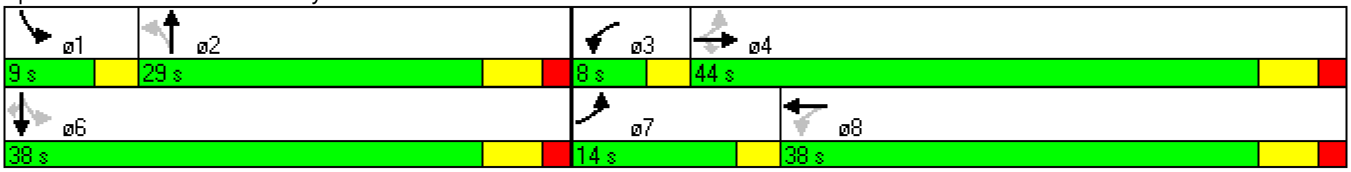
Natural Cycle: 80

Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	275	355	50	180	275	180	55	70	140	225	110	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0		2.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	0.99		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1735	1881	1583	1770	1743		1751	1632		1768	1863	1599
Flt Permitted	0.37	1.00	1.00	0.51	1.00		0.69	1.00		0.31	1.00	1.00
Satd. Flow (perm)	668	1881	1583	956	1743		1264	1632		584	1863	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	275	355	50	180	275	180	55	70	140	225	110	285
RTOR Reduction (vph)	0	0	24	0	21	0	0	94	0	0	0	217
Lane Group Flow (vph)	275	355	26	180	434	0	55	116	0	225	110	68
Confl. Peds. (#/hr)	2					2			2	2		
Heavy Vehicles (%)	4%	1%	2%	2%	2%	1%	0%	0%	0%	2%	2%	1%
Turn Type	pm+pt		Perm	pm+pt			Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	57.2	46.0	46.0	51.8	43.3		11.5	11.5		20.5	20.5	20.5
Effective Green, g (s)	58.5	47.0	47.0	53.8	44.3		12.5	12.5		21.5	21.5	21.5
Actuated g/C Ratio	0.65	0.52	0.52	0.60	0.49		0.14	0.14		0.24	0.24	0.24
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	579	982	827	657	858		176	227		232	445	382
v/s Ratio Prot	c0.06	0.19		0.03	c0.25			c0.07		c0.08	0.06	
v/s Ratio Perm	0.24		0.02	0.13			0.04			0.16		0.04
v/c Ratio	0.47	0.36	0.03	0.27	0.51		0.31	0.51		0.97	0.25	0.18
Uniform Delay, d1	7.8	12.7	10.4	8.2	15.5		34.9	35.9		32.5	27.7	27.2
Progression Factor	1.00	1.00	1.00	0.44	0.47		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.6	1.0	0.1	0.1	1.4		1.0	1.9		49.9	0.3	0.2
Delay (s)	8.4	13.7	10.5	3.7	8.6		35.9	37.9		82.4	28.0	27.5
Level of Service	A	B	B	A	A		D	D		F	C	C
Approach Delay (s)		11.3			7.2			37.5			47.5	
Approach LOS		B			A			D			D	

Intersection Summary			
HCM Average Control Delay	23.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	81.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	105	465	135	115	455	140
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	105	465	135	115	455	140
Approach Volume (veh/h)	570			250	595	
Crossing Volume (veh/h)	135			455	105	
High Capacity (veh/h)	1246			968	1276	
High v/c (veh/h)	0.46			0.26	0.47	
Low Capacity (veh/h)	1035			785	1062	
Low v/c (veh/h)	0.55			0.32	0.56	

Intersection Summary			
Maximum v/c High	0.47		
Maximum v/c Low	0.56		
Intersection Capacity Utilization	91.5%	ICU Level of Service	F

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	105	340	50	310	55	535	50	505
Lane Group Flow (vph)	105	415	50	355	55	570	50	615
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.0	29.0	29.0	29.0	28.0	28.0	28.0	28.0
Total Split (s)	38.0	38.0	38.0	38.0	52.0	52.0	52.0	52.0
Total Split (%)	42.2%	42.2%	42.2%	42.2%	57.8%	57.8%	57.8%	57.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.58	0.75	0.37	0.64	0.15	0.51	0.12	0.55
Control Delay	27.8	25.4	31.4	31.3	8.9	9.6	10.2	13.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.8	25.4	31.4	31.3	8.9	9.6	10.2	13.4
Queue Length 50th (m)	9.2	43.4	6.2	47.1	2.3	24.6	3.1	51.1
Queue Length 95th (m)	m19.4	m60.9	14.6	64.9	m7.5	56.2	9.4	93.6
Internal Link Dist (m)		1197.0		206.3		775.8		167.4
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	226	692	168	694	371	1128	405	1126
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.60	0.30	0.51	0.15	0.51	0.12	0.55

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 24 (27%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	340	75	50	310	45	55	535	35	50	505	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1789	1810		1800	1823		1805	1846		1802	1834	
Flt Permitted	0.32	1.00		0.23	1.00		0.32	1.00		0.35	1.00	
Satd. Flow (perm)	597	1810		445	1823		608	1846		663	1834	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	105	340	75	50	310	45	55	535	35	50	505	110
RTOR Reduction (vph)	0	10	0	0	6	0	0	2	0	0	7	0
Lane Group Flow (vph)	105	405	0	50	349	0	55	568	0	50	608	0
Confl. Peds. (#/hr)	10		4	4		10			4	4		
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	2%	0%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	25.1	25.1		25.1	25.1		52.9	52.9		52.9	52.9	
Effective Green, g (s)	27.1	27.1		27.1	27.1		54.9	54.9		54.9	54.9	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.61	0.61		0.61	0.61	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	180	545		134	549		371	1126		404	1119	
v/s Ratio Prot		c0.22			0.19			0.31			c0.33	
v/s Ratio Perm	0.18			0.11			0.09			0.08		
v/c Ratio	0.58	0.74		0.37	0.64		0.15	0.50		0.12	0.54	
Uniform Delay, d1	26.7	28.3		24.8	27.2		7.5	9.9		7.4	10.2	
Progression Factor	0.64	0.66		1.00	1.00		0.83	0.71		1.00	1.00	
Incremental Delay, d2	4.0	4.6		1.7	2.4		0.8	1.5		0.6	1.9	
Delay (s)	21.0	23.5		26.5	29.6		7.0	8.6		8.0	12.1	
Level of Service	C	C		C	C		A	A		A	B	
Approach Delay (s)		23.0			29.2			8.5			11.8	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	16.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	40	145	75	195	20	475	30	520
Lane Group Flow (vph)	40	200	75	220	20	540	30	550
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	57.0	57.0	57.0	57.0
Total Split (s)	26.0	26.0	26.0	26.0	64.0	64.0	64.0	64.0
Total Split (%)	28.9%	28.9%	28.9%	28.9%	71.1%	71.1%	71.1%	71.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Min	C-Min
v/c Ratio	0.28	0.55	0.47	0.62	0.04	0.41	0.05	0.41
Control Delay	34.8	34.4	41.0	39.2	1.6	4.2	2.8	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.8	34.4	41.0	39.2	1.6	4.2	2.8	3.8
Queue Length 50th (m)	5.5	25.8	10.6	31.1	0.3	22.5	0.6	12.1
Queue Length 95th (m)	13.2	42.3	21.9	48.8	0.9	34.2	m1.4	19.7
Internal Link Dist (m)		218.2		241.7		109.7		775.8
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	177	454	201	447	553	1333	562	1339
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.44	0.37	0.49	0.04	0.41	0.05	0.41

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 79 (88%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	145	55	75	195	25	20	475	65	30	520	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1698	1795		1744	1806		1803	1854		1804	1865	
Flt Permitted	0.40	1.00		0.45	1.00		0.41	1.00		0.41	1.00	
Satd. Flow (perm)	723	1795		825	1806		773	1854		784	1865	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	145	55	75	195	25	20	475	65	30	520	30
RTOR Reduction (vph)	0	16	0	0	6	0	0	5	0	0	2	0
Lane Group Flow (vph)	40	184	0	75	214	0	20	535	0	30	548	0
Confl. Peds. (#/hr)	2		3	3		2	3		2	2		3
Heavy Vehicles (%)	6%	1%	0%	3%	3%	4%	0%	0%	3%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	15.5	15.5		15.5	15.5		62.5	62.5		62.5	62.5	
Effective Green, g (s)	17.5	17.5		17.5	17.5		64.5	64.5		64.5	64.5	
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.72	0.72		0.72	0.72	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	141	349		160	351		554	1329		562	1337	
v/s Ratio Prot		0.10			c0.12			0.29			c0.29	
v/s Ratio Perm	0.06			0.09			0.03			0.04		
v/c Ratio	0.28	0.53		0.47	0.61		0.04	0.40		0.05	0.41	
Uniform Delay, d1	30.9	32.5		32.1	33.1		3.7	5.1		3.8	5.1	
Progression Factor	1.00	1.00		1.00	1.00		0.31	0.58		0.56	0.51	
Incremental Delay, d2	1.1	1.4		2.2	3.1		0.1	0.9		0.2	0.8	
Delay (s)	32.0	34.0		34.3	36.3		1.3	3.8		2.3	3.4	
Level of Service	C	C		C	D		A	A		A	A	
Approach Delay (s)		33.6			35.8			3.7			3.4	
Approach LOS		C			D			A			A	

Intersection Summary			
HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	640	145	200	595	45	180	480	175	65	540	45
Lane Group Flow (vph)	35	640	145	200	595	45	180	480	175	65	540	45
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	13.0	43.0	43.0	9.0	47.0	47.0	38.0	38.0	38.0
Total Split (%)	33.3%	33.3%	33.3%	14.4%	47.8%	47.8%	10.0%	52.2%	52.2%	42.2%	42.2%	42.2%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	1.0	-2.0	-2.0	1.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.17	0.70	0.28	0.74	0.42	0.07	0.46	0.26	0.20	0.18	0.38	0.07
Control Delay	26.9	34.5	5.9	35.6	20.0	5.0	17.7	13.5	2.8	18.9	17.5	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.9	34.5	5.9	35.6	20.0	5.0	17.7	13.5	2.8	18.9	17.5	6.7
Queue Length 50th (m)	4.3	47.8	0.0	20.5	34.2	0.0	15.3	22.2	0.0	4.4	22.9	0.0
Queue Length 95th (m)	11.1	62.8	11.8	#38.5	44.9	5.4	27.4	32.5	9.2	13.9	41.5	m5.1
Internal Link Dist (m)		464.5			263.2			253.7			91.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	227	1013	570	275	1534	715	389	1823	889	353	1419	633
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.63	0.25	0.73	0.39	0.06	0.46	0.26	0.20	0.18	0.38	0.07

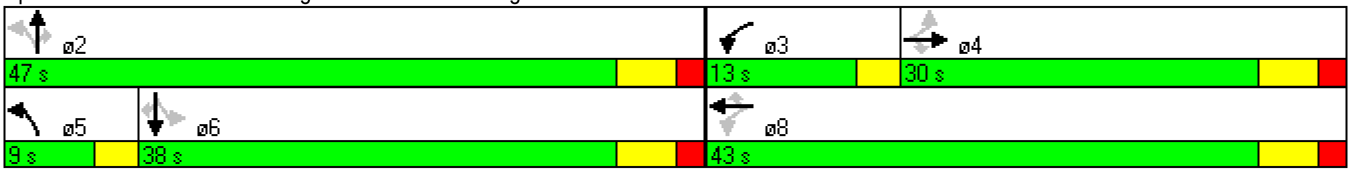
Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 76 (84%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	640	145	200	595	45	180	480	175	65	540	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1751	3505	1615	1805	3539	1592	1769	3574	1576	1767	3574	1526
Flt Permitted	0.43	1.00	1.00	0.16	1.00	1.00	0.33	1.00	1.00	0.48	1.00	1.00
Satd. Flow (perm)	787	3505	1615	311	3539	1592	606	3574	1576	889	3574	1526
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	640	145	200	595	45	180	480	175	65	540	45
RTOR Reduction (vph)	0	0	107	0	0	27	0	0	86	0	0	27
Lane Group Flow (vph)	35	640	38	200	595	18	180	480	89	65	540	18
Confl. Peds. (#/hr)	2					2	6		3	3		6
Heavy Vehicles (%)	3%	3%	0%	0%	2%	0%	2%	1%	1%	2%	1%	4%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	21.4	21.4	21.4	34.1	34.1	34.1	43.9	43.9	43.9	33.7	33.7	33.7
Effective Green, g (s)	23.4	23.4	23.4	33.1	36.1	36.1	42.9	45.9	45.9	35.7	35.7	35.7
Actuated g/C Ratio	0.26	0.26	0.26	0.37	0.40	0.40	0.48	0.51	0.51	0.40	0.40	0.40
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	205	911	420	259	1420	639	369	1823	804	353	1418	605
v/s Ratio Prot		0.18		c0.07	0.17		c0.03	0.13			0.15	
v/s Ratio Perm	0.04		0.02	c0.21		0.01	c0.20		0.06	0.07		0.01
v/c Ratio	0.17	0.70	0.09	0.77	0.42	0.03	0.49	0.26	0.11	0.18	0.38	0.03
Uniform Delay, d1	25.8	30.1	25.2	21.9	19.4	16.3	14.5	12.5	11.5	17.7	19.3	16.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.84	1.11
Incremental Delay, d2	0.4	2.5	0.1	13.3	0.2	0.0	1.0	0.4	0.3	1.1	0.7	0.1
Delay (s)	26.2	32.6	25.3	35.2	19.6	16.3	15.5	12.8	11.7	17.2	16.9	18.5
Level of Service	C	C	C	D	B	B	B	B	B	B	B	B
Approach Delay (s)		31.1			23.2			13.2			17.1	
Approach LOS		C			C			B			B	

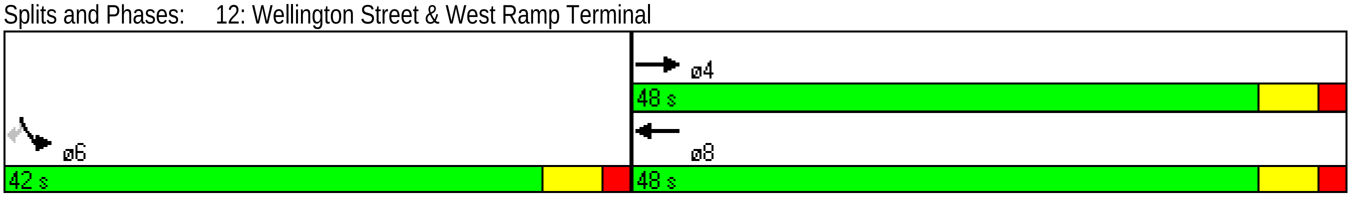
Intersection Summary			
HCM Average Control Delay	21.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	545	700	190	120
Lane Group Flow (vph)	592	761	207	130
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	37.0	37.0	37.0	37.0
Total Split (s)	48.0	48.0	42.0	42.0
Total Split (%)	53.3%	53.3%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.17	0.21	0.34	0.36
Control Delay	3.5	3.7	24.4	8.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	3.5	3.7	24.4	8.1
Queue Length 50th (m)	6.2	8.3	10.1	0.0
Queue Length 95th (m)	10.3	13.4	17.6	10.9
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3549	3549	2090	928
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.17	0.21	0.10	0.14

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 63.1
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	545	700	0	190	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	5085		3467	1455
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	5085		3467	1455
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	592	761	0	207	130
RTOR Reduction (vph)	0	0	0	0	0	107
Lane Group Flow (vph)	0	592	761	0	207	23
Heavy Vehicles (%)	0%	2%	2%	0%	1%	11%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		42.0	42.0		9.1	9.1
Effective Green, g (s)		44.0	44.0		11.1	11.1
Actuated g/C Ratio		0.70	0.70		0.18	0.18
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3546	3546		610	256
v/s Ratio Prot		0.12	c0.15		c0.06	
v/s Ratio Perm						0.02
v/c Ratio		0.17	0.21		0.34	0.09
Uniform Delay, d1		3.3	3.4		22.8	21.8
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.1	0.1		0.3	0.2
Delay (s)		3.4	3.5		23.1	21.9
Level of Service		A	A		C	C
Approach Delay (s)		3.4	3.5		22.7	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	7.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	63.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	27.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	140	545	615	205	210	245	105	170	435
Lane Group Flow (vph)	152	592	668	223	205	289	114	185	473
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	12.0	38.0	26.0	26.0	25.0	25.0	25.0	27.0	39.0
Total Split (%)	13.3%	42.2%	28.9%	28.9%	27.8%	27.8%	27.8%	30.0%	43.3%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	1.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
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					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.51	0.29	0.51	0.39	0.55	0.73	0.26	0.73	0.45
Control Delay	24.9	18.5	29.3	6.4	36.0	43.1	7.6	48.0	21.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.9	18.5	29.3	6.4	36.0	43.1	7.6	48.0	21.6
Queue Length 50th (m)	16.2	23.8	33.9	0.0	30.1	44.4	0.0	26.4	30.7
Queue Length 95th (m)	28.6	31.9	44.6	15.3	50.6	70.4	11.6	#51.7	43.8
Internal Link Dist (m)		163.9	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	296	2053	1315	566	423	448	476	298	1057
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	0.51	0.29	0.51	0.39	0.48	0.65	0.24	0.62	0.45

Intersection Summary

Cycle Length: 90

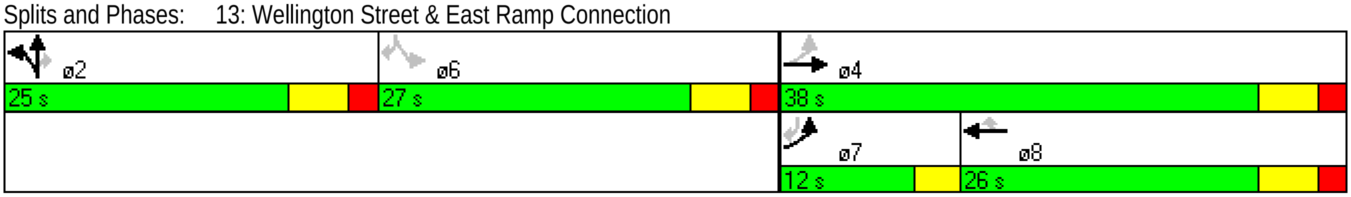
Actuated Cycle Length: 84.8

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

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

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	545	0	0	615	205	210	245	105	170	0	435
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00	0.95		1.00
Satd. Flow (prot)	1770	5085			5036	1538	1698	1796	1568	1805		2814
Flt Permitted	0.22	1.00			1.00	1.00	0.95	1.00	1.00	0.57		1.00
Satd. Flow (perm)	413	5085			5036	1538	1698	1796	1568	1092		2814
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	592	0	0	668	223	228	266	114	185	0	473
RTOR Reduction (vph)	0	0	0	0	0	165	0	0	89	0	0	0
Lane Group Flow (vph)	152	592	0	0	668	58	205	289	25	185	0	473
Heavy Vehicles (%)	2%	2%	0%	0%	3%	5%	1%	0%	3%	0%	0%	1%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	32.2	32.2			20.1	20.1	16.7	16.7	16.7	17.8		32.9
Effective Green, g (s)	31.2	34.2			22.1	22.1	18.7	18.7	18.7	19.8		34.9
Actuated g/C Ratio	0.37	0.40			0.26	0.26	0.22	0.22	0.22	0.23		0.41
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	282	2053			1314	401	375	397	346	255		1159
v/s Ratio Prot	0.05	0.12			0.13		0.12	c0.16				
v/s Ratio Perm	c0.15					0.04			0.02	c0.17		c0.17
v/c Ratio	0.54	0.29			0.51	0.15	0.55	0.73	0.07	0.73		0.41
Uniform Delay, d1	19.2	17.0			26.7	24.0	29.2	30.6	26.1	29.9		17.6
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	7.2	0.4			1.4	0.8	1.6	6.5	0.1	9.8		0.2
Delay (s)	26.4	17.4			28.1	24.8	30.9	37.2	26.2	39.8		17.8
Level of Service	C	B			C	C	C	D	C	D		B
Approach Delay (s)		19.2			27.3			33.0			24.0	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM Average Control Delay	25.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	84.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			305							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

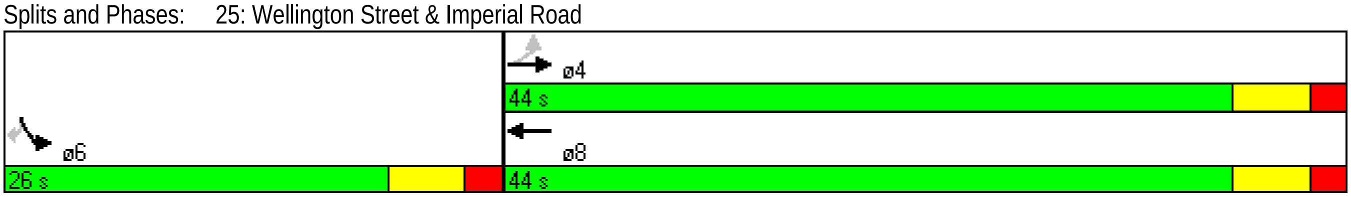
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	80	540	555	320	80
Lane Group Flow (vph)	0	620	800	320	80
Turn Type	Perm				Perm
Protected Phases		4	8	6	
Permitted Phases	4			6	6
Detector Phase	4	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	41.0	41.0	41.0	24.0	24.0
Total Split (s)	44.0	44.0	44.0	26.0	26.0
Total Split (%)	62.9%	62.9%	62.9%	37.1%	37.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Max	C-Max	C-Max	None	None
v/c Ratio		0.37	0.38	0.63	0.16
Control Delay		8.4	6.5	27.5	5.6
Queue Delay		0.0	0.0	0.0	0.0
Total Delay		8.4	6.5	27.5	5.6
Queue Length 50th (m)		18.8	18.3	32.5	0.0
Queue Length 95th (m)		28.9	28.6	53.1	7.5
Internal Link Dist (m)		188.7	176.3	303.2	
Turn Bay Length (m)					
Base Capacity (vph)		1655	2094	567	557
Starvation Cap Reductn		0	0	0	0
Spillback Cap Reductn		0	0	0	0
Storage Cap Reductn		0	0	0	0
Reduced v/c Ratio		0.37	0.38	0.56	0.14

Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	80	540	555	245	320	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.95		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3520	3360		1805	1599
Flt Permitted		0.77	1.00		0.95	1.00
Satd. Flow (perm)		2740	3360		1805	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	540	555	245	320	80
RTOR Reduction (vph)	0	0	66	0	0	57
Lane Group Flow (vph)	0	620	734	0	320	23
Confl. Peds. (#/hr)	6			6		
Heavy Vehicles (%)	1%	2%	2%	1%	0%	1%
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)		40.2	40.2		17.8	17.8
Effective Green, g (s)		42.2	42.2		19.8	19.8
Actuated g/C Ratio		0.60	0.60		0.28	0.28
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		5.0	5.0
Lane Grp Cap (vph)		1652	2026		511	452
v/s Ratio Prot			0.22		c0.18	
v/s Ratio Perm		c0.23				0.01
v/c Ratio		0.38	0.36		0.63	0.05
Uniform Delay, d1		7.1	7.1		21.9	18.3
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.7	0.5		3.4	0.1
Delay (s)		7.8	7.6		25.3	18.4
Level of Service		A	A		C	B
Approach Delay (s)		7.8	7.6		23.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	11.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	735	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	735	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		314	188			
pX, platoon unblocked						
vC, conflicting volume	0				245	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				245	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				722	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	245	245	245	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.14	0.14	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

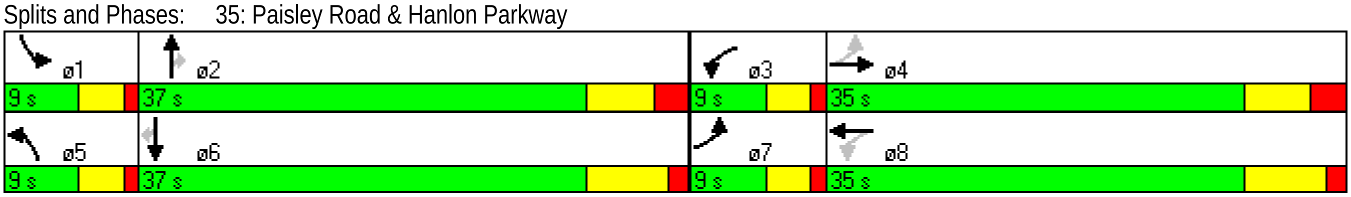
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	130	345	80	125	330	155	1050	160	45	1095	90
Lane Group Flow (vph)	141	375	87	136	413	168	1141	174	49	1190	98
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	33.0	33.0	9.0	33.0	33.0
Total Split (s)	9.0	35.0	0.0	9.0	35.0	9.0	37.0	37.0	9.0	37.0	37.0
Total Split (%)	10.0%	38.9%	0.0%	10.0%	38.9%	10.0%	41.1%	41.1%	10.0%	41.1%	41.1%
Yellow Time (s)	3.0	4.5		3.0	5.5	3.0	4.5	4.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	1.5	1.0	2.5	2.5	1.0	1.5	1.5
Lost Time Adjust (s)	0.0	-3.0	0.0	0.0	-3.0	0.0	-3.0	-3.0	0.0	-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	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.64	0.50	0.06	0.56	0.56	0.42	0.62	0.19	0.31	0.75	0.13
Control Delay	37.7	33.6	0.1	28.9	29.3	40.1	19.6	3.4	42.8	25.9	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.7	33.6	0.1	28.9	29.3	40.1	19.6	3.4	42.8	25.9	7.7
Queue Length 50th (m)	16.8	28.0	0.0	17.1	28.8	12.9	71.4	0.0	7.4	80.7	2.8
Queue Length 95th (m)	28.0	37.8	0.0	25.8	39.9	21.2	107.1	10.7	16.8	#128.1	12.1
Internal Link Dist (m)		119.3			210.1		643.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	222	1243	1577	243	1212	397	1832	909	159	1579	750
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.30	0.06	0.56	0.34	0.42	0.62	0.19	0.31	0.75	0.13

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 52 (58%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 35: Paisley Road & Hanlon Parkway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	345	80	125	330	50	155	1050	160	45	1095	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1786	3610	1577	1803	3483		3467	3539	1594	1805	3539	1599
Flt Permitted	0.32	1.00	1.00	0.37	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	599	3610	1577	693	3483		3467	3539	1594	1805	3539	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	375	87	136	359	54	168	1141	174	49	1190	98
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	87	0	0	37
Lane Group Flow (vph)	141	375	87	136	397	0	168	1141	87	49	1190	61
Confl. Peds. (#/hr)	4		5	5		4			1	1		
Heavy Vehicles (%)	1%	0%	1%	0%	1%	4%	1%	2%	0%	0%	2%	1%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	20.5	15.5	90.0	20.5	15.5		10.3	42.0	42.0	5.5	37.2	37.2
Effective Green, g (s)	20.5	18.5	90.0	20.5	18.5		10.3	45.0	45.0	5.5	40.2	40.2
Actuated g/C Ratio	0.23	0.21	1.00	0.23	0.21		0.11	0.50	0.50	0.06	0.45	0.45
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	202	742	1577	220	716		397	1770	797	110	1581	714
v/s Ratio Prot	c0.04	0.10		0.03	0.11		c0.05	c0.32		0.03	c0.34	
v/s Ratio Perm	c0.12		0.06	0.11					0.05			0.04
v/c Ratio	0.70	0.51	0.06	0.62	0.55		0.42	0.64	0.11	0.45	0.75	0.09
Uniform Delay, d1	30.3	31.7	0.0	29.7	32.1		37.1	16.6	11.9	40.8	20.8	14.3
Progression Factor	1.00	1.00	1.00	0.83	0.87		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.0	0.5	0.1	4.9	0.9		0.7	1.8	0.3	2.9	3.4	0.2
Delay (s)	40.3	32.2	0.1	29.7	28.9		37.8	18.4	12.2	43.6	24.1	14.6
Level of Service	D	C	A	C	C		D	B	B	D	C	B
Approach Delay (s)		29.5			29.1			19.9			24.1	
Approach LOS		C			C			B			C	

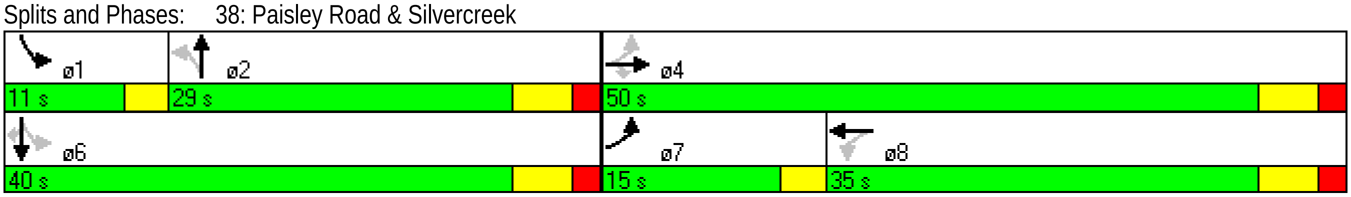
Intersection Summary			
HCM Average Control Delay	24.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	235	240	70	205	235	65	80	230	120	200
Lane Group Flow (vph)	235	240	70	205	380	65	240	230	120	200
Turn Type	pm+pt		Perm	Perm		Perm		pm+pt		Perm
Protected Phases	7	4			8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	35.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	15.0	50.0	50.0	35.0	35.0	29.0	29.0	11.0	40.0	40.0
Total Split (%)	16.7%	55.6%	55.6%	38.9%	38.9%	32.2%	32.2%	12.2%	44.4%	44.4%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	C-Max	C-Max	None	None	None	None	None
v/c Ratio	0.42	0.20	0.07	0.39	0.45	0.31	0.66	0.97	0.22	0.33
Control Delay	6.5	4.5	0.9	15.1	12.7	34.8	26.7	79.5	23.9	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.5	4.5	0.9	15.1	12.7	34.8	26.7	79.5	23.9	4.7
Queue Length 50th (m)	3.8	4.0	0.0	12.5	19.5	9.2	18.8	29.8	14.5	0.0
Queue Length 95th (m)	42.3	42.9	2.1	30.9	46.3	18.0	36.9	#57.0	23.5	11.9
Internal Link Dist (m)		210.1			1197.0		117.0		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	588	1172	956	532	849	348	533	238	745	766
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.20	0.07	0.39	0.45	0.19	0.45	0.97	0.16	0.26

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 47 (52%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	235	240	70	205	235	145	65	80	160	230	120	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	4.0	4.0	6.0	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	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	1881	1544	1764	1763		1751	1630		1786	1863	1615
Flt Permitted	0.38	1.00	1.00	0.61	1.00		0.68	1.00		0.25	1.00	1.00
Satd. Flow (perm)	719	1881	1544	1132	1763		1253	1630		473	1863	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	235	240	70	205	235	145	65	80	160	230	120	200
RTOR Reduction (vph)	0	0	28	0	20	0	0	93	0	0	0	142
Lane Group Flow (vph)	235	240	42	205	360	0	65	147	0	230	120	58
Confl. Peds. (#/hr)			3	3					3	3		
Heavy Vehicles (%)	0%	1%	2%	2%	2%	1%	0%	0%	0%	1%	2%	0%
Turn Type	pm+pt		Perm	Perm			Perm			pm+pt		Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	54.1	54.1	54.1	40.3	40.3		12.9	12.9		23.9	23.9	23.9
Effective Green, g (s)	53.1	56.1	54.1	42.3	42.3		14.9	14.9		22.9	25.9	25.9
Actuated g/C Ratio	0.59	0.62	0.60	0.47	0.47		0.17	0.17		0.25	0.29	0.29
Clearance Time (s)	3.0	6.0	6.0	6.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	542	1172	928	532	829		207	270		222	536	465
v/s Ratio Prot	c0.05	0.13			c0.20			0.09		c0.08	0.06	
v/s Ratio Perm	0.21		0.03	0.18			0.05			c0.18		0.04
v/c Ratio	0.43	0.20	0.05	0.39	0.43		0.31	0.55		1.04	0.22	0.12
Uniform Delay, d1	9.9	7.3	7.4	15.4	15.9		33.1	34.4		32.0	24.4	23.7
Progression Factor	0.50	0.48	0.28	0.69	0.66		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.4	0.1	2.0	1.6		0.9	2.3		70.1	0.2	0.1
Delay (s)	5.5	3.9	2.2	12.7	12.0		33.9	36.7		102.2	24.6	23.8
Level of Service	A	A	A	B	B		C	D		F	C	C
Approach Delay (s)		4.4			12.3			36.1			56.7	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	26.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX F

Capacity Analysis Results

Phase 3, Options 1 & 2

Future Total Traffic Conditions

Opening Day

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	100	530	315	105	420	285
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	530	315	105	420	285
Approach Volume (veh/h)	630			420	705	
Crossing Volume (veh/h)	315			420	100	
High Capacity (veh/h)	1081			995	1281	
High v/c (veh/h)	0.58			0.42	0.55	
Low Capacity (veh/h)	887			809	1067	
Low v/c (veh/h)	0.71			0.52	0.66	

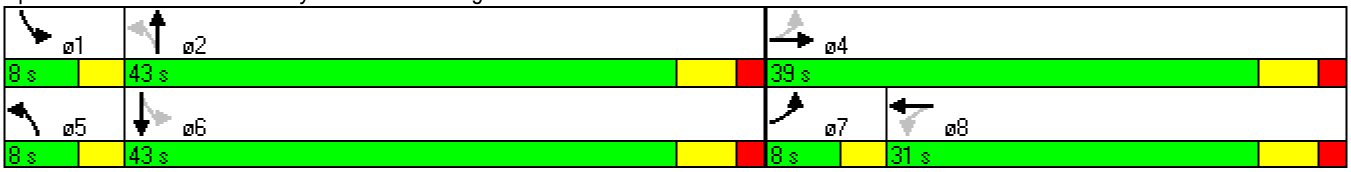
Intersection Summary			
Maximum v/c High	0.58		
Maximum v/c Low	0.71		
Intersection Capacity Utilization	111.6%	ICU Level of Service	H

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	175	450	40	425	110	630	90	580
Lane Group Flow (vph)	175	525	40	480	110	660	90	690
Turn Type	pm+pt		Perm		pm+pt		pm+pt	
Protected Phases	7	4		8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	29.0	29.0	29.0	8.0	28.0	8.0	28.0
Total Split (s)	8.0	39.0	31.0	31.0	8.0	43.0	8.0	43.0
Total Split (%)	8.9%	43.3%	34.4%	34.4%	8.9%	47.8%	8.9%	47.8%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	2.0	5.0	2.0	5.0
Lead/Lag	Lead		Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.82	0.76	0.27	0.92	0.46	0.79	0.34	0.83
Control Delay	44.6	26.6	30.4	56.2	17.4	27.2	13.4	33.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.6	26.6	30.4	56.2	17.4	27.2	13.4	33.4
Queue Length 50th (m)	15.7	56.4	4.9	72.3	7.7	58.2	6.5	96.7
Queue Length 95th (m)	m#40.9	93.1	13.1	#123.9	m14.8	#142.9	12.8	#158.3
Internal Link Dist (m)		1213.0		222.3		775.1		164.8
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	214	703	153	533	241	836	266	828
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.82	0.75	0.26	0.90	0.46	0.79	0.34	0.83

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 32 (36%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	450	75	40	425	55	110	630	30	90	580	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0		5.0	5.0		2.0	5.0		2.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1843		1805	1829		1787	1869		1805	1839	
Flt Permitted	0.15	1.00		0.28	1.00		0.13	1.00		0.16	1.00	
Satd. Flow (perm)	277	1843		530	1829		254	1869		306	1839	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	175	450	75	40	425	55	110	630	30	90	580	110
RTOR Reduction (vph)	0	7	0	0	5	0	0	2	0	0	7	0
Lane Group Flow (vph)	175	518	0	40	475	0	110	658	0	90	683	0
Confl. Peds. (#/hr)	4					4						
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	1%	1%	0%	0%	1%	0%
Turn Type	pm+pt			Perm			pm+pt			pm+pt		
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	32.4	32.4		24.4	24.4		42.6	38.6		42.6	38.6	
Effective Green, g (s)	33.4	33.4		25.4	25.4		44.6	39.6		44.6	39.6	
Actuated g/C Ratio	0.37	0.37		0.28	0.28		0.50	0.44		0.50	0.44	
Clearance Time (s)	3.0	6.0		6.0	6.0		3.0	6.0		3.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	205	684		150	516		211	822		235	809	
v/s Ratio Prot	c0.06	0.28			c0.26		c0.03	0.35		0.02	c0.37	
v/s Ratio Perm	0.26			0.08			0.23			0.17		
v/c Ratio	0.85	0.76		0.27	0.92		0.52	0.80		0.38	0.84	
Uniform Delay, d1	22.7	24.8		25.1	31.3		16.7	21.8		15.7	22.4	
Progression Factor	0.89	0.80		1.00	1.00		1.25	0.91		1.00	1.00	
Incremental Delay, d2	24.6	4.2		1.0	21.9		1.8	6.3		1.0	10.5	
Delay (s)	44.6	24.0		26.0	53.2		22.6	26.3		16.8	32.9	
Level of Service	D	C		C	D		C	C		B	C	
Approach Delay (s)		29.2			51.1			25.7			31.1	
Approach LOS		C			D			C			C	

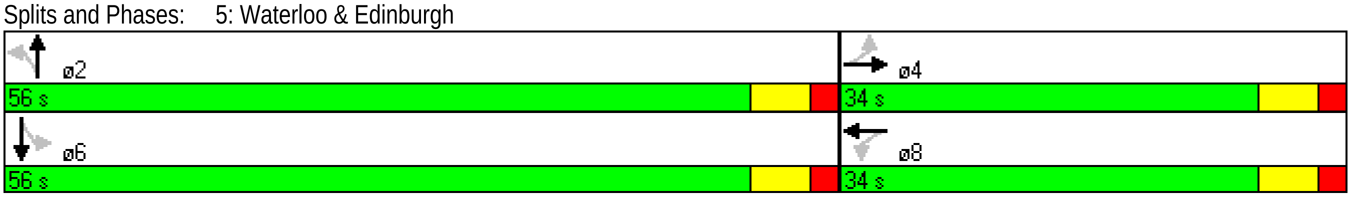
Intersection Summary			
HCM Average Control Delay	32.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	93.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	60	280	110	330	45	675	40	700
Lane Group Flow (vph)	60	320	110	390	45	740	40	745
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	55.0	55.0	55.0	55.0
Total Split (s)	34.0	34.0	34.0	34.0	56.0	56.0	56.0	56.0
Total Split (%)	37.8%	37.8%	37.8%	37.8%	62.2%	62.2%	62.2%	62.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.49	0.64	0.64	0.79	0.15	0.65	0.14	0.64
Control Delay	40.6	33.9	45.4	41.1	9.1	23.7	5.2	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.6	33.9	45.4	41.1	9.1	23.7	5.2	6.7
Queue Length 50th (m)	7.9	43.1	15.2	55.2	2.4	68.9	1.3	24.9
Queue Length 95th (m)	18.9	63.7	30.5	80.0	6.4	107.3	m1.9	m31.6
Internal Link Dist (m)		842.2		241.7		111.7		775.1
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	146	590	205	585	292	1135	290	1163
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.54	0.54	0.67	0.15	0.65	0.14	0.64

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 82 (91%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	280	40	110	330	60	45	675	65	40	700	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.97	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1753	1814		1717	1792		1797	1832		1759	1879	
Flt Permitted	0.25	1.00		0.35	1.00		0.25	1.00		0.25	1.00	
Satd. Flow (perm)	452	1814		639	1792		473	1832		468	1879	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	280	40	110	330	60	45	675	65	40	700	45
RTOR Reduction (vph)	0	6	0	0	8	0	0	3	0	0	2	0
Lane Group Flow (vph)	60	314	0	110	382	0	45	737	0	40	743	0
Confl. Peds. (#/hr)	10		25	25		10	16		22	22		16
Heavy Vehicles (%)	2%	2%	0%	2%	3%	2%	0%	2%	2%	2%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.4	23.4		23.4	23.4		54.6	54.6		54.6	54.6	
Effective Green, g (s)	24.4	24.4		24.4	24.4		55.6	55.6		55.6	55.6	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.62	0.62		0.62	0.62	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	123	492		173	486		292	1132		289	1161	
v/s Ratio Prot		0.17			c0.21			c0.40			0.40	
v/s Ratio Perm	0.13			0.17			0.10			0.09		
v/c Ratio	0.49	0.64		0.64	0.79		0.15	0.65		0.14	0.64	
Uniform Delay, d1	27.6	28.9		28.9	30.4		7.3	11.0		7.2	10.9	
Progression Factor	1.00	1.00		1.00	1.00		0.86	1.68		0.49	0.39	
Incremental Delay, d2	3.0	2.7		7.4	8.2		1.1	2.8		0.7	1.9	
Delay (s)	30.6	31.6		36.3	38.6		7.3	21.3		4.2	6.2	
Level of Service	C	C		D	D		A	C		A	A	
Approach Delay (s)		31.5			38.1			20.5			6.1	
Approach LOS		C			D			C			A	

Intersection Summary			
HCM Average Control Delay	21.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	740	195	230	945	80	195	655	160	55	725	65
Lane Group Flow (vph)	50	740	195	230	945	80	195	655	160	55	725	65
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	13.0	43.0	43.0	9.0	47.0	47.0	38.0	38.0	38.0
Total Split (%)	33.3%	33.3%	33.3%	14.4%	47.8%	47.8%	10.0%	52.2%	52.2%	42.2%	42.2%	42.2%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.36	0.83	0.34	0.74	0.67	0.11	0.56	0.38	0.19	0.20	0.54	0.10
Control Delay	35.1	40.0	5.7	32.8	24.2	4.4	19.5	16.0	3.0	11.9	14.1	1.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.1	40.0	5.7	32.8	24.2	4.4	19.5	16.0	3.0	11.9	14.1	1.2
Queue Length 50th (m)	6.4	57.2	0.0	22.1	61.1	0.0	16.6	34.4	0.1	3.6	31.8	0.2
Queue Length 95th (m)	16.4	76.5	13.7	#47.4	79.7	7.2	28.1	46.3	9.1	m5.8	43.1	m0.9
Internal Link Dist (m)		464.5			263.2			253.7			89.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	144	937	589	311	1466	721	347	1717	833	281	1342	627
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.79	0.33	0.74	0.64	0.11	0.56	0.38	0.19	0.20	0.54	0.10

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 20 (22%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

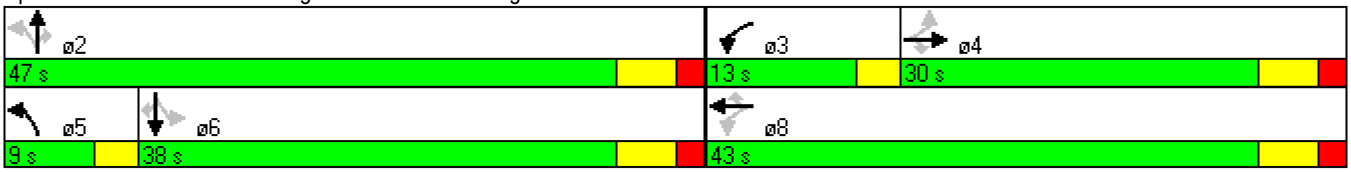
Natural Cycle: 85

Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	740	195	230	945	80	195	655	160	55	725	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3374	1615	1787	3471	1599	1769	3574	1563	1762	3574	1562
Flt Permitted	0.27	1.00	1.00	0.15	1.00	1.00	0.25	1.00	1.00	0.40	1.00	1.00
Satd. Flow (perm)	517	3374	1615	291	3471	1599	463	3574	1563	747	3574	1562
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	50	740	195	230	945	80	195	655	160	55	725	65
RTOR Reduction (vph)	0	0	143	0	0	47	0	0	83	0	0	41
Lane Group Flow (vph)	50	740	52	230	945	33	195	655	77	55	725	24
Confl. Peds. (#/hr)							2		12	12		2
Heavy Vehicles (%)	0%	7%	0%	1%	4%	1%	2%	1%	1%	2%	1%	2%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	22.9	22.9	22.9	35.8	35.8	35.8	42.2	42.2	42.2	32.8	32.8	32.8
Effective Green, g (s)	23.9	23.9	23.9	36.8	36.8	36.8	43.2	43.2	43.2	33.8	33.8	33.8
Actuated g/C Ratio	0.27	0.27	0.27	0.41	0.41	0.41	0.48	0.48	0.48	0.38	0.38	0.38
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	137	896	429	300	1419	654	330	1716	750	281	1342	587
v/s Ratio Prot		c0.22		c0.09	0.27		c0.05	0.18			c0.20	
v/s Ratio Perm	0.10		0.03	0.22		0.02	0.24		0.05	0.07		0.02
v/c Ratio	0.36	0.83	0.12	0.77	0.67	0.05	0.59	0.38	0.10	0.20	0.54	0.04
Uniform Delay, d1	26.9	31.1	25.1	20.0	21.6	16.1	14.8	14.9	12.8	18.9	22.0	17.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.52	0.57	0.19
Incremental Delay, d2	1.7	6.3	0.1	11.1	1.2	0.0	2.8	0.6	0.3	1.2	1.2	0.1
Delay (s)	28.5	37.4	25.2	31.1	22.8	16.1	17.6	15.5	13.1	11.1	13.8	3.4
Level of Service	C	D	C	C	C	B	B	B	B	B	B	A
Approach Delay (s)		34.5			23.9			15.6			12.8	
Approach LOS		C			C			B			B	

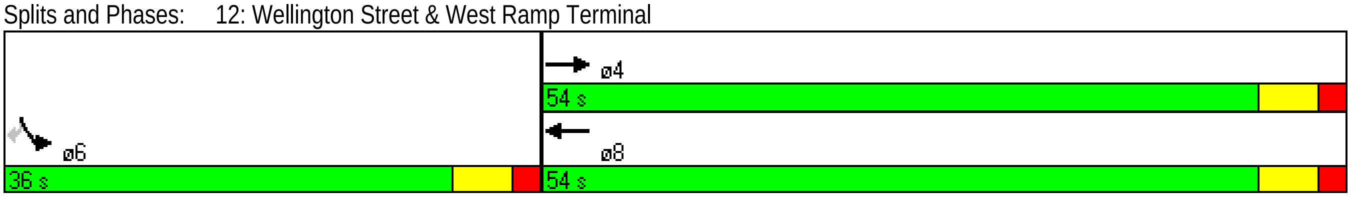
Intersection Summary			
HCM Average Control Delay	22.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	980	1435	160	90
Lane Group Flow (vph)	1065	1560	174	98
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	38.0	38.0	33.0	33.0
Total Split (s)	54.0	54.0	36.0	36.0
Total Split (%)	60.0%	60.0%	40.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.30	0.43	0.35	0.42
Control Delay	4.3	5.0	28.3	27.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	4.3	5.0	28.3	27.0
Queue Length 50th (m)	13.4	22.4	9.7	8.3
Queue Length 95th (m)	22.6	36.6	17.0	19.8
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3561	3596	1479	652
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.30	0.43	0.12	0.15

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 69.9
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	980	1435	0	160	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5036	5085		3335	1442
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5036	5085		3335	1442
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1065	1560	0	174	98
RTOR Reduction (vph)	0	0	0	0	0	19
Lane Group Flow (vph)	0	1065	1560	0	174	79
Heavy Vehicles (%)	0%	3%	2%	0%	5%	12%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		48.5	48.5		9.5	9.5
Effective Green, g (s)		49.5	49.5		10.5	10.5
Actuated g/C Ratio		0.71	0.71		0.15	0.15
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3561	3596		500	216
v/s Ratio Prot		0.21	c0.31		0.05	
v/s Ratio Perm						c0.05
v/c Ratio		0.30	0.43		0.35	0.37
Uniform Delay, d1		3.8	4.3		26.7	26.8
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.2	0.4		0.4	1.1
Delay (s)		4.0	4.7		27.1	27.8
Level of Service		A	A		C	C
Approach Delay (s)		4.0	4.7		27.4	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	6.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	170	715	945	255	310	280	85	185	660
Lane Group Flow (vph)	185	777	1027	277	303	338	92	201	717
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	9.0	37.0	28.0	28.0	26.0	26.0	26.0	27.0	36.0
Total Split (%)	10.0%	41.1%	31.1%	31.1%	28.9%	28.9%	28.9%	30.0%	40.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.80	0.43	0.79	0.44	0.81	0.84	0.22	0.80	0.75
Control Delay	46.4	22.5	35.9	6.0	51.3	53.2	7.9	57.2	31.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.4	22.5	35.9	6.0	51.3	53.2	7.9	57.2	31.7
Queue Length 50th (m)	19.7	34.1	56.2	0.0	47.8	53.8	0.0	30.0	56.5
Queue Length 95th (m)	#44.9	44.1	70.4	16.5	#85.7	#94.8	10.5	#62.5	77.3
Internal Link Dist (m)		150.3	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	232	1795	1303	627	394	423	441	260	947
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	0.80	0.43	0.79	0.44	0.77	0.80	0.21	0.77	0.76

Intersection Summary

Cycle Length: 90

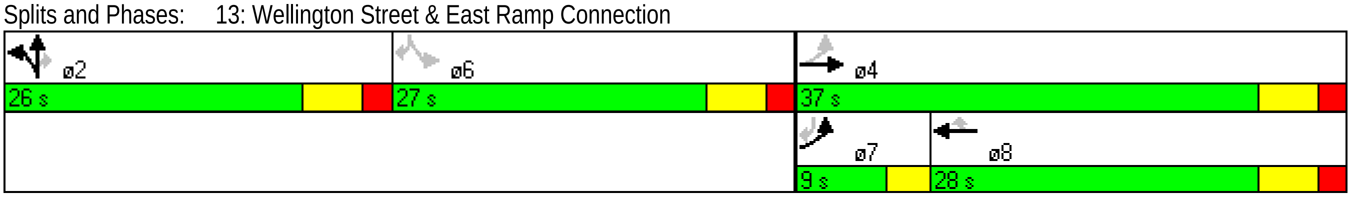
Actuated Cycle Length: 88.2

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

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

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	715	0	0	945	255	310	280	85	185	0	660
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.99	1.00	0.95		1.00
Satd. Flow (prot)	1752	4940			4988	1615	1649	1773	1553	1805		2787
Flt Permitted	0.16	1.00			1.00	1.00	0.95	0.99	1.00	0.55		1.00
Satd. Flow (perm)	294	4940			4988	1615	1649	1773	1553	1042		2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	185	777	0	0	1027	277	337	304	92	201	0	717
RTOR Reduction (vph)	0	0	0	0	0	204	0	0	71	0	0	0
Lane Group Flow (vph)	185	777	0	0	1027	73	303	338	21	201	0	717
Heavy Vehicles (%)	3%	5%	0%	0%	4%	0%	4%	1%	4%	0%	0%	2%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	31.1	31.1			22.1	22.1	18.9	18.9	18.9	20.2		32.2
Effective Green, g (s)	32.1	32.1			23.1	23.1	19.9	19.9	19.9	21.2		33.2
Actuated g/C Ratio	0.36	0.36			0.26	0.26	0.23	0.23	0.23	0.24		0.38
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	223	1798			1306	423	372	400	350	250		1049
v/s Ratio Prot	0.07	0.16			c0.21		0.18	c0.19				
v/s Ratio Perm	0.24					0.04			0.01	c0.19		c0.26
v/c Ratio	0.83	0.43			0.79	0.17	0.81	0.84	0.06	0.80		0.68
Uniform Delay, d1	21.5	21.2			30.3	25.2	32.4	32.7	26.8	31.5		23.1
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	28.6	0.8			4.8	0.9	12.8	15.0	0.1	16.9		1.9
Delay (s)	50.1	21.9			35.1	26.0	45.2	47.7	26.9	48.4		24.9
Level of Service	D	C			D	C	D	D	C	D		C
Approach Delay (s)		27.4			33.2			44.1			30.1	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM Average Control Delay	33.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	88.2	Sum of lost time (s)	15.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			303							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

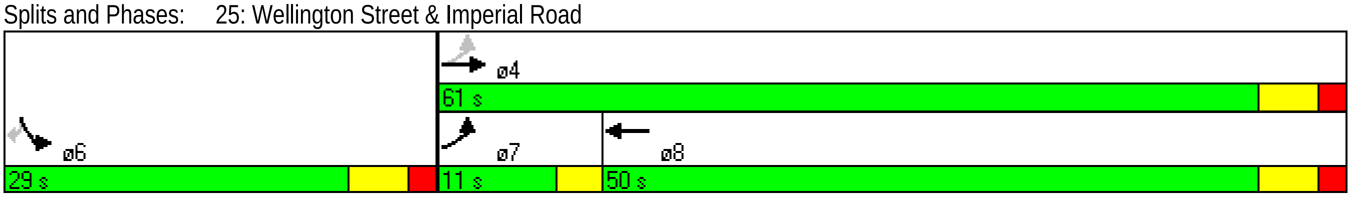
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	110	805	1175	395	35
Lane Group Flow (vph)	110	805	1495	395	35
Turn Type	pm+pt				Perm
Protected Phases	7	4	8	6	
Permitted Phases	4			6	6
Detector Phase	7	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	41.0	41.0	24.0	24.0
Total Split (s)	11.0	61.0	50.0	29.0	29.0
Total Split (%)	12.2%	67.8%	55.6%	32.2%	32.2%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	C-Max	C-Max	None	None
v/c Ratio	0.43	0.71	0.82	0.85	0.09
Control Delay	13.6	15.7	22.5	50.4	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.6	15.7	22.5	50.4	9.5
Queue Length 50th (m)	5.7	79.1	101.6	59.2	0.0
Queue Length 95th (m)	15.5	119.1	133.3	#101.7	6.3
Internal Link Dist (m)		188.7	176.5	303.2	
Turn Bay Length (m)	100.0				
Base Capacity (vph)	267	1139	1827	477	404
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.41	0.71	0.82	0.83	0.09

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	110	805	1175	320	395	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1810	3362		1787	1417
Flt Permitted	0.08	1.00	1.00		0.95	1.00
Satd. Flow (perm)	153	1810	3362		1787	1417
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	805	1175	320	395	35
RTOR Reduction (vph)	0	0	26	0	0	26
Lane Group Flow (vph)	110	805	1469	0	395	9
Confl. Peds. (#/hr)	4			4		
Heavy Vehicles (%)	0%	5%	4%	1%	1%	14%
Turn Type	pm+pt					Perm
Protected Phases	7	4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)	55.7	55.7	46.6		22.3	22.3
Effective Green, g (s)	56.7	56.7	47.6		23.3	23.3
Actuated g/C Ratio	0.63	0.63	0.53		0.26	0.26
Clearance Time (s)	3.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	227	1140	1778		463	367
v/s Ratio Prot	0.04	c0.44	c0.44		c0.22	
v/s Ratio Perm	0.27					0.01
v/c Ratio	0.48	0.71	0.83		0.85	0.02
Uniform Delay, d1	13.5	11.1	17.7		31.7	24.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.6	3.7	4.5		15.4	0.1
Delay (s)	15.1	14.8	22.3		47.1	24.9
Level of Service	B	B	C		D	C
Approach Delay (s)		14.8	22.3		45.3	
Approach LOS		B	C		D	

Intersection Summary			
HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑↑↑	↑↑↑			
Volume (veh/h)	0	935	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	935	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		327	174			
pX, platoon unblocked						
vC, conflicting volume	0				312	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				312	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				656	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	312	312	312	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.18	0.18	0.18	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	340	165	165	390	290	1325	255	105	1410	80
Lane Group Flow (vph)	114	370	179	179	500	315	1440	277	114	1533	87
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	59.0	59.0	9.0	57.0	57.0
Total Split (s)	11.0	35.0	0.0	12.0	36.0	19.0	81.0	81.0	16.0	78.0	78.0
Total Split (%)	7.6%	24.3%	0.0%	8.3%	25.0%	13.2%	56.3%	56.3%	11.1%	54.2%	54.2%
Yellow Time (s)	3.0	4.5		3.0	4.5	3.0	5.5	5.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	2.5	1.0	1.5	1.5	1.0	1.5	1.5
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.0	6.0	3.0	3.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.63	0.59	0.11	0.75	0.79	0.76	0.76	0.29	0.69	0.84	0.10
Control Delay	56.0	58.4	0.1	62.7	64.1	73.8	29.5	4.9	83.9	35.4	11.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.0	58.4	0.1	62.7	64.1	73.8	29.5	4.9	83.9	35.4	11.6
Queue Length 50th (m)	23.1	47.4	0.0	37.7	64.8	41.1	157.4	6.8	28.9	184.1	6.8
Queue Length 95th (m)	37.0	61.0	0.0	#56.4	81.0	#61.9	186.3	20.6	#55.6	215.5	15.5
Internal Link Dist (m)		119.3			205.7		653.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	182	727	1594	240	731	420	1892	970	172	1824	847
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.51	0.11	0.75	0.68	0.75	0.76	0.29	0.66	0.84	0.10

Intersection Summary

Cycle Length: 144
Actuated Cycle Length: 144
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 35: Paisley Road & Hanlon Parkway

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	340	165	165	390	70	290	1325	255	105	1410	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1594	1786	3462		3502	3471	1594	1770	3505	1593
Flt Permitted	0.22	1.00	1.00	0.34	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	420	3610	1594	637	3462		3502	3471	1594	1770	3505	1593
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	370	179	179	424	76	315	1440	277	114	1533	87
RTOR Reduction (vph)	0	0	0	0	11	0	0	0	101	0	0	17
Lane Group Flow (vph)	114	370	179	179	489	0	315	1440	176	114	1533	70
Confl. Peds. (#/hr)	1		3	3		1	2		1	1		2
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	4%	0%	2%	3%	0%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	31.0	24.0	144.0	33.0	25.0		16.1	77.5	77.5	12.5	73.9	73.9
Effective Green, g (s)	33.0	25.0	144.0	35.0	26.0		17.1	78.5	78.5	13.5	74.9	74.9
Actuated g/C Ratio	0.23	0.17	1.00	0.24	0.18		0.12	0.55	0.55	0.09	0.52	0.52
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	173	627	1594	227	625		416	1892	869	166	1823	829
v/s Ratio Prot	0.04	0.10		c0.05	0.14		c0.09	0.41		0.06	c0.44	
v/s Ratio Perm	0.11		0.11	c0.14					0.11			0.04
v/c Ratio	0.66	0.59	0.11	0.79	0.78		0.76	0.76	0.20	0.69	0.84	0.08
Uniform Delay, d1	46.4	54.8	0.0	48.8	56.3		61.4	25.5	16.7	63.2	29.5	17.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.7	1.5	0.1	16.4	6.4		7.7	2.9	0.5	11.2	4.9	0.2
Delay (s)	55.1	56.3	0.1	65.2	62.7		69.1	28.4	17.3	74.4	34.4	17.5
Level of Service	E	E	A	E	E		E	C	B	E	C	B
Approach Delay (s)		40.9			63.3			33.2			36.1	
Approach LOS		D			E			C			D	

Intersection Summary			
HCM Average Control Delay	39.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	28	355	60	210	275	65	85	225	135	285
Lane Group Flow (vph)	28	355	60	210	455	65	250	225	135	285
Turn Type	pm+pt		Perm	pm+pt		Perm		pm+pt		Perm
Protected Phases	7	4		3	8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	3	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	8.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	8.0	36.0	36.0	12.0	40.0	29.0	29.0	13.0	42.0	42.0
Total Split (%)	8.9%	40.0%	40.0%	13.3%	44.4%	32.2%	32.2%	14.4%	46.7%	46.7%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	2.0	5.0	5.0	5.0	2.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None
v/c Ratio	0.05	0.43	0.08	0.35	0.47	0.32	0.70	0.69	0.24	0.41
Control Delay	9.1	21.4	5.9	6.7	8.3	35.2	30.1	32.8	22.9	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.1	21.4	5.9	6.7	8.3	35.2	30.1	32.8	22.9	4.4
Queue Length 50th (m)	1.6	38.2	0.0	8.4	17.4	9.2	21.4	26.7	15.9	0.0
Queue Length 95th (m)	5.5	69.5	7.2	m12.6	m28.6	18.1	40.1	38.1	25.0	13.5
Internal Link Dist (m)		205.7			1213.0		75.2		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	541	828	730	609	958	330	513	328	766	825
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.43	0.08	0.34	0.47	0.20	0.49	0.69	0.18	0.35

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

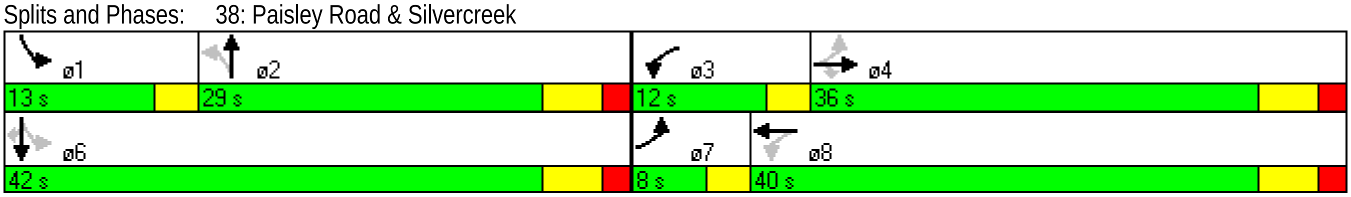
Offset: 62 (69%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	28	355	60	210	275	180	65	85	165	225	135	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0		2.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	0.99		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1734	1881	1583	1770	1743		1751	1634		1769	1863	1599
Flt Permitted	0.47	1.00	1.00	0.42	1.00		0.67	1.00		0.28	1.00	1.00
Satd. Flow (perm)	852	1881	1583	792	1743		1236	1634		513	1863	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	28	355	60	210	275	180	65	85	165	225	135	285
RTOR Reduction (vph)	0	0	34	0	21	0	0	89	0	0	0	197
Lane Group Flow (vph)	28	355	26	210	434	0	65	161	0	225	135	88
Confl. Peds. (#/hr)	2					2			2	2		
Heavy Vehicles (%)	4%	1%	2%	2%	2%	1%	0%	0%	0%	2%	2%	1%
Turn Type	pm+pt		Perm	pm+pt			Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	41.3	38.6	38.6	51.3	45.6		13.8	13.8		26.7	26.7	26.7
Effective Green, g (s)	43.3	39.6	39.6	52.3	46.6		14.8	14.8		27.7	27.7	27.7
Actuated g/C Ratio	0.48	0.44	0.44	0.58	0.52		0.16	0.16		0.31	0.31	0.31
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	446	828	697	577	902		203	269		310	573	492
v/s Ratio Prot	0.00	0.19		c0.04	c0.25			c0.10		c0.09	0.07	
v/s Ratio Perm	0.03		0.02	0.17			0.05			0.14		0.05
v/c Ratio	0.06	0.43	0.04	0.36	0.48		0.32	0.60		0.73	0.24	0.18
Uniform Delay, d1	12.4	17.4	14.4	9.6	13.9		33.2	34.9		25.3	23.2	22.8
Progression Factor	1.00	1.00	1.00	0.65	0.50		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.1	1.6	0.1	0.2	1.1		0.9	3.7		8.2	0.2	0.2
Delay (s)	12.4	19.0	14.5	6.5	8.1		34.1	38.6		33.5	23.5	23.0
Level of Service	B	B	B	A	A		C	D		C	C	C
Approach Delay (s)		18.0			7.6			37.7			26.7	
Approach LOS		B			A			D			C	

Intersection Summary			
HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	72.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

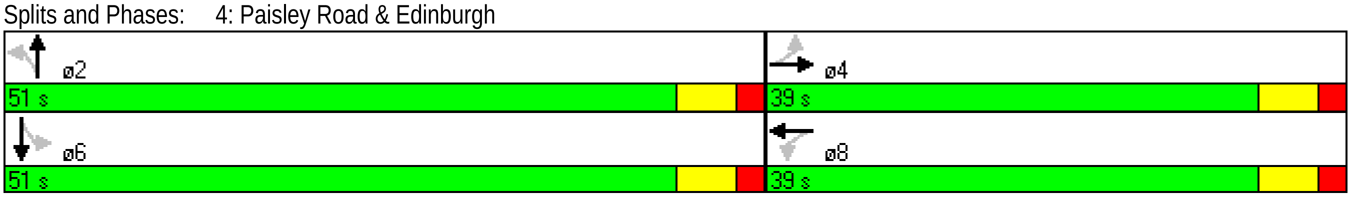
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	120	540	135	130	525	140
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	120	540	135	130	525	140
Approach Volume (veh/h)	660			265	665	
Crossing Volume (veh/h)	135			525	120	
High Capacity (veh/h)	1246			915	1261	
High v/c (veh/h)	0.53			0.29	0.53	
Low Capacity (veh/h)	1035			738	1049	
Low v/c (veh/h)	0.64			0.36	0.63	

Intersection Summary			
Maximum v/c High	0.53		
Maximum v/c Low	0.64		
Intersection Capacity Utilization	101.5%	ICU Level of Service	G

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	110	360	50	330	55	535	50	515
Lane Group Flow (vph)	110	440	50	375	55	570	50	630
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.0	29.0	29.0	29.0	28.0	28.0	28.0	28.0
Total Split (s)	39.0	39.0	39.0	39.0	51.0	51.0	51.0	51.0
Total Split (%)	43.3%	43.3%	43.3%	43.3%	56.7%	56.7%	56.7%	56.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.60	0.76	0.38	0.65	0.16	0.52	0.13	0.57
Control Delay	30.8	27.4	30.8	30.5	5.0	6.3	11.0	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.8	27.4	30.8	30.5	5.0	6.3	11.0	14.6
Queue Length 50th (m)	11.8	52.5	6.1	49.4	1.5	16.4	3.2	55.3
Queue Length 95th (m)	m22.3	m73.1	14.5	67.6	m4.0	33.4	9.7	99.9
Internal Link Dist (m)		1197.0		206.3		775.8		167.4
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	225	713	164	715	342	1102	387	1101
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.62	0.30	0.52	0.16	0.52	0.13	0.57

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 34 (38%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	360	80	50	330	45	55	535	35	50	515	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1790	1809		1800	1825		1805	1846		1802	1833	
Flt Permitted	0.31	1.00		0.22	1.00		0.30	1.00		0.34	1.00	
Satd. Flow (perm)	578	1809		422	1825		573	1846		649	1833	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	360	80	50	330	45	55	535	35	50	515	115
RTOR Reduction (vph)	0	10	0	0	6	0	0	2	0	0	8	0
Lane Group Flow (vph)	110	430	0	50	369	0	55	568	0	50	622	0
Confl. Peds. (#/hr)	10		4	4		10			4	4		
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	2%	0%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	26.4	26.4		26.4	26.4		51.6	51.6		51.6	51.6	
Effective Green, g (s)	28.4	28.4		28.4	28.4		53.6	53.6		53.6	53.6	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.60	0.60		0.60	0.60	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	182	571		133	576		341	1099		387	1092	
v/s Ratio Prot		c0.24			0.20			0.31			c0.34	
v/s Ratio Perm	0.19			0.12			0.10			0.08		
v/c Ratio	0.60	0.75		0.38	0.64		0.16	0.52		0.13	0.57	
Uniform Delay, d1	26.0	27.6		23.9	26.4		8.1	10.6		8.0	11.1	
Progression Factor	0.74	0.76		1.00	1.00		0.38	0.39		1.00	1.00	
Incremental Delay, d2	4.7	4.8		1.8	2.4		1.0	1.7		0.7	2.2	
Delay (s)	24.0	25.7		25.7	28.9		4.1	5.7		8.7	13.3	
Level of Service	C	C		C	C		A	A		A	B	
Approach Delay (s)		25.3			28.5			5.6			13.0	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	40	165	75	210	20	480	30	520
Lane Group Flow (vph)	40	220	75	235	20	545	30	555
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	57.0	57.0	57.0	57.0
Total Split (s)	26.0	26.0	26.0	26.0	64.0	64.0	64.0	64.0
Total Split (%)	28.9%	28.9%	28.9%	28.9%	71.1%	71.1%	71.1%	71.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Min	C-Min
v/c Ratio	0.29	0.59	0.49	0.64	0.04	0.41	0.05	0.42
Control Delay	35.0	35.8	42.3	39.9	1.7	4.4	3.6	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.0	35.8	42.3	39.9	1.7	4.4	3.6	4.6
Queue Length 50th (m)	5.4	29.1	10.6	33.4	0.3	23.9	0.9	22.5
Queue Length 95th (m)	13.3	47.1	22.4	52.3	0.9	34.8	m1.8	29.8
Internal Link Dist (m)		218.2		241.7		109.7		775.8
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	167	454	186	446	542	1322	551	1326
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.48	0.40	0.53	0.04	0.41	0.05	0.42

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 66 (73%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	165	55	75	210	25	20	480	65	30	520	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1698	1803		1744	1809		1803	1855		1804	1862	
Flt Permitted	0.38	1.00		0.41	1.00		0.40	1.00		0.41	1.00	
Satd. Flow (perm)	683	1803		761	1809		763	1855		774	1862	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	165	55	75	210	25	20	480	65	30	520	35
RTOR Reduction (vph)	0	14	0	0	5	0	0	5	0	0	2	0
Lane Group Flow (vph)	40	206	0	75	230	0	20	540	0	30	553	0
Confl. Peds. (#/hr)	2		3	3		2	3		2	2		3
Heavy Vehicles (%)	6%	1%	0%	3%	3%	4%	0%	0%	3%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	16.1	16.1		16.1	16.1		61.9	61.9		61.9	61.9	
Effective Green, g (s)	18.1	18.1		18.1	18.1		63.9	63.9		63.9	63.9	
Actuated g/C Ratio	0.20	0.20		0.20	0.20		0.71	0.71		0.71	0.71	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	137	363		153	364		542	1317		550	1322	
v/s Ratio Prot		0.11			c0.13			0.29			c0.30	
v/s Ratio Perm	0.06			0.10			0.03			0.04		
v/c Ratio	0.29	0.57		0.49	0.63		0.04	0.41		0.05	0.42	
Uniform Delay, d1	30.5	32.4		31.9	32.9		3.9	5.3		3.9	5.4	
Progression Factor	1.00	1.00		1.00	1.00		0.33	0.59		0.70	0.64	
Incremental Delay, d2	1.2	2.0		2.5	3.6		0.1	0.9		0.2	0.8	
Delay (s)	31.7	34.4		34.3	36.5		1.4	4.1		2.9	4.2	
Level of Service	C	C		C	D		A	A		A	A	
Approach Delay (s)		34.0			36.0			4.0			4.2	
Approach LOS		C			D			A			A	

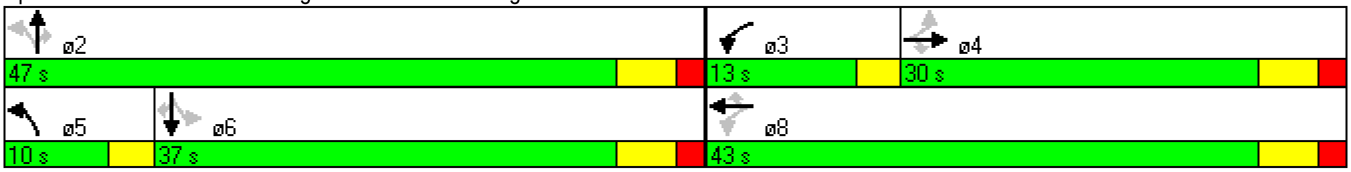
Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	660	160	200	620	45	190	485	175	65	540	45
Lane Group Flow (vph)	35	660	160	200	620	45	190	485	175	65	540	45
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	13.0	43.0	43.0	10.0	47.0	47.0	37.0	37.0	37.0
Total Split (%)	33.3%	33.3%	33.3%	14.4%	47.8%	47.8%	11.1%	52.2%	52.2%	41.1%	41.1%	41.1%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	1.0	-2.0	-2.0	1.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.17	0.71	0.29	0.74	0.43	0.07	0.49	0.27	0.20	0.19	0.39	0.07
Control Delay	26.8	34.5	5.8	35.4	19.9	5.0	18.3	13.8	2.8	20.7	22.2	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.8	34.5	5.8	35.4	19.9	5.0	18.3	13.8	2.8	20.7	22.2	7.9
Queue Length 50th (m)	4.2	48.6	0.0	19.9	35.0	0.0	16.8	23.3	0.0	6.9	36.4	1.0
Queue Length 95th (m)	11.1	65.0	12.4	#39.5	46.8	5.4	28.8	32.9	9.2	15.2	44.9	m5.9
Internal Link Dist (m)		464.5			263.2			253.7			91.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	222	1013	580	274	1534	715	387	1805	882	343	1383	618
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.65	0.28	0.73	0.40	0.06	0.49	0.27	0.20	0.19	0.39	0.07

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 62 (69%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	660	160	200	620	45	190	485	175	65	540	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1751	3505	1615	1805	3539	1592	1769	3574	1576	1767	3574	1526
Flt Permitted	0.42	1.00	1.00	0.16	1.00	1.00	0.32	1.00	1.00	0.48	1.00	1.00
Satd. Flow (perm)	768	3505	1615	306	3539	1592	597	3574	1576	885	3574	1526
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	660	160	200	620	45	190	485	175	65	540	45
RTOR Reduction (vph)	0	0	118	0	0	27	0	0	87	0	0	28
Lane Group Flow (vph)	35	660	42	200	620	18	190	485	88	65	540	17
Confl. Peds. (#/hr)	2					2	6		3	3		6
Heavy Vehicles (%)	3%	3%	0%	0%	2%	0%	2%	1%	1%	2%	1%	4%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	21.8	21.8	21.8	34.6	34.6	34.6	43.4	43.4	43.4	32.8	32.8	32.8
Effective Green, g (s)	23.8	23.8	23.8	33.6	36.6	36.6	42.4	45.4	45.4	34.8	34.8	34.8
Actuated g/C Ratio	0.26	0.26	0.26	0.37	0.41	0.41	0.47	0.50	0.50	0.39	0.39	0.39
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	203	927	427	261	1439	647	367	1803	795	342	1382	590
v/s Ratio Prot		0.19		c0.07	0.18		c0.04	0.14			0.15	
v/s Ratio Perm	0.05		0.03	c0.21		0.01	c0.21		0.06	0.07		0.01
v/c Ratio	0.17	0.71	0.10	0.77	0.43	0.03	0.52	0.27	0.11	0.19	0.39	0.03
Uniform Delay, d1	25.5	30.0	25.0	21.7	19.2	16.0	14.9	12.8	11.7	18.3	19.9	17.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.03	1.27
Incremental Delay, d2	0.4	2.6	0.1	12.6	0.2	0.0	1.2	0.4	0.3	1.1	0.8	0.1
Delay (s)	25.9	32.6	25.1	34.3	19.4	16.0	16.1	13.2	12.0	18.8	21.4	21.8
Level of Service	C	C	C	C	B	B	B	B	B	B	C	C
Approach Delay (s)		30.9			22.7			13.6			21.2	
Approach LOS		C			C			B			C	

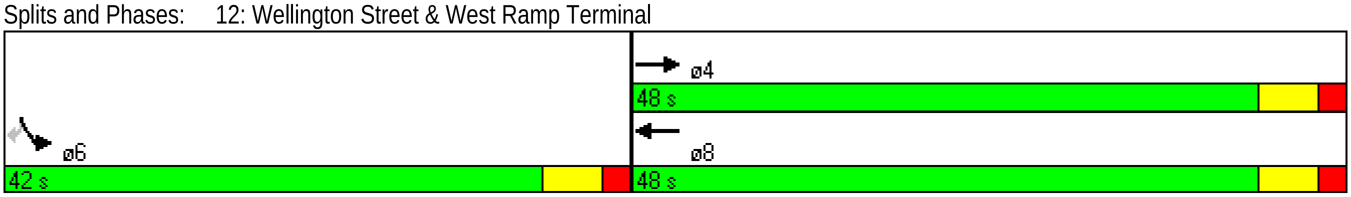
Intersection Summary			
HCM Average Control Delay	22.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	560	710	200	125
Lane Group Flow (vph)	609	772	217	136
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	37.0	37.0	37.0	37.0
Total Split (s)	48.0	48.0	42.0	42.0
Total Split (%)	53.3%	53.3%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.17	0.22	0.35	0.37
Control Delay	3.6	3.8	24.4	8.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	3.6	3.8	24.4	8.0
Queue Length 50th (m)	6.5	8.5	10.6	0.0
Queue Length 95th (m)	10.8	13.7	18.3	11.1
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3540	3540	2084	929
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.17	0.22	0.10	0.15

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 63.2
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	560	710	0	200	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	5085		3467	1455
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	5085		3467	1455
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	609	772	0	217	136
RTOR Reduction (vph)	0	0	0	0	0	112
Lane Group Flow (vph)	0	609	772	0	217	24
Heavy Vehicles (%)	0%	2%	2%	0%	1%	11%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		42.0	42.0		9.2	9.2
Effective Green, g (s)		44.0	44.0		11.2	11.2
Actuated g/C Ratio		0.70	0.70		0.18	0.18
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3540	3540		614	258
v/s Ratio Prot		0.12	c0.15		c0.06	
v/s Ratio Perm						0.02
v/c Ratio		0.17	0.22		0.35	0.09
Uniform Delay, d1		3.3	3.4		22.8	21.8
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.1	0.1		0.4	0.2
Delay (s)		3.4	3.6		23.2	21.9
Level of Service		A	A		C	C
Approach Delay (s)		3.4	3.6		22.7	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	7.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	63.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	28.1%	ICU Level of Service	A
Analysis Period (min)	15		

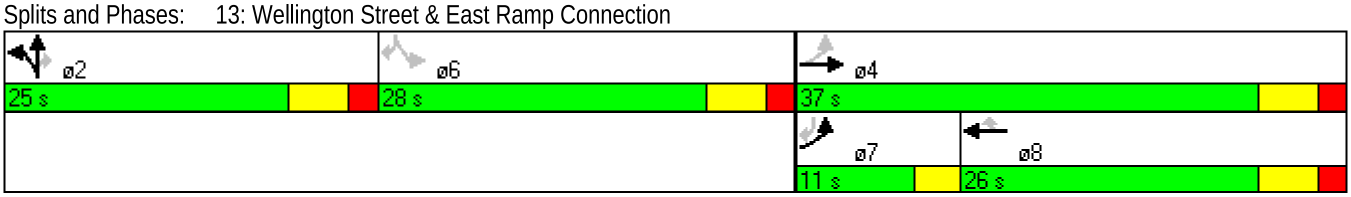
c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	155	555	625	230	215	280	105	200	475
Lane Group Flow (vph)	168	603	679	250	211	327	114	217	516
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	11.0	37.0	26.0	26.0	25.0	25.0	25.0	28.0	39.0
Total Split (%)	12.2%	41.1%	28.9%	28.9%	27.8%	27.8%	27.8%	31.1%	43.3%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	1.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
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					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.64	0.31	0.53	0.43	0.55	0.80	0.26	0.82	0.48
Control Delay	33.1	20.1	30.4	6.4	36.1	48.3	7.4	55.8	22.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.1	20.1	30.4	6.4	36.1	48.3	7.4	55.8	22.4
Queue Length 50th (m)	18.4	24.8	34.6	0.0	31.0	51.5	0.0	31.9	34.2
Queue Length 95th (m)	#36.2	33.0	45.5	16.1	52.0	#89.5	11.6	#64.5	48.2
Internal Link Dist (m)		163.9	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	261	1937	1279	577	411	436	466	292	1048
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	0.64	0.31	0.53	0.43	0.51	0.75	0.24	0.74	0.49

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 87
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	555	0	0	625	230	215	280	105	200	0	475
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00	0.95		1.00
Satd. Flow (prot)	1770	5085			5036	1538	1698	1797	1568	1805		2814
Flt Permitted	0.21	1.00			1.00	1.00	0.95	1.00	1.00	0.55		1.00
Satd. Flow (perm)	392	5085			5036	1538	1698	1797	1568	1053		2814
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	603	0	0	679	250	234	304	114	217	0	516
RTOR Reduction (vph)	0	0	0	0	0	186	0	0	88	0	0	0
Lane Group Flow (vph)	168	603	0	0	679	64	211	327	26	217	0	516
Heavy Vehicles (%)	2%	2%	0%	0%	3%	5%	1%	0%	3%	0%	0%	1%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	31.1	31.1			20.1	20.1	17.8	17.8	17.8	20.0		34.0
Effective Green, g (s)	30.1	33.1			22.1	22.1	19.8	19.8	19.8	22.0		36.0
Actuated g/C Ratio	0.35	0.38			0.25	0.25	0.23	0.23	0.23	0.25		0.41
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	247	1937			1281	391	387	409	357	267		1166
v/s Ratio Prot	c0.05	0.12			0.13		0.12	c0.18				
v/s Ratio Perm	c0.18					0.04			0.02	c0.21		0.18
v/c Ratio	0.68	0.31			0.53	0.16	0.55	0.80	0.07	0.81		0.44
Uniform Delay, d1	21.3	18.9			27.9	25.2	29.6	31.7	26.3	30.5		18.3
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	14.1	0.4			1.6	0.9	1.6	10.5	0.1	17.0		0.3
Delay (s)	35.4	19.3			29.5	26.1	31.2	42.1	26.4	47.5		18.5
Level of Service	D	B			C	C	C	D	C	D		B
Approach Delay (s)		22.8			28.6			35.8			27.1	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM Average Control Delay	28.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	86.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			305							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

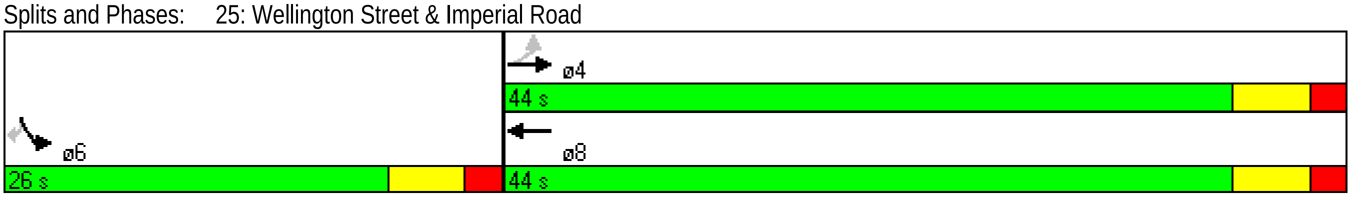
25: Wellington Street & Imperial Road

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	80	555	565	320	80
Lane Group Flow (vph)	0	635	810	320	80
Turn Type	Perm				Perm
Protected Phases		4	8	6	
Permitted Phases	4			6	6
Detector Phase	4	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	41.0	41.0	41.0	24.0	24.0
Total Split (s)	44.0	44.0	44.0	26.0	26.0
Total Split (%)	62.9%	62.9%	62.9%	37.1%	37.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Max	C-Max	C-Max	None	None
v/c Ratio		0.38	0.39	0.63	0.16
Control Delay		8.5	6.6	27.5	5.6
Queue Delay		0.0	0.0	0.0	0.0
Total Delay		8.5	6.6	27.5	5.6
Queue Length 50th (m)		19.4	18.9	32.5	0.0
Queue Length 95th (m)		29.7	29.3	53.1	7.5
Internal Link Dist (m)		188.7	176.3	303.2	
Turn Bay Length (m)					
Base Capacity (vph)		1655	2094	567	557
Starvation Cap Reductn		0	0	0	0
Spillback Cap Reductn		0	0	0	0
Storage Cap Reductn		0	0	0	0
Reduced v/c Ratio		0.38	0.39	0.56	0.14

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	80	555	565	245	320	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.95		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3521	3362		1805	1599
Flt Permitted		0.77	1.00		0.95	1.00
Satd. Flow (perm)		2743	3362		1805	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	555	565	245	320	80
RTOR Reduction (vph)	0	0	64	0	0	57
Lane Group Flow (vph)	0	635	746	0	320	23
Confl. Peds. (#/hr)	6			6		
Heavy Vehicles (%)	1%	2%	2%	1%	0%	1%
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)		40.2	40.2		17.8	17.8
Effective Green, g (s)		42.2	42.2		19.8	19.8
Actuated g/C Ratio		0.60	0.60		0.28	0.28
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		5.0	5.0
Lane Grp Cap (vph)		1654	2027		511	452
v/s Ratio Prot			0.22		c0.18	
v/s Ratio Perm		c0.23				0.01
v/c Ratio		0.38	0.37		0.63	0.05
Uniform Delay, d1		7.2	7.1		21.9	18.3
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.7	0.5		3.4	0.1
Delay (s)		7.9	7.6		25.3	18.4
Level of Service		A	A		C	B
Approach Delay (s)		7.9	7.6		23.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	11.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	735	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	735	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		314	188			
pX, platoon unblocked						
vC, conflicting volume	0				245	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				245	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				722	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	245	245	245	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.14	0.14	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

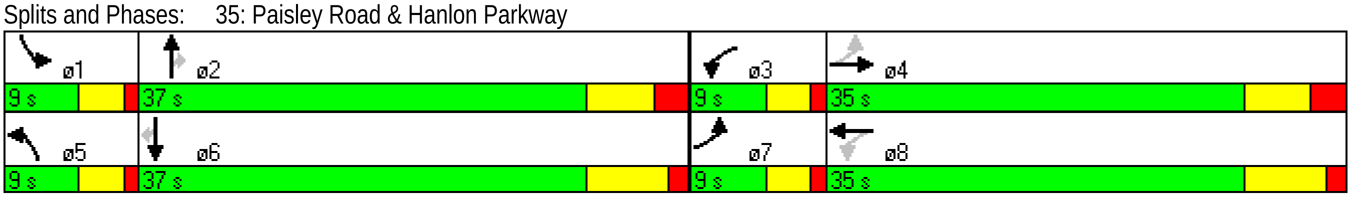
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	130	350	80	125	335	155	1070	160	50	1125	95
Lane Group Flow (vph)	141	380	87	136	424	168	1163	174	54	1223	103
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	33.0	33.0	9.0	33.0	33.0
Total Split (s)	9.0	35.0	0.0	9.0	35.0	9.0	37.0	37.0	9.0	37.0	37.0
Total Split (%)	10.0%	38.9%	0.0%	10.0%	38.9%	10.0%	41.1%	41.1%	10.0%	41.1%	41.1%
Yellow Time (s)	3.0	4.5		3.0	5.5	3.0	4.5	4.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	1.5	1.0	2.5	2.5	1.0	1.5	1.5
Lost Time Adjust (s)	0.0	-3.0	0.0	0.0	-3.0	0.0	-3.0	-3.0	0.0	-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	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.64	0.50	0.06	0.56	0.57	0.42	0.67	0.20	0.33	0.78	0.14
Control Delay	37.9	33.4	0.1	29.9	30.2	40.1	22.1	3.5	42.9	27.1	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.9	33.4	0.1	29.9	30.2	40.1	22.1	3.5	42.9	27.1	7.9
Queue Length 50th (m)	16.8	28.3	0.0	17.2	29.0	12.9	74.4	0.0	8.2	84.7	3.1
Queue Length 95th (m)	27.9	38.2	0.0	26.3	40.1	21.2	111.6	10.8	17.8	#135.1	12.7
Internal Link Dist (m)		119.3			210.1		643.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	221	1243	1577	244	1212	397	1726	866	165	1569	747
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.31	0.06	0.56	0.35	0.42	0.67	0.20	0.33	0.78	0.14

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 64 (71%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 35: Paisley Road & Hanlon Parkway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	350	80	125	335	55	155	1070	160	50	1125	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1786	3610	1577	1803	3476		3467	3539	1594	1805	3539	1599
Flt Permitted	0.31	1.00	1.00	0.36	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	584	3610	1577	690	3476		3467	3539	1594	1805	3539	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	380	87	136	364	60	168	1163	174	54	1223	103
RTOR Reduction (vph)	0	0	0	0	17	0	0	0	91	0	0	38
Lane Group Flow (vph)	141	380	87	136	407	0	168	1163	83	54	1223	65
Confl. Peds. (#/hr)	4		5	5		4			1	1		
Heavy Vehicles (%)	1%	0%	1%	0%	1%	4%	1%	2%	0%	0%	2%	1%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	20.8	15.8	90.0	20.8	15.8		10.3	40.1	40.1	7.1	36.9	36.9
Effective Green, g (s)	20.8	18.8	90.0	20.8	18.8		10.3	43.1	43.1	7.1	39.9	39.9
Actuated g/C Ratio	0.23	0.21	1.00	0.23	0.21		0.11	0.48	0.48	0.08	0.44	0.44
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	202	754	1577	221	726		397	1695	763	142	1569	709
v/s Ratio Prot	c0.04	0.11		0.03	0.12		c0.05	c0.33		0.03	c0.35	
v/s Ratio Perm	c0.12		0.06	0.11					0.05			0.04
v/c Ratio	0.70	0.50	0.06	0.62	0.56		0.42	0.69	0.11	0.38	0.78	0.09
Uniform Delay, d1	30.0	31.5	0.0	29.5	31.9		37.1	18.2	12.9	39.4	21.3	14.5
Progression Factor	1.00	1.00	1.00	0.89	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.0	0.5	0.1	4.8	1.0		0.7	2.3	0.3	1.7	3.9	0.3
Delay (s)	40.1	32.0	0.1	31.1	30.0		37.8	20.5	13.2	41.1	25.2	14.8
Level of Service	D	C	A	C	C		D	C	B	D	C	B
Approach Delay (s)		29.3			30.2			21.6			25.1	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	25.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	240	245	80	235	240	75	105	235	145	200
Lane Group Flow (vph)	240	245	80	235	385	75	295	235	145	200
Turn Type	pm+pt		Perm	Perm		Perm		pm+pt		Perm
Protected Phases	7	4			8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	35.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	12.0	48.0	48.0	36.0	36.0	29.0	29.0	13.0	42.0	42.0
Total Split (%)	13.3%	53.3%	53.3%	40.0%	40.0%	32.2%	32.2%	14.4%	46.7%	46.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	C-Max	C-Max	None	None	None	None	None
v/c Ratio	0.50	0.23	0.09	0.50	0.51	0.30	0.72	0.85	0.22	0.29
Control Delay	9.3	5.1	0.8	20.9	17.1	31.6	31.1	50.7	20.3	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.3	5.1	0.8	20.9	17.1	31.6	31.1	50.7	20.3	3.8
Queue Length 50th (m)	4.7	4.8	0.0	17.9	25.0	10.2	28.8	27.6	16.0	0.0
Queue Length 95th (m)	43.5	43.9	0.2	39.6	53.6	19.5	49.2	#46.1	25.0	10.8
Internal Link Dist (m)		210.1			1197.0		117.0		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	482	1060	872	473	762	341	527	275	787	797
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.23	0.09	0.50	0.51	0.22	0.56	0.85	0.18	0.25

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

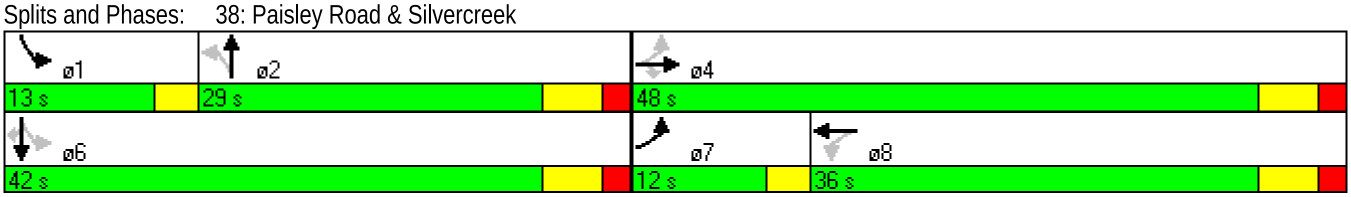
Offset: 52 (58%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

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

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	240	245	80	235	240	145	75	105	190	235	145	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	4.0	4.0	6.0	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	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	1881	1544	1764	1764		1751	1637		1786	1863	1615
Flt Permitted	0.34	1.00	1.00	0.61	1.00		0.66	1.00		0.21	1.00	1.00
Satd. Flow (perm)	641	1881	1544	1127	1764		1225	1637		390	1863	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	240	245	80	235	240	145	75	105	190	235	145	200
RTOR Reduction (vph)	0	0	37	0	22	0	0	80	0	0	0	130
Lane Group Flow (vph)	240	245	43	235	363	0	75	215	0	235	145	70
Confl. Peds. (#/hr)			3	3					3	3		
Heavy Vehicles (%)	0%	1%	2%	2%	2%	1%	0%	0%	0%	1%	2%	0%
Turn Type	pm+pt		Perm	Perm			Perm			pm+pt		Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	48.7	48.7	48.7	35.7	35.7		16.3	16.3		29.3	29.3	29.3
Effective Green, g (s)	47.7	50.7	48.7	37.7	37.7		18.3	18.3		28.3	31.3	31.3
Actuated g/C Ratio	0.53	0.56	0.54	0.42	0.42		0.20	0.20		0.31	0.35	0.35
Clearance Time (s)	3.0	6.0	6.0	6.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	456	1060	835	472	739		249	333		262	648	562
v/s Ratio Prot	c0.05	0.13			0.21			0.13		c0.09	0.08	
v/s Ratio Perm	c0.23		0.03	0.21			0.06			c0.19		0.04
v/c Ratio	0.53	0.23	0.05	0.50	0.49		0.30	0.65		0.90	0.22	0.12
Uniform Delay, d1	12.9	9.9	9.7	19.2	19.1		30.4	32.9		26.1	20.8	20.0
Progression Factor	0.48	0.41	0.17	0.79	0.77		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.1	0.5	0.1	3.5	2.2		0.7	4.3		29.9	0.2	0.1
Delay (s)	7.3	4.6	1.8	18.6	16.9		31.1	37.2		56.0	20.9	20.1
Level of Service	A	A	A	B	B		C	D		E	C	C
Approach Delay (s)		5.3			17.6			35.9			34.9	
Approach LOS		A			B			D			C	

Intersection Summary			
HCM Average Control Delay	22.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	110	575	315	105	420	285
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	110	575	315	105	420	285
Approach Volume (veh/h)	685			420	705	
Crossing Volume (veh/h)	315			420	110	
High Capacity (veh/h)	1081			995	1271	
High v/c (veh/h)	0.63			0.42	0.55	
Low Capacity (veh/h)	887			809	1058	
Low v/c (veh/h)	0.77			0.52	0.67	

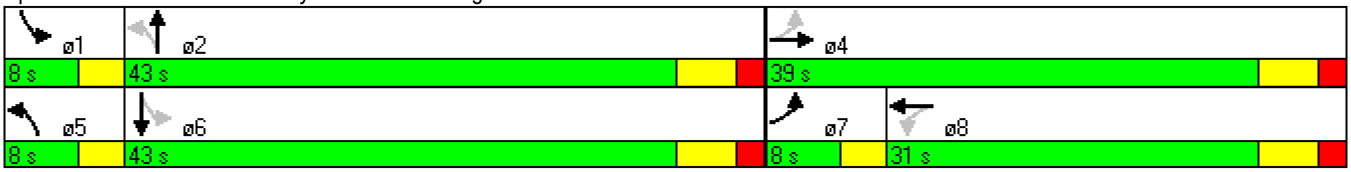
Intersection Summary			
Maximum v/c High	0.63		
Maximum v/c Low	0.77		
Intersection Capacity Utilization	114.9%	ICU Level of Service	H

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	185	460	40	425	110	630	90	580
Lane Group Flow (vph)	185	535	40	480	110	660	90	690
Turn Type	pm+pt		Perm		pm+pt		pm+pt	
Protected Phases	7	4		8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	29.0	29.0	29.0	8.0	28.0	8.0	28.0
Total Split (s)	8.0	39.0	31.0	31.0	8.0	43.0	8.0	43.0
Total Split (%)	8.9%	43.3%	34.4%	34.4%	8.9%	47.8%	8.9%	47.8%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	2.0	5.0	2.0	5.0
Lead/Lag	Lead		Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.86	0.77	0.28	0.92	0.46	0.79	0.34	0.83
Control Delay	49.6	27.0	31.1	56.2	17.1	26.4	13.4	33.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.6	27.0	31.1	56.2	17.1	26.4	13.4	33.4
Queue Length 50th (m)	16.1	54.6	4.9	72.3	7.2	55.7	6.5	96.7
Queue Length 95th (m)	m#43.8	101.1	13.2	#123.9	m14.8	#142.9	12.8	#158.3
Internal Link Dist (m)		1213.0		222.3		775.1		164.8
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	214	703	146	533	241	836	266	828
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.76	0.27	0.90	0.46	0.79	0.34	0.83

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 30 (33%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	460	75	40	425	55	110	630	30	90	580	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0		5.0	5.0		2.0	5.0		2.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1844		1805	1829		1787	1869		1805	1839	
Flt Permitted	0.15	1.00		0.26	1.00		0.13	1.00		0.16	1.00	
Satd. Flow (perm)	277	1844		503	1829		254	1869		306	1839	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	185	460	75	40	425	55	110	630	30	90	580	110
RTOR Reduction (vph)	0	6	0	0	5	0	0	2	0	0	7	0
Lane Group Flow (vph)	185	529	0	40	475	0	110	658	0	90	683	0
Confl. Peds. (#/hr)	4					4						
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	1%	1%	0%	0%	1%	0%
Turn Type	pm+pt			Perm			pm+pt			pm+pt		
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	32.4	32.4		24.4	24.4		42.6	38.6		42.6	38.6	
Effective Green, g (s)	33.4	33.4		25.4	25.4		44.6	39.6		44.6	39.6	
Actuated g/C Ratio	0.37	0.37		0.28	0.28		0.50	0.44		0.50	0.44	
Clearance Time (s)	3.0	6.0		6.0	6.0		3.0	6.0		3.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	205	684		142	516		211	822		235	809	
v/s Ratio Prot	c0.06	0.29			c0.26		c0.03	0.35		0.02	c0.37	
v/s Ratio Perm	0.27			0.08			0.23			0.17		
v/c Ratio	0.90	0.77		0.28	0.92		0.52	0.80		0.38	0.84	
Uniform Delay, d1	23.8	25.0		25.2	31.3		16.7	21.8		15.7	22.4	
Progression Factor	0.85	0.80		1.00	1.00		1.22	0.88		1.00	1.00	
Incremental Delay, d2	32.3	4.5		1.1	21.9		1.8	6.3		1.0	10.5	
Delay (s)	52.5	24.4		26.3	53.2		22.1	25.4		16.8	32.9	
Level of Service	D	C		C	D		C	C		B	C	
Approach Delay (s)		31.6			51.1			25.0			31.1	
Approach LOS		C			D			C			C	

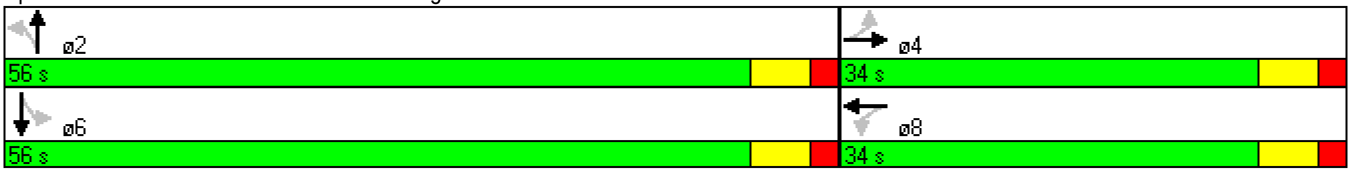
Intersection Summary			
HCM Average Control Delay	33.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	94.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	60	295	110	330	45	675	40	700
Lane Group Flow (vph)	60	335	110	390	45	740	40	745
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	55.0	55.0	55.0	55.0
Total Split (s)	34.0	34.0	34.0	34.0	56.0	56.0	56.0	56.0
Total Split (%)	37.8%	37.8%	37.8%	37.8%	62.2%	62.2%	62.2%	62.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.49	0.67	0.68	0.79	0.15	0.65	0.14	0.64
Control Delay	40.6	35.0	50.0	41.1	9.7	24.7	5.2	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.6	35.0	50.0	41.1	9.7	24.7	5.2	6.7
Queue Length 50th (m)	7.9	45.7	15.4	55.2	2.5	72.5	1.3	25.0
Queue Length 95th (m)	18.9	67.2	#33.7	80.0	7.1	110.9	m1.9	m31.5
Internal Link Dist (m)		842.2		241.7		111.7		775.1
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	146	591	192	585	292	1135	290	1163
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.57	0.57	0.67	0.15	0.65	0.14	0.64

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 80 (89%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	295	40	110	330	60	45	675	65	40	700	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.97	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1753	1816		1719	1792		1797	1832		1759	1879	
Flt Permitted	0.25	1.00		0.33	1.00		0.25	1.00		0.25	1.00	
Satd. Flow (perm)	452	1816		597	1792		473	1832		468	1879	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	295	40	110	330	60	45	675	65	40	700	45
RTOR Reduction (vph)	0	6	0	0	8	0	0	3	0	0	2	0
Lane Group Flow (vph)	60	329	0	110	382	0	45	737	0	40	743	0
Confl. Peds. (#/hr)	10		25	25		10	16		22	22		16
Heavy Vehicles (%)	2%	2%	0%	2%	3%	2%	0%	2%	2%	2%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.4	23.4		23.4	23.4		54.6	54.6		54.6	54.6	
Effective Green, g (s)	24.4	24.4		24.4	24.4		55.6	55.6		55.6	55.6	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.62	0.62		0.62	0.62	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	123	492		162	486		292	1132		289	1161	
v/s Ratio Prot		0.18			c0.21			c0.40			0.40	
v/s Ratio Perm	0.13			0.18			0.10			0.09		
v/c Ratio	0.49	0.67		0.68	0.79		0.15	0.65		0.14	0.64	
Uniform Delay, d1	27.6	29.2		29.3	30.4		7.3	11.0		7.2	10.9	
Progression Factor	1.00	1.00		1.00	1.00		0.93	1.76		0.49	0.39	
Incremental Delay, d2	3.0	3.4		10.8	8.2		1.1	2.8		0.7	1.9	
Delay (s)	30.6	32.6		40.1	38.6		7.8	22.1		4.2	6.1	
Level of Service	C	C		D	D		A	C		A	A	
Approach Delay (s)		32.3			38.9			21.3			6.0	
Approach LOS		C			D			C			A	

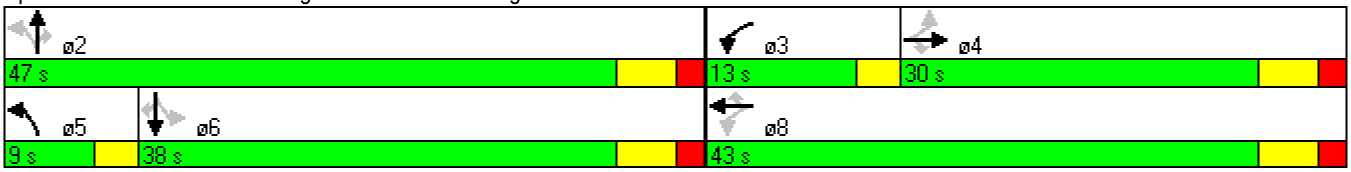
Intersection Summary			
HCM Average Control Delay	21.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	750	200	230	945	80	195	655	160	55	725	65
Lane Group Flow (vph)	50	750	200	230	945	80	195	655	160	55	725	65
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	13.0	43.0	43.0	9.0	47.0	47.0	38.0	38.0	38.0
Total Split (%)	33.3%	33.3%	33.3%	14.4%	47.8%	47.8%	10.0%	52.2%	52.2%	42.2%	42.2%	42.2%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.35	0.83	0.34	0.74	0.66	0.11	0.57	0.38	0.19	0.20	0.54	0.10
Control Delay	34.5	39.6	5.7	32.8	23.8	4.4	20.0	16.2	3.0	11.4	14.0	1.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.5	39.6	5.7	32.8	23.8	4.4	20.0	16.2	3.0	11.4	14.0	1.2
Queue Length 50th (m)	6.4	58.2	0.0	22.1	61.1	0.0	16.6	34.4	0.1	3.5	33.0	0.2
Queue Length 95th (m)	16.4	77.7	13.8	#47.9	79.7	7.2	28.1	46.3	9.1	m5.7	43.0	m1.1
Internal Link Dist (m)		464.5			263.2			253.7			89.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	145	937	593	311	1466	721	340	1702	827	279	1333	624
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.80	0.34	0.74	0.64	0.11	0.57	0.38	0.19	0.20	0.54	0.10

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 19 (21%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



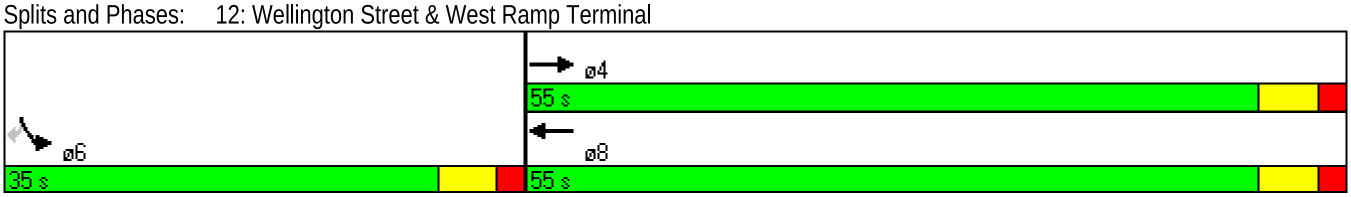
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	750	200	230	945	80	195	655	160	55	725	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3374	1615	1787	3471	1599	1769	3574	1563	1762	3574	1562
Flt Permitted	0.27	1.00	1.00	0.15	1.00	1.00	0.25	1.00	1.00	0.40	1.00	1.00
Satd. Flow (perm)	522	3374	1615	286	3471	1599	460	3574	1563	747	3574	1562
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	50	750	200	230	945	80	195	655	160	55	725	65
RTOR Reduction (vph)	0	0	146	0	0	47	0	0	83	0	0	41
Lane Group Flow (vph)	50	750	54	230	945	33	195	655	77	55	725	24
Confl. Peds. (#/hr)							2		12	12		2
Heavy Vehicles (%)	0%	7%	0%	1%	4%	1%	2%	1%	1%	2%	1%	2%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	23.3	23.3	23.3	36.2	36.2	36.2	41.8	41.8	41.8	32.5	32.5	32.5
Effective Green, g (s)	24.3	24.3	24.3	37.2	37.2	37.2	42.8	42.8	42.8	33.5	33.5	33.5
Actuated g/C Ratio	0.27	0.27	0.27	0.41	0.41	0.41	0.48	0.48	0.48	0.37	0.37	0.37
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	141	911	436	300	1435	661	325	1700	743	278	1330	581
v/s Ratio Prot		c0.22		c0.09	0.27		c0.05	0.18			c0.20	
v/s Ratio Perm	0.10		0.03	0.22		0.02	0.24		0.05	0.07		0.02
v/c Ratio	0.35	0.82	0.12	0.77	0.66	0.05	0.60	0.39	0.10	0.20	0.55	0.04
Uniform Delay, d1	26.5	30.8	24.8	19.8	21.3	15.8	15.1	15.2	13.0	19.1	22.2	18.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.56	0.19
Incremental Delay, d2	1.5	6.1	0.1	11.1	1.1	0.0	3.1	0.7	0.3	1.2	1.3	0.1
Delay (s)	28.1	36.9	24.9	30.9	22.4	15.8	18.2	15.8	13.3	10.8	13.8	3.5
Level of Service	C	D	C	C	C	B	B	B	B	B	B	A
Approach Delay (s)		34.1			23.5			15.9			12.8	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	22.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	85.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	985	1460	160	90
Lane Group Flow (vph)	1071	1587	174	98
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	38.0	38.0	33.0	33.0
Total Split (s)	55.0	55.0	35.0	35.0
Total Split (%)	61.1%	61.1%	38.9%	38.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.30	0.44	0.35	0.42
Control Delay	4.2	5.0	28.9	27.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	4.2	5.0	28.9	27.5
Queue Length 50th (m)	13.6	23.0	9.9	8.4
Queue Length 95th (m)	22.8	37.6	17.3	20.0
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3580	3615	1410	622
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.30	0.44	0.12	0.16

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 71
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	985	1460	0	160	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5036	5085		3335	1442
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5036	5085		3335	1442
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1071	1587	0	174	98
RTOR Reduction (vph)	0	0	0	0	0	19
Lane Group Flow (vph)	0	1071	1587	0	174	79
Heavy Vehicles (%)	0%	3%	2%	0%	5%	12%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		49.5	49.5		9.5	9.5
Effective Green, g (s)		50.5	50.5		10.5	10.5
Actuated g/C Ratio		0.71	0.71		0.15	0.15
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3582	3617		493	213
v/s Ratio Prot		0.21	c0.31		0.05	
v/s Ratio Perm						c0.05
v/c Ratio		0.30	0.44		0.35	0.37
Uniform Delay, d1		3.8	4.3		27.2	27.3
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.2	0.4		0.4	1.1
Delay (s)		4.0	4.7		27.6	28.4
Level of Service		A	A		C	C
Approach Delay (s)		4.0	4.7		27.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	6.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	71.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	175	715	945	255	310	280	85	200	690
Lane Group Flow (vph)	190	777	1027	277	303	338	92	217	750
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	10.0	37.0	27.0	27.0	25.0	25.0	25.0	28.0	38.0
Total Split (%)	11.1%	41.1%	30.0%	30.0%	27.8%	27.8%	27.8%	31.1%	42.2%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.75	0.44	0.83	0.45	0.84	0.88	0.22	0.83	0.74
Control Delay	40.2	22.7	38.8	6.3	55.9	58.4	8.1	58.4	29.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.2	22.7	38.8	6.3	55.9	58.4	8.1	58.4	29.8
Queue Length 50th (m)	20.3	34.1	57.1	0.0	48.6	54.7	0.0	32.5	57.7
Queue Length 95th (m)	#42.6	44.1	#72.0	16.8	#89.0	#98.3	10.7	#66.9	78.9
Internal Link Dist (m)		150.3	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	252	1783	1237	609	372	400	422	270	1004
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	0.75	0.44	0.83	0.45	0.81	0.85	0.22	0.80	0.75

Intersection Summary

Cycle Length: 90

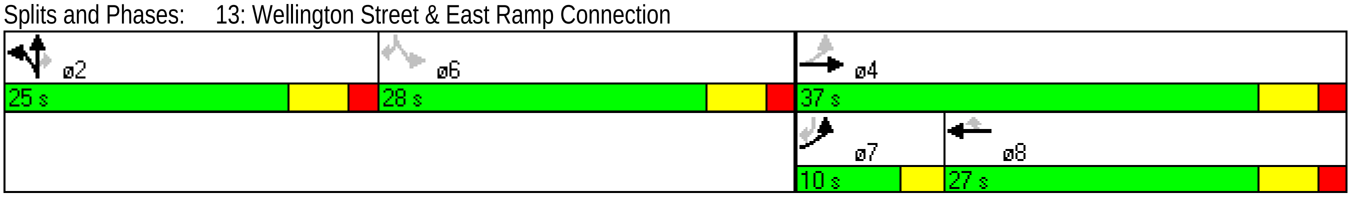
Actuated Cycle Length: 88.7

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

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

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	715	0	0	945	255	310	280	85	200	0	690
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.99	1.00	0.95		1.00
Satd. Flow (prot)	1752	4940			4988	1615	1649	1773	1553	1805		2787
Flt Permitted	0.17	1.00			1.00	1.00	0.95	0.99	1.00	0.55		1.00
Satd. Flow (perm)	307	4940			4988	1615	1649	1773	1553	1042		2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	190	777	0	0	1027	277	337	304	92	217	0	750
RTOR Reduction (vph)	0	0	0	0	0	208	0	0	72	0	0	0
Lane Group Flow (vph)	190	777	0	0	1027	69	303	338	20	217	0	750
Heavy Vehicles (%)	3%	5%	0%	0%	4%	0%	4%	1%	4%	0%	0%	2%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	31.0	31.0			21.0	21.0	18.3	18.3	18.3	21.4		34.4
Effective Green, g (s)	32.0	32.0			22.0	22.0	19.3	19.3	19.3	22.4		35.4
Actuated g/C Ratio	0.36	0.36			0.25	0.25	0.22	0.22	0.22	0.25		0.40
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	241	1782			1237	401	359	386	338	263		1112
v/s Ratio Prot	0.07	0.16			c0.21		0.18	c0.19				
v/s Ratio Perm	0.21					0.04			0.01	c0.21		c0.27
v/c Ratio	0.79	0.44			0.83	0.17	0.84	0.88	0.06	0.83		0.67
Uniform Delay, d1	21.9	21.5			31.6	26.2	33.3	33.5	27.5	31.3		21.9
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	22.5	0.8			6.6	0.9	16.4	19.3	0.1	18.6		1.6
Delay (s)	44.4	22.3			38.1	27.1	49.6	52.9	27.6	49.9		23.5
Level of Service	D	C			D	C	D	D	C	D		C
Approach Delay (s)		26.6			35.8			48.4			29.5	
Approach LOS		C			D			D			C	

Intersection Summary			
HCM Average Control Delay	34.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	88.7	Sum of lost time (s)	15.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			303							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

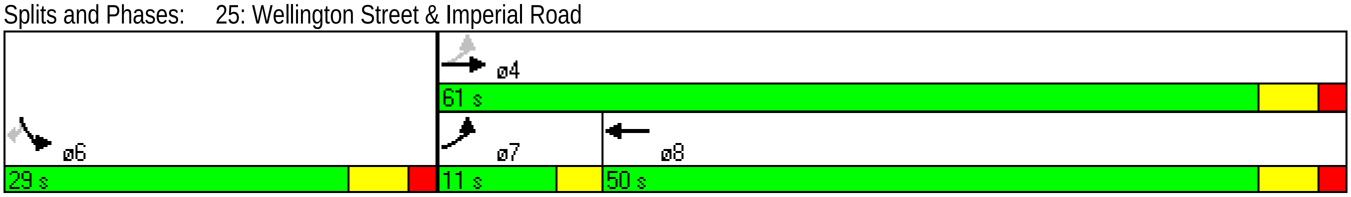
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	110	810	1195	395	35
Lane Group Flow (vph)	110	810	1515	395	35
Turn Type	pm+pt				Perm
Protected Phases	7	4	8	6	
Permitted Phases	4			6	6
Detector Phase	7	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	41.0	41.0	24.0	24.0
Total Split (s)	11.0	61.0	50.0	29.0	29.0
Total Split (%)	12.2%	67.8%	55.6%	32.2%	32.2%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	C-Max	C-Max	None	None
v/c Ratio	0.43	0.71	0.83	0.85	0.09
Control Delay	13.6	15.8	23.1	50.4	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.6	15.8	23.1	50.4	9.5
Queue Length 50th (m)	5.7	79.9	104.1	59.2	0.0
Queue Length 95th (m)	15.5	120.6	#140.6	#101.7	6.3
Internal Link Dist (m)		188.7	176.5	303.2	
Turn Bay Length (m)	100.0				
Base Capacity (vph)	267	1139	1826	477	404
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.41	0.71	0.83	0.83	0.09

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	110	810	1195	320	395	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1810	3364		1787	1417
Flt Permitted	0.08	1.00	1.00		0.95	1.00
Satd. Flow (perm)	153	1810	3364		1787	1417
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	810	1195	320	395	35
RTOR Reduction (vph)	0	0	25	0	0	26
Lane Group Flow (vph)	110	810	1490	0	395	9
Confl. Peds. (#/hr)	4			4		
Heavy Vehicles (%)	0%	5%	4%	1%	1%	14%
Turn Type	pm+pt					Perm
Protected Phases	7	4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)	55.7	55.7	46.6		22.3	22.3
Effective Green, g (s)	56.7	56.7	47.6		23.3	23.3
Actuated g/C Ratio	0.63	0.63	0.53		0.26	0.26
Clearance Time (s)	3.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	227	1140	1779		463	367
v/s Ratio Prot	0.04	c0.45	c0.44		c0.22	
v/s Ratio Perm	0.27					0.01
v/c Ratio	0.48	0.71	0.84		0.85	0.02
Uniform Delay, d1	13.8	11.2	17.9		31.7	24.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.6	3.8	4.9		15.4	0.1
Delay (s)	15.4	14.9	22.8		47.1	24.9
Level of Service	B	B	C		D	C
Approach Delay (s)		15.0	22.8		45.3	
Approach LOS		B	C		D	

Intersection Summary			
HCM Average Control Delay	23.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	935	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	935	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		327	174			
pX, platoon unblocked						
vC, conflicting volume	0				312	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				312	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				656	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	312	312	312	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.18	0.18	0.18	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	345	165	165	400	290	1330	255	105	1410	80
Lane Group Flow (vph)	114	375	179	179	511	315	1446	277	114	1533	87
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	59.0	59.0	9.0	57.0	57.0
Total Split (s)	10.0	35.0	0.0	12.0	37.0	18.0	81.0	81.0	16.0	79.0	79.0
Total Split (%)	6.9%	24.3%	0.0%	8.3%	25.7%	12.5%	56.3%	56.3%	11.1%	54.9%	54.9%
Yellow Time (s)	3.0	4.5		3.0	4.5	3.0	5.5	5.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	2.5	1.0	1.5	1.5	1.0	1.5	1.5
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.0	6.0	3.0	3.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.67	0.61	0.11	0.77	0.79	0.77	0.76	0.28	0.68	0.83	0.10
Control Delay	61.5	59.3	0.1	65.2	63.6	74.5	29.4	5.0	83.3	34.6	11.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.5	59.3	0.1	65.2	63.6	74.5	29.4	5.0	83.3	34.6	11.2
Queue Length 50th (m)	23.2	48.4	0.0	38.0	66.3	41.2	156.9	6.9	28.9	181.2	6.5
Queue Length 95th (m)	37.0	61.8	0.0	#58.3	82.0	#65.3	187.6	20.8	#55.6	212.3	15.1
Internal Link Dist (m)		119.3			205.7		653.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	169	727	1594	233	756	410	1901	974	173	1840	854
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.52	0.11	0.77	0.68	0.77	0.76	0.28	0.66	0.83	0.10

Intersection Summary

Cycle Length: 144
Actuated Cycle Length: 144
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 35: Paisley Road & Hanlon Parkway

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	345	165	165	400	70	290	1330	255	105	1410	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1594	1786	3463		3502	3471	1594	1770	3505	1593
Flt Permitted	0.22	1.00	1.00	0.32	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	426	3610	1594	592	3463		3502	3471	1594	1770	3505	1593
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	375	179	179	435	76	315	1446	277	114	1533	87
RTOR Reduction (vph)	0	0	0	0	11	0	0	0	100	0	0	18
Lane Group Flow (vph)	114	375	179	179	500	0	315	1446	177	114	1533	69
Confl. Peds. (#/hr)	1		3	3		1	2		1	1		2
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	4%	0%	2%	3%	0%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	29.5	23.5	144.0	33.5	25.5		15.9	77.9	77.9	12.6	74.6	74.6
Effective Green, g (s)	31.5	24.5	144.0	35.5	26.5		16.9	78.9	78.9	13.6	75.6	75.6
Actuated g/C Ratio	0.22	0.17	1.00	0.25	0.18		0.12	0.55	0.55	0.09	0.52	0.52
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	160	614	1594	221	637		411	1902	873	167	1840	836
v/s Ratio Prot	0.03	0.10		c0.05	0.14		c0.09	0.42		0.06	c0.44	
v/s Ratio Perm	0.12		0.11	c0.15					0.11			0.04
v/c Ratio	0.71	0.61	0.11	0.81	0.79		0.77	0.76	0.20	0.68	0.83	0.08
Uniform Delay, d1	48.4	55.3	0.0	48.7	56.0		61.6	25.2	16.6	63.1	28.9	17.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	13.9	1.8	0.1	19.3	6.3		8.3	2.9	0.5	10.9	4.6	0.2
Delay (s)	62.4	57.1	0.1	68.0	62.4		69.9	28.1	17.1	74.1	33.5	17.2
Level of Service	E	E	A	E	E		E	C	B	E	C	B
Approach Delay (s)		42.8			63.8			33.1			35.3	
Approach LOS		D			E			C			D	

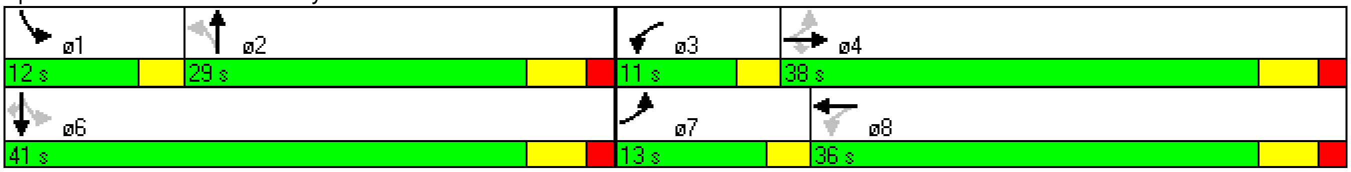
Intersection Summary			
HCM Average Control Delay	39.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	86.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	280	355	60	210	275	80	135	225	145	285
Lane Group Flow (vph)	280	355	60	210	455	80	320	225	145	285
Turn Type	pm+pt		Perm	pm+pt		Perm		pm+pt		Perm
Protected Phases	7	4		3	8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	3	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	8.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	13.0	38.0	38.0	11.0	36.0	29.0	29.0	12.0	41.0	41.0
Total Split (%)	14.4%	42.2%	42.2%	12.2%	40.0%	32.2%	32.2%	13.3%	45.6%	45.6%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	2.0	5.0	5.0	5.0	2.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None
v/c Ratio	0.61	0.46	0.09	0.38	0.65	0.31	0.77	0.71	0.22	0.39
Control Delay	17.1	22.9	5.7	7.9	14.1	31.4	38.0	32.7	20.6	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.1	22.9	5.7	7.9	14.1	31.4	38.0	32.7	20.6	3.9
Queue Length 50th (m)	21.4	42.3	0.0	9.8	24.2	10.7	36.7	24.6	15.9	0.0
Queue Length 95th (m)	38.5	66.9	6.9	m13.0	m29.0	20.9	59.9	#38.1	26.1	13.2
Internal Link Dist (m)		205.7			1213.0		75.2		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	465	774	687	552	703	327	497	315	745	811
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.46	0.09	0.38	0.65	0.24	0.64	0.71	0.19	0.35

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 60 (67%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	280	355	60	210	275	180	80	135	185	225	145	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0		2.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	0.99		1.00	0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1735	1881	1583	1770	1743		1751	1660		1769	1863	1599
Flt Permitted	0.29	1.00	1.00	0.45	1.00		0.66	1.00		0.24	1.00	1.00
Satd. Flow (perm)	529	1881	1583	846	1743		1225	1660		442	1863	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	280	355	60	210	275	180	80	135	185	225	145	285
RTOR Reduction (vph)	0	0	35	0	24	0	0	59	0	0	0	186
Lane Group Flow (vph)	280	355	25	210	431	0	80	261	0	225	145	99
Confl. Peds. (#/hr)	2					2			2	2		
Heavy Vehicles (%)	4%	1%	2%	2%	2%	1%	0%	0%	0%	2%	2%	1%
Turn Type	pm+pt		Perm	pm+pt			Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	46.8	36.0	36.0	42.8	34.0		18.2	18.2		30.2	30.2	30.2
Effective Green, g (s)	48.8	37.0	37.0	44.8	35.0		19.2	19.2		31.2	31.2	31.2
Actuated g/C Ratio	0.54	0.41	0.41	0.50	0.39		0.21	0.21		0.35	0.35	0.35
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	445	773	651	522	678		261	354		301	646	554
v/s Ratio Prot	c0.08	0.19		0.04	c0.25			c0.16		c0.08	0.08	
v/s Ratio Perm	0.26		0.02	0.16			0.07			0.18		0.06
v/c Ratio	0.63	0.46	0.04	0.40	0.64		0.31	0.74		0.75	0.22	0.18
Uniform Delay, d1	13.2	19.2	15.9	13.1	22.3		29.8	33.0		23.1	20.8	20.5
Progression Factor	1.00	1.00	1.00	0.63	0.51		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.8	2.0	0.1	0.3	2.7		0.7	7.8		9.7	0.2	0.2
Delay (s)	16.0	21.2	16.0	8.6	14.1		30.5	40.8		32.8	21.0	20.6
Level of Service	B	C	B	A	B		C	D		C	C	C
Approach Delay (s)		18.6			12.3			38.8			24.9	
Approach LOS		B			B			D			C	

Intersection Summary			
HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	87.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	125	545	135	130	530	140
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	125	545	135	130	530	140
Approach Volume (veh/h)	670			265	670	
Crossing Volume (veh/h)	135			530	125	
High Capacity (veh/h)	1246			911	1256	
High v/c (veh/h)	0.54			0.29	0.53	
Low Capacity (veh/h)	1035			735	1044	
Low v/c (veh/h)	0.65			0.36	0.64	

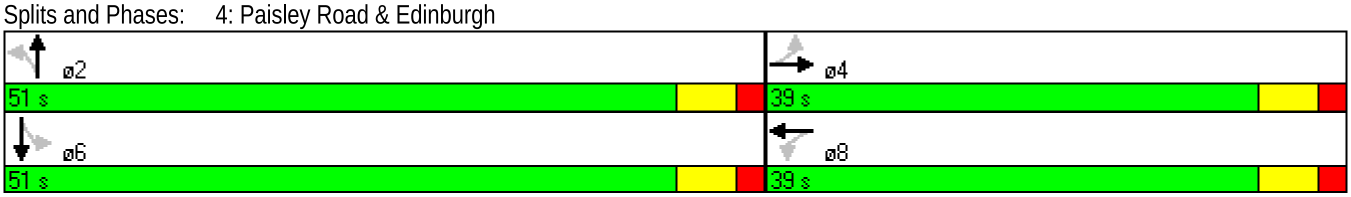
Intersection Summary			
Maximum v/c High	0.54		
Maximum v/c Low	0.65		
Intersection Capacity Utilization	102.4%	ICU Level of Service	G

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	115	360	50	330	55	535	50	515
Lane Group Flow (vph)	115	440	50	375	55	570	50	630
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.0	29.0	29.0	29.0	28.0	28.0	28.0	28.0
Total Split (s)	39.0	39.0	39.0	39.0	51.0	51.0	51.0	51.0
Total Split (%)	43.3%	43.3%	43.3%	43.3%	56.7%	56.7%	56.7%	56.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.63	0.76	0.38	0.65	0.16	0.52	0.13	0.57
Control Delay	31.7	26.7	30.8	30.5	5.2	6.7	11.0	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.7	26.7	30.8	30.5	5.2	6.7	11.0	14.6
Queue Length 50th (m)	12.6	52.2	6.1	49.4	1.5	16.3	3.2	55.3
Queue Length 95th (m)	m23.0	m71.1	14.5	67.6	m4.0	47.0	9.7	99.9
Internal Link Dist (m)		1197.0		206.3		775.8		167.4
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	225	713	164	715	342	1102	387	1101
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.62	0.30	0.52	0.16	0.52	0.13	0.57

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 37 (41%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	115	360	80	50	330	45	55	535	35	50	515	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1790	1809		1800	1825		1805	1846		1802	1833	
Flt Permitted	0.31	1.00		0.22	1.00		0.30	1.00		0.34	1.00	
Satd. Flow (perm)	578	1809		422	1825		573	1846		649	1833	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	115	360	80	50	330	45	55	535	35	50	515	115
RTOR Reduction (vph)	0	10	0	0	6	0	0	2	0	0	8	0
Lane Group Flow (vph)	115	430	0	50	369	0	55	568	0	50	622	0
Confl. Peds. (#/hr)	10		4	4		10			4	4		
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	2%	0%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	26.4	26.4		26.4	26.4		51.6	51.6		51.6	51.6	
Effective Green, g (s)	28.4	28.4		28.4	28.4		53.6	53.6		53.6	53.6	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.60	0.60		0.60	0.60	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	182	571		133	576		341	1099		387	1092	
v/s Ratio Prot		c0.24			0.20			0.31			c0.34	
v/s Ratio Perm	0.20			0.12			0.10			0.08		
v/c Ratio	0.63	0.75		0.38	0.64		0.16	0.52		0.13	0.57	
Uniform Delay, d1	26.3	27.6		23.9	26.4		8.1	10.6		8.0	11.1	
Progression Factor	0.71	0.73		1.00	1.00		0.40	0.42		1.00	1.00	
Incremental Delay, d2	5.9	4.7		1.8	2.4		1.0	1.7		0.7	2.2	
Delay (s)	24.6	24.9		25.7	28.9		4.2	6.1		8.7	13.3	
Level of Service	C	C		C	C		A	A		A	B	
Approach Delay (s)		24.8			28.5			5.9			13.0	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	40	165	75	210	20	480	30	520
Lane Group Flow (vph)	40	220	75	235	20	545	30	555
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	57.0	57.0	57.0	57.0
Total Split (s)	26.0	26.0	26.0	26.0	64.0	64.0	64.0	64.0
Total Split (%)	28.9%	28.9%	28.9%	28.9%	71.1%	71.1%	71.1%	71.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Min	C-Min
v/c Ratio	0.29	0.59	0.49	0.64	0.04	0.41	0.05	0.42
Control Delay	35.0	35.8	42.3	39.9	1.8	4.4	3.8	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.0	35.8	42.3	39.9	1.8	4.4	3.8	4.8
Queue Length 50th (m)	5.4	29.1	10.6	33.4	0.3	24.0	0.9	22.8
Queue Length 95th (m)	13.3	47.1	22.4	52.3	0.9	34.8	m1.9	31.8
Internal Link Dist (m)		218.2		241.7		109.7		775.8
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	167	454	186	446	542	1322	551	1326
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.48	0.40	0.53	0.04	0.41	0.05	0.42

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 68 (76%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	165	55	75	210	25	20	480	65	30	520	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1698	1803		1744	1809		1803	1855		1804	1862	
Flt Permitted	0.38	1.00		0.41	1.00		0.40	1.00		0.41	1.00	
Satd. Flow (perm)	683	1803		761	1809		763	1855		774	1862	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	165	55	75	210	25	20	480	65	30	520	35
RTOR Reduction (vph)	0	14	0	0	5	0	0	5	0	0	2	0
Lane Group Flow (vph)	40	206	0	75	230	0	20	540	0	30	553	0
Confl. Peds. (#/hr)	2		3	3		2	3		2	2		3
Heavy Vehicles (%)	6%	1%	0%	3%	3%	4%	0%	0%	3%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	16.1	16.1		16.1	16.1		61.9	61.9		61.9	61.9	
Effective Green, g (s)	18.1	18.1		18.1	18.1		63.9	63.9		63.9	63.9	
Actuated g/C Ratio	0.20	0.20		0.20	0.20		0.71	0.71		0.71	0.71	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	137	363		153	364		542	1317		550	1322	
v/s Ratio Prot		0.11			c0.13			0.29			c0.30	
v/s Ratio Perm	0.06			0.10			0.03			0.04		
v/c Ratio	0.29	0.57		0.49	0.63		0.04	0.41		0.05	0.42	
Uniform Delay, d1	30.5	32.4		31.9	32.9		3.9	5.3		3.9	5.4	
Progression Factor	1.00	1.00		1.00	1.00		0.33	0.59		0.74	0.66	
Incremental Delay, d2	1.2	2.0		2.5	3.6		0.1	0.9		0.2	0.8	
Delay (s)	31.7	34.4		34.3	36.5		1.4	4.1		3.1	4.4	
Level of Service	C	C		C	D		A	A		A	A	
Approach Delay (s)		34.0			36.0			4.0			4.3	
Approach LOS		C			D			A			A	

Intersection Summary			
HCM Average Control Delay	14.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

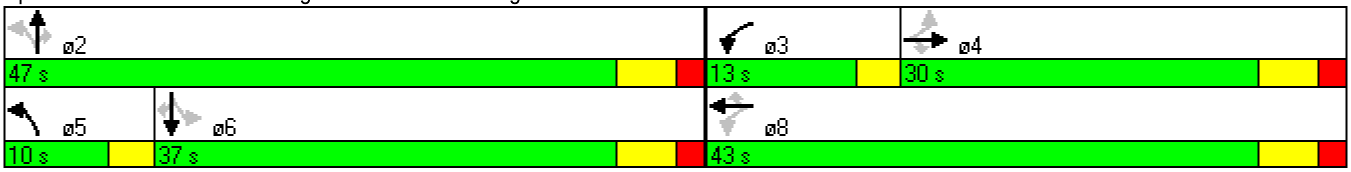
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	665	160	200	625	45	190	485	175	65	540	45
Lane Group Flow (vph)	35	665	160	200	625	45	190	485	175	65	540	45
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	13.0	43.0	43.0	10.0	47.0	47.0	37.0	37.0	37.0
Total Split (%)	33.3%	33.3%	33.3%	14.4%	47.8%	47.8%	11.1%	52.2%	52.2%	41.1%	41.1%	41.1%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	1.0	-2.0	-2.0	1.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.17	0.72	0.29	0.74	0.43	0.07	0.49	0.27	0.20	0.19	0.39	0.07
Control Delay	26.8	34.5	5.7	35.3	19.9	5.0	18.3	13.8	2.8	20.2	21.7	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.8	34.5	5.7	35.3	19.9	5.0	18.3	13.8	2.8	20.2	21.7	7.5
Queue Length 50th (m)	4.2	49.0	0.0	19.9	35.2	0.0	16.8	23.3	0.0	6.9	36.2	1.0
Queue Length 95th (m)	11.1	65.5	12.4	#39.5	47.4	5.4	28.8	32.9	9.2	14.9	43.9	m5.7
Internal Link Dist (m)		464.5			263.2			253.7			91.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	221	1013	580	275	1534	715	386	1802	881	342	1382	618
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.66	0.28	0.73	0.41	0.06	0.49	0.27	0.20	0.19	0.39	0.07

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 64 (71%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	665	160	200	625	45	190	485	175	65	540	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1751	3505	1615	1805	3539	1592	1769	3574	1576	1767	3574	1526
Flt Permitted	0.41	1.00	1.00	0.16	1.00	1.00	0.32	1.00	1.00	0.48	1.00	1.00
Satd. Flow (perm)	765	3505	1615	305	3539	1592	595	3574	1576	885	3574	1526
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	665	160	200	625	45	190	485	175	65	540	45
RTOR Reduction (vph)	0	0	118	0	0	27	0	0	87	0	0	28
Lane Group Flow (vph)	35	665	42	200	625	18	190	485	88	65	540	17
Confl. Peds. (#/hr)	2					2	6		3	3		6
Heavy Vehicles (%)	3%	3%	0%	0%	2%	0%	2%	1%	1%	2%	1%	4%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	21.9	21.9	21.9	34.7	34.7	34.7	43.3	43.3	43.3	32.7	32.7	32.7
Effective Green, g (s)	23.9	23.9	23.9	33.7	36.7	36.7	42.3	45.3	45.3	34.7	34.7	34.7
Actuated g/C Ratio	0.27	0.27	0.27	0.37	0.41	0.41	0.47	0.50	0.50	0.39	0.39	0.39
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	203	931	429	261	1443	649	366	1799	793	341	1378	588
v/s Ratio Prot		0.19		c0.07	0.18		c0.04	0.14			0.15	
v/s Ratio Perm	0.05		0.03	c0.21		0.01	c0.21		0.06	0.07		0.01
v/c Ratio	0.17	0.71	0.10	0.77	0.43	0.03	0.52	0.27	0.11	0.19	0.39	0.03
Uniform Delay, d1	25.4	30.0	24.9	21.7	19.2	16.0	14.9	12.8	11.8	18.3	20.0	17.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.01	1.21
Incremental Delay, d2	0.4	2.6	0.1	12.6	0.2	0.0	1.2	0.4	0.3	1.1	0.8	0.1
Delay (s)	25.8	32.6	25.0	34.3	19.4	16.0	16.2	13.2	12.0	18.4	21.0	20.9
Level of Service	C	C	C	C	B	B	B	B	B	B	C	C
Approach Delay (s)		30.9			22.6			13.6			20.7	
Approach LOS		C			C			B			C	

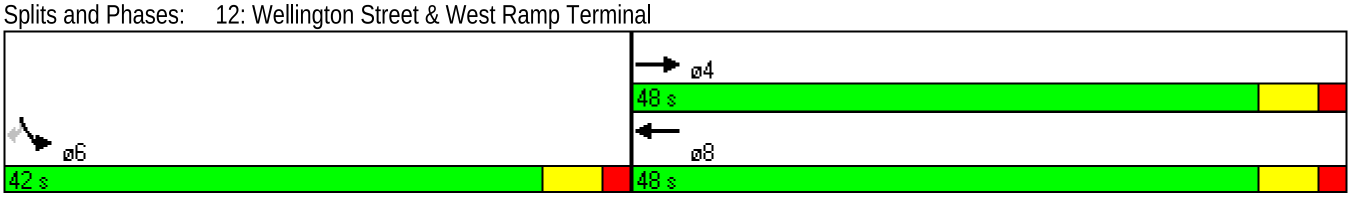
Intersection Summary			
HCM Average Control Delay	22.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	560	715	200	125
Lane Group Flow (vph)	609	777	217	136
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	37.0	37.0	37.0	37.0
Total Split (s)	48.0	48.0	42.0	42.0
Total Split (%)	53.3%	53.3%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.17	0.22	0.35	0.37
Control Delay	3.6	3.8	24.4	8.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	3.6	3.8	24.4	8.2
Queue Length 50th (m)	6.5	8.6	10.6	0.2
Queue Length 95th (m)	10.8	13.8	18.3	11.3
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3540	3540	2084	928
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.17	0.22	0.10	0.15

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 63.2
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	560	715	0	200	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	5085		3467	1455
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	5085		3467	1455
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	609	777	0	217	136
RTOR Reduction (vph)	0	0	0	0	0	110
Lane Group Flow (vph)	0	609	777	0	217	26
Heavy Vehicles (%)	0%	2%	2%	0%	1%	11%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		42.0	42.0		9.2	9.2
Effective Green, g (s)		44.0	44.0		11.2	11.2
Actuated g/C Ratio		0.70	0.70		0.18	0.18
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3540	3540		614	258
v/s Ratio Prot		0.12	c0.15		c0.06	
v/s Ratio Perm						0.02
v/c Ratio		0.17	0.22		0.35	0.10
Uniform Delay, d1		3.3	3.4		22.8	21.8
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.1	0.1		0.4	0.2
Delay (s)		3.4	3.6		23.2	21.9
Level of Service		A	A		C	C
Approach Delay (s)		3.4	3.6		22.7	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	7.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	63.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	28.2%	ICU Level of Service	A
Analysis Period (min)	15		

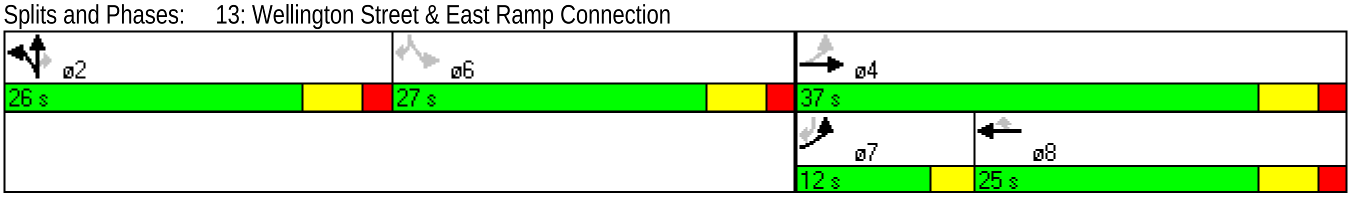
c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	160	555	625	235	215	280	105	200	480
Lane Group Flow (vph)	174	603	679	255	211	327	114	217	522
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	12.0	37.0	25.0	25.0	26.0	26.0	26.0	27.0	39.0
Total Split (%)	13.3%	41.1%	27.8%	27.8%	28.9%	28.9%	28.9%	30.0%	43.3%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	1.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
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					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.64	0.31	0.56	0.45	0.53	0.78	0.25	0.83	0.48
Control Delay	32.3	20.1	31.6	6.7	35.1	45.9	7.2	59.0	22.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.3	20.1	31.6	6.7	35.1	45.9	7.2	59.0	22.1
Queue Length 50th (m)	19.2	24.8	35.2	0.0	30.6	50.7	0.0	32.4	34.7
Queue Length 95th (m)	#36.6	33.0	46.2	16.5	51.2	#86.1	11.4	#66.4	48.9
Internal Link Dist (m)		163.9	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	271	1937	1220	566	431	456	483	279	1086
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	0.64	0.31	0.56	0.45	0.49	0.72	0.24	0.78	0.48

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 87
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	555	0	0	625	235	215	280	105	200	0	480
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00	0.95		1.00
Satd. Flow (prot)	1770	5085			5036	1538	1698	1797	1568	1805		2814
Flt Permitted	0.20	1.00			1.00	1.00	0.95	1.00	1.00	0.55		1.00
Satd. Flow (perm)	372	5085			5036	1538	1698	1797	1568	1053		2814
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	603	0	0	679	255	234	304	114	217	0	522
RTOR Reduction (vph)	0	0	0	0	0	193	0	0	87	0	0	0
Lane Group Flow (vph)	174	603	0	0	679	62	211	327	27	217	0	522
Heavy Vehicles (%)	2%	2%	0%	0%	3%	5%	1%	0%	3%	0%	0%	1%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	31.1	31.1			19.1	19.1	18.3	18.3	18.3	19.5		34.5
Effective Green, g (s)	30.1	33.1			21.1	21.1	20.3	20.3	20.3	21.5		36.5
Actuated g/C Ratio	0.35	0.38			0.24	0.24	0.23	0.23	0.23	0.25		0.42
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	258	1937			1223	373	397	420	366	261		1182
v/s Ratio Prot	c0.06	0.12			0.13		0.12	c0.18				
v/s Ratio Perm	c0.17					0.04			0.02	c0.21		0.19
v/c Ratio	0.67	0.31			0.56	0.17	0.53	0.78	0.07	0.83		0.44
Uniform Delay, d1	21.4	18.9			28.8	26.0	29.1	31.2	26.0	31.0		17.9
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	13.3	0.4			1.8	1.0	1.4	8.8	0.1	19.7		0.3
Delay (s)	34.7	19.3			30.6	26.9	30.5	40.0	26.0	50.6		18.2
Level of Service	C	B			C	C	C	D	C	D		B
Approach Delay (s)		22.8			29.6			34.5			27.7	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	86.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			305							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

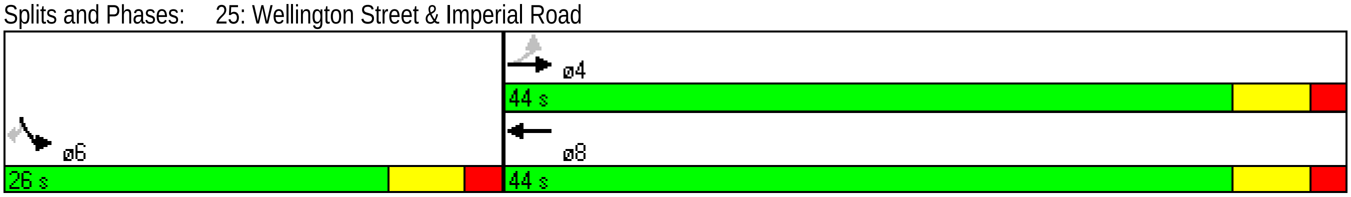
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	80	555	570	320	80
Lane Group Flow (vph)	0	635	815	320	80
Turn Type	Perm				Perm
Protected Phases		4	8	6	
Permitted Phases	4			6	6
Detector Phase	4	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	41.0	41.0	41.0	24.0	24.0
Total Split (s)	44.0	44.0	44.0	26.0	26.0
Total Split (%)	62.9%	62.9%	62.9%	37.1%	37.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Max	C-Max	C-Max	None	None
v/c Ratio		0.38	0.39	0.63	0.16
Control Delay		8.5	6.6	27.5	5.6
Queue Delay		0.0	0.0	0.0	0.0
Total Delay		8.5	6.6	27.5	5.6
Queue Length 50th (m)		19.4	19.1	32.5	0.0
Queue Length 95th (m)		29.7	29.8	53.1	7.5
Internal Link Dist (m)		188.7	176.3	303.2	
Turn Bay Length (m)					
Base Capacity (vph)		1653	2094	567	557
Starvation Cap Reductn		0	0	0	0
Spillback Cap Reductn		0	0	0	0
Storage Cap Reductn		0	0	0	0
Reduced v/c Ratio		0.38	0.39	0.56	0.14

Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	80	555	570	245	320	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.95		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3521	3363		1805	1599
Flt Permitted		0.77	1.00		0.95	1.00
Satd. Flow (perm)		2739	3363		1805	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	555	570	245	320	80
RTOR Reduction (vph)	0	0	64	0	0	57
Lane Group Flow (vph)	0	635	751	0	320	23
Confl. Peds. (#/hr)	6			6		
Heavy Vehicles (%)	1%	2%	2%	1%	0%	1%
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)		40.2	40.2		17.8	17.8
Effective Green, g (s)		42.2	42.2		19.8	19.8
Actuated g/C Ratio		0.60	0.60		0.28	0.28
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		5.0	5.0
Lane Grp Cap (vph)		1651	2027		511	452
v/s Ratio Prot			0.22		c0.18	
v/s Ratio Perm		c0.23				0.01
v/c Ratio		0.38	0.37		0.63	0.05
Uniform Delay, d1		7.2	7.1		21.9	18.3
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.7	0.5		3.4	0.1
Delay (s)		7.9	7.6		25.3	18.4
Level of Service		A	A		C	B
Approach Delay (s)		7.9	7.6		23.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	11.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	735	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	735	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		314	188			
pX, platoon unblocked						
vC, conflicting volume	0				245	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				245	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				722	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	245	245	245	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.14	0.14	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	130	355	80	125	340	155	1070	160	50	1125	95
Lane Group Flow (vph)	141	386	87	136	430	168	1163	174	54	1223	103
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	33.0	33.0	9.0	33.0	33.0
Total Split (s)	9.0	35.0	0.0	9.0	35.0	9.0	37.0	37.0	9.0	37.0	37.0
Total Split (%)	10.0%	38.9%	0.0%	10.0%	38.9%	10.0%	41.1%	41.1%	10.0%	41.1%	41.1%
Yellow Time (s)	3.0	4.5		3.0	5.5	3.0	4.5	4.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	1.5	1.0	2.5	2.5	1.0	1.5	1.5
Lost Time Adjust (s)	0.0	-3.0	0.0	0.0	-3.0	0.0	-3.0	-3.0	0.0	-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	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.64	0.51	0.06	0.56	0.57	0.42	0.68	0.20	0.33	0.78	0.14
Control Delay	37.9	33.4	0.1	29.7	29.9	40.1	22.2	3.5	42.9	27.3	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.9	33.4	0.1	29.7	29.9	40.1	22.2	3.5	42.9	27.3	7.9
Queue Length 50th (m)	16.7	28.8	0.0	17.0	29.2	12.9	74.6	0.0	8.2	85.0	3.1
Queue Length 95th (m)	27.8	38.7	0.0	26.1	40.1	21.2	112.0	10.9	17.8	#135.8	12.8
Internal Link Dist (m)		119.3			210.1		643.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	220	1243	1577	243	1212	397	1720	864	165	1563	744
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.31	0.06	0.56	0.35	0.42	0.68	0.20	0.33	0.78	0.14

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

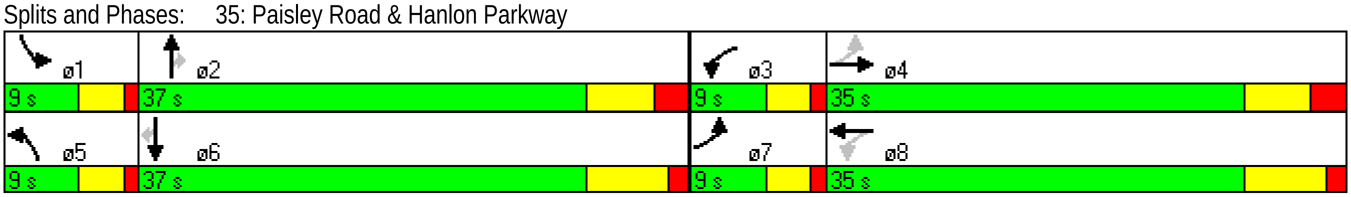
Offset: 66 (73%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

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

Splits and Phases: 35: Paisley Road & Hanlon Parkway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	355	80	125	340	55	155	1070	160	50	1125	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1786	3610	1577	1804	3477		3467	3539	1594	1805	3539	1599
Flt Permitted	0.31	1.00	1.00	0.36	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	574	3610	1577	678	3477		3467	3539	1594	1805	3539	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	386	87	136	370	60	168	1163	174	54	1223	103
RTOR Reduction (vph)	0	0	0	0	17	0	0	0	91	0	0	38
Lane Group Flow (vph)	141	386	87	136	413	0	168	1163	83	54	1223	65
Confl. Peds. (#/hr)	4		5	5		4			1	1		
Heavy Vehicles (%)	1%	0%	1%	0%	1%	4%	1%	2%	0%	0%	2%	1%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	20.9	15.9	90.0	20.9	15.9		10.3	40.0	40.0	7.1	36.8	36.8
Effective Green, g (s)	20.9	18.9	90.0	20.9	18.9		10.3	43.0	43.0	7.1	39.8	39.8
Actuated g/C Ratio	0.23	0.21	1.00	0.23	0.21		0.11	0.48	0.48	0.08	0.44	0.44
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	201	758	1577	220	730		397	1691	762	142	1565	707
v/s Ratio Prot	c0.04	0.11		0.03	0.12		c0.05	c0.33		0.03	c0.35	
v/s Ratio Perm	c0.12		0.06	0.11					0.05			0.04
v/c Ratio	0.70	0.51	0.06	0.62	0.57		0.42	0.69	0.11	0.38	0.78	0.09
Uniform Delay, d1	30.0	31.4	0.0	29.4	31.9		37.1	18.3	12.9	39.4	21.4	14.6
Progression Factor	1.00	1.00	1.00	0.88	0.90		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.5	0.5	0.1	4.9	1.0		0.7	2.3	0.3	1.7	4.0	0.3
Delay (s)	40.5	32.0	0.1	30.9	29.7		37.8	20.6	13.2	41.1	25.3	14.9
Level of Service	D	C	A	C	C		D	C	B	D	C	B
Approach Delay (s)		29.4			30.0			21.7			25.2	
Approach LOS		C			C			C			C	

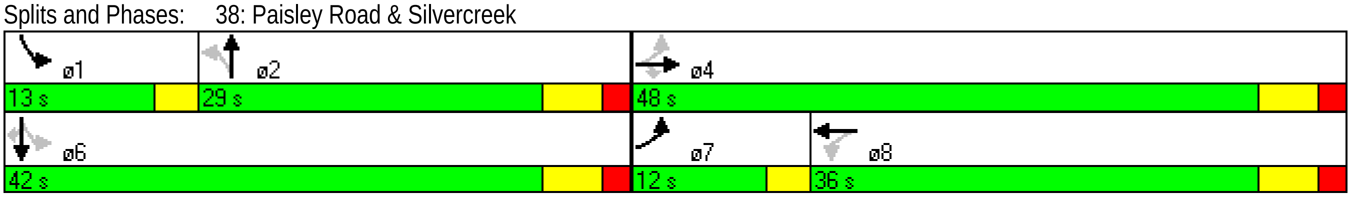
Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	240	245	85	240	240	80	110	235	150	200
Lane Group Flow (vph)	240	245	85	240	385	80	305	235	150	200
Turn Type	pm+pt		Perm	Perm		Perm		pm+pt		Perm
Protected Phases	7	4			8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	35.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	12.0	48.0	48.0	36.0	36.0	29.0	29.0	13.0	42.0	42.0
Total Split (%)	13.3%	53.3%	53.3%	40.0%	40.0%	32.2%	32.2%	14.4%	46.7%	46.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	C-Max	C-Max	None	None	None	None	None
v/c Ratio	0.51	0.23	0.10	0.51	0.51	0.31	0.73	0.85	0.23	0.29
Control Delay	9.7	5.3	0.8	22.4	18.2	31.6	32.0	50.5	20.1	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.7	5.3	0.8	22.4	18.2	31.6	32.0	50.5	20.1	3.7
Queue Length 50th (m)	4.7	4.8	0.0	19.5	27.0	10.8	30.6	27.2	16.4	0.0
Queue Length 95th (m)	43.5	43.9	0.1	41.7	55.8	20.5	51.7	#47.0	25.7	10.8
Internal Link Dist (m)		210.1			1197.0		117.0		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	474	1050	867	467	754	339	526	275	787	797
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.23	0.10	0.51	0.51	0.24	0.58	0.85	0.19	0.25

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 54 (60%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	240	245	85	240	240	145	80	110	195	235	150	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	4.0	4.0	6.0	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	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	1881	1544	1764	1764		1751	1639		1786	1863	1615
Flt Permitted	0.33	1.00	1.00	0.61	1.00		0.66	1.00		0.20	1.00	1.00
Satd. Flow (perm)	634	1881	1544	1127	1764		1219	1639		380	1863	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	240	245	85	240	240	145	80	110	195	235	150	200
RTOR Reduction (vph)	0	0	39	0	22	0	0	78	0	0	0	129
Lane Group Flow (vph)	240	245	46	240	363	0	80	227	0	235	150	71
Confl. Peds. (#/hr)			3	3					3	3		
Heavy Vehicles (%)	0%	1%	2%	2%	2%	1%	0%	0%	0%	1%	2%	0%
Turn Type	pm+pt		Perm	Perm			Perm			pm+pt		Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	48.2	48.2	48.2	35.3	35.3		16.8	16.8		29.8	29.8	29.8
Effective Green, g (s)	47.2	50.2	48.2	37.3	37.3		18.8	18.8		28.8	31.8	31.8
Actuated g/C Ratio	0.52	0.56	0.54	0.41	0.41		0.21	0.21		0.32	0.35	0.35
Clearance Time (s)	3.0	6.0	6.0	6.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	448	1049	827	467	731		255	342		262	658	571
v/s Ratio Prot	c0.05	0.13			0.21			0.14		c0.09	0.08	
v/s Ratio Perm	c0.23		0.03	0.21			0.07			c0.20		0.04
v/c Ratio	0.54	0.23	0.06	0.51	0.50		0.31	0.67		0.90	0.23	0.12
Uniform Delay, d1	13.2	10.1	10.0	19.6	19.4		30.1	32.7		25.7	20.5	19.7
Progression Factor	0.49	0.42	0.19	0.83	0.81		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.2	0.5	0.1	3.7	2.2		0.7	4.8		29.9	0.2	0.1
Delay (s)	7.7	4.8	2.1	20.0	18.1		30.8	37.5		55.7	20.6	19.8
Level of Service	A	A	A	B	B		C	D		E	C	B
Approach Delay (s)		5.6			18.8			36.1			34.4	
Approach LOS		A			B			D			C	

Intersection Summary			
HCM Average Control Delay	22.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX G
Capacity Analysis Results
Future Total Traffic Conditions
Opening Day + 5 Years

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	100	530	325	105	420	290
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	530	325	105	420	290
Approach Volume (veh/h)	630			430	710	
Crossing Volume (veh/h)	325			420	100	
High Capacity (veh/h)	1073			995	1281	
High v/c (veh/h)	0.59			0.43	0.55	
Low Capacity (veh/h)	879			809	1067	
Low v/c (veh/h)	0.72			0.53	0.67	

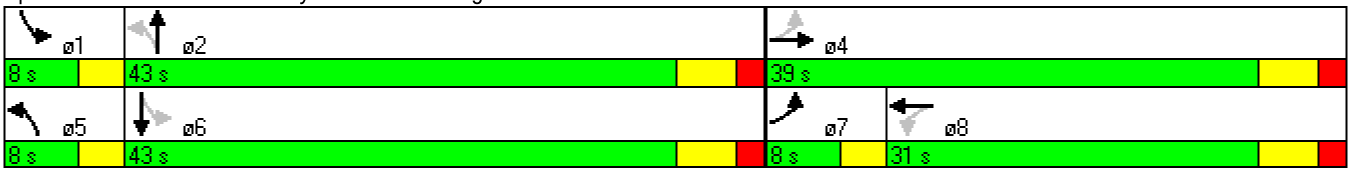
Intersection Summary			
Maximum v/c High	0.59		
Maximum v/c Low	0.72		
Intersection Capacity Utilization	112.5%	ICU Level of Service	H

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	180	460	40	435	115	645	90	595
Lane Group Flow (vph)	180	535	40	490	115	675	90	705
Turn Type	pm+pt		Perm		pm+pt		pm+pt	
Protected Phases	7	4		8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	29.0	29.0	29.0	8.0	28.0	8.0	28.0
Total Split (s)	8.0	39.0	31.0	31.0	8.0	43.0	8.0	43.0
Total Split (%)	8.9%	43.3%	34.4%	34.4%	8.9%	47.8%	8.9%	47.8%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	2.0	5.0	2.0	5.0
Lead/Lag	Lead		Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.84	0.77	0.28	0.93	0.51	0.81	0.36	0.85
Control Delay	49.2	26.7	30.9	58.1	21.2	28.7	14.0	35.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.2	26.7	30.9	58.1	21.2	28.7	14.0	35.2
Queue Length 50th (m)	17.4	53.1	4.9	74.3	8.5	60.8	6.5	100.1
Queue Length 95th (m)	m#35.7	m80.7	13.2	#127.6	m16.8	#148.5	12.8	#163.6
Internal Link Dist (m)		1213.0		222.3		775.1		164.8
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	214	703	147	533	227	832	251	825
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.84	0.76	0.27	0.92	0.51	0.81	0.36	0.85

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 32 (36%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
\#   95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m   Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	460	75	40	435	55	115	645	30	90	595	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0		5.0	5.0		2.0	5.0		2.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1844		1805	1830		1787	1869		1805	1840	
Flt Permitted	0.14	1.00		0.27	1.00		0.12	1.00		0.15	1.00	
Satd. Flow (perm)	275	1844		509	1830		224	1869		276	1840	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	180	460	75	40	435	55	115	645	30	90	595	110
RTOR Reduction (vph)	0	6	0	0	5	0	0	2	0	0	7	0
Lane Group Flow (vph)	180	529	0	40	485	0	115	673	0	90	698	0
Confl. Peds. (#/hr)	4					4						
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	1%	1%	0%	0%	1%	0%
Turn Type	pm+pt			Perm			pm+pt			pm+pt		
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	32.6	32.6		24.6	24.6		42.4	38.4		42.4	38.4	
Effective Green, g (s)	33.6	33.6		25.6	25.6		44.4	39.4		44.4	39.4	
Actuated g/C Ratio	0.37	0.37		0.28	0.28		0.49	0.44		0.49	0.44	
Clearance Time (s)	3.0	6.0		6.0	6.0		3.0	6.0		3.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	205	688		145	521		197	818		221	806	
v/s Ratio Prot	c0.06	0.29			c0.27		c0.03	0.36		0.02	c0.38	
v/s Ratio Perm	0.27			0.08			0.25			0.18		
v/c Ratio	0.88	0.77		0.28	0.93		0.58	0.82		0.41	0.87	
Uniform Delay, d1	23.2	24.8		25.0	31.3		17.3	22.2		16.2	22.9	
Progression Factor	1.02	0.79		1.00	1.00		1.49	0.93		1.00	1.00	
Incremental Delay, d2	27.5	4.3		1.0	23.5		3.3	7.1		1.2	12.0	
Delay (s)	51.1	24.0		26.0	54.9		29.1	27.8		17.4	34.9	
Level of Service	D	C		C	D		C	C		B	C	
Approach Delay (s)		30.8			52.7			28.0			32.9	
Approach LOS		C			D			C			C	

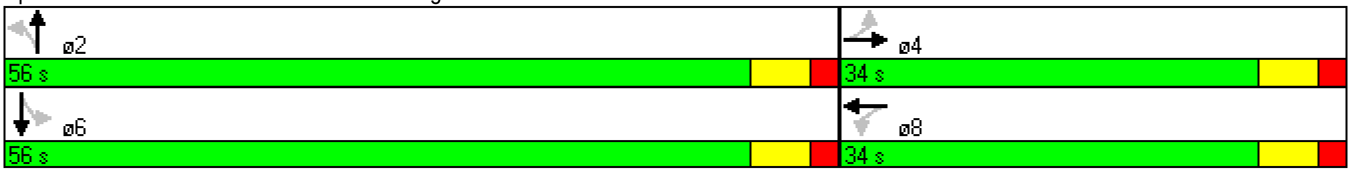
Intersection Summary			
HCM Average Control Delay	34.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	95.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	60	285	115	335	45	690	40	715
Lane Group Flow (vph)	60	325	115	395	45	755	40	760
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	55.0	55.0	55.0	55.0
Total Split (s)	34.0	34.0	34.0	34.0	56.0	56.0	56.0	56.0
Total Split (%)	37.8%	37.8%	37.8%	37.8%	62.2%	62.2%	62.2%	62.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.49	0.65	0.66	0.79	0.16	0.67	0.15	0.66
Control Delay	40.4	33.8	47.1	41.0	8.8	23.7	5.1	6.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.4	33.8	47.1	41.0	8.8	23.7	5.1	6.5
Queue Length 50th (m)	7.9	43.8	16.0	55.9	2.3	68.3	1.3	25.3
Queue Length 95th (m)	19.0	65.0	#32.3	81.2	m5.7	105.3	m1.9	m31.2
Internal Link Dist (m)		842.2		241.7		111.7		775.1
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	144	590	204	585	277	1130	274	1157
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.55	0.56	0.68	0.16	0.67	0.15	0.66

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 81 (90%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	285	40	115	335	60	45	690	65	40	715	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.97	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1754	1814		1718	1793		1798	1832		1760	1879	
Flt Permitted	0.24	1.00		0.35	1.00		0.24	1.00		0.24	1.00	
Satd. Flow (perm)	448	1814		632	1793		451	1832		447	1879	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	285	40	115	335	60	45	690	65	40	715	45
RTOR Reduction (vph)	0	6	0	0	8	0	0	3	0	0	2	0
Lane Group Flow (vph)	60	319	0	115	387	0	45	752	0	40	758	0
Confl. Peds. (#/hr)	10		25	25		10	16		22	22		16
Heavy Vehicles (%)	2%	2%	0%	2%	3%	2%	0%	2%	2%	2%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.7	23.7		23.7	23.7		54.3	54.3		54.3	54.3	
Effective Green, g (s)	24.7	24.7		24.7	24.7		55.3	55.3		55.3	55.3	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.61	0.61		0.61	0.61	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	123	498		173	492		277	1126		275	1155	
v/s Ratio Prot		0.18			c0.22			c0.41			0.40	
v/s Ratio Perm	0.13			0.18			0.10			0.09		
v/c Ratio	0.49	0.64		0.66	0.79		0.16	0.67		0.15	0.66	
Uniform Delay, d1	27.4	28.7		29.0	30.2		7.4	11.3		7.3	11.2	
Progression Factor	1.00	1.00		1.00	1.00		0.80	1.62		0.46	0.36	
Incremental Delay, d2	3.0	2.8		9.3	8.1		1.2	3.0		0.8	2.0	
Delay (s)	30.4	31.6		38.2	38.3		7.2	21.3		4.1	6.0	
Level of Service	C	C		D	D		A	C		A	A	
Approach Delay (s)		31.4			38.3			20.5			5.9	
Approach LOS		C			D			C			A	

Intersection Summary			
HCM Average Control Delay	21.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	810	200	235	1025	80	200	670	165	55	745	65
Lane Group Flow (vph)	50	810	200	235	1025	80	200	670	165	55	745	65
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	12.0	42.0	42.0	9.0	48.0	48.0	39.0	39.0	39.0
Total Split (%)	33.3%	33.3%	33.3%	13.3%	46.7%	46.7%	10.0%	53.3%	53.3%	43.3%	43.3%	43.3%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.45	0.88	0.34	0.80	0.73	0.12	0.59	0.39	0.20	0.20	0.55	0.10
Control Delay	41.8	43.6	5.7	39.7	26.1	5.1	20.3	15.8	2.9	12.0	14.3	1.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.8	43.6	5.7	39.7	26.1	5.1	20.3	15.8	2.9	12.0	14.3	1.1
Queue Length 50th (m)	6.6	64.3	0.0	23.2	70.0	0.5	16.7	34.5	0.1	3.6	29.6	0.2
Queue Length 95th (m)	17.8	#92.7	13.8	#53.9	90.7	7.8	28.0	46.4	9.0	m5.6	43.3	m0.6
Internal Link Dist (m)		464.5			263.2			253.7			89.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	113	937	593	292	1427	702	338	1724	838	279	1353	632
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.86	0.34	0.80	0.72	0.11	0.59	0.39	0.20	0.20	0.55	0.10

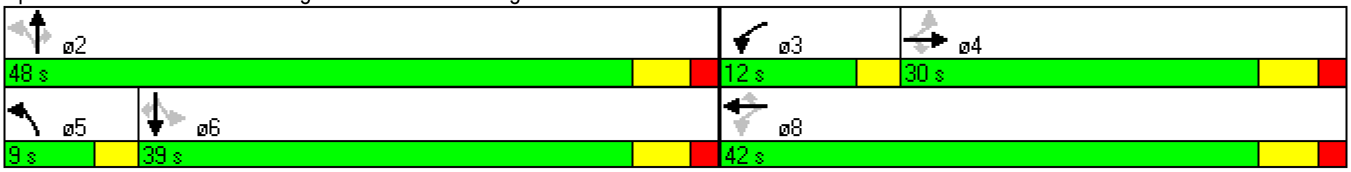
Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 18 (20%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



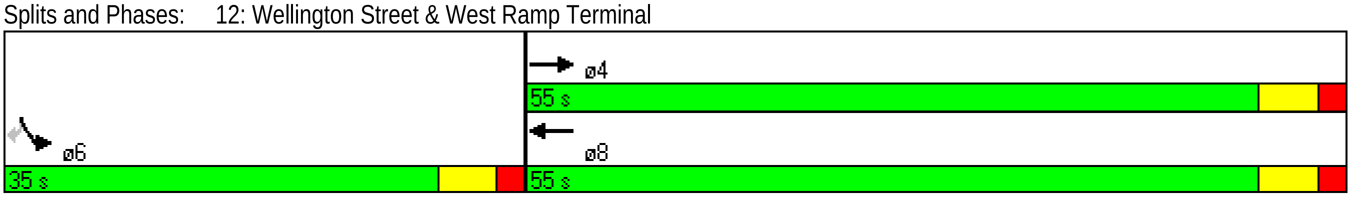
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	810	200	235	1025	80	200	670	165	55	745	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3374	1615	1787	3471	1599	1769	3574	1563	1762	3574	1562
Flt Permitted	0.21	1.00	1.00	0.15	1.00	1.00	0.24	1.00	1.00	0.40	1.00	1.00
Satd. Flow (perm)	405	3374	1615	283	3471	1599	448	3574	1563	736	3574	1562
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	50	810	200	235	1025	80	200	670	165	55	745	65
RTOR Reduction (vph)	0	0	145	0	0	45	0	0	85	0	0	40
Lane Group Flow (vph)	50	810	55	235	1025	36	200	670	80	55	745	25
Confl. Peds. (#/hr)							2		12	12		2
Heavy Vehicles (%)	0%	7%	0%	1%	4%	1%	2%	1%	1%	2%	1%	2%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	23.6	23.6	23.6	35.6	35.6	35.6	42.4	42.4	42.4	33.1	33.1	33.1
Effective Green, g (s)	24.6	24.6	24.6	36.6	36.6	36.6	43.4	43.4	43.4	34.1	34.1	34.1
Actuated g/C Ratio	0.27	0.27	0.27	0.41	0.41	0.41	0.48	0.48	0.48	0.38	0.38	0.38
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	111	922	441	282	1412	650	323	1723	754	279	1354	592
v/s Ratio Prot		c0.24		c0.09	0.30		c0.05	0.19			c0.21	
v/s Ratio Perm	0.12		0.03	0.25		0.02	0.25		0.05	0.07		0.02
v/c Ratio	0.45	0.88	0.12	0.83	0.73	0.05	0.62	0.39	0.11	0.20	0.55	0.04
Uniform Delay, d1	27.1	31.3	24.6	20.6	22.5	16.2	14.8	14.8	12.7	18.8	21.9	17.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.55	0.59	0.17
Incremental Delay, d2	2.9	9.5	0.1	18.6	1.9	0.0	3.5	0.7	0.3	1.2	1.2	0.1
Delay (s)	30.0	40.8	24.7	39.2	24.4	16.2	18.4	15.5	13.0	11.5	14.1	3.1
Level of Service	C	D	C	D	C	B	B	B	B	B	B	A
Approach Delay (s)		37.3			26.5			15.7			13.1	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM Average Control Delay	23.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	87.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1065	1565	170	100
Lane Group Flow (vph)	1158	1701	185	109
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	38.0	38.0	33.0	33.0
Total Split (s)	55.0	55.0	35.0	35.0
Total Split (%)	61.1%	61.1%	38.9%	38.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.33	0.48	0.35	0.45
Control Delay	4.6	5.5	28.5	29.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	4.6	5.5	28.5	29.3
Queue Length 50th (m)	15.8	26.9	10.6	10.3
Queue Length 95th (m)	26.7	43.9	18.2	22.8
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3540	3575	1407	618
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.33	0.48	0.13	0.18

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 71.2
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1065	1565	0	170	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5036	5085		3335	1442
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5036	5085		3335	1442
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1158	1701	0	185	109
RTOR Reduction (vph)	0	0	0	0	0	14
Lane Group Flow (vph)	0	1158	1701	0	185	95
Heavy Vehicles (%)	0%	3%	2%	0%	5%	12%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		49.1	49.1		10.1	10.1
Effective Green, g (s)		50.1	50.1		11.1	11.1
Actuated g/C Ratio		0.70	0.70		0.16	0.16
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3544	3578		520	225
v/s Ratio Prot		0.23	c0.33		0.06	
v/s Ratio Perm						c0.07
v/c Ratio		0.33	0.48		0.36	0.42
Uniform Delay, d1		4.1	4.7		26.9	27.1
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.2	0.5		0.4	1.3
Delay (s)		4.3	5.2		27.3	28.4
Level of Service		A	A		C	C
Approach Delay (s)		4.3	5.2		27.7	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	6.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	71.2	Sum of lost time (s)	10.0
Intersection Capacity Utilization	44.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	175	780	1030	255	340	285	95	185	670
Lane Group Flow (vph)	190	848	1120	277	333	347	103	201	728
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	9.0	40.0	31.0	31.0	25.0	25.0	25.0	25.0	34.0
Total Split (%)	10.0%	44.4%	34.4%	34.4%	27.8%	27.8%	27.8%	27.8%	37.8%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.84	0.44	0.78	0.42	0.92	0.89	0.24	0.87	0.81
Control Delay	50.0	21.1	33.7	5.3	66.2	60.0	7.8	70.1	36.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.0	21.1	33.7	5.3	66.2	60.0	7.8	70.1	36.4
Queue Length 50th (m)	19.1	35.7	59.7	0.0	54.7	56.5	0.0	31.1	59.8
Queue Length 95th (m)	#47.0	45.7	74.2	15.7	#101.3	#102.1	11.2	#66.6	#83.2
Internal Link Dist (m)		150.3	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	227	1925	1444	665	367	395	426	230	900
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	0.84	0.44	0.78	0.42	0.91	0.88	0.24	0.87	0.81

Intersection Summary

Cycle Length: 90

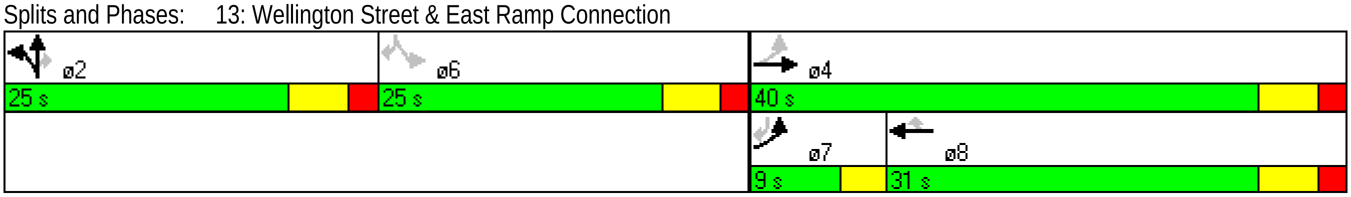
Actuated Cycle Length: 89.8

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

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

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	780	0	0	1030	255	340	285	95	185	0	670
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.99	1.00	0.95		1.00
Satd. Flow (prot)	1752	4940			4988	1615	1649	1772	1553	1805		2787
Flt Permitted	0.14	1.00			1.00	1.00	0.95	0.99	1.00	0.54		1.00
Satd. Flow (perm)	264	4940			4988	1615	1649	1772	1553	1033		2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	190	848	0	0	1120	277	370	310	103	201	0	728
RTOR Reduction (vph)	0	0	0	0	0	197	0	0	80	0	0	0
Lane Group Flow (vph)	190	848	0	0	1120	80	333	347	23	201	0	728
Heavy Vehicles (%)	3%	5%	0%	0%	4%	0%	4%	1%	4%	0%	0%	2%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	34.0	34.0			25.0	25.0	18.8	18.8	18.8	19.0		31.0
Effective Green, g (s)	35.0	35.0			26.0	26.0	19.8	19.8	19.8	20.0		32.0
Actuated g/C Ratio	0.39	0.39			0.29	0.29	0.22	0.22	0.22	0.22		0.36
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	219	1925			1444	468	364	391	342	230		993
v/s Ratio Prot	0.07	0.17			c0.22		c0.20	0.20				
v/s Ratio Perm	0.27					0.05			0.01	c0.19		c0.26
v/c Ratio	0.87	0.44			0.78	0.17	0.91	0.89	0.07	0.87		0.73
Uniform Delay, d1	20.8	20.2			29.2	23.8	34.2	33.9	27.7	33.7		25.2
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	34.2	0.7			4.1	0.8	26.8	20.8	0.1	28.6		2.8
Delay (s)	55.0	20.9			33.4	24.6	60.9	54.7	27.8	62.3		28.0
Level of Service	D	C			C	C	E	D	C	E		C
Approach Delay (s)		27.2			31.6			53.8			35.4	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	35.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	89.8	Sum of lost time (s)	15.0
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			303							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

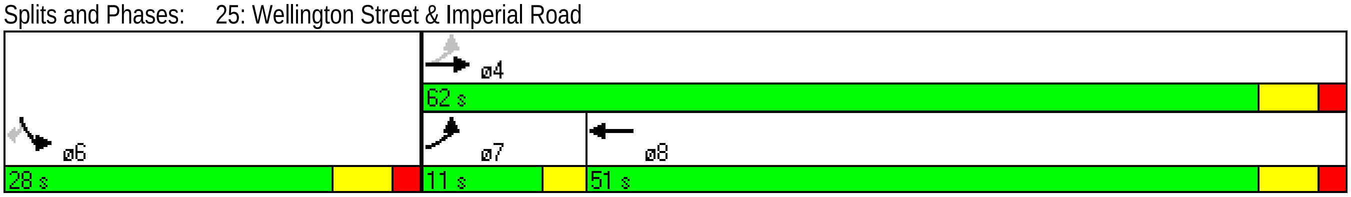
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	115	875	1280	405	35
Lane Group Flow (vph)	115	875	1610	405	35
Turn Type	pm+pt				Perm
Protected Phases	7	4	8	6	
Permitted Phases	4			6	6
Detector Phase	7	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	41.0	41.0	24.0	24.0
Total Split (s)	11.0	62.0	51.0	28.0	28.0
Total Split (%)	12.2%	68.9%	56.7%	31.1%	31.1%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	C-Max	C-Max	None	None
v/c Ratio	0.45	0.76	0.87	0.89	0.09
Control Delay	14.2	17.2	25.1	56.6	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.2	17.2	25.1	56.6	9.7
Queue Length 50th (m)	5.7	89.1	113.9	62.2	0.0
Queue Length 95th (m)	16.6	136.2	#165.4	#108.7	6.4
Internal Link Dist (m)		188.7	176.5	303.2	
Turn Bay Length (m)	100.0				
Base Capacity (vph)	267	1150	1846	457	388
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.76	0.87	0.89	0.09

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	115	875	1280	330	405	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1810	3367		1787	1417
Flt Permitted	0.08	1.00	1.00		0.95	1.00
Satd. Flow (perm)	152	1810	3367		1787	1417
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	115	875	1280	330	405	35
RTOR Reduction (vph)	0	0	24	0	0	26
Lane Group Flow (vph)	115	875	1586	0	405	9
Confl. Peds. (#/hr)	4			4		
Heavy Vehicles (%)	0%	5%	4%	1%	1%	14%
Turn Type	pm+pt					Perm
Protected Phases	7	4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)	56.2	56.2	47.1		21.8	21.8
Effective Green, g (s)	57.2	57.2	48.1		22.8	22.8
Actuated g/C Ratio	0.64	0.64	0.53		0.25	0.25
Clearance Time (s)	3.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	227	1150	1799		453	359
v/s Ratio Prot	0.04	c0.48	c0.47		c0.23	
v/s Ratio Perm	0.28					0.01
v/c Ratio	0.51	0.76	0.88		0.89	0.02
Uniform Delay, d1	15.0	11.6	18.4		32.4	25.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.8	4.8	6.6		20.7	0.1
Delay (s)	16.7	16.3	25.1		53.2	25.3
Level of Service	B	B	C		D	C
Approach Delay (s)		16.4	25.1		51.0	
Approach LOS		B	C		D	

Intersection Summary			
HCM Average Control Delay	26.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	935	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	935	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		327	174			
pX, platoon unblocked						
vC, conflicting volume	0				312	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				312	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				656	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	312	312	312	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.18	0.18	0.18	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	110	350	170	170	400	295	1440	260	105	1535	80
Lane Group Flow (vph)	120	380	185	185	511	321	1565	283	114	1668	87
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	59.0	59.0	9.0	57.0	57.0
Total Split (s)	12.0	35.0	0.0	12.0	35.0	18.0	81.0	81.0	16.0	79.0	79.0
Total Split (%)	8.3%	24.3%	0.0%	8.3%	24.3%	12.5%	56.3%	56.3%	11.1%	54.9%	54.9%
Yellow Time (s)	3.0	4.5		3.0	4.5	3.0	5.5	5.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	2.5	1.0	1.5	1.5	1.0	1.5	1.5
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.0	6.0	3.0	3.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.63	0.58	0.12	0.76	0.80	0.81	0.83	0.30	0.71	0.92	0.10
Control Delay	54.6	57.4	0.1	62.9	65.2	78.6	33.4	5.9	86.8	41.5	11.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.6	57.4	0.1	62.9	65.2	78.6	33.4	5.9	86.8	41.5	11.8
Queue Length 50th (m)	24.0	48.2	0.0	38.5	66.4	42.8	183.7	9.4	29.1	211.7	6.9
Queue Length 95th (m)	38.6	62.6	0.0	#60.3	83.6	#67.0	215.2	24.0	#55.6	#262.4	15.5
Internal Link Dist (m)		119.3			205.7		653.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	190	727	1594	244	707	396	1876	958	167	1817	842
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.52	0.12	0.76	0.72	0.81	0.83	0.30	0.68	0.92	0.10

Intersection Summary

Cycle Length: 144

Actuated Cycle Length: 144

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 115

Control Type: Actuated-Coordinated

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

Splits and Phases: 35: Paisley Road & Hanlon Parkway

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	350	170	170	400	70	295	1440	260	105	1535	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1594	1786	3463		3502	3471	1594	1770	3505	1593
Flt Permitted	0.20	1.00	1.00	0.35	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	384	3610	1594	658	3463		3502	3471	1594	1770	3505	1593
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	380	185	185	435	76	321	1565	283	114	1668	87
RTOR Reduction (vph)	0	0	0	0	10	0	0	0	97	0	0	16
Lane Group Flow (vph)	120	380	185	185	501	0	321	1565	186	114	1668	71
Confl. Peds. (#/hr)	1		3	3		1	2		1	1		2
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	4%	0%	2%	3%	0%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	33.1	25.1	144.0	33.1	25.1		15.3	76.8	76.8	12.1	73.6	73.6
Effective Green, g (s)	35.1	26.1	144.0	35.1	26.1		16.3	77.8	77.8	13.1	74.6	74.6
Actuated g/C Ratio	0.24	0.18	1.00	0.24	0.18		0.11	0.54	0.54	0.09	0.52	0.52
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	182	654	1594	231	628		396	1875	861	161	1816	825
v/s Ratio Prot	0.04	0.11		c0.05	0.14		c0.09	0.45		0.06	c0.48	
v/s Ratio Perm	0.12		0.12	c0.15					0.12			0.04
v/c Ratio	0.66	0.58	0.12	0.80	0.80		0.81	0.83	0.22	0.71	0.92	0.09
Uniform Delay, d1	45.0	53.9	0.0	49.0	56.4		62.3	27.7	17.2	63.6	31.9	17.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.4	1.3	0.1	17.8	7.0		11.9	4.6	0.6	13.3	9.0	0.2
Delay (s)	53.3	55.3	0.1	66.7	63.4		74.2	32.3	17.8	76.9	40.9	17.7
Level of Service	D	E	A	E	E		E	C	B	E	D	B
Approach Delay (s)		40.0			64.3			36.6			42.0	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	42.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	285	365	60	210	285	65	85	230	135	295
Lane Group Flow (vph)	285	365	60	210	470	65	250	230	135	295
Turn Type	pm+pt		Perm	pm+pt		Perm		pm+pt		Perm
Protected Phases	7	4		3	8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	3	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	8.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	14.0	41.0	41.0	11.0	38.0	29.0	29.0	9.0	38.0	38.0
Total Split (%)	15.6%	45.6%	45.6%	12.2%	42.2%	32.2%	32.2%	10.0%	42.2%	42.2%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	2.0	5.0	5.0	5.0	2.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None
v/c Ratio	0.51	0.40	0.07	0.32	0.56	0.32	0.70	0.92	0.27	0.46
Control Delay	10.8	17.9	5.0	4.1	10.4	35.2	30.1	68.5	26.3	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.8	17.9	5.0	4.1	10.4	35.2	30.1	68.5	26.3	5.3
Queue Length 50th (m)	16.5	35.6	0.0	6.4	18.5	9.2	21.4	29.4	17.0	0.0
Queue Length 95th (m)	33.9	64.9	6.5	m9.0	m40.3	18.1	40.1	#53.8	27.1	14.9
Internal Link Dist (m)		205.7			1213.0		75.2		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	568	922	807	657	839	330	513	249	683	773
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.40	0.07	0.32	0.56	0.20	0.49	0.92	0.20	0.38

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 68 (76%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green

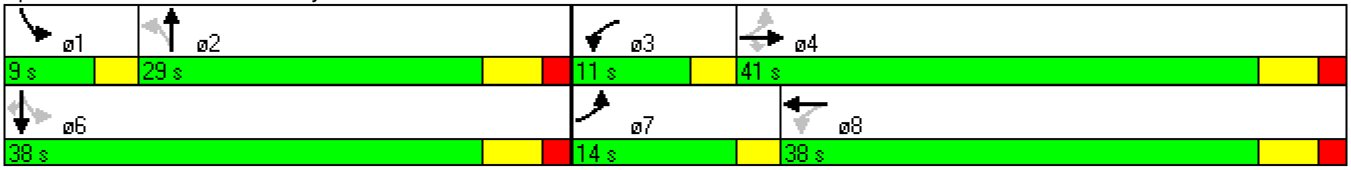
Natural Cycle: 80

Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	285	365	60	210	285	185	65	85	165	230	135	295
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0		2.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	0.99		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1735	1881	1583	1770	1744		1751	1634		1769	1863	1599
Flt Permitted	0.34	1.00	1.00	0.48	1.00		0.67	1.00		0.27	1.00	1.00
Satd. Flow (perm)	618	1881	1583	901	1744		1236	1634		509	1863	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	285	365	60	210	285	185	65	85	165	230	135	295
RTOR Reduction (vph)	0	0	31	0	22	0	0	89	0	0	0	217
Lane Group Flow (vph)	285	365	29	210	448	0	65	161	0	230	135	78
Confl. Peds. (#/hr)	2					2			2	2		
Heavy Vehicles (%)	4%	1%	2%	2%	2%	1%	0%	0%	0%	2%	2%	1%
Turn Type	pm+pt		Perm	pm+pt			Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	54.3	43.2	43.2	50.3	41.2		13.7	13.7		22.7	22.7	22.7
Effective Green, g (s)	56.3	44.2	44.2	52.3	42.2		14.7	14.7		23.7	23.7	23.7
Actuated g/C Ratio	0.63	0.49	0.49	0.58	0.47		0.16	0.16		0.26	0.26	0.26
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	537	924	777	621	818		202	267		232	491	421
v/s Ratio Prot	c0.07	0.19		0.04	c0.26			c0.10		c0.08	0.07	
v/s Ratio Perm	0.26		0.02	0.16			0.05			0.18		0.05
v/c Ratio	0.53	0.40	0.04	0.34	0.55		0.32	0.60		0.99	0.27	0.18
Uniform Delay, d1	9.1	14.5	11.9	9.1	17.1		33.2	34.9		31.4	26.3	25.7
Progression Factor	1.00	1.00	1.00	0.47	0.49		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.0	1.3	0.1	0.2	1.5		0.9	3.8		56.5	0.3	0.2
Delay (s)	10.1	15.7	12.0	4.5	9.9		34.2	38.8		87.8	26.6	25.9
Level of Service	B	B	B	A	A		C	D		F	C	C
Approach Delay (s)		13.2			8.2			37.8			47.6	
Approach LOS		B			A			D			D	

Intersection Summary			
HCM Average Control Delay	24.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	84.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	120	540	140	130	525	145
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	120	540	140	130	525	145
Approach Volume (veh/h)	660			270	670	
Crossing Volume (veh/h)	140			525	120	
High Capacity (veh/h)	1241			915	1261	
High v/c (veh/h)	0.53			0.30	0.53	
Low Capacity (veh/h)	1031			738	1049	
Low v/c (veh/h)	0.64			0.37	0.64	

Intersection Summary			
Maximum v/c High	0.53		
Maximum v/c Low	0.64		
Intersection Capacity Utilization	102.1%	ICU Level of Service	G

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	110	365	50	335	55	550	50	525
Lane Group Flow (vph)	110	440	50	380	55	585	50	640
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.0	29.0	29.0	29.0	28.0	28.0	28.0	28.0
Total Split (s)	38.0	38.0	38.0	38.0	52.0	52.0	52.0	52.0
Total Split (%)	42.2%	42.2%	42.2%	42.2%	57.8%	57.8%	57.8%	57.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.62	0.76	0.38	0.66	0.16	0.53	0.13	0.58
Control Delay	33.2	28.5	31.6	31.2	10.8	11.5	10.8	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.2	28.5	31.6	31.2	10.8	11.5	10.8	14.6
Queue Length 50th (m)	12.0	53.7	6.1	50.3	2.6	28.2	3.2	56.6
Queue Length 95th (m)	m23.8	m76.5	14.9	70.3	m8.8	64.9	9.5	99.6
Internal Link Dist (m)		1197.0		206.3		775.8		167.4
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	212	693	158	695	337	1106	378	1105
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.63	0.32	0.55	0.16	0.53	0.13	0.58

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 36 (40%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	365	75	50	335	45	55	550	35	50	525	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1790	1813		1800	1825		1805	1846		1802	1834	
Flt Permitted	0.30	1.00		0.22	1.00		0.30	1.00		0.33	1.00	
Satd. Flow (perm)	561	1813		416	1825		564	1846		632	1834	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	365	75	50	335	45	55	550	35	50	525	115
RTOR Reduction (vph)	0	9	0	0	6	0	0	2	0	0	8	0
Lane Group Flow (vph)	110	431	0	50	374	0	55	583	0	50	632	0
Confl. Peds. (#/hr)	10		4	4		10			4	4		
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	2%	0%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	26.2	26.2		26.2	26.2		51.8	51.8		51.8	51.8	
Effective Green, g (s)	28.2	28.2		28.2	28.2		53.8	53.8		53.8	53.8	
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.60	0.60		0.60	0.60	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	176	568		130	572		337	1103		378	1096	
v/s Ratio Prot		c0.24			0.20			0.32			c0.34	
v/s Ratio Perm	0.20			0.12			0.10			0.08		
v/c Ratio	0.62	0.76		0.38	0.65		0.16	0.53		0.13	0.58	
Uniform Delay, d1	26.4	27.8		24.1	26.7		8.1	10.6		7.9	11.1	
Progression Factor	0.76	0.78		1.00	1.00		0.94	0.81		1.00	1.00	
Incremental Delay, d2	5.7	4.9		1.9	2.7		1.0	1.7		0.7	2.2	
Delay (s)	25.8	26.5		26.0	29.4		8.6	10.4		8.6	13.3	
Level of Service	C	C		C	C		A	B		A	B	
Approach Delay (s)		26.4			29.0			10.2			13.0	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	40	165	75	215	20	490	30	535
Lane Group Flow (vph)	40	220	75	240	20	555	30	570
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	57.0	57.0	57.0	57.0
Total Split (s)	26.0	26.0	26.0	26.0	64.0	64.0	64.0	64.0
Total Split (%)	28.9%	28.9%	28.9%	28.9%	71.1%	71.1%	71.1%	71.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Min	C-Min
v/c Ratio	0.30	0.58	0.48	0.65	0.04	0.42	0.06	0.43
Control Delay	35.2	35.5	41.8	40.1	1.5	4.3	2.7	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.2	35.5	41.8	40.1	1.5	4.3	2.7	3.8
Queue Length 50th (m)	5.4	28.9	10.6	34.2	0.3	24.3	0.6	11.3
Queue Length 95th (m)	13.3	47.1	22.3	53.4	0.8	35.0	m1.3	19.0
Internal Link Dist (m)		218.2		241.7		109.7		775.8
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	163	454	187	447	529	1319	539	1323
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.48	0.40	0.54	0.04	0.42	0.06	0.43

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 2 (2%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	165	55	75	215	25	20	490	65	30	535	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1698	1803		1744	1809		1803	1855		1804	1862	
Flt Permitted	0.37	1.00		0.42	1.00		0.39	1.00		0.40	1.00	
Satd. Flow (perm)	668	1803		764	1809		745	1855		762	1862	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	165	55	75	215	25	20	490	65	30	535	35
RTOR Reduction (vph)	0	14	0	0	5	0	0	5	0	0	2	0
Lane Group Flow (vph)	40	206	0	75	235	0	20	550	0	30	568	0
Confl. Peds. (#/hr)	2		3	3		2	3		2	2		3
Heavy Vehicles (%)	6%	1%	0%	3%	3%	4%	0%	0%	3%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	16.2	16.2		16.2	16.2		61.8	61.8		61.8	61.8	
Effective Green, g (s)	18.2	18.2		18.2	18.2		63.8	63.8		63.8	63.8	
Actuated g/C Ratio	0.20	0.20		0.20	0.20		0.71	0.71		0.71	0.71	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	135	365		154	366		528	1315		540	1320	
v/s Ratio Prot		0.11			c0.13			0.30			c0.30	
v/s Ratio Perm	0.06			0.10			0.03			0.04		
v/c Ratio	0.30	0.56		0.49	0.64		0.04	0.42		0.06	0.43	
Uniform Delay, d1	30.5	32.3		31.8	32.9		3.9	5.4		4.0	5.5	
Progression Factor	1.00	1.00		1.00	1.00		0.27	0.55		0.52	0.49	
Incremental Delay, d2	1.2	2.0		2.4	3.8		0.1	1.0		0.2	0.9	
Delay (s)	31.7	34.3		34.2	36.8		1.2	4.0		2.2	3.5	
Level of Service	C	C		C	D		A	A		A	A	
Approach Delay (s)		33.9			36.1			3.9			3.4	
Approach LOS		C			D			A			A	

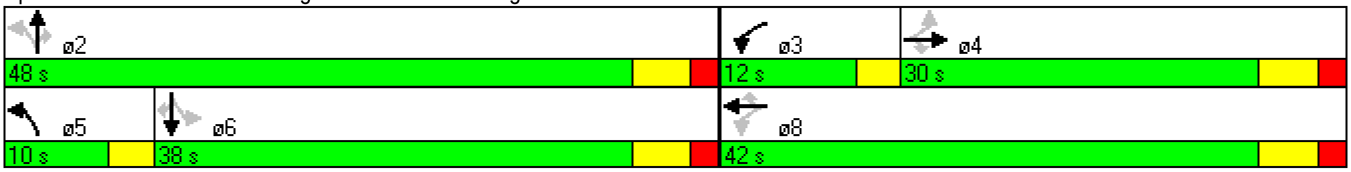
Intersection Summary			
HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	720	160	205	670	45	195	495	180	65	555	45
Lane Group Flow (vph)	35	720	160	205	670	45	195	495	180	65	555	45
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	12.0	42.0	42.0	10.0	48.0	48.0	38.0	38.0	38.0
Total Split (%)	33.3%	33.3%	33.3%	13.3%	46.7%	46.7%	11.1%	53.3%	53.3%	42.2%	42.2%	42.2%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	1.0	-2.0	-2.0	1.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.18	0.76	0.29	0.80	0.47	0.07	0.51	0.27	0.20	0.19	0.40	0.07
Control Delay	26.9	35.6	5.7	43.5	20.7	5.2	18.5	13.6	2.7	18.9	17.7	6.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.9	35.6	5.7	43.5	20.7	5.2	18.5	13.6	2.7	18.9	17.7	6.5
Queue Length 50th (m)	4.2	53.8	0.0	20.7	38.8	0.0	17.1	23.5	0.0	4.5	24.6	0.1
Queue Length 95th (m)	11.2	71.7	12.4	#46.4	52.2	5.5	28.8	32.7	9.0	13.7	41.0	m4.7
Internal Link Dist (m)		464.5			263.2			253.7			91.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	211	1013	580	255	1494	698	380	1810	887	342	1394	622
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.71	0.28	0.80	0.45	0.06	0.51	0.27	0.20	0.19	0.40	0.07

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 1 (1%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
\#   95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m   Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



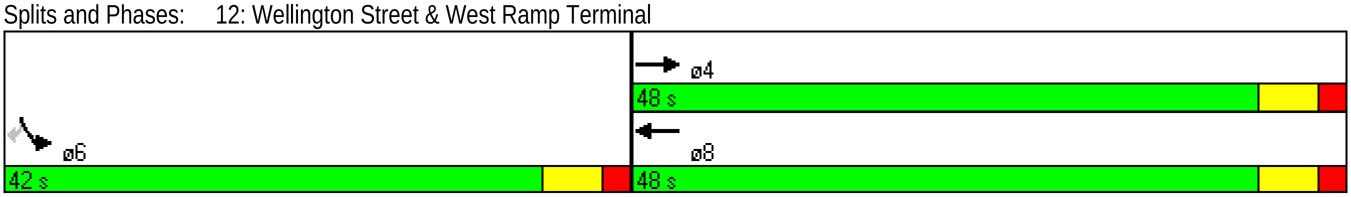
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	720	160	205	670	45	195	495	180	65	555	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1751	3505	1615	1805	3539	1592	1769	3574	1576	1767	3574	1526
Flt Permitted	0.40	1.00	1.00	0.16	1.00	1.00	0.31	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)	732	3505	1615	299	3539	1592	583	3574	1576	876	3574	1526
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	720	160	205	670	45	195	495	180	65	555	45
RTOR Reduction (vph)	0	0	117	0	0	27	0	0	89	0	0	27
Lane Group Flow (vph)	35	720	43	205	670	18	195	495	91	65	555	18
Confl. Peds. (#/hr)	2					2	6		3	3		6
Heavy Vehicles (%)	3%	3%	0%	0%	2%	0%	2%	1%	1%	2%	1%	4%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	22.4	22.4	22.4	34.4	34.4	34.4	43.6	43.6	43.6	33.1	33.1	33.1
Effective Green, g (s)	24.4	24.4	24.4	33.4	36.4	36.4	42.6	45.6	45.6	35.1	35.1	35.1
Actuated g/C Ratio	0.27	0.27	0.27	0.37	0.40	0.40	0.47	0.51	0.51	0.39	0.39	0.39
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	198	950	438	245	1431	644	362	1811	799	342	1394	595
v/s Ratio Prot		0.21		c0.07	0.19		c0.04	0.14			0.16	
v/s Ratio Perm	0.05		0.03	c0.24		0.01	c0.22		0.06	0.07		0.01
v/c Ratio	0.18	0.76	0.10	0.84	0.47	0.03	0.54	0.27	0.11	0.19	0.40	0.03
Uniform Delay, d1	25.1	30.1	24.6	22.2	19.7	16.1	14.9	12.7	11.6	18.1	19.8	16.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.83	1.08
Incremental Delay, d2	0.4	3.5	0.1	21.3	0.2	0.0	1.5	0.4	0.3	1.1	0.8	0.1
Delay (s)	25.5	33.6	24.7	43.5	19.9	16.2	16.4	13.1	11.9	17.5	17.3	18.3
Level of Service	C	C	C	D	B	B	B	B	B	B	B	B
Approach Delay (s)		31.7			25.0			13.6			17.4	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	22.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	610	775	215	135
Lane Group Flow (vph)	663	842	234	147
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	37.0	37.0	37.0	37.0
Total Split (s)	48.0	48.0	42.0	42.0
Total Split (%)	53.3%	53.3%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.19	0.24	0.37	0.41
Control Delay	3.8	4.0	24.5	11.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	3.8	4.0	24.5	11.8
Queue Length 50th (m)	7.3	9.6	11.5	3.2
Queue Length 95th (m)	12.0	15.6	19.5	15.3
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3521	3521	2074	915
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.19	0.24	0.11	0.16

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 63.6
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	610	775	0	215	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	5085		3467	1455
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	5085		3467	1455
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	663	842	0	234	147
RTOR Reduction (vph)	0	0	0	0	0	92
Lane Group Flow (vph)	0	663	842	0	234	55
Heavy Vehicles (%)	0%	2%	2%	0%	1%	11%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		42.0	42.0		9.5	9.5
Effective Green, g (s)		44.0	44.0		11.5	11.5
Actuated g/C Ratio		0.69	0.69		0.18	0.18
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3523	3523		628	264
v/s Ratio Prot		0.13	c0.17		c0.07	
v/s Ratio Perm						0.04
v/c Ratio		0.19	0.24		0.37	0.21
Uniform Delay, d1		3.4	3.6		22.8	22.1
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.1	0.2		0.4	0.4
Delay (s)		3.6	3.7		23.2	22.5
Level of Service		A	A		C	C
Approach Delay (s)		3.6	3.7		22.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	63.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	30.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	155	605	680	230	235	280	115	200	480
Lane Group Flow (vph)	168	658	739	250	229	330	125	217	522
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	11.0	37.0	26.0	26.0	25.0	25.0	25.0	28.0	39.0
Total Split (%)	12.2%	41.1%	28.9%	28.9%	27.8%	27.8%	27.8%	31.1%	43.3%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	1.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
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					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.69	0.34	0.58	0.43	0.59	0.80	0.28	0.82	0.49
Control Delay	36.8	20.5	31.2	6.4	37.5	48.8	7.3	56.0	22.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.8	20.5	31.2	6.4	37.5	48.8	7.3	56.0	22.5
Queue Length 50th (m)	18.4	27.4	38.2	0.0	34.2	52.2	0.0	31.9	34.7
Queue Length 95th (m)	#35.1	36.1	49.7	16.1	56.3	#90.7	12.0	#64.5	48.9
Internal Link Dist (m)		163.9	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	244	1935	1277	577	411	435	474	291	1048
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	0.69	0.34	0.58	0.43	0.56	0.76	0.26	0.75	0.50

Intersection Summary

Cycle Length: 90

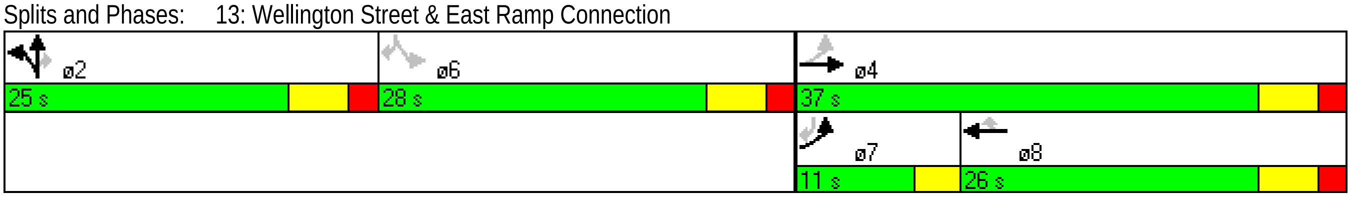
Actuated Cycle Length: 87.1

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

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

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	605	0	0	680	230	235	280	115	200	0	480
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00	0.95		1.00
Satd. Flow (prot)	1770	5085			5036	1538	1698	1797	1568	1805		2814
Flt Permitted	0.18	1.00			1.00	1.00	0.95	1.00	1.00	0.55		1.00
Satd. Flow (perm)	336	5085			5036	1538	1698	1797	1568	1050		2814
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	658	0	0	739	250	255	304	125	217	0	522
RTOR Reduction (vph)	0	0	0	0	0	186	0	0	96	0	0	0
Lane Group Flow (vph)	168	658	0	0	739	64	229	330	29	217	0	522
Heavy Vehicles (%)	2%	2%	0%	0%	3%	5%	1%	0%	3%	0%	0%	1%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	31.1	31.1			20.1	20.1	17.9	17.9	17.9	20.0		34.0
Effective Green, g (s)	30.1	33.1			22.1	22.1	19.9	19.9	19.9	22.0		36.0
Actuated g/C Ratio	0.35	0.38			0.25	0.25	0.23	0.23	0.23	0.25		0.41
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	232	1935			1279	391	388	411	359	266		1164
v/s Ratio Prot	c0.06	0.13			0.15		0.13	c0.18				
v/s Ratio Perm	c0.19					0.04			0.02	c0.21		0.19
v/c Ratio	0.72	0.34			0.58	0.16	0.59	0.80	0.08	0.82		0.45
Uniform Delay, d1	21.6	19.2			28.4	25.2	29.9	31.7	26.4	30.6		18.4
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	17.8	0.5			1.9	0.9	2.4	10.8	0.1	17.3		0.3
Delay (s)	39.4	19.7			30.3	26.1	32.3	42.5	26.5	47.9		18.6
Level of Service	D	B			C	C	C	D	C	D		B
Approach Delay (s)		23.7			29.2			36.2			27.2	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM Average Control Delay	28.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			305							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

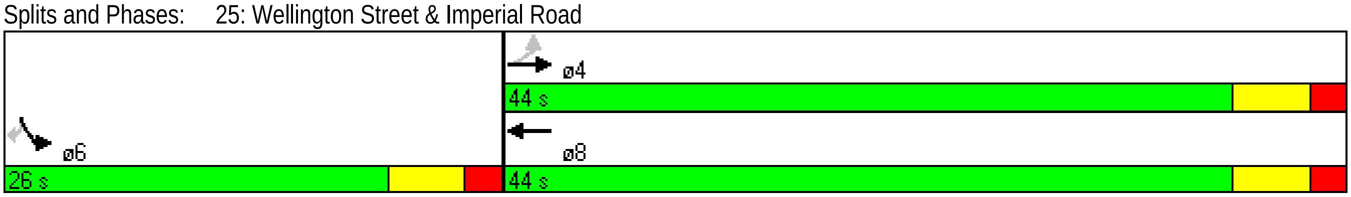
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	80	605	615	330	80
Lane Group Flow (vph)	0	685	865	330	80
Turn Type	Perm				Perm
Protected Phases		4	8	6	
Permitted Phases	4			6	6
Detector Phase	4	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	41.0	41.0	41.0	24.0	24.0
Total Split (s)	44.0	44.0	44.0	26.0	26.0
Total Split (%)	62.9%	62.9%	62.9%	37.1%	37.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Max	C-Max	C-Max	None	None
v/c Ratio		0.42	0.42	0.64	0.16
Control Delay		8.9	7.1	27.6	5.6
Queue Delay		0.0	0.0	0.0	0.0
Total Delay		8.9	7.1	27.6	5.6
Queue Length 50th (m)		22.4	22.6	33.0	0.0
Queue Length 95th (m)		32.6	33.1	54.9	7.5
Internal Link Dist (m)		188.7	176.3	303.2	
Turn Bay Length (m)					
Base Capacity (vph)		1638	2077	567	557
Starvation Cap Reductn		0	0	0	0
Spillback Cap Reductn		0	0	0	0
Storage Cap Reductn		0	0	0	0
Reduced v/c Ratio		0.42	0.42	0.58	0.14

Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	80	605	615	250	330	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.96		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3522	3370		1805	1599
Flt Permitted		0.77	1.00		0.95	1.00
Satd. Flow (perm)		2735	3370		1805	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	605	615	250	330	80
RTOR Reduction (vph)	0	0	59	0	0	57
Lane Group Flow (vph)	0	685	806	0	330	23
Confl. Peds. (#/hr)	6			6		
Heavy Vehicles (%)	1%	2%	2%	1%	0%	1%
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)		39.9	39.9		18.1	18.1
Effective Green, g (s)		41.9	41.9		20.1	20.1
Actuated g/C Ratio		0.60	0.60		0.29	0.29
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		5.0	5.0
Lane Grp Cap (vph)		1637	2017		518	459
v/s Ratio Prot			0.24		c0.18	
v/s Ratio Perm		c0.25				0.01
v/c Ratio		0.42	0.40		0.64	0.05
Uniform Delay, d1		7.5	7.4		21.8	18.0
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.8	0.6		3.6	0.1
Delay (s)		8.3	8.0		25.3	18.1
Level of Service		A	A		C	B
Approach Delay (s)		8.3	8.0		23.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	11.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	735	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	735	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		314	188			
pX, platoon unblocked						
vC, conflicting volume	0				245	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				245	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				722	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	245	245	245	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.14	0.14	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

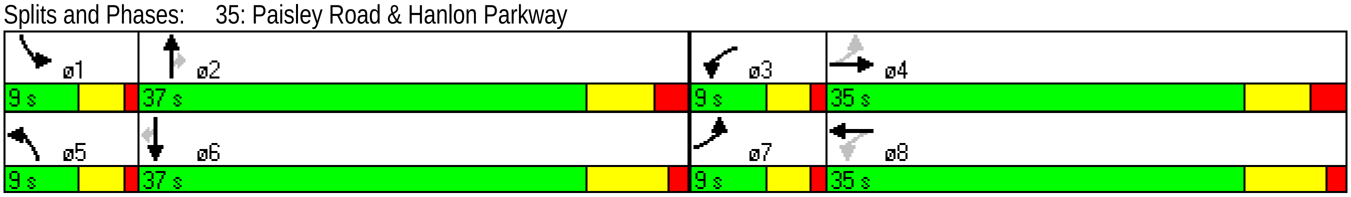
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	135	360	80	130	345	160	1165	165	50	1220	95
Lane Group Flow (vph)	147	391	87	141	435	174	1266	179	54	1326	103
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	33.0	33.0	9.0	33.0	33.0
Total Split (s)	9.0	35.0	0.0	9.0	35.0	9.0	37.0	37.0	9.0	37.0	37.0
Total Split (%)	10.0%	38.9%	0.0%	10.0%	38.9%	10.0%	41.1%	41.1%	10.0%	41.1%	41.1%
Yellow Time (s)	3.0	4.5		3.0	5.5	3.0	4.5	4.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	1.5	1.0	2.5	2.5	1.0	1.5	1.5
Lost Time Adjust (s)	0.0	-3.0	0.0	0.0	-3.0	0.0	-3.0	-3.0	0.0	-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	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.67	0.51	0.06	0.58	0.58	0.43	0.74	0.21	0.33	0.86	0.14
Control Delay	39.7	33.3	0.1	30.8	30.1	39.9	24.2	3.5	42.9	31.2	8.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.7	33.3	0.1	30.8	30.1	39.9	24.2	3.5	42.9	31.2	8.7
Queue Length 50th (m)	17.4	29.1	0.0	17.7	29.8	13.4	85.4	0.0	8.2	97.3	3.6
Queue Length 95th (m)	28.6	39.1	0.0	27.5	41.5	21.9	#139.1	11.0	17.8	#155.4	13.4
Internal Link Dist (m)		119.3			210.1		643.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	220	1243	1577	243	1212	408	1714	865	165	1546	734
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.31	0.06	0.58	0.36	0.43	0.74	0.21	0.33	0.86	0.14

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 67 (74%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 35: Paisley Road & Hanlon Parkway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	135	360	80	130	345	55	160	1165	165	50	1220	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1786	3610	1577	1804	3478		3467	3539	1594	1805	3539	1599
Flt Permitted	0.30	1.00	1.00	0.35	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	569	3610	1577	672	3478		3467	3539	1594	1805	3539	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	147	391	87	141	375	60	174	1266	179	54	1326	103
RTOR Reduction (vph)	0	0	0	0	17	0	0	0	94	0	0	35
Lane Group Flow (vph)	147	391	87	141	418	0	174	1266	85	54	1326	68
Confl. Peds. (#/hr)	4		5	5		4			1	1		
Heavy Vehicles (%)	1%	0%	1%	0%	1%	4%	1%	2%	0%	0%	2%	1%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	21.1	16.1	90.0	21.1	16.1		10.6	39.8	39.8	7.1	36.3	36.3
Effective Green, g (s)	21.1	19.1	90.0	21.1	19.1		10.6	42.8	42.8	7.1	39.3	39.3
Actuated g/C Ratio	0.23	0.21	1.00	0.23	0.21		0.12	0.48	0.48	0.08	0.44	0.44
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	201	766	1577	220	738		408	1683	758	142	1545	698
v/s Ratio Prot	c0.04	0.11		0.04	0.12		c0.05	c0.36		0.03	c0.37	
v/s Ratio Perm	c0.13		0.06	0.11					0.05			0.04
v/c Ratio	0.73	0.51	0.06	0.64	0.57		0.43	0.75	0.11	0.38	0.86	0.10
Uniform Delay, d1	30.2	31.3	0.0	29.5	31.7		36.9	19.3	13.1	39.4	22.8	14.9
Progression Factor	1.00	1.00	1.00	0.89	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.8	0.6	0.1	6.0	1.0		0.7	3.2	0.3	1.7	6.4	0.3
Delay (s)	43.0	31.9	0.1	32.3	29.9		37.6	22.4	13.4	41.1	29.3	15.2
Level of Service	D	C	A	C	C		D	C	B	D	C	B
Approach Delay (s)		30.1			30.5			23.1			28.7	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	27.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	245	250	80	235	245	75	105	240	145	205
Lane Group Flow (vph)	245	250	80	235	395	75	295	240	145	205
Turn Type	pm+pt		Perm	Perm		Perm		pm+pt		Perm
Protected Phases	7	4			8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	35.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	13.0	48.0	48.0	35.0	35.0	29.0	29.0	13.0	42.0	42.0
Total Split (%)	14.4%	53.3%	53.3%	38.9%	38.9%	32.2%	32.2%	14.4%	46.7%	46.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	C-Max	C-Max	None	None	None	None	None
v/c Ratio	0.52	0.24	0.09	0.51	0.53	0.30	0.72	0.87	0.22	0.29
Control Delay	9.5	5.2	0.8	21.3	17.6	31.6	31.1	53.5	20.3	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.5	5.2	0.8	21.3	17.6	31.6	31.1	53.5	20.3	3.8
Queue Length 50th (m)	4.8	4.9	0.0	16.9	24.1	10.2	28.8	28.3	16.0	0.0
Queue Length 95th (m)	44.3	44.7	0.1	39.9	56.0	19.5	49.2	#48.0	25.0	11.0
Internal Link Dist (m)		210.1			1197.0		117.0		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	478	1060	872	464	751	341	527	275	787	800
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.24	0.09	0.51	0.53	0.22	0.56	0.87	0.18	0.26

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

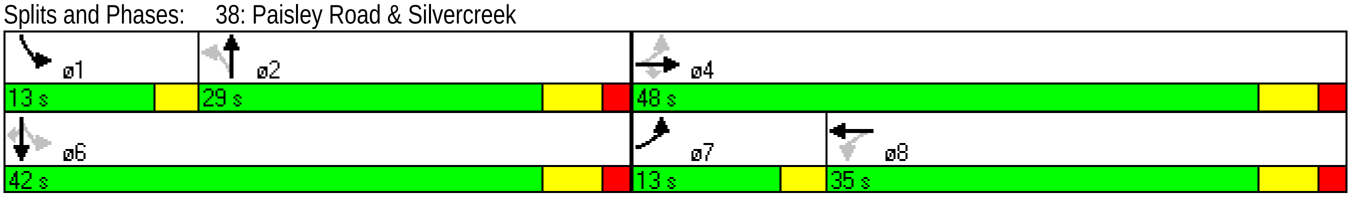
Offset: 56 (62%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

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

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	245	250	80	235	245	150	75	105	190	240	145	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	4.0	4.0	6.0	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	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	1881	1544	1764	1763		1751	1637		1786	1863	1615
Flt Permitted	0.32	1.00	1.00	0.60	1.00		0.66	1.00		0.21	1.00	1.00
Satd. Flow (perm)	614	1881	1544	1121	1763		1225	1637		390	1863	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	245	250	80	235	245	150	75	105	190	240	145	205
RTOR Reduction (vph)	0	0	37	0	22	0	0	80	0	0	0	134
Lane Group Flow (vph)	245	250	43	235	373	0	75	215	0	240	145	71
Confl. Peds. (#/hr)			3	3					3	3		
Heavy Vehicles (%)	0%	1%	2%	2%	2%	1%	0%	0%	0%	1%	2%	0%
Turn Type	pm+pt		Perm	Perm			Perm			pm+pt		Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	48.7	48.7	48.7	35.2	35.2		16.3	16.3		29.3	29.3	29.3
Effective Green, g (s)	47.7	50.7	48.7	37.2	37.2		18.3	18.3		28.3	31.3	31.3
Actuated g/C Ratio	0.53	0.56	0.54	0.41	0.41		0.20	0.20		0.31	0.35	0.35
Clearance Time (s)	3.0	6.0	6.0	6.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	451	1060	835	463	729		249	333		262	648	562
v/s Ratio Prot	c0.06	0.13			0.21			0.13		c0.09	0.08	
v/s Ratio Perm	c0.23		0.03	0.21			0.06			c0.20		0.04
v/c Ratio	0.54	0.24	0.05	0.51	0.51		0.30	0.65		0.92	0.22	0.13
Uniform Delay, d1	13.1	9.9	9.7	19.6	19.6		30.4	32.9		26.4	20.8	20.0
Progression Factor	0.48	0.41	0.17	0.78	0.76		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.3	0.5	0.1	3.7	2.4		0.7	4.3		33.8	0.2	0.1
Delay (s)	7.6	4.6	1.8	18.9	17.2		31.1	37.2		60.3	20.9	20.1
Level of Service	A	A	A	B	B		C	D		E	C	C
Approach Delay (s)		5.5			17.8			35.9			36.7	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM Average Control Delay	22.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	110	575	325	105	420	290
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	110	575	325	105	420	290
Approach Volume (veh/h)	685			430	710	
Crossing Volume (veh/h)	325			420	110	
High Capacity (veh/h)	1073			995	1271	
High v/c (veh/h)	0.64			0.43	0.56	
Low Capacity (veh/h)	879			809	1058	
Low v/c (veh/h)	0.78			0.53	0.67	

Intersection Summary			
Maximum v/c High	0.64		
Maximum v/c Low	0.78		
Intersection Capacity Utilization	115.8%	ICU Level of Service	H

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	190	470	40	435	115	645	90	595
Lane Group Flow (vph)	190	545	40	490	115	675	90	705
Turn Type	pm+pt		Perm		pm+pt		pm+pt	
Protected Phases	7	4		8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	29.0	29.0	29.0	8.0	28.0	8.0	28.0
Total Split (s)	8.0	39.0	31.0	31.0	8.0	43.0	8.0	43.0
Total Split (%)	8.9%	43.3%	34.4%	34.4%	8.9%	47.8%	8.9%	47.8%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	2.0	5.0	2.0	5.0
Lead/Lag	Lead		Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.89	0.78	0.29	0.93	0.51	0.81	0.36	0.85
Control Delay	53.6	27.5	31.7	58.1	20.7	26.9	14.0	35.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.6	27.5	31.7	58.1	20.7	26.9	14.0	35.2
Queue Length 50th (m)	16.8	58.3	4.9	74.3	7.1	53.2	6.5	100.1
Queue Length 95th (m)	m#46.1	#106.7	13.4	#127.6	m16.8	#148.5	12.8	#163.6
Internal Link Dist (m)		1213.0		222.3		775.1		164.8
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	214	703	140	533	227	832	251	825
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.89	0.78	0.29	0.92	0.51	0.81	0.36	0.85

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 30 (33%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

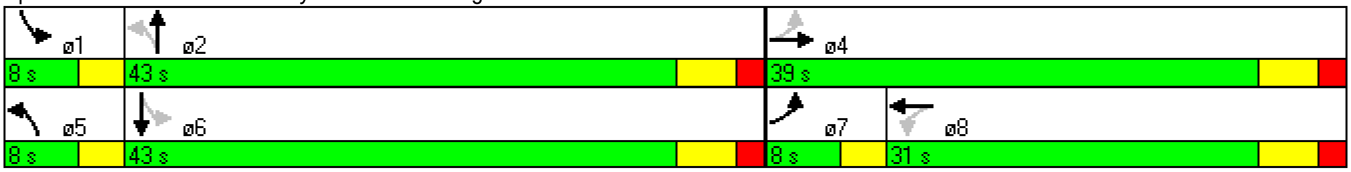
Natural Cycle: 90

Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	190	470	75	40	435	55	115	645	30	90	595	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0		5.0	5.0		2.0	5.0		2.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1845		1805	1830		1787	1869		1805	1840	
Flt Permitted	0.14	1.00		0.25	1.00		0.12	1.00		0.15	1.00	
Satd. Flow (perm)	275	1845		482	1830		224	1869		276	1840	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	190	470	75	40	435	55	115	645	30	90	595	110
RTOR Reduction (vph)	0	6	0	0	5	0	0	2	0	0	7	0
Lane Group Flow (vph)	190	539	0	40	485	0	115	673	0	90	698	0
Confl. Peds. (#/hr)	4					4						
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	1%	1%	0%	0%	1%	0%
Turn Type	pm+pt			Perm			pm+pt			pm+pt		
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	32.6	32.6		24.6	24.6		42.4	38.4		42.4	38.4	
Effective Green, g (s)	33.6	33.6		25.6	25.6		44.4	39.4		44.4	39.4	
Actuated g/C Ratio	0.37	0.37		0.28	0.28		0.49	0.44		0.49	0.44	
Clearance Time (s)	3.0	6.0		6.0	6.0		3.0	6.0		3.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	205	689		137	521		197	818		221	806	
v/s Ratio Prot	c0.06	0.29			c0.27		c0.03	0.36		0.02	c0.38	
v/s Ratio Perm	0.28			0.08			0.25			0.18		
v/c Ratio	0.93	0.78		0.29	0.93		0.58	0.82		0.41	0.87	
Uniform Delay, d1	24.2	25.0		25.1	31.3		17.3	22.2		16.2	22.9	
Progression Factor	0.86	0.80		1.00	1.00		1.43	0.85		1.00	1.00	
Incremental Delay, d2	37.1	4.7		1.2	23.5		3.3	7.1		1.2	12.0	
Delay (s)	57.8	24.7		26.3	54.9		28.2	25.9		17.4	34.9	
Level of Service	E	C		C	D		C	C		B	C	
Approach Delay (s)		33.2			52.7			26.3			32.9	
Approach LOS		C			D			C			C	

Intersection Summary			
HCM Average Control Delay	34.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	96.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	60	300	115	335	45	690	40	715
Lane Group Flow (vph)	60	340	115	395	45	755	40	760
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	55.0	55.0	55.0	55.0
Total Split (s)	34.0	34.0	34.0	34.0	56.0	56.0	56.0	56.0
Total Split (%)	37.8%	37.8%	37.8%	37.8%	62.2%	62.2%	62.2%	62.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.49	0.67	0.71	0.79	0.16	0.67	0.15	0.66
Control Delay	40.4	34.9	53.2	41.0	11.0	26.4	5.1	6.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.4	34.9	53.2	41.0	11.0	26.4	5.1	6.5
Queue Length 50th (m)	7.9	46.4	16.3	55.9	2.5	79.0	1.3	25.3
Queue Length 95th (m)	19.0	68.3	#36.5	81.2	m7.8	116.0	m1.9	m31.1
Internal Link Dist (m)		842.2		241.7		111.7		775.1
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	144	591	190	585	277	1130	274	1157
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.58	0.61	0.68	0.16	0.67	0.15	0.66

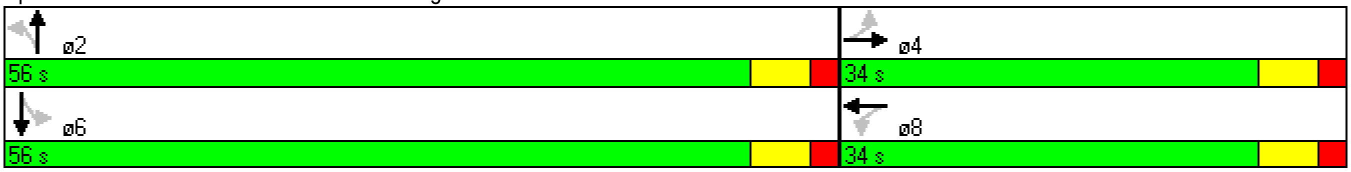
Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 79 (88%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	300	40	115	335	60	45	690	65	40	715	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.97	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1754	1817		1720	1793		1798	1832		1760	1879	
Flt Permitted	0.24	1.00		0.33	1.00		0.24	1.00		0.24	1.00	
Satd. Flow (perm)	448	1817		591	1793		451	1832		447	1879	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	300	40	115	335	60	45	690	65	40	715	45
RTOR Reduction (vph)	0	6	0	0	8	0	0	3	0	0	2	0
Lane Group Flow (vph)	60	334	0	115	387	0	45	752	0	40	758	0
Confl. Peds. (#/hr)	10		25	25		10	16		22	22		16
Heavy Vehicles (%)	2%	2%	0%	2%	3%	2%	0%	2%	2%	2%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.7	23.7		23.7	23.7		54.3	54.3		54.3	54.3	
Effective Green, g (s)	24.7	24.7		24.7	24.7		55.3	55.3		55.3	55.3	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.61	0.61		0.61	0.61	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	123	499		162	492		277	1126		275	1155	
v/s Ratio Prot		0.18			c0.22			c0.41			0.40	
v/s Ratio Perm	0.13			0.19			0.10			0.09		
v/c Ratio	0.49	0.67		0.71	0.79		0.16	0.67		0.15	0.66	
Uniform Delay, d1	27.4	29.0		29.4	30.2		7.4	11.3		7.3	11.2	
Progression Factor	1.00	1.00		1.00	1.00		1.03	1.82		0.46	0.36	
Incremental Delay, d2	3.0	3.4		13.3	8.1		1.2	3.0		0.8	2.0	
Delay (s)	30.4	32.4		42.7	38.3		8.8	23.7		4.2	6.0	
Level of Service	C	C		D	D		A	C		A	A	
Approach Delay (s)		32.1			39.3			22.8			5.9	
Approach LOS		C			D			C			A	

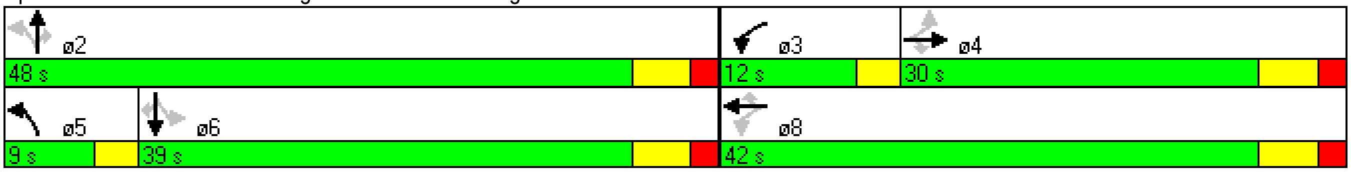
Intersection Summary			
HCM Average Control Delay	22.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	820	205	235	1025	80	200	670	165	55	745	65
Lane Group Flow (vph)	50	820	205	235	1025	80	200	670	165	55	745	65
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	12.0	42.0	42.0	9.0	48.0	48.0	39.0	39.0	39.0
Total Split (%)	33.3%	33.3%	33.3%	13.3%	46.7%	46.7%	10.0%	53.3%	53.3%	43.3%	43.3%	43.3%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.45	0.89	0.35	0.80	0.72	0.11	0.59	0.39	0.20	0.20	0.55	0.10
Control Delay	41.7	44.3	5.6	39.5	26.0	5.1	20.3	15.8	2.9	10.8	13.7	1.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.7	44.3	5.6	39.5	26.0	5.1	20.3	15.8	2.9	10.8	13.7	1.2
Queue Length 50th (m)	6.6	65.4	0.0	23.2	70.0	0.5	16.7	34.5	0.1	3.4	33.2	0.2
Queue Length 95th (m)	17.7	#94.6	14.1	#53.9	90.7	7.8	28.0	46.4	9.0	m5.5	43.2	m1.2
Internal Link Dist (m)		464.5			263.2			253.7			89.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	113	937	597	292	1427	702	337	1721	837	278	1350	631
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.88	0.34	0.80	0.72	0.11	0.59	0.39	0.20	0.20	0.55	0.10

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 19 (21%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	820	205	235	1025	80	200	670	165	55	745	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3374	1615	1787	3471	1599	1769	3574	1563	1762	3574	1562
Flt Permitted	0.21	1.00	1.00	0.15	1.00	1.00	0.24	1.00	1.00	0.40	1.00	1.00
Satd. Flow (perm)	406	3374	1615	282	3471	1599	447	3574	1563	736	3574	1562
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	50	820	205	235	1025	80	200	670	165	55	745	65
RTOR Reduction (vph)	0	0	149	0	0	44	0	0	85	0	0	40
Lane Group Flow (vph)	50	820	56	235	1025	36	200	670	80	55	745	25
Confl. Peds. (#/hr)							2		12	12		2
Heavy Vehicles (%)	0%	7%	0%	1%	4%	1%	2%	1%	1%	2%	1%	2%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	23.7	23.7	23.7	35.7	35.7	35.7	42.3	42.3	42.3	33.0	33.0	33.0
Effective Green, g (s)	24.7	24.7	24.7	36.7	36.7	36.7	43.3	43.3	43.3	34.0	34.0	34.0
Actuated g/C Ratio	0.27	0.27	0.27	0.41	0.41	0.41	0.48	0.48	0.48	0.38	0.38	0.38
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	111	926	443	282	1415	652	322	1719	752	278	1350	590
v/s Ratio Prot		c0.24		c0.09	0.30		c0.05	0.19			c0.21	
v/s Ratio Perm	0.12		0.03	0.25		0.02	0.25		0.05	0.07		0.02
v/c Ratio	0.45	0.89	0.13	0.83	0.72	0.05	0.62	0.39	0.11	0.20	0.55	0.04
Uniform Delay, d1	27.0	31.3	24.5	20.6	22.4	16.1	14.9	14.9	12.8	18.8	22.0	17.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.49	0.56	0.19
Incremental Delay, d2	2.9	10.2	0.1	18.6	1.9	0.0	3.7	0.7	0.3	1.2	1.2	0.1
Delay (s)	29.9	41.4	24.7	39.2	24.3	16.2	18.6	15.6	13.1	10.4	13.6	3.5
Level of Service	C	D	C	D	C	B	B	B	B	B	B	A
Approach Delay (s)		37.7			26.4			15.8			12.6	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM Average Control Delay	23.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1070	1590	170	100
Lane Group Flow (vph)	1163	1728	185	109
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	38.0	38.0	33.0	33.0
Total Split (s)	55.0	55.0	35.0	35.0
Total Split (%)	61.1%	61.1%	38.9%	38.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.33	0.48	0.35	0.46
Control Delay	4.7	5.6	28.5	29.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	4.7	5.6	28.5	29.5
Queue Length 50th (m)	16.0	27.7	10.6	10.5
Queue Length 95th (m)	26.7	45.0	18.2	22.9
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3539	3574	1406	617
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.33	0.48	0.13	0.18

Intersection Summary

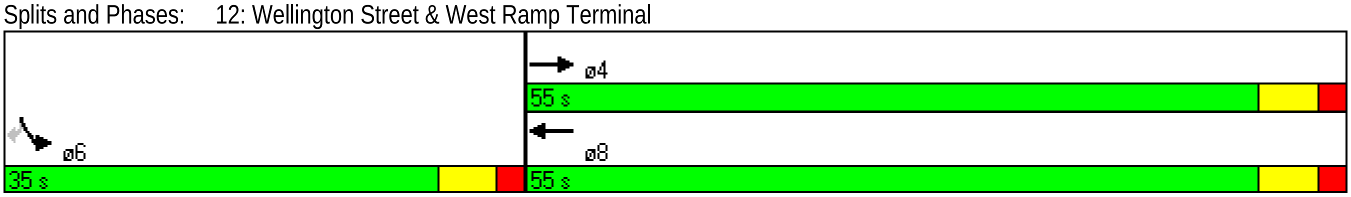
Cycle Length: 90

Actuated Cycle Length: 71.2

Natural Cycle: 75

Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1070	1590	0	170	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5036	5085		3335	1442
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5036	5085		3335	1442
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1163	1728	0	185	109
RTOR Reduction (vph)	0	0	0	0	0	13
Lane Group Flow (vph)	0	1163	1728	0	185	96
Heavy Vehicles (%)	0%	3%	2%	0%	5%	12%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		49.1	49.1		10.2	10.2
Effective Green, g (s)		50.1	50.1		11.2	11.2
Actuated g/C Ratio		0.70	0.70		0.16	0.16
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3539	3573		524	227
v/s Ratio Prot		0.23	c0.34		0.06	
v/s Ratio Perm						c0.07
v/c Ratio		0.33	0.48		0.35	0.42
Uniform Delay, d1		4.1	4.8		26.8	27.1
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.2	0.5		0.4	1.3
Delay (s)		4.3	5.2		27.2	28.4
Level of Service		A	A		C	C
Approach Delay (s)		4.3	5.2		27.7	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	7.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	71.3	Sum of lost time (s)	10.0
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	180	780	1030	255	340	285	95	200	700
Lane Group Flow (vph)	196	848	1120	277	333	347	103	217	761
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	9.0	39.0	30.0	30.0	25.0	25.0	25.0	26.0	35.0
Total Split (%)	10.0%	43.3%	33.3%	33.3%	27.8%	27.8%	27.8%	28.9%	38.9%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.86	0.45	0.81	0.43	0.92	0.89	0.24	0.90	0.82
Control Delay	54.5	21.9	35.6	5.6	66.2	60.0	7.8	72.7	36.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.5	21.9	35.6	5.6	66.2	60.0	7.8	72.7	36.1
Queue Length 50th (m)	20.2	36.5	60.7	0.0	54.7	56.5	0.0	33.7	62.5
Queue Length 95th (m)	#49.8	46.6	75.6	16.0	#101.3	#102.1	11.2	#71.1	#86.9
Internal Link Dist (m)		150.3	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	228	1870	1389	650	367	395	426	242	931
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	0.86	0.45	0.81	0.43	0.91	0.88	0.24	0.90	0.82

Intersection Summary

Cycle Length: 90

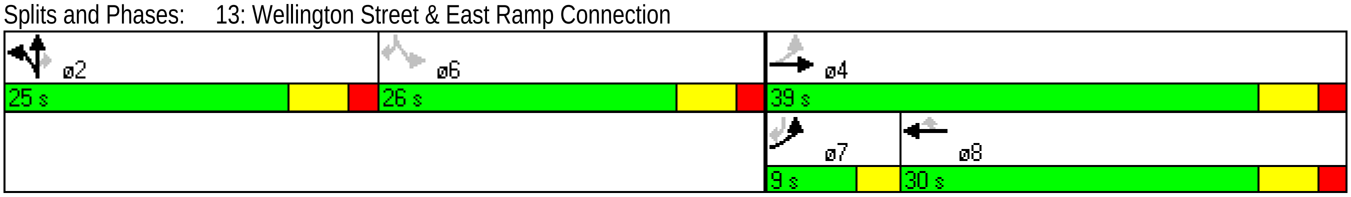
Actuated Cycle Length: 89.8

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

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

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	780	0	0	1030	255	340	285	95	200	0	700
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.99	1.00	0.95		1.00
Satd. Flow (prot)	1752	4940			4988	1615	1649	1772	1553	1805		2787
Flt Permitted	0.15	1.00			1.00	1.00	0.95	0.99	1.00	0.54		1.00
Satd. Flow (perm)	273	4940			4988	1615	1649	1772	1553	1033		2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	196	848	0	0	1120	277	370	310	103	217	0	761
RTOR Reduction (vph)	0	0	0	0	0	200	0	0	80	0	0	0
Lane Group Flow (vph)	196	848	0	0	1120	77	333	347	23	217	0	761
Heavy Vehicles (%)	3%	5%	0%	0%	4%	0%	4%	1%	4%	0%	0%	2%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	33.0	33.0			24.0	24.0	18.8	18.8	18.8	20.0		32.0
Effective Green, g (s)	34.0	34.0			25.0	25.0	19.8	19.8	19.8	21.0		33.0
Actuated g/C Ratio	0.38	0.38			0.28	0.28	0.22	0.22	0.22	0.23		0.37
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	219	1870			1389	450	364	391	342	242		1024
v/s Ratio Prot	0.07	0.17			c0.22		c0.20	0.20				
v/s Ratio Perm	0.27					0.05			0.01	c0.21		c0.27
v/c Ratio	0.89	0.45			0.81	0.17	0.91	0.89	0.07	0.90		0.74
Uniform Delay, d1	21.6	20.9			30.1	24.6	34.2	33.9	27.7	33.3		24.7
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	38.6	0.8			5.1	0.8	26.8	20.8	0.1	31.7		3.0
Delay (s)	60.2	21.7			35.2	25.4	60.9	54.7	27.8	65.0		27.7
Level of Service	E	C			D	C	E	D	C	E		C
Approach Delay (s)		28.9			33.3			53.8			36.0	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	36.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	89.8	Sum of lost time (s)	15.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			303							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

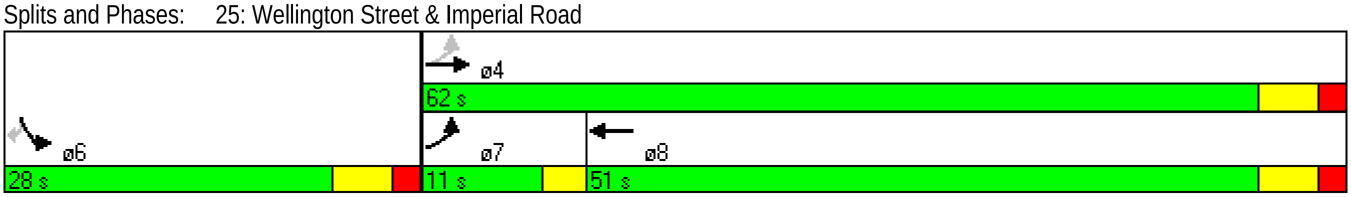
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	115	880	1300	405	35
Lane Group Flow (vph)	115	880	1630	405	35
Turn Type	pm+pt				Perm
Protected Phases	7	4	8	6	
Permitted Phases	4			6	6
Detector Phase	7	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	41.0	41.0	24.0	24.0
Total Split (s)	11.0	62.0	51.0	28.0	28.0
Total Split (%)	12.2%	68.9%	56.7%	31.1%	31.1%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	C-Max	C-Max	None	None
v/c Ratio	0.45	0.77	0.88	0.89	0.09
Control Delay	14.2	17.4	25.8	56.6	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.2	17.4	25.8	56.6	9.7
Queue Length 50th (m)	5.7	90.1	116.7	62.2	0.0
Queue Length 95th (m)	16.6	137.6	#169.1	#108.7	6.4
Internal Link Dist (m)		188.7	176.5	303.2	
Turn Bay Length (m)	100.0				
Base Capacity (vph)	267	1150	1848	457	388
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.77	0.88	0.89	0.09

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	115	880	1300	330	405	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1810	3368		1787	1417
Flt Permitted	0.08	1.00	1.00		0.95	1.00
Satd. Flow (perm)	152	1810	3368		1787	1417
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	115	880	1300	330	405	35
RTOR Reduction (vph)	0	0	24	0	0	26
Lane Group Flow (vph)	115	880	1606	0	405	9
Confl. Peds. (#/hr)	4			4		
Heavy Vehicles (%)	0%	5%	4%	1%	1%	14%
Turn Type	pm+pt					Perm
Protected Phases	7	4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)	56.2	56.2	47.1		21.8	21.8
Effective Green, g (s)	57.2	57.2	48.1		22.8	22.8
Actuated g/C Ratio	0.64	0.64	0.53		0.25	0.25
Clearance Time (s)	3.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	227	1150	1800		453	359
v/s Ratio Prot	0.04	c0.49	c0.48		c0.23	
v/s Ratio Perm	0.28					0.01
v/c Ratio	0.51	0.77	0.89		0.89	0.02
Uniform Delay, d1	15.3	11.6	18.6		32.4	25.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.8	4.9	7.2		20.7	0.1
Delay (s)	17.0	16.5	25.9		53.2	25.3
Level of Service	B	B	C		D	C
Approach Delay (s)		16.6	25.9		51.0	
Approach LOS		B	C		D	

Intersection Summary			
HCM Average Control Delay	26.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	935	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	935	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		327	174			
pX, platoon unblocked						
vC, conflicting volume	0				312	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				312	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				656	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	312	312	312	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.18	0.18	0.18	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	110	355	170	170	410	295	1445	260	105	1535	80
Lane Group Flow (vph)	120	386	185	185	522	321	1571	283	114	1668	87
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	59.0	59.0	9.0	57.0	57.0
Total Split (s)	10.0	35.0	0.0	12.0	37.0	18.0	81.0	81.0	16.0	79.0	79.0
Total Split (%)	6.9%	24.3%	0.0%	8.3%	25.7%	12.5%	56.3%	56.3%	11.1%	54.9%	54.9%
Yellow Time (s)	3.0	4.5		3.0	4.5	3.0	5.5	5.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	2.5	1.0	1.5	1.5	1.0	1.5	1.5
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.0	6.0	3.0	3.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.71	0.62	0.12	0.80	0.79	0.78	0.83	0.29	0.69	0.91	0.10
Control Delay	65.2	59.3	0.1	68.7	63.8	75.8	32.8	5.9	83.9	40.5	11.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.2	59.3	0.1	68.7	63.8	75.8	32.8	5.9	83.9	40.5	11.7
Queue Length 50th (m)	24.4	49.7	0.0	39.2	67.8	42.2	183.2	9.4	28.9	211.7	6.9
Queue Length 95th (m)	#41.3	63.6	0.0	#63.5	84.1	#67.0	216.5	24.2	#55.6	#262.4	15.5
Internal Link Dist (m)		119.3			205.7		653.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	168	727	1594	231	755	409	1894	964	172	1832	848
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.53	0.12	0.80	0.69	0.78	0.83	0.29	0.66	0.91	0.10

Intersection Summary

Cycle Length: 144
Actuated Cycle Length: 144
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 35: Paisley Road & Hanlon Parkway

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	355	170	170	410	70	295	1445	260	105	1535	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1594	1786	3465		3502	3471	1594	1770	3505	1593
Flt Permitted	0.22	1.00	1.00	0.31	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	413	3610	1594	576	3465		3502	3471	1594	1770	3505	1593
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	386	185	185	446	76	321	1571	283	114	1668	87
RTOR Reduction (vph)	0	0	0	0	10	0	0	0	95	0	0	16
Lane Group Flow (vph)	120	386	185	185	512	0	321	1571	188	114	1668	71
Confl. Peds. (#/hr)	1		3	3		1	2		1	1		2
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	4%	0%	2%	3%	0%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	29.9	23.9	144.0	33.9	25.9		15.8	77.6	77.6	12.5	74.3	74.3
Effective Green, g (s)	31.9	24.9	144.0	35.9	26.9		16.8	78.6	78.6	13.5	75.3	75.3
Actuated g/C Ratio	0.22	0.17	1.00	0.25	0.19		0.12	0.55	0.55	0.09	0.52	0.52
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	159	624	1594	219	647		409	1895	870	166	1833	833
v/s Ratio Prot	0.04	0.11		c0.05	0.15		c0.09	0.45		0.06	c0.48	
v/s Ratio Perm	0.13		0.12	c0.16					0.12			0.04
v/c Ratio	0.75	0.62	0.12	0.84	0.79		0.78	0.83	0.22	0.69	0.91	0.08
Uniform Delay, d1	48.9	55.2	0.0	49.0	55.9		61.8	27.1	16.8	63.2	31.3	17.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	18.2	1.8	0.1	24.6	6.6		9.5	4.4	0.6	11.2	8.2	0.2
Delay (s)	67.2	57.0	0.1	73.7	62.5		71.4	31.5	17.4	74.4	39.5	17.4
Level of Service	E	E	A	E	E		E	C	B	E	D	B
Approach Delay (s)		43.5			65.4			35.5			40.6	
Approach LOS		D			E			D			D	

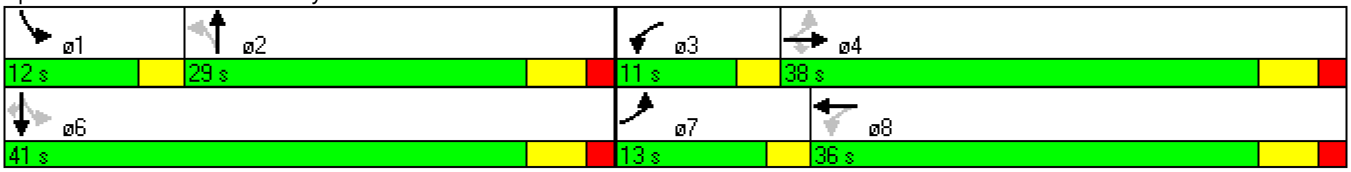
Intersection Summary			
HCM Average Control Delay	42.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	88.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	285	365	60	210	285	80	135	230	145	295
Lane Group Flow (vph)	285	365	60	210	470	80	320	230	145	295
Turn Type	pm+pt		Perm	pm+pt		Perm		pm+pt		Perm
Protected Phases	7	4		3	8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	3	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	8.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	13.0	38.0	38.0	11.0	36.0	29.0	29.0	12.0	41.0	41.0
Total Split (%)	14.4%	42.2%	42.2%	12.2%	40.0%	32.2%	32.2%	13.3%	45.6%	45.6%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	2.0	5.0	5.0	5.0	2.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None
v/c Ratio	0.63	0.47	0.09	0.39	0.67	0.31	0.77	0.73	0.22	0.39
Control Delay	18.2	23.1	5.7	8.1	14.8	31.4	38.0	33.8	20.6	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.2	23.1	5.7	8.1	14.8	31.4	38.0	33.8	20.6	3.9
Queue Length 50th (m)	21.9	43.8	0.0	9.5	25.1	10.7	36.7	25.2	15.9	0.0
Queue Length 95th (m)	#40.2	69.0	6.9	m12.8	m29.6	20.9	59.9	#40.0	26.1	13.5
Internal Link Dist (m)		205.7			1213.0		75.2		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		
Base Capacity (vph)	454	774	687	544	699	327	497	315	745	817
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.47	0.09	0.39	0.67	0.24	0.64	0.73	0.19	0.36

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 60 (67%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	285	365	60	210	285	185	80	135	185	230	145	295
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0		2.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	0.99		1.00	0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1735	1881	1583	1770	1744		1751	1660		1769	1863	1599
Flt Permitted	0.27	1.00	1.00	0.45	1.00		0.66	1.00		0.24	1.00	1.00
Satd. Flow (perm)	497	1881	1583	830	1744		1225	1660		442	1863	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	285	365	60	210	285	185	80	135	185	230	145	295
RTOR Reduction (vph)	0	0	35	0	25	0	0	59	0	0	0	193
Lane Group Flow (vph)	285	365	25	210	445	0	80	261	0	230	145	102
Confl. Peds. (#/hr)	2					2			2	2		
Heavy Vehicles (%)	4%	1%	2%	2%	2%	1%	0%	0%	0%	2%	2%	1%
Turn Type	pm+pt		Perm	pm+pt			Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	47.0	36.0	36.0	42.6	33.8		18.2	18.2		30.2	30.2	30.2
Effective Green, g (s)	48.8	37.0	37.0	44.6	34.8		19.2	19.2		31.2	31.2	31.2
Actuated g/C Ratio	0.54	0.41	0.41	0.50	0.39		0.21	0.21		0.35	0.35	0.35
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	435	773	651	514	674		261	354		301	646	554
v/s Ratio Prot	c0.09	0.19		0.04	c0.26			c0.16		c0.08	0.08	
v/s Ratio Perm	0.27		0.02	0.16			0.07			0.18		0.06
v/c Ratio	0.66	0.47	0.04	0.41	0.66		0.31	0.74		0.76	0.22	0.18
Uniform Delay, d1	13.5	19.4	15.9	13.3	22.7		29.8	33.0		23.2	20.8	20.5
Progression Factor	1.00	1.00	1.00	0.66	0.51		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.5	2.1	0.1	0.3	2.8		0.7	7.8		11.0	0.2	0.2
Delay (s)	17.0	21.4	16.0	9.0	14.5		30.5	40.8		34.1	21.0	20.7
Level of Service	B	C	B	A	B		C	D		C	C	C
Approach Delay (s)		19.2			12.8			38.8			25.4	
Approach LOS		B			B			D			C	

Intersection Summary			
HCM Average Control Delay	22.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	88.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	125	545	140	130	530	145
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	125	545	140	130	530	145
Approach Volume (veh/h)	670			270	675	
Crossing Volume (veh/h)	140			530	125	
High Capacity (veh/h)	1241			911	1256	
High v/c (veh/h)	0.54			0.30	0.54	
Low Capacity (veh/h)	1031			735	1044	
Low v/c (veh/h)	0.65			0.37	0.65	

Intersection Summary			
Maximum v/c High	0.54		
Maximum v/c Low	0.65		
Intersection Capacity Utilization	103.0%	ICU Level of Service	G

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	115	365	50	335	55	550	50	525
Lane Group Flow (vph)	115	445	50	380	55	585	50	640
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.0	29.0	29.0	29.0	28.0	28.0	28.0	28.0
Total Split (s)	38.0	38.0	38.0	38.0	52.0	52.0	52.0	52.0
Total Split (%)	42.2%	42.2%	42.2%	42.2%	57.8%	57.8%	57.8%	57.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.65	0.77	0.39	0.65	0.16	0.53	0.13	0.58
Control Delay	34.7	28.7	32.0	31.0	4.9	6.5	10.9	14.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.7	28.7	32.0	31.0	4.9	6.5	10.9	14.7
Queue Length 50th (m)	13.1	54.9	6.1	50.0	1.5	16.8	3.3	56.9
Queue Length 95th (m)	m24.6	m76.4	15.0	70.3	m4.0	34.1	9.5	99.6
Internal Link Dist (m)		1197.0		206.3		775.8		167.4
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	213	692	154	695	335	1103	376	1101
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.64	0.32	0.55	0.16	0.53	0.13	0.58

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 32 (36%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	115	365	80	50	335	45	55	550	35	50	525	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1790	1810		1800	1825		1805	1846		1802	1834	
Flt Permitted	0.30	1.00		0.21	1.00		0.30	1.00		0.33	1.00	
Satd. Flow (perm)	564	1810		407	1825		562	1846		631	1834	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	115	365	80	50	335	45	55	550	35	50	525	115
RTOR Reduction (vph)	0	10	0	0	6	0	0	2	0	0	8	0
Lane Group Flow (vph)	115	435	0	50	374	0	55	583	0	50	632	0
Confl. Peds. (#/hr)	10		4	4		10			4	4		
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	2%	0%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	26.3	26.3		26.3	26.3		51.7	51.7		51.7	51.7	
Effective Green, g (s)	28.3	28.3		28.3	28.3		53.7	53.7		53.7	53.7	
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.60	0.60		0.60	0.60	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	177	569		128	574		335	1101		376	1094	
v/s Ratio Prot		c0.24			0.20			0.32			c0.34	
v/s Ratio Perm	0.20			0.12			0.10			0.08		
v/c Ratio	0.65	0.77		0.39	0.65		0.16	0.53		0.13	0.58	
Uniform Delay, d1	26.6	27.9		24.1	26.6		8.1	10.7		8.0	11.2	
Progression Factor	0.77	0.78		1.00	1.00		0.38	0.39		1.00	1.00	
Incremental Delay, d2	6.7	5.1		2.0	2.6		1.0	1.7		0.7	2.2	
Delay (s)	27.3	26.9		26.1	29.2		4.1	5.9		8.7	13.4	
Level of Service	C	C		C	C		A	A		A	B	
Approach Delay (s)		27.0			28.9			5.8			13.1	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	40	165	75	215	20	490	30	535
Lane Group Flow (vph)	40	220	75	240	20	555	30	570
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	57.0	57.0	57.0	57.0
Total Split (s)	26.0	26.0	26.0	26.0	64.0	64.0	64.0	64.0
Total Split (%)	28.9%	28.9%	28.9%	28.9%	71.1%	71.1%	71.1%	71.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Min	C-Min
v/c Ratio	0.30	0.58	0.48	0.65	0.04	0.42	0.06	0.43
Control Delay	35.2	35.5	41.8	40.1	1.7	4.6	3.5	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.2	35.5	41.8	40.1	1.7	4.6	3.5	4.6
Queue Length 50th (m)	5.4	28.9	10.6	34.2	0.3	25.2	0.9	23.1
Queue Length 95th (m)	13.3	47.1	22.3	53.4	0.9	35.9	m1.7	28.9
Internal Link Dist (m)		218.2		241.7		109.7		775.8
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	163	454	187	447	529	1319	539	1323
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.48	0.40	0.54	0.04	0.42	0.06	0.43

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 65 (72%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	165	55	75	215	25	20	490	65	30	535	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1698	1803		1744	1809		1803	1855		1804	1862	
Flt Permitted	0.37	1.00		0.42	1.00		0.39	1.00		0.40	1.00	
Satd. Flow (perm)	668	1803		764	1809		745	1855		762	1862	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	165	55	75	215	25	20	490	65	30	535	35
RTOR Reduction (vph)	0	14	0	0	5	0	0	5	0	0	2	0
Lane Group Flow (vph)	40	206	0	75	235	0	20	550	0	30	568	0
Confl. Peds. (#/hr)	2		3	3		2	3		2	2		3
Heavy Vehicles (%)	6%	1%	0%	3%	3%	4%	0%	0%	3%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	16.2	16.2		16.2	16.2		61.8	61.8		61.8	61.8	
Effective Green, g (s)	18.2	18.2		18.2	18.2		63.8	63.8		63.8	63.8	
Actuated g/C Ratio	0.20	0.20		0.20	0.20		0.71	0.71		0.71	0.71	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	135	365		154	366		528	1315		540	1320	
v/s Ratio Prot		0.11			c0.13			0.30			c0.30	
v/s Ratio Perm	0.06			0.10			0.03			0.04		
v/c Ratio	0.30	0.56		0.49	0.64		0.04	0.42		0.06	0.43	
Uniform Delay, d1	30.5	32.3		31.8	32.9		3.9	5.4		4.0	5.5	
Progression Factor	1.00	1.00		1.00	1.00		0.32	0.60		0.68	0.62	
Incremental Delay, d2	1.2	2.0		2.4	3.8		0.1	1.0		0.2	0.8	
Delay (s)	31.7	34.3		34.2	36.8		1.4	4.2		2.9	4.2	
Level of Service	C	C		C	D		A	A		A	A	
Approach Delay (s)		33.9			36.1			4.1			4.2	
Approach LOS		C			D			A			A	

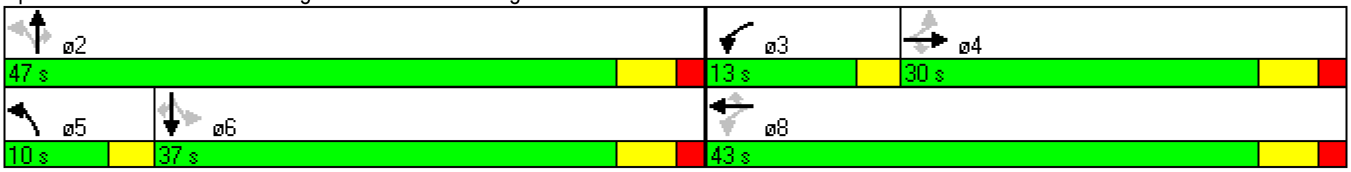
Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	725	160	205	675	45	195	495	180	65	555	45
Lane Group Flow (vph)	35	725	160	205	675	45	195	495	180	65	555	45
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	13.0	43.0	43.0	10.0	47.0	47.0	37.0	37.0	37.0
Total Split (%)	33.3%	33.3%	33.3%	14.4%	47.8%	47.8%	11.1%	52.2%	52.2%	41.1%	41.1%	41.1%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	1.0	-2.0	-2.0	1.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.18	0.76	0.29	0.76	0.46	0.07	0.53	0.28	0.21	0.20	0.41	0.07
Control Delay	26.9	35.7	5.7	36.5	20.0	5.0	19.5	14.2	2.8	20.7	22.4	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.9	35.7	5.7	36.5	20.0	5.0	19.5	14.2	2.8	20.7	22.4	7.8
Queue Length 50th (m)	4.2	54.2	0.0	20.2	38.4	0.0	17.5	24.1	0.0	6.8	37.1	1.0
Queue Length 95th (m)	11.2	72.4	12.4	#42.8	51.5	5.4	29.6	33.5	9.3	15.4	46.3	m6.2
Internal Link Dist (m)		464.5			263.2			253.7			91.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	210	1013	580	274	1534	715	371	1775	873	333	1360	609
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.72	0.28	0.75	0.44	0.06	0.53	0.28	0.21	0.20	0.41	0.07

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 60 (67%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



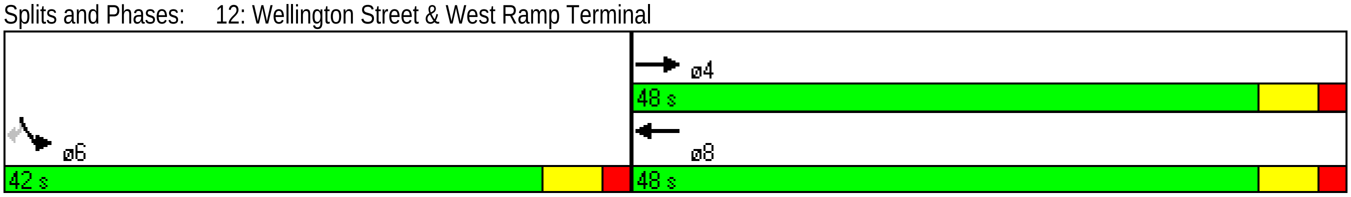
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	725	160	205	675	45	195	495	180	65	555	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1751	3505	1615	1805	3539	1592	1769	3574	1576	1767	3574	1526
Flt Permitted	0.40	1.00	1.00	0.16	1.00	1.00	0.31	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)	728	3505	1615	298	3539	1592	574	3574	1576	876	3574	1526
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	725	160	205	675	45	195	495	180	65	555	45
RTOR Reduction (vph)	0	0	116	0	0	26	0	0	91	0	0	28
Lane Group Flow (vph)	35	725	44	205	675	19	195	495	89	65	555	17
Confl. Peds. (#/hr)	2					2	6		3	3		6
Heavy Vehicles (%)	3%	3%	0%	0%	2%	0%	2%	1%	1%	2%	1%	4%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	22.5	22.5	22.5	35.3	35.3	35.3	42.7	42.7	42.7	32.3	32.3	32.3
Effective Green, g (s)	24.5	24.5	24.5	34.3	37.3	37.3	41.7	44.7	44.7	34.3	34.3	34.3
Actuated g/C Ratio	0.27	0.27	0.27	0.38	0.41	0.41	0.46	0.50	0.50	0.38	0.38	0.38
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	198	954	440	261	1467	660	351	1775	783	334	1362	582
v/s Ratio Prot		0.21		c0.08	0.19		c0.04	0.14			0.16	
v/s Ratio Perm	0.05		0.03	c0.22		0.01	c0.22		0.06	0.07		0.01
v/c Ratio	0.18	0.76	0.10	0.79	0.46	0.03	0.56	0.28	0.11	0.19	0.41	0.03
Uniform Delay, d1	25.0	30.1	24.5	21.6	19.1	15.6	15.4	13.2	12.1	18.6	20.4	17.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.02	1.25
Incremental Delay, d2	0.4	3.5	0.1	14.3	0.2	0.0	1.9	0.4	0.3	1.2	0.8	0.1
Delay (s)	25.5	33.6	24.6	36.0	19.3	15.6	17.3	13.6	12.4	19.1	21.7	21.9
Level of Service	C	C	C	D	B	B	B	B	B	B	C	C
Approach Delay (s)		31.7			22.8			14.2			21.5	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM Average Control Delay	22.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	610	780	215	135
Lane Group Flow (vph)	663	848	234	147
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	37.0	37.0	37.0	37.0
Total Split (s)	48.0	48.0	42.0	42.0
Total Split (%)	53.3%	53.3%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.19	0.24	0.37	0.42
Control Delay	3.8	4.0	24.5	12.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	3.8	4.0	24.5	12.1
Queue Length 50th (m)	7.3	9.8	11.5	3.4
Queue Length 95th (m)	12.0	15.6	19.5	15.5
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3521	3521	2074	914
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.19	0.24	0.11	0.16

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 63.6
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	610	780	0	215	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	5085		3467	1455
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	5085		3467	1455
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	663	848	0	234	147
RTOR Reduction (vph)	0	0	0	0	0	90
Lane Group Flow (vph)	0	663	848	0	234	57
Heavy Vehicles (%)	0%	2%	2%	0%	1%	11%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		42.0	42.0		9.5	9.5
Effective Green, g (s)		44.0	44.0		11.5	11.5
Actuated g/C Ratio		0.69	0.69		0.18	0.18
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3523	3523		628	264
v/s Ratio Prot		0.13	c0.17		c0.07	
v/s Ratio Perm						0.04
v/c Ratio		0.19	0.24		0.37	0.22
Uniform Delay, d1		3.4	3.6		22.8	22.2
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.1	0.2		0.4	0.4
Delay (s)		3.6	3.8		23.2	22.6
Level of Service		A	A		C	C
Approach Delay (s)		3.6	3.8		23.0	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	63.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	30.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	160	605	680	235	235	280	115	200	485
Lane Group Flow (vph)	174	658	739	255	229	330	125	217	527
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	12.0	37.0	25.0	25.0	26.0	26.0	26.0	27.0	39.0
Total Split (%)	13.3%	41.1%	27.8%	27.8%	28.9%	28.9%	28.9%	30.0%	43.3%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	1.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
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					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.67	0.34	0.61	0.45	0.58	0.79	0.27	0.83	0.49
Control Delay	34.4	20.4	32.4	6.7	36.3	46.2	7.0	59.2	22.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.4	20.4	32.4	6.7	36.3	46.2	7.0	59.2	22.2
Queue Length 50th (m)	19.2	27.4	38.8	0.0	33.6	51.3	0.0	32.5	35.0
Queue Length 95th (m)	#35.4	36.1	50.5	16.5	55.3	#87.1	11.8	#66.5	49.4
Internal Link Dist (m)		163.9	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	260	1935	1219	565	431	455	491	279	1085
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	0.67	0.34	0.61	0.45	0.53	0.73	0.25	0.78	0.49

Intersection Summary

Cycle Length: 90

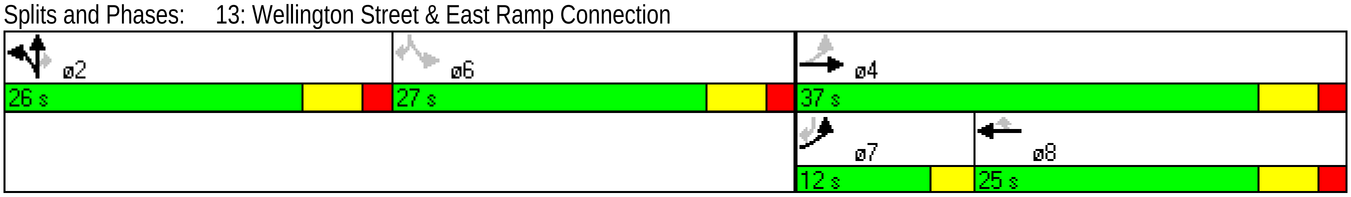
Actuated Cycle Length: 87.1

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

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

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	605	0	0	680	235	235	280	115	200	0	485
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00	0.95		1.00
Satd. Flow (prot)	1770	5085			5036	1538	1698	1797	1568	1805		2814
Flt Permitted	0.18	1.00			1.00	1.00	0.95	1.00	1.00	0.55		1.00
Satd. Flow (perm)	337	5085			5036	1538	1698	1797	1568	1050		2814
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	658	0	0	739	255	255	304	125	217	0	527
RTOR Reduction (vph)	0	0	0	0	0	193	0	0	96	0	0	0
Lane Group Flow (vph)	174	658	0	0	739	62	229	330	29	217	0	527
Heavy Vehicles (%)	2%	2%	0%	0%	3%	5%	1%	0%	3%	0%	0%	1%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	31.1	31.1			19.1	19.1	18.4	18.4	18.4	19.5		34.5
Effective Green, g (s)	30.1	33.1			21.1	21.1	20.4	20.4	20.4	21.5		36.5
Actuated g/C Ratio	0.35	0.38			0.24	0.24	0.23	0.23	0.23	0.25		0.42
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	248	1935			1221	373	398	421	368	259		1181
v/s Ratio Prot	c0.06	0.13			0.15		0.13	c0.18				
v/s Ratio Perm	c0.18					0.04			0.02	c0.21		0.19
v/c Ratio	0.70	0.34			0.61	0.17	0.58	0.78	0.08	0.84		0.45
Uniform Delay, d1	21.7	19.2			29.3	26.0	29.5	31.2	26.0	31.1		18.0
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	15.3	0.5			2.2	1.0	2.0	9.2	0.1	20.4		0.3
Delay (s)	37.0	19.7			31.5	27.0	31.5	40.5	26.1	51.5		18.3
Level of Service	D	B			C	C	C	D	C	D		B
Approach Delay (s)		23.3			30.3			34.8			28.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			305							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

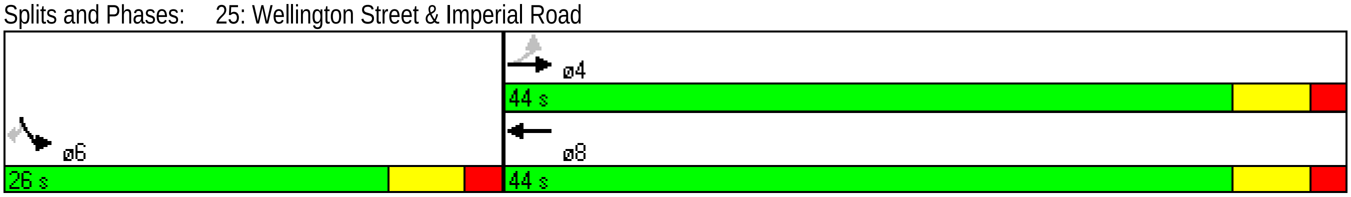
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	80	605	620	330	80
Lane Group Flow (vph)	0	685	870	330	80
Turn Type	Perm				Perm
Protected Phases		4	8	6	
Permitted Phases	4			6	6
Detector Phase	4	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	41.0	41.0	41.0	24.0	24.0
Total Split (s)	44.0	44.0	44.0	26.0	26.0
Total Split (%)	62.9%	62.9%	62.9%	37.1%	37.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Max	C-Max	C-Max	None	None
v/c Ratio		0.42	0.42	0.64	0.16
Control Delay		8.9	7.2	27.6	5.6
Queue Delay		0.0	0.0	0.0	0.0
Total Delay		8.9	7.2	27.6	5.6
Queue Length 50th (m)		22.4	22.8	33.0	0.0
Queue Length 95th (m)		32.7	33.4	54.9	7.5
Internal Link Dist (m)		188.7	176.3	303.2	
Turn Bay Length (m)					
Base Capacity (vph)		1636	2076	567	557
Starvation Cap Reductn		0	0	0	0
Spillback Cap Reductn		0	0	0	0
Storage Cap Reductn		0	0	0	0
Reduced v/c Ratio		0.42	0.42	0.58	0.14

Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	80	605	620	250	330	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.96		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3522	3371		1805	1599
Flt Permitted		0.77	1.00		0.95	1.00
Satd. Flow (perm)		2732	3371		1805	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	605	620	250	330	80
RTOR Reduction (vph)	0	0	58	0	0	57
Lane Group Flow (vph)	0	685	812	0	330	23
Confl. Peds. (#/hr)	6			6		
Heavy Vehicles (%)	1%	2%	2%	1%	0%	1%
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)		39.9	39.9		18.1	18.1
Effective Green, g (s)		41.9	41.9		20.1	20.1
Actuated g/C Ratio		0.60	0.60		0.29	0.29
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		5.0	5.0
Lane Grp Cap (vph)		1635	2018		518	459
v/s Ratio Prot			0.24		c0.18	
v/s Ratio Perm		c0.25				0.01
v/c Ratio		0.42	0.40		0.64	0.05
Uniform Delay, d1		7.5	7.4		21.8	18.0
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.8	0.6		3.6	0.1
Delay (s)		8.3	8.0		25.3	18.1
Level of Service		A	A		C	B
Approach Delay (s)		8.3	8.0		23.9	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	11.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	735	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	735	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		314	188			
pX, platoon unblocked						
vC, conflicting volume	0				245	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				245	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				722	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	245	245	245	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.14	0.14	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

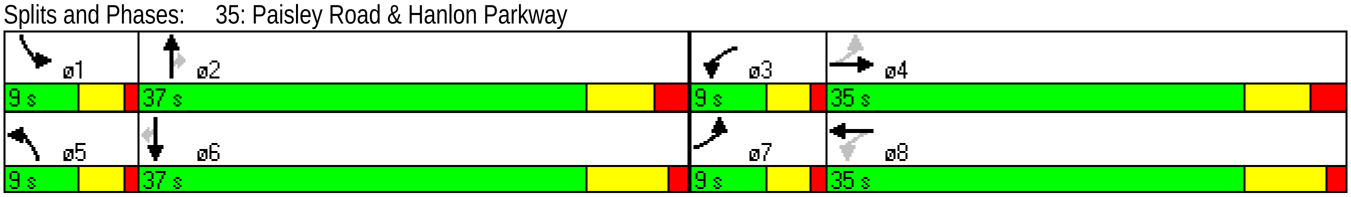
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	135	365	80	130	350	160	1165	165	50	1220	95
Lane Group Flow (vph)	147	397	87	141	440	174	1266	179	54	1326	103
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	33.0	33.0	9.0	33.0	33.0
Total Split (s)	9.0	35.0	0.0	9.0	35.0	9.0	37.0	37.0	9.0	37.0	37.0
Total Split (%)	10.0%	38.9%	0.0%	10.0%	38.9%	10.0%	41.1%	41.1%	10.0%	41.1%	41.1%
Yellow Time (s)	3.0	4.5		3.0	5.5	3.0	4.5	4.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	1.5	1.0	2.5	2.5	1.0	1.5	1.5
Lost Time Adjust (s)	0.0	-3.0	0.0	0.0	-3.0	0.0	-3.0	-3.0	0.0	-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	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.67	0.52	0.06	0.59	0.58	0.43	0.74	0.21	0.33	0.86	0.14
Control Delay	39.9	33.3	0.1	30.7	30.0	39.9	24.3	3.5	42.9	31.5	8.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.9	33.3	0.1	30.7	30.0	39.9	24.3	3.5	42.9	31.5	8.7
Queue Length 50th (m)	17.4	29.6	0.0	17.7	30.1	13.4	85.5	0.0	8.2	97.6	3.6
Queue Length 95th (m)	28.5	39.6	0.0	27.2	41.6	21.9	#139.7	11.1	17.8	#156.1	13.5
Internal Link Dist (m)		119.3			210.1		643.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	219	1243	1577	241	1213	408	1710	863	165	1542	732
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.32	0.06	0.59	0.36	0.43	0.74	0.21	0.33	0.86	0.14

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 63 (70%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 35: Paisley Road & Hanlon Parkway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	135	365	80	130	350	55	160	1165	165	50	1220	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1786	3610	1577	1804	3480		3467	3539	1594	1805	3539	1599
Flt Permitted	0.30	1.00	1.00	0.35	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	562	3610	1577	662	3480		3467	3539	1594	1805	3539	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	147	397	87	141	380	60	174	1266	179	54	1326	103
RTOR Reduction (vph)	0	0	0	0	17	0	0	0	94	0	0	36
Lane Group Flow (vph)	147	397	87	141	423	0	174	1266	85	54	1326	67
Confl. Peds. (#/hr)	4		5	5		4			1	1		
Heavy Vehicles (%)	1%	0%	1%	0%	1%	4%	1%	2%	0%	0%	2%	1%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	21.2	16.2	90.0	21.2	16.2		10.6	39.7	39.7	7.1	36.2	36.2
Effective Green, g (s)	21.2	19.2	90.0	21.2	19.2		10.6	42.7	42.7	7.1	39.2	39.2
Actuated g/C Ratio	0.24	0.21	1.00	0.24	0.21		0.12	0.47	0.47	0.08	0.44	0.44
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	200	770	1577	219	742		408	1679	756	142	1541	696
v/s Ratio Prot	c0.04	0.11		0.04	0.12		c0.05	c0.36		0.03	c0.37	
v/s Ratio Perm	c0.13		0.06	0.12					0.05			0.04
v/c Ratio	0.74	0.52	0.06	0.64	0.57		0.43	0.75	0.11	0.38	0.86	0.10
Uniform Delay, d1	30.1	31.3	0.0	29.4	31.7		36.9	19.4	13.1	39.4	22.9	15.0
Progression Factor	1.00	1.00	1.00	0.89	0.90		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	13.1	0.6	0.1	6.1	1.0		0.7	3.2	0.3	1.7	6.5	0.3
Delay (s)	43.2	31.9	0.1	32.2	29.7		37.6	22.5	13.4	41.1	29.5	15.2
Level of Service	D	C	A	C	C		D	C	B	D	C	B
Approach Delay (s)		30.1			30.3			23.2			28.9	
Approach LOS		C			C			C			C	

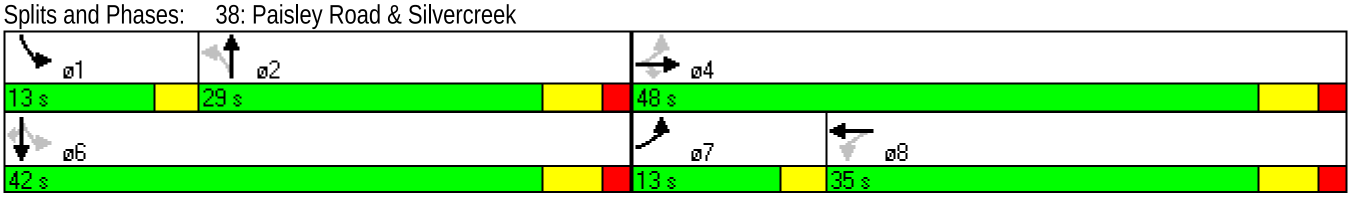
Intersection Summary			
HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	245	250	85	240	245	80	110	240	150	205
Lane Group Flow (vph)	245	250	85	240	395	80	305	240	150	205
Turn Type	pm+pt		Perm	Perm		Perm		pm+pt		Perm
Protected Phases	7	4			8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	35.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	13.0	48.0	48.0	35.0	35.0	29.0	29.0	13.0	42.0	42.0
Total Split (%)	14.4%	53.3%	53.3%	38.9%	38.9%	32.2%	32.2%	14.4%	46.7%	46.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	C-Max	C-Max	None	None	None	None	None
v/c Ratio	0.53	0.24	0.10	0.52	0.53	0.31	0.73	0.87	0.23	0.29
Control Delay	9.9	5.3	0.8	22.3	18.3	31.6	32.0	53.3	20.1	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.9	5.3	0.8	22.3	18.3	31.6	32.0	53.3	20.1	3.7
Queue Length 50th (m)	4.9	4.9	0.0	18.8	26.6	10.8	30.6	27.9	16.4	0.0
Queue Length 95th (m)	44.1	44.7	0.1	40.7	56.2	20.5	51.7	#49.0	25.7	11.0
Internal Link Dist (m)		210.1			1197.0		117.0		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	470	1050	867	459	744	339	526	275	787	800
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.24	0.10	0.52	0.53	0.24	0.58	0.87	0.19	0.26

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 52 (58%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	245	250	85	240	245	150	80	110	195	240	150	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	4.0	4.0	6.0	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	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	1881	1544	1764	1763		1751	1639		1786	1863	1615
Flt Permitted	0.32	1.00	1.00	0.60	1.00		0.66	1.00		0.20	1.00	1.00
Satd. Flow (perm)	607	1881	1544	1121	1763		1219	1639		380	1863	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	245	250	85	240	245	150	80	110	195	240	150	205
RTOR Reduction (vph)	0	0	39	0	22	0	0	78	0	0	0	133
Lane Group Flow (vph)	245	250	46	240	373	0	80	227	0	240	150	72
Confl. Peds. (#/hr)			3	3					3	3		
Heavy Vehicles (%)	0%	1%	2%	2%	2%	1%	0%	0%	0%	1%	2%	0%
Turn Type	pm+pt		Perm	Perm			Perm			pm+pt		Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	48.2	48.2	48.2	34.8	34.8		16.8	16.8		29.8	29.8	29.8
Effective Green, g (s)	47.2	50.2	48.2	36.8	36.8		18.8	18.8		28.8	31.8	31.8
Actuated g/C Ratio	0.52	0.56	0.54	0.41	0.41		0.21	0.21		0.32	0.35	0.35
Clearance Time (s)	3.0	6.0	6.0	6.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	443	1049	827	458	721		255	342		262	658	571
v/s Ratio Prot	c0.06	0.13			0.21			0.14		c0.09	0.08	
v/s Ratio Perm	c0.23		0.03	0.21			0.07			c0.20		0.04
v/c Ratio	0.55	0.24	0.06	0.52	0.52		0.31	0.67		0.92	0.23	0.13
Uniform Delay, d1	13.4	10.1	10.0	20.0	19.9		30.1	32.7		26.1	20.5	19.7
Progression Factor	0.49	0.42	0.19	0.80	0.78		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	0.5	0.1	4.0	2.5		0.7	4.8		33.8	0.2	0.1
Delay (s)	8.0	4.8	2.0	19.9	18.0		30.8	37.5		59.9	20.6	19.8
Level of Service	A	A	A	B	B		C	D		E	C	B
Approach Delay (s)		5.7			18.7			36.1			36.2	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM Average Control Delay	23.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX H
Capacity Analysis Results
Future Total Traffic Conditions
Opening Day + 10 Years

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	100	530	335	105	420	295
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	530	335	105	420	295
Approach Volume (veh/h)	630			440	715	
Crossing Volume (veh/h)	335			420	100	
High Capacity (veh/h)	1064			995	1281	
High v/c (veh/h)	0.59			0.44	0.56	
Low Capacity (veh/h)	871			809	1067	
Low v/c (veh/h)	0.72			0.54	0.67	

Intersection Summary			
Maximum v/c High	0.59		
Maximum v/c Low	0.72		
Intersection Capacity Utilization	113.3%	ICU Level of Service	H

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	185	470	40	445	120	660	90	610
Lane Group Flow (vph)	185	545	40	500	120	690	90	720
Turn Type	pm+pt		Perm		pm+pt		pm+pt	
Protected Phases	7	4		8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	29.0	29.0	29.0	8.0	28.0	8.0	28.0
Total Split (s)	8.0	38.0	30.0	30.0	8.0	44.0	8.0	44.0
Total Split (%)	8.9%	42.2%	33.3%	33.3%	8.9%	48.9%	8.9%	48.9%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	2.0	5.0	2.0	5.0
Lead/Lag	Lead		Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.86	0.80	0.31	0.97	0.58	0.82	0.36	0.89
Control Delay	52.5	29.0	33.6	67.6	26.0	27.9	13.6	39.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.5	29.0	33.6	67.6	26.0	27.9	13.6	39.0
Queue Length 50th (m)	18.2	55.8	5.0	77.8	8.7	61.0	6.3	101.4
Queue Length 95th (m)	m#37.7	m92.5	13.7	#135.3	m18.5	#150.5	12.4	#165.6
Internal Link Dist (m)		1213.0		222.3		775.1		164.8
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	214	682	129	513	208	845	248	805
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.80	0.31	0.97	0.58	0.82	0.36	0.89

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 24 (27%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	470	75	40	445	55	120	660	30	90	610	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0		5.0	5.0		2.0	5.0		2.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1845		1805	1830		1787	1870		1805	1841	
Flt Permitted	0.15	1.00		0.24	1.00		0.10	1.00		0.14	1.00	
Satd. Flow (perm)	281	1845		464	1830		188	1870		273	1841	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	185	470	75	40	445	55	120	660	30	90	610	110
RTOR Reduction (vph)	0	6	0	0	5	0	0	2	0	0	7	0
Lane Group Flow (vph)	185	539	0	40	495	0	120	688	0	90	713	0
Confl. Peds. (#/hr)	4					4						
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	1%	1%	0%	0%	1%	0%
Turn Type	pm+pt			Perm			pm+pt			pm+pt		
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	32.0	32.0		24.0	24.0		44.0	39.0		42.0	38.0	
Effective Green, g (s)	33.0	33.0		25.0	25.0		46.0	40.0		44.0	39.0	
Actuated g/C Ratio	0.37	0.37		0.28	0.28		0.51	0.44		0.49	0.43	
Clearance Time (s)	3.0	6.0		6.0	6.0		3.0	6.0		3.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	205	677		129	508		203	831		219	798	
v/s Ratio Prot	c0.06	0.29			c0.27		c0.04	0.37		0.02	c0.39	
v/s Ratio Perm	0.27			0.09			0.26			0.18		
v/c Ratio	0.90	0.80		0.31	0.97		0.59	0.83		0.41	0.89	
Uniform Delay, d1	24.4	25.5		25.7	32.2		17.5	22.0		16.3	23.6	
Progression Factor	0.99	0.80		1.00	1.00		1.53	0.91		1.00	1.00	
Incremental Delay, d2	32.1	5.3		1.4	33.1		3.4	7.1		1.3	14.5	
Delay (s)	56.3	25.7		27.1	65.3		30.2	27.2		17.6	38.0	
Level of Service	E	C		C	E		C	C		B	D	
Approach Delay (s)		33.4			62.5			27.6			35.8	
Approach LOS		C			E			C			D	

Intersection Summary			
HCM Average Control Delay	37.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	97.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	60	290	120	340	45	705	40	730
Lane Group Flow (vph)	60	330	120	400	45	770	40	775
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	55.0	55.0	55.0	55.0
Total Split (s)	33.0	33.0	33.0	33.0	57.0	57.0	57.0	57.0
Total Split (%)	36.7%	36.7%	36.7%	36.7%	63.3%	63.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.52	0.66	0.72	0.81	0.17	0.68	0.15	0.67
Control Delay	44.1	34.8	54.5	43.0	9.0	24.6	4.9	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.1	34.8	54.5	43.0	9.0	24.6	4.9	6.3
Queue Length 50th (m)	7.9	44.5	16.9	56.7	2.2	73.3	1.3	25.4
Queue Length 95th (m)	19.8	67.1	#38.8	83.9	m6.0	107.7	m1.7	m29.9
Internal Link Dist (m)		842.2		241.7		111.7		775.1
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	132	570	190	565	270	1135	268	1163
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.58	0.63	0.71	0.17	0.68	0.15	0.67

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 73 (81%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	290	40	120	340	60	45	705	65	40	730	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.97	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1754	1815		1719	1794		1798	1833		1760	1880	
Flt Permitted	0.23	1.00		0.34	1.00		0.23	1.00		0.23	1.00	
Satd. Flow (perm)	425	1815		611	1794		438	1833		434	1880	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	290	40	120	340	60	45	705	65	40	730	45
RTOR Reduction (vph)	0	6	0	0	7	0	0	3	0	0	2	0
Lane Group Flow (vph)	60	324	0	120	393	0	45	767	0	40	773	0
Confl. Peds. (#/hr)	10		25	25		10	16		22	22		16
Heavy Vehicles (%)	2%	2%	0%	2%	3%	2%	0%	2%	2%	2%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.4	23.4		23.4	23.4		54.6	54.6		54.6	54.6	
Effective Green, g (s)	24.4	24.4		24.4	24.4		55.6	55.6		55.6	55.6	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.62	0.62		0.62	0.62	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	115	492		166	486		271	1132		268	1161	
v/s Ratio Prot		0.18			c0.22			c0.42			0.41	
v/s Ratio Perm	0.14			0.20			0.10			0.09		
v/c Ratio	0.52	0.66		0.72	0.81		0.17	0.68		0.15	0.67	
Uniform Delay, d1	27.8	29.1		29.7	30.6		7.3	11.3		7.2	11.2	
Progression Factor	1.00	1.00		1.00	1.00		0.84	1.70		0.46	0.35	
Incremental Delay, d2	4.2	3.2		14.4	9.5		1.2	3.1		0.7	1.9	
Delay (s)	32.1	32.3		44.1	40.2		7.4	22.3		4.1	5.8	
Level of Service	C	C		D	D		A	C		A	A	
Approach Delay (s)		32.3			41.1			21.5			5.7	
Approach LOS		C			D			C			A	

Intersection Summary			
HCM Average Control Delay	22.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	880	205	240	1105	80	205	685	170	55	765	65
Lane Group Flow (vph)	50	880	205	240	1105	80	205	685	170	55	765	65
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	32.0	32.0	32.0	12.0	44.0	44.0	9.0	46.0	46.0	37.0	37.0	37.0
Total Split (%)	35.6%	35.6%	35.6%	13.3%	48.9%	48.9%	10.0%	51.1%	51.1%	41.1%	41.1%	41.1%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.49	0.89	0.33	0.82	0.74	0.11	0.66	0.42	0.21	0.21	0.60	0.11
Control Delay	44.1	42.4	5.2	41.8	25.3	5.1	25.3	17.3	3.7	14.1	16.2	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.1	42.4	5.2	41.8	25.3	5.1	25.3	17.3	3.7	14.1	16.2	1.8
Queue Length 50th (m)	6.5	69.4	0.0	22.7	74.6	0.7	18.0	37.3	1.0	3.7	34.1	0.2
Queue Length 95th (m)	#19.9	#99.3	13.6	#56.1	96.4	7.8	#33.1	49.9	10.6	m6.2	51.7	m0.8
Internal Link Dist (m)		464.5			263.2			253.7			89.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	105	1012	628	291	1504	734	312	1647	806	259	1274	597
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.87	0.33	0.82	0.73	0.11	0.66	0.42	0.21	0.21	0.60	0.11

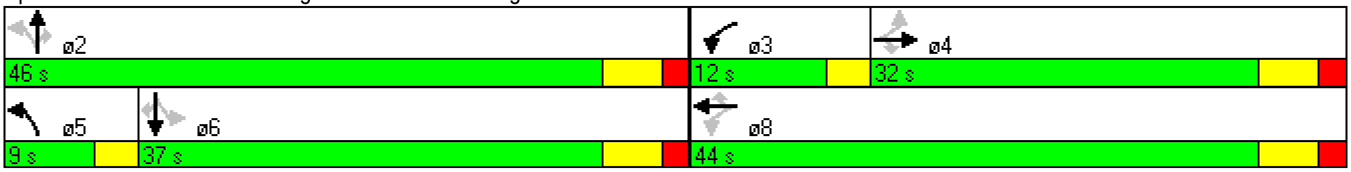
Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 11 (12%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

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

m   Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



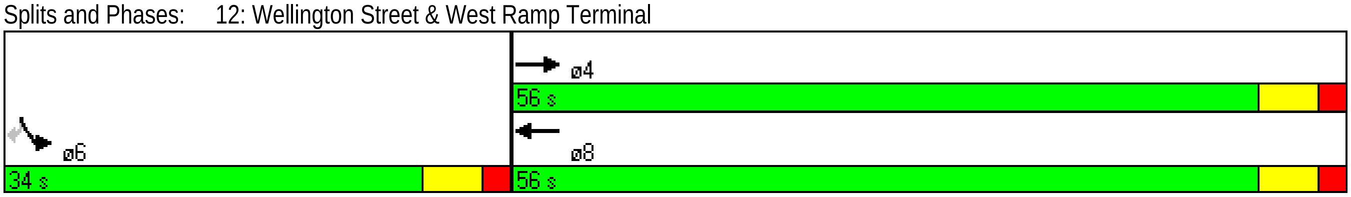
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	880	205	240	1105	80	205	685	170	55	765	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3374	1615	1787	3471	1599	1769	3574	1563	1762	3574	1562
Flt Permitted	0.18	1.00	1.00	0.14	1.00	1.00	0.22	1.00	1.00	0.39	1.00	1.00
Satd. Flow (perm)	350	3374	1615	264	3471	1599	403	3574	1563	726	3574	1562
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	50	880	205	240	1105	80	205	685	170	55	765	65
RTOR Reduction (vph)	0	0	145	0	0	41	0	0	85	0	0	41
Lane Group Flow (vph)	50	880	60	240	1105	39	205	685	85	55	765	24
Confl. Peds. (#/hr)							2		12	12		2
Heavy Vehicles (%)	0%	7%	0%	1%	4%	1%	2%	1%	1%	2%	1%	2%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	25.5	25.5	25.5	37.5	37.5	37.5	40.5	40.5	40.5	31.1	31.1	31.1
Effective Green, g (s)	26.5	26.5	26.5	38.5	38.5	38.5	41.5	41.5	41.5	32.1	32.1	32.1
Actuated g/C Ratio	0.29	0.29	0.29	0.43	0.43	0.43	0.46	0.46	0.46	0.36	0.36	0.36
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	103	993	476	282	1485	684	298	1648	721	259	1275	557
v/s Ratio Prot		c0.26		c0.09	0.32		c0.06	0.19			c0.21	
v/s Ratio Perm	0.14		0.04	0.27		0.02	0.26		0.05	0.08		0.02
v/c Ratio	0.49	0.89	0.13	0.85	0.74	0.06	0.69	0.42	0.12	0.21	0.60	0.04
Uniform Delay, d1	26.1	30.3	23.3	19.9	21.6	15.1	16.3	16.2	13.8	20.2	23.7	18.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.60	0.61	0.26
Incremental Delay, d2	3.6	9.6	0.1	21.1	2.1	0.0	6.5	0.8	0.3	1.4	1.6	0.1
Delay (s)	29.7	39.9	23.4	41.0	23.7	15.1	22.7	16.9	14.2	13.5	16.0	5.0
Level of Service	C	D	C	D	C	B	C	B	B	B	B	A
Approach Delay (s)		36.5			26.1			17.6			15.0	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM Average Control Delay	24.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1150	1695	180	110
Lane Group Flow (vph)	1250	1842	196	120
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	38.0	38.0	33.0	33.0
Total Split (s)	56.0	56.0	34.0	34.0
Total Split (%)	62.2%	62.2%	37.8%	37.8%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.35	0.52	0.36	0.49
Control Delay	5.0	6.1	28.8	31.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	5.0	6.1	28.8	31.5
Queue Length 50th (m)	18.6	32.3	11.4	12.4
Queue Length 95th (m)	30.9	52.3	19.3	25.8
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3525	3559	1327	582
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.35	0.52	0.15	0.21

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 73
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1150	1695	0	180	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5036	5085		3335	1442
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5036	5085		3335	1442
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1250	1842	0	196	120
RTOR Reduction (vph)	0	0	0	0	0	11
Lane Group Flow (vph)	0	1250	1842	0	196	109
Heavy Vehicles (%)	0%	3%	2%	0%	5%	12%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		50.1	50.1		10.9	10.9
Effective Green, g (s)		51.1	51.1		11.9	11.9
Actuated g/C Ratio		0.70	0.70		0.16	0.16
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3525	3560		544	235
v/s Ratio Prot		0.25	c0.36		0.06	
v/s Ratio Perm						c0.08
v/c Ratio		0.35	0.52		0.36	0.46
Uniform Delay, d1		4.4	5.2		27.2	27.7
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.3	0.5		0.4	1.5
Delay (s)		4.6	5.7		27.6	29.1
Level of Service		A	A		C	C
Approach Delay (s)		4.6	5.7		28.2	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	7.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

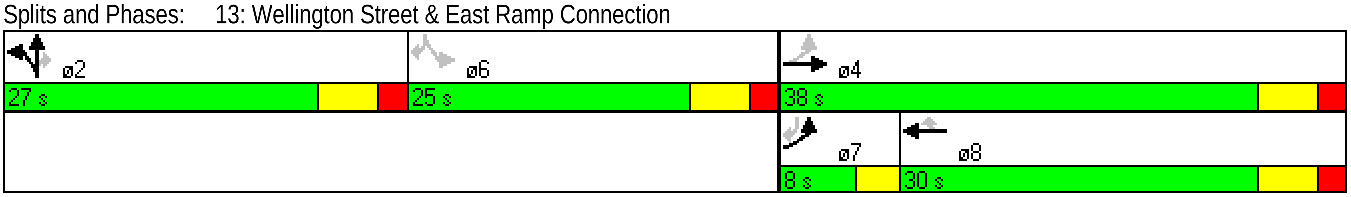
c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	180	845	1115	255	370	290	105	185	680
Lane Group Flow (vph)	196	918	1212	277	350	367	114	201	739
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	8.0	38.0	30.0	30.0	27.0	27.0	27.0	25.0	33.0
Total Split (%)	8.9%	42.2%	33.3%	33.3%	30.0%	30.0%	30.0%	27.8%	36.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.93	0.50	0.87	0.42	0.89	0.87	0.25	0.89	0.85
Control Delay	71.8	23.1	38.7	5.5	59.4	55.3	7.1	72.8	39.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.8	23.1	38.7	5.5	59.4	55.3	7.1	72.8	39.5
Queue Length 50th (m)	20.6	40.9	67.2	0.0	56.4	58.7	0.0	31.2	62.2
Queue Length 95th (m)	#53.2	52.0	#85.8	16.0	#102.0	#103.2	11.4	#67.4	#92.5
Internal Link Dist (m)		150.3	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	210	1826	1397	652	406	436	469	227	874
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	0.93	0.50	0.87	0.42	0.86	0.84	0.24	0.89	0.85

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 89.3
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	845	0	0	1115	255	370	290	105	185	0	680
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.99	1.00	0.95		1.00
Satd. Flow (prot)	1752	4940			4988	1615	1649	1767	1553	1805		2787
Flt Permitted	0.15	1.00			1.00	1.00	0.95	0.99	1.00	0.53		1.00
Satd. Flow (perm)	273	4940			4988	1615	1649	1767	1553	1013		2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	196	918	0	0	1212	277	402	315	114	201	0	739
RTOR Reduction (vph)	0	0	0	0	0	199	0	0	87	0	0	0
Lane Group Flow (vph)	196	918	0	0	1212	78	350	367	27	201	0	739
Heavy Vehicles (%)	3%	5%	0%	0%	4%	0%	4%	1%	4%	0%	0%	2%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	32.0	32.0			24.0	24.0	20.3	20.3	20.3	19.0		30.0
Effective Green, g (s)	33.0	33.0			25.0	25.0	21.3	21.3	21.3	20.0		31.0
Actuated g/C Ratio	0.37	0.37			0.28	0.28	0.24	0.24	0.24	0.22		0.35
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	200	1826			1396	452	393	421	370	227		967
v/s Ratio Prot	0.07	0.19			c0.24		c0.21	0.21				
v/s Ratio Perm	0.30					0.05			0.02	c0.20		c0.27
v/c Ratio	0.98	0.50			0.87	0.17	0.89	0.87	0.07	0.89		0.76
Uniform Delay, d1	24.7	21.8			30.6	24.3	32.9	32.7	26.4	33.5		25.9
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	58.7	1.0			7.5	0.8	21.4	17.6	0.1	30.9		3.6
Delay (s)	83.4	22.8			38.1	25.1	54.3	50.3	26.4	64.5		29.5
Level of Service	F	C			D	C	D	D	C	E		C
Approach Delay (s)		33.5			35.7			48.7			37.0	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM Average Control Delay	37.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	89.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	75.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			303							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

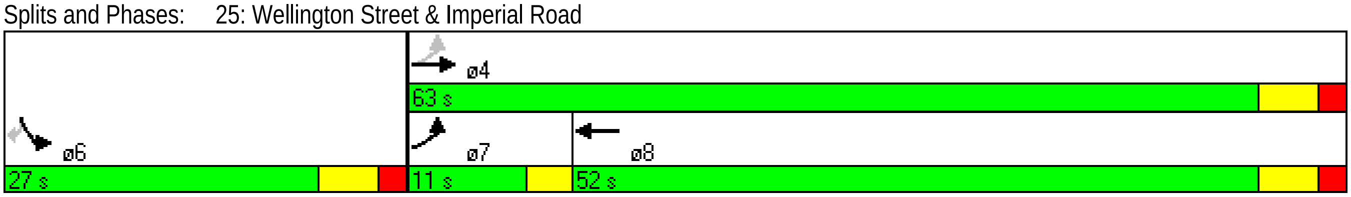
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	120	945	1385	415	35
Lane Group Flow (vph)	120	945	1725	415	35
Turn Type	pm+pt				Perm
Protected Phases	7	4	8	6	
Permitted Phases	4			6	6
Detector Phase	7	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	41.0	41.0	24.0	24.0
Total Split (s)	11.0	63.0	52.0	27.0	27.0
Total Split (%)	12.2%	70.0%	57.8%	30.0%	30.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	C-Max	C-Max	None	None
v/c Ratio	0.47	0.81	0.95	0.95	0.09
Control Delay	14.7	19.1	33.3	67.5	10.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.7	19.1	33.3	67.5	10.1
Queue Length 50th (m)	5.8	100.1	127.6	65.2	0.0
Queue Length 95th (m)	17.4	155.6	#183.2	#115.6	6.5
Internal Link Dist (m)		188.7	176.5	303.2	
Turn Bay Length (m)	100.0				
Base Capacity (vph)	268	1166	1810	437	373
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.45	0.81	0.95	0.95	0.09

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	120	945	1385	340	415	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1810	3371		1787	1417
Flt Permitted	0.08	1.00	1.00		0.95	1.00
Satd. Flow (perm)	153	1810	3371		1787	1417
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	120	945	1385	340	415	35
RTOR Reduction (vph)	0	0	24	0	0	26
Lane Group Flow (vph)	120	945	1702	0	415	9
Confl. Peds. (#/hr)	4			4		
Heavy Vehicles (%)	0%	5%	4%	1%	1%	14%
Turn Type	pm+pt					Perm
Protected Phases	7	4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)	57.0	57.0	46.7		21.0	21.0
Effective Green, g (s)	58.0	58.0	47.7		22.0	22.0
Actuated g/C Ratio	0.64	0.64	0.53		0.24	0.24
Clearance Time (s)	3.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	251	1166	1787		437	346
v/s Ratio Prot	0.04	c0.52	c0.50		c0.23	
v/s Ratio Perm	0.26					0.01
v/c Ratio	0.48	0.81	0.95		0.95	0.02
Uniform Delay, d1	16.6	11.9	20.1		33.5	25.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.4	6.2	12.6		30.9	0.1
Delay (s)	18.0	18.1	32.7		64.4	25.9
Level of Service	B	B	C		E	C
Approach Delay (s)		18.1	32.7		61.4	
Approach LOS		B	C		E	

Intersection Summary			
HCM Average Control Delay	31.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	90.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑↑↑	↑↑↑			
Volume (veh/h)	0	935	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	935	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		327	174			
pX, platoon unblocked						
vC, conflicting volume	0				312	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				312	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				656	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	312	312	312	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.18	0.18	0.18	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	115	360	175	175	410	300	1555	265	105	1660	80
Lane Group Flow (vph)	125	391	190	190	522	326	1690	288	114	1804	87
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	59.0	59.0	9.0	57.0	57.0
Total Split (s)	11.0	35.0	0.0	12.0	36.0	17.0	77.0	77.0	20.0	80.0	80.0
Total Split (%)	7.6%	24.3%	0.0%	8.3%	25.0%	11.8%	53.5%	53.5%	13.9%	55.6%	55.6%
Yellow Time (s)	3.0	4.5		3.0	4.5	3.0	5.5	5.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	2.5	1.0	1.5	1.5	1.0	1.5	1.5
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.0	6.0	3.0	3.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.70	0.61	0.12	0.81	0.80	0.82	0.91	0.31	0.63	0.99	0.10
Control Delay	61.6	58.4	0.2	68.4	64.6	79.6	40.3	7.9	77.6	52.5	11.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.6	58.4	0.2	68.4	64.6	79.6	40.3	7.9	77.6	52.5	11.8
Queue Length 50th (m)	25.2	50.0	0.0	40.0	67.8	43.7	212.1	13.2	29.0	~244.3	7.1
Queue Length 95th (m)	#42.2	64.5	0.0	#66.1	84.9	#72.3	#277.8	31.1	47.7	#297.3	15.6
Internal Link Dist (m)		119.3			205.7		653.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	179	727	1594	236	731	396	1848	936	210	1826	845
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.54	0.12	0.81	0.71	0.82	0.91	0.31	0.54	0.99	0.10

Intersection Summary

Cycle Length: 144
Actuated Cycle Length: 144
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated
~ 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.

Splits and Phases: 35: Paisley Road & Hanlon Parkway

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	115	360	175	175	410	70	300	1555	265	105	1660	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1594	1786	3465		3502	3471	1594	1770	3505	1593
Flt Permitted	0.21	1.00	1.00	0.32	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	392	3610	1594	603	3465		3502	3471	1594	1770	3505	1593
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	125	391	190	190	446	76	326	1690	288	114	1804	87
RTOR Reduction (vph)	0	0	0	0	10	0	0	0	87	0	0	15
Lane Group Flow (vph)	125	391	190	190	512	0	326	1690	201	114	1804	72
Confl. Peds. (#/hr)	1		3	3		1	2		1	1		2
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	4%	0%	2%	3%	0%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	31.7	24.7	144.0	33.7	25.7		15.3	75.7	75.7	13.6	74.0	74.0
Effective Green, g (s)	33.7	25.7	144.0	35.7	26.7		16.3	76.7	76.7	14.6	75.0	75.0
Actuated g/C Ratio	0.23	0.18	1.00	0.25	0.19		0.11	0.53	0.53	0.10	0.52	0.52
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	170	644	1594	223	642		396	1849	849	179	1826	830
v/s Ratio Prot	0.04	0.11		c0.05	0.15		c0.09	0.49		0.06	c0.51	
v/s Ratio Perm	0.13		c0.12	c0.16					0.13			0.04
v/c Ratio	0.74	0.61	0.12	0.85	0.80		0.82	0.91	0.24	0.64	0.99	0.09
Uniform Delay, d1	46.5	54.5	0.0	49.4	56.1		62.4	30.6	18.0	62.2	34.1	17.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	15.2	1.6	0.2	25.5	6.9		13.0	8.5	0.7	7.2	18.4	0.2
Delay (s)	61.7	56.1	0.2	74.9	62.9		75.4	39.1	18.6	69.4	52.5	17.5
Level of Service	E	E	A	E	E		E	D	B	E	D	B
Approach Delay (s)		42.0			66.1			41.7			51.9	
Approach LOS		D			E			D			D	

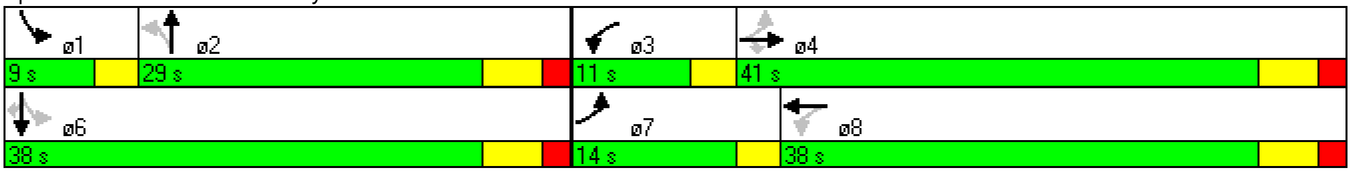
Intersection Summary			
HCM Average Control Delay	48.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	92.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	290	375	60	210	295	65	85	235	135	305
Lane Group Flow (vph)	290	375	60	210	485	65	250	235	135	305
Turn Type	pm+pt		Perm	pm+pt		Perm		pm+pt		Perm
Protected Phases	7	4		3	8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	3	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	8.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	14.0	41.0	41.0	11.0	38.0	29.0	29.0	9.0	38.0	38.0
Total Split (%)	15.6%	45.6%	45.6%	12.2%	42.2%	32.2%	32.2%	10.0%	42.2%	42.2%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	2.0	5.0	5.0	5.0	2.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None
v/c Ratio	0.53	0.41	0.07	0.33	0.58	0.32	0.70	0.94	0.27	0.47
Control Delay	11.1	18.0	5.0	3.9	10.4	35.2	30.1	72.8	26.3	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.1	18.0	5.0	3.9	10.4	35.2	30.1	72.8	26.3	5.4
Queue Length 50th (m)	16.8	36.8	0.0	5.8	18.9	9.2	21.4	30.2	17.0	0.0
Queue Length 95th (m)	34.5	66.7	6.5	m8.6	m24.7	18.1	40.1	#56.0	27.1	15.0
Internal Link Dist (m)		205.7			1213.0		75.2		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	556	922	807	648	833	330	513	249	683	779
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.41	0.07	0.32	0.58	0.20	0.49	0.94	0.20	0.39

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 60 (67%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	290	375	60	210	295	190	65	85	165	235	135	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0		2.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	0.99		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1735	1881	1583	1770	1744		1751	1634		1769	1863	1599
Flt Permitted	0.32	1.00	1.00	0.48	1.00		0.67	1.00		0.27	1.00	1.00
Satd. Flow (perm)	591	1881	1583	890	1744		1236	1634		509	1863	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	290	375	60	210	295	190	65	85	165	235	135	305
RTOR Reduction (vph)	0	0	31	0	22	0	0	89	0	0	0	225
Lane Group Flow (vph)	290	375	29	210	463	0	65	161	0	235	135	80
Confl. Peds. (#/hr)	2					2			2	2		
Heavy Vehicles (%)	4%	1%	2%	2%	2%	1%	0%	0%	0%	2%	2%	1%
Turn Type	pm+pt		Perm	pm+pt			Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	54.6	43.2	43.2	50.0	40.9		13.7	13.7		22.7	22.7	22.7
Effective Green, g (s)	56.3	44.2	44.2	52.0	41.9		14.7	14.7		23.7	23.7	23.7
Actuated g/C Ratio	0.63	0.49	0.49	0.58	0.47		0.16	0.16		0.26	0.26	0.26
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	527	924	777	613	812		202	267		232	491	421
v/s Ratio Prot	c0.08	0.20		0.04	c0.27			c0.10		c0.08	0.07	
v/s Ratio Perm	0.27		0.02	0.16			0.05			0.19		0.05
v/c Ratio	0.55	0.41	0.04	0.34	0.57		0.32	0.60		1.01	0.27	0.19
Uniform Delay, d1	9.4	14.6	11.9	9.3	17.5		33.2	34.9		31.5	26.3	25.7
Progression Factor	1.00	1.00	1.00	0.46	0.49		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.2	1.3	0.1	0.2	1.4		0.9	3.8		62.4	0.3	0.2
Delay (s)	10.6	15.9	12.0	4.4	9.9		34.2	38.8		93.9	26.6	25.9
Level of Service	B	B	B	A	A		C	D		F	C	C
Approach Delay (s)		13.4			8.2			37.8			49.7	
Approach LOS		B			A			D			D	

Intersection Summary			
HCM Average Control Delay	25.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	120	540	145	130	525	150
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	120	540	145	130	525	150
Approach Volume (veh/h)	660			275	675	
Crossing Volume (veh/h)	145			525	120	
High Capacity (veh/h)	1236			915	1261	
High v/c (veh/h)	0.53			0.30	0.54	
Low Capacity (veh/h)	1026			738	1049	
Low v/c (veh/h)	0.64			0.37	0.64	

Intersection Summary			
Maximum v/c High	0.54		
Maximum v/c Low	0.64		
Intersection Capacity Utilization	102.7%	ICU Level of Service	G

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	110	370	50	340	55	565	50	535
Lane Group Flow (vph)	110	450	50	385	55	600	50	650
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.0	29.0	29.0	29.0	28.0	28.0	28.0	28.0
Total Split (s)	38.0	38.0	38.0	38.0	52.0	52.0	52.0	52.0
Total Split (%)	42.2%	42.2%	42.2%	42.2%	57.8%	57.8%	57.8%	57.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.62	0.77	0.39	0.66	0.17	0.55	0.14	0.59
Control Delay	32.5	28.0	32.2	31.0	5.2	6.9	11.1	15.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.5	28.0	32.2	31.0	5.2	6.9	11.1	15.0
Queue Length 50th (m)	11.6	53.5	6.1	50.6	1.5	17.2	3.3	59.1
Queue Length 95th (m)	m24.2	m78.4	15.1	71.3	m3.9	36.7	9.6	102.1
Internal Link Dist (m)		1197.0		206.3		775.8		167.4
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	210	692	152	695	325	1099	362	1097
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.65	0.33	0.55	0.17	0.55	0.14	0.59

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 32 (36%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	370	80	50	340	45	55	565	35	50	535	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1790	1810		1800	1826		1805	1847		1802	1834	
Flt Permitted	0.30	1.00		0.21	1.00		0.29	1.00		0.32	1.00	
Satd. Flow (perm)	556	1810		401	1826		547	1847		609	1834	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	370	80	50	340	45	55	565	35	50	535	115
RTOR Reduction (vph)	0	10	0	0	6	0	0	2	0	0	7	0
Lane Group Flow (vph)	110	440	0	50	379	0	55	598	0	50	643	0
Confl. Peds. (#/hr)	10		4	4		10			4	4		
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	2%	0%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	26.5	26.5		26.5	26.5		51.5	51.5		51.5	51.5	
Effective Green, g (s)	28.5	28.5		28.5	28.5		53.5	53.5		53.5	53.5	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.59	0.59		0.59	0.59	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	176	573		127	578		325	1098		362	1090	
v/s Ratio Prot		c0.24			0.21			0.32			c0.35	
v/s Ratio Perm	0.20			0.12			0.10			0.08		
v/c Ratio	0.62	0.77		0.39	0.66		0.17	0.54		0.14	0.59	
Uniform Delay, d1	26.2	27.8		24.0	26.5		8.2	10.9		8.1	11.4	
Progression Factor	0.74	0.76		1.00	1.00		0.39	0.40		1.00	1.00	
Incremental Delay, d2	5.7	5.2		2.0	2.7		1.1	1.8		0.8	2.3	
Delay (s)	25.1	26.2		26.0	29.2		4.3	6.3		8.9	13.7	
Level of Service	C	C		C	C		A	A		A	B	
Approach Delay (s)		26.0			28.8			6.1			13.4	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	17.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	40	165	75	220	20	500	30	550
Lane Group Flow (vph)	40	220	75	245	20	565	30	585
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	57.0	57.0	57.0	57.0
Total Split (s)	26.0	26.0	26.0	26.0	64.0	64.0	64.0	64.0
Total Split (%)	28.9%	28.9%	28.9%	28.9%	71.1%	71.1%	71.1%	71.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Min	C-Min
v/c Ratio	0.30	0.58	0.48	0.65	0.04	0.43	0.06	0.44
Control Delay	35.2	35.2	41.2	40.2	1.6	4.6	3.9	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.2	35.2	41.2	40.2	1.6	4.6	3.9	4.9
Queue Length 50th (m)	5.4	28.9	10.5	34.9	0.3	25.8	0.9	24.1
Queue Length 95th (m)	13.4	47.1	22.3	54.6	0.9	37.2	m1.8	32.6
Internal Link Dist (m)		218.2		241.7		109.7		775.8
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	160	454	188	447	514	1317	530	1319
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.48	0.40	0.55	0.04	0.43	0.06	0.44

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 64 (71%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	165	55	75	220	25	20	500	65	30	550	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1698	1803		1744	1810		1803	1856		1804	1863	
Flt Permitted	0.37	1.00		0.42	1.00		0.38	1.00		0.39	1.00	
Satd. Flow (perm)	655	1803		770	1810		727	1856		749	1863	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	165	55	75	220	25	20	500	65	30	550	35
RTOR Reduction (vph)	0	14	0	0	5	0	0	5	0	0	2	0
Lane Group Flow (vph)	40	206	0	75	240	0	20	560	0	30	583	0
Confl. Peds. (#/hr)	2		3	3		2	3		2	2		3
Heavy Vehicles (%)	6%	1%	0%	3%	3%	4%	0%	0%	3%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	16.4	16.4		16.4	16.4		61.6	61.6		61.6	61.6	
Effective Green, g (s)	18.4	18.4		18.4	18.4		63.6	63.6		63.6	63.6	
Actuated g/C Ratio	0.20	0.20		0.20	0.20		0.71	0.71		0.71	0.71	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	134	369		157	370		514	1312		529	1317	
v/s Ratio Prot		0.11			c0.13			0.30			c0.31	
v/s Ratio Perm	0.06			0.10			0.03			0.04		
v/c Ratio	0.30	0.56		0.48	0.65		0.04	0.43		0.06	0.44	
Uniform Delay, d1	30.3	32.1		31.6	32.8		4.0	5.5		4.0	5.6	
Progression Factor	1.00	1.00		1.00	1.00		0.31	0.60		0.73	0.64	
Incremental Delay, d2	1.3	1.8		2.3	3.9		0.1	1.0		0.2	0.9	
Delay (s)	31.6	34.0		33.8	36.7		1.4	4.3		3.1	4.5	
Level of Service	C	C		C	D		A	A		A	A	
Approach Delay (s)		33.6			36.1			4.2			4.4	
Approach LOS		C			D			A			A	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

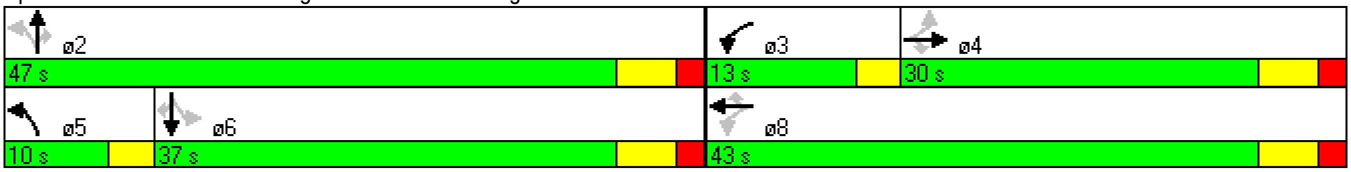
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	780	160	210	720	45	190	505	185	65	570	45
Lane Group Flow (vph)	35	780	160	210	720	45	190	505	185	65	570	45
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	13.0	43.0	43.0	10.0	47.0	47.0	37.0	37.0	37.0
Total Split (%)	33.3%	33.3%	33.3%	14.4%	47.8%	47.8%	11.1%	52.2%	52.2%	41.1%	41.1%	41.1%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	1.0	-2.0	-2.0	1.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.18	0.80	0.28	0.77	0.48	0.06	0.54	0.29	0.21	0.20	0.42	0.07
Control Delay	27.0	37.0	5.6	37.9	20.0	5.0	20.2	14.5	2.8	20.8	22.8	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.0	37.0	5.6	37.9	20.0	5.0	20.2	14.5	2.8	20.8	22.8	7.7
Queue Length 50th (m)	4.2	59.5	0.0	20.8	41.6	0.0	17.0	24.6	0.0	7.0	38.7	1.1
Queue Length 95th (m)	11.2	79.0	12.4	#45.7	55.5	5.4	28.8	34.2	9.4	15.3	47.2	m5.6
Internal Link Dist (m)		464.5			263.2			253.7			91.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	201	1013	580	275	1534	715	353	1749	866	326	1343	602
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.77	0.28	0.76	0.47	0.06	0.54	0.29	0.21	0.20	0.42	0.07

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 60 (67%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



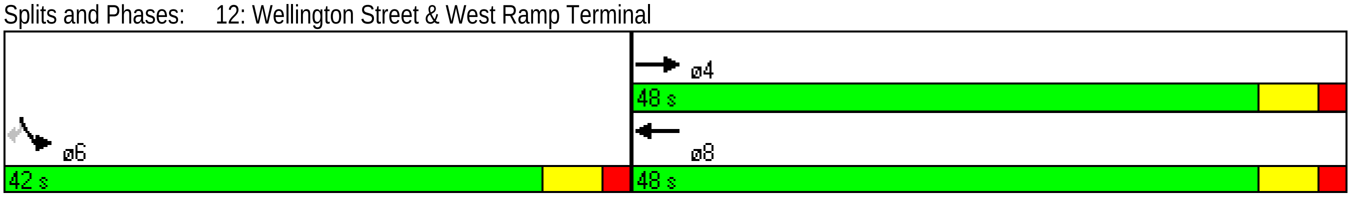
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	780	160	210	720	45	190	505	185	65	570	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1751	3505	1615	1805	3539	1592	1769	3574	1576	1767	3574	1526
Flt Permitted	0.38	1.00	1.00	0.15	1.00	1.00	0.30	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)	697	3505	1615	290	3539	1592	552	3574	1576	868	3574	1526
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	780	160	210	720	45	190	505	185	65	570	45
RTOR Reduction (vph)	0	0	115	0	0	26	0	0	95	0	0	28
Lane Group Flow (vph)	35	780	45	210	720	19	190	505	90	65	570	17
Confl. Peds. (#/hr)	2					2	6		3	3		6
Heavy Vehicles (%)	3%	3%	0%	0%	2%	0%	2%	1%	1%	2%	1%	4%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	23.2	23.2	23.2	36.0	36.0	36.0	42.0	42.0	42.0	31.8	31.8	31.8
Effective Green, g (s)	25.2	25.2	25.2	35.0	38.0	38.0	41.0	44.0	44.0	33.8	33.8	33.8
Actuated g/C Ratio	0.28	0.28	0.28	0.39	0.42	0.42	0.46	0.49	0.49	0.38	0.38	0.38
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	195	981	452	261	1494	672	335	1747	770	326	1342	573
v/s Ratio Prot		c0.22		c0.08	0.20		c0.04	0.14			0.16	
v/s Ratio Perm	0.05		0.03	0.23		0.01	c0.22		0.06	0.07		0.01
v/c Ratio	0.18	0.80	0.10	0.80	0.48	0.03	0.57	0.29	0.12	0.20	0.42	0.03
Uniform Delay, d1	24.6	30.0	24.0	21.5	18.9	15.2	15.9	13.7	12.5	19.0	20.9	17.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.03	1.24
Incremental Delay, d2	0.4	4.5	0.1	16.3	0.2	0.0	2.2	0.4	0.3	1.3	0.9	0.1
Delay (s)	25.0	34.5	24.1	37.8	19.1	15.2	18.1	14.1	12.8	19.5	22.3	22.1
Level of Service	C	C	C	D	B	B	B	B	B	B	C	C
Approach Delay (s)		32.5			23.0			14.7			22.1	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	660	840	230	145
Lane Group Flow (vph)	717	913	250	158
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	37.0	37.0	37.0	37.0
Total Split (s)	48.0	48.0	42.0	42.0
Total Split (%)	53.3%	53.3%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.21	0.26	0.38	0.45
Control Delay	4.1	4.3	24.3	15.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	4.1	4.3	24.3	15.3
Queue Length 50th (m)	8.2	10.9	12.4	6.3
Queue Length 95th (m)	14.9	19.4	20.5	19.3
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3485	3485	2052	898
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.21	0.26	0.12	0.18

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 64.3
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	660	840	0	230	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	5085		3467	1455
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	5085		3467	1455
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	717	913	0	250	158
RTOR Reduction (vph)	0	0	0	0	0	74
Lane Group Flow (vph)	0	717	913	0	250	84
Heavy Vehicles (%)	0%	2%	2%	0%	1%	11%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		42.1	42.1		10.2	10.2
Effective Green, g (s)		44.1	44.1		12.2	12.2
Actuated g/C Ratio		0.69	0.69		0.19	0.19
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3488	3488		658	276
v/s Ratio Prot		0.14	c0.18		c0.07	
v/s Ratio Perm						0.06
v/c Ratio		0.21	0.26		0.38	0.31
Uniform Delay, d1		3.7	3.9		22.7	22.4
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.1	0.2		0.4	0.6
Delay (s)		3.8	4.1		23.1	23.0
Level of Service		A	A		C	C
Approach Delay (s)		3.8	4.1		23.1	
Approach LOS		A	A		C	

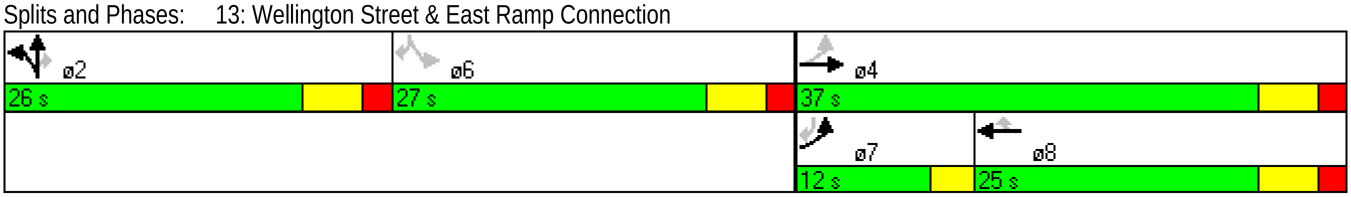
Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	64.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	31.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	155	655	735	230	255	280	125	200	485
Lane Group Flow (vph)	168	712	799	250	249	332	136	217	527
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	12.0	37.0	25.0	25.0	26.0	26.0	26.0	27.0	39.0
Total Split (%)	13.3%	41.1%	27.8%	27.8%	28.9%	28.9%	28.9%	30.0%	43.3%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	1.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
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					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.65	0.37	0.66	0.44	0.63	0.79	0.29	0.84	0.49
Control Delay	32.9	20.8	33.4	6.7	38.1	46.5	7.0	59.6	22.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.9	20.8	33.4	6.7	38.1	46.5	7.0	59.6	22.3
Queue Length 50th (m)	18.4	30.0	42.6	0.0	37.0	51.7	0.0	32.5	35.0
Queue Length 95th (m)	#33.1	39.2	54.9	16.4	60.5	#88.2	12.2	#66.7	49.4
Internal Link Dist (m)		163.9	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	260	1933	1218	562	430	455	499	278	1085
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	0.65	0.37	0.66	0.44	0.58	0.73	0.27	0.78	0.49

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 87.2
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	655	0	0	735	230	255	280	125	200	0	485
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00	0.95		1.00
Satd. Flow (prot)	1770	5085			5036	1538	1698	1796	1568	1805		2814
Flt Permitted	0.18	1.00			1.00	1.00	0.95	1.00	1.00	0.55		1.00
Satd. Flow (perm)	337	5085			5036	1538	1698	1796	1568	1048		2814
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	712	0	0	799	250	277	304	136	217	0	527
RTOR Reduction (vph)	0	0	0	0	0	189	0	0	104	0	0	0
Lane Group Flow (vph)	168	712	0	0	799	61	249	332	32	217	0	527
Heavy Vehicles (%)	2%	2%	0%	0%	3%	5%	1%	0%	3%	0%	0%	1%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	31.1	31.1			19.1	19.1	18.4	18.4	18.4	19.6		34.6
Effective Green, g (s)	30.1	33.1			21.1	21.1	20.4	20.4	20.4	21.6		36.6
Actuated g/C Ratio	0.35	0.38			0.24	0.24	0.23	0.23	0.23	0.25		0.42
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	248	1932			1220	373	398	421	367	260		1182
v/s Ratio Prot	c0.06	0.14			0.16		0.15	c0.18				
v/s Ratio Perm	c0.17					0.04			0.02	c0.21		0.19
v/c Ratio	0.68	0.37			0.65	0.16	0.63	0.79	0.09	0.83		0.45
Uniform Delay, d1	21.8	19.5			29.7	26.0	29.9	31.3	26.1	31.1		18.0
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	13.9	0.5			2.8	0.9	3.1	9.5	0.1	20.0		0.3
Delay (s)	35.7	20.0			32.5	27.0	33.0	40.8	26.2	51.1		18.3
Level of Service	D	C			C	C	C	D	C	D		B
Approach Delay (s)		23.0			31.2			35.3			27.9	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM Average Control Delay	29.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	87.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			305							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	80	655	665	340	80
Lane Group Flow (vph)	0	735	920	340	80
Turn Type	Perm				Perm
Protected Phases		4	8	6	
Permitted Phases	4			6	6
Detector Phase	4	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	41.0	41.0	41.0	24.0	24.0
Total Split (s)	45.0	45.0	45.0	25.0	25.0
Total Split (%)	64.3%	64.3%	64.3%	35.7%	35.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Max	C-Max	C-Max	None	None
v/c Ratio		0.44	0.44	0.67	0.16
Control Delay		8.8	7.2	29.5	5.8
Queue Delay		0.0	0.0	0.0	0.0
Total Delay		8.8	7.2	29.5	5.8
Queue Length 50th (m)		23.6	24.2	35.0	0.0
Queue Length 95th (m)		34.3	34.7	58.1	7.7
Internal Link Dist (m)		188.7	176.3	303.2	
Turn Bay Length (m)					
Base Capacity (vph)		1653	2100	542	536
Starvation Cap Reductn		0	0	0	0
Spillback Cap Reductn		0	0	0	0
Storage Cap Reductn		0	0	0	0
Reduced v/c Ratio		0.44	0.44	0.63	0.15

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 25: Wellington Street & Imperial Road

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	80	655	665	255	340	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.96		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3523	3377		1805	1599
Flt Permitted		0.77	1.00		0.95	1.00
Satd. Flow (perm)		2727	3377		1805	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	655	665	255	340	80
RTOR Reduction (vph)	0	0	54	0	0	58
Lane Group Flow (vph)	0	735	866	0	340	22
Confl. Peds. (#/hr)	6			6		
Heavy Vehicles (%)	1%	2%	2%	1%	0%	1%
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)		40.4	40.4		17.6	17.6
Effective Green, g (s)		42.4	42.4		19.6	19.6
Actuated g/C Ratio		0.61	0.61		0.28	0.28
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		5.0	5.0
Lane Grp Cap (vph)		1652	2045		505	448
v/s Ratio Prot			0.26		c0.19	
v/s Ratio Perm		c0.27				0.01
v/c Ratio		0.44	0.42		0.67	0.05
Uniform Delay, d1		7.4	7.3		22.4	18.4
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.9	0.6		4.6	0.1
Delay (s)		8.3	8.0		26.9	18.5
Level of Service		A	A		C	B
Approach Delay (s)		8.3	8.0		25.3	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑↑↑	↑↑↑			
Volume (veh/h)	0	735	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	735	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		314	188			
pX, platoon unblocked						
vC, conflicting volume	0				245	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				245	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				722	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	245	245	245	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.14	0.14	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	140	370	80	135	355	165	1260	170	50	1315	95
Lane Group Flow (vph)	152	402	87	147	446	179	1370	185	54	1429	103
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	33.0	33.0	9.0	33.0	33.0
Total Split (s)	9.0	35.0	0.0	9.0	35.0	9.0	37.0	37.0	9.0	37.0	37.0
Total Split (%)	10.0%	38.9%	0.0%	10.0%	38.9%	10.0%	41.1%	41.1%	10.0%	41.1%	41.1%
Yellow Time (s)	3.0	4.5		3.0	5.5	3.0	4.5	4.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	1.5	1.0	2.5	2.5	1.0	1.5	1.5
Lost Time Adjust (s)	0.0	-3.0	0.0	0.0	-3.0	0.0	-3.0	-3.0	0.0	-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	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.69	0.52	0.06	0.61	0.58	0.43	0.80	0.21	0.33	0.94	0.14
Control Delay	41.6	33.2	0.1	31.7	29.9	39.9	26.8	3.5	42.9	38.6	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.6	33.2	0.1	31.7	29.9	39.9	26.8	3.5	42.9	38.6	9.5
Queue Length 50th (m)	18.0	29.9	0.0	18.5	30.9	13.8	97.5	0.0	8.2	111.5	4.1
Queue Length 95th (m)	#30.4	39.9	0.0	27.8	42.1	22.4	#159.5	11.3	17.8	#174.5	14.1
Internal Link Dist (m)		119.3			210.1		643.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	219	1243	1577	242	1213	415	1703	863	165	1528	723
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.32	0.06	0.61	0.37	0.43	0.80	0.21	0.33	0.94	0.14

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

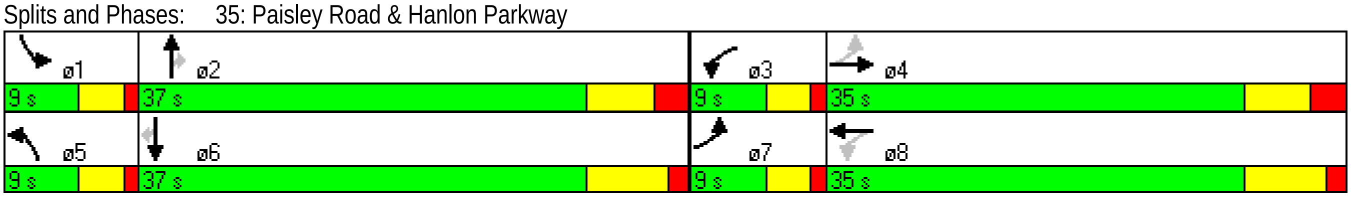
Offset: 62 (69%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

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

Splits and Phases: 35: Paisley Road & Hanlon Parkway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	370	80	135	355	55	165	1260	170	50	1315	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1786	3610	1577	1804	3481		3467	3539	1594	1805	3539	1599
Flt Permitted	0.30	1.00	1.00	0.35	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	556	3610	1577	656	3481		3467	3539	1594	1805	3539	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	402	87	147	386	60	179	1370	185	54	1429	103
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	98	0	0	33
Lane Group Flow (vph)	152	402	87	147	430	0	179	1370	87	54	1429	70
Confl. Peds. (#/hr)	4		5	5		4			1	1		
Heavy Vehicles (%)	1%	0%	1%	0%	1%	4%	1%	2%	0%	0%	2%	1%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	21.4	16.4	90.0	21.4	16.4		10.8	39.5	39.5	7.1	35.8	35.8
Effective Green, g (s)	21.4	19.4	90.0	21.4	19.4		10.8	42.5	42.5	7.1	38.8	38.8
Actuated g/C Ratio	0.24	0.22	1.00	0.24	0.22		0.12	0.47	0.47	0.08	0.43	0.43
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	201	778	1577	220	750		416	1671	753	142	1526	689
v/s Ratio Prot	c0.04	0.11		0.04	0.12		c0.05	c0.39		0.03	c0.40	
v/s Ratio Perm	c0.14		0.06	0.12					0.05			0.04
v/c Ratio	0.76	0.52	0.06	0.67	0.57		0.43	0.82	0.12	0.38	0.94	0.10
Uniform Delay, d1	30.3	31.2	0.0	29.6	31.6		36.7	20.5	13.3	39.4	24.4	15.2
Progression Factor	1.00	1.00	1.00	0.89	0.90		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.9	0.6	0.1	7.1	1.0		0.7	4.6	0.3	1.7	12.2	0.3
Delay (s)	45.2	31.7	0.1	33.4	29.6		37.5	25.1	13.6	41.1	36.6	15.5
Level of Service	D	C	A	C	C		D	C	B	D	D	B
Approach Delay (s)		30.6			30.5			25.1			35.4	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	30.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	250	255	80	235	250	75	105	245	145	210
Lane Group Flow (vph)	250	255	80	235	405	75	295	245	145	210
Turn Type	pm+pt		Perm	Perm		Perm		pm+pt		Perm
Protected Phases	7	4			8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	35.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	13.0	48.0	48.0	35.0	35.0	29.0	29.0	13.0	42.0	42.0
Total Split (%)	14.4%	53.3%	53.3%	38.9%	38.9%	32.2%	32.2%	14.4%	46.7%	46.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	C-Max	C-Max	None	None	None	None	None
v/c Ratio	0.54	0.24	0.09	0.51	0.54	0.30	0.72	0.89	0.22	0.30
Control Delay	10.4	5.6	1.0	22.1	18.4	31.6	31.1	56.6	20.3	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.4	5.6	1.0	22.1	18.4	31.6	31.1	56.6	20.3	3.7
Queue Length 50th (m)	4.9	5.1	0.0	18.4	27.4	10.2	28.8	29.0	16.0	0.0
Queue Length 95th (m)	45.5	45.9	1.9	40.1	57.5	19.5	49.2	#50.0	25.0	11.1
Internal Link Dist (m)		210.1			1197.0		117.0		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	470	1060	872	459	748	341	527	275	787	803
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.24	0.09	0.51	0.54	0.22	0.56	0.89	0.18	0.26

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

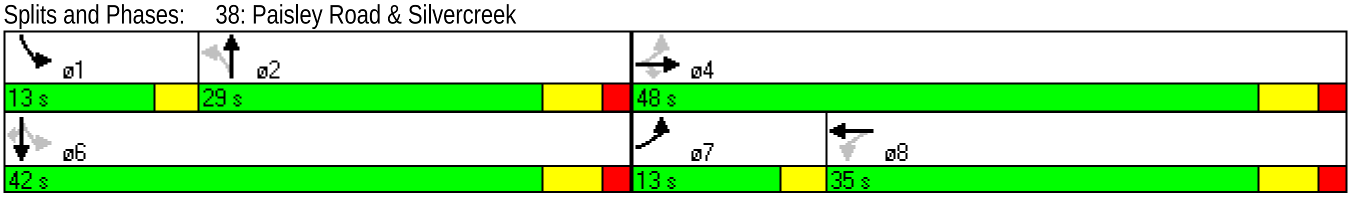
Offset: 52 (58%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

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

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	255	80	235	250	155	75	105	190	245	145	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	4.0	4.0	6.0	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	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	1881	1544	1764	1762		1751	1637		1786	1863	1615
Flt Permitted	0.31	1.00	1.00	0.60	1.00		0.66	1.00		0.21	1.00	1.00
Satd. Flow (perm)	593	1881	1544	1116	1762		1225	1637		390	1863	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	250	255	80	235	250	155	75	105	190	245	145	210
RTOR Reduction (vph)	0	0	37	0	22	0	0	80	0	0	0	137
Lane Group Flow (vph)	250	255	43	235	383	0	75	215	0	245	145	73
Confl. Peds. (#/hr)			3	3					3	3		
Heavy Vehicles (%)	0%	1%	2%	2%	2%	1%	0%	0%	0%	1%	2%	0%
Turn Type	pm+pt		Perm	Perm			Perm			pm+pt		Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	48.7	48.7	48.7	35.0	35.0		16.3	16.3		29.3	29.3	29.3
Effective Green, g (s)	47.7	50.7	48.7	37.0	37.0		18.3	18.3		28.3	31.3	31.3
Actuated g/C Ratio	0.53	0.56	0.54	0.41	0.41		0.20	0.20		0.31	0.35	0.35
Clearance Time (s)	3.0	6.0	6.0	6.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	445	1060	835	459	724		249	333		262	648	562
v/s Ratio Prot	c0.06	0.14			0.22			0.13		c0.09	0.08	
v/s Ratio Perm	c0.24		0.03	0.21			0.06			c0.20		0.05
v/c Ratio	0.56	0.24	0.05	0.51	0.53		0.30	0.65		0.94	0.22	0.13
Uniform Delay, d1	13.3	9.9	9.7	19.8	19.9		30.4	32.9		26.8	20.8	20.0
Progression Factor	0.52	0.45	0.23	0.80	0.78		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.6	0.5	0.1	3.7	2.6		0.7	4.3		38.1	0.2	0.1
Delay (s)	8.5	5.0	2.4	19.6	18.1		31.1	37.2		64.9	20.9	20.2
Level of Service	A	A	A	B	B		C	D		E	C	C
Approach Delay (s)		6.1			18.7			35.9			38.6	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM Average Control Delay	23.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	100	530	335	105	420	295
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	530	335	105	420	295
Approach Volume (veh/h)	630			440	715	
Crossing Volume (veh/h)	335			420	100	
High Capacity (veh/h)	1064			995	1281	
High v/c (veh/h)	0.59			0.44	0.56	
Low Capacity (veh/h)	871			809	1067	
Low v/c (veh/h)	0.72			0.54	0.67	

Intersection Summary			
Maximum v/c High	0.59		
Maximum v/c Low	0.72		
Intersection Capacity Utilization	113.3%	ICU Level of Service	H

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	195	480	40	445	120	660	90	610
Lane Group Flow (vph)	195	555	40	500	120	690	90	720
Turn Type	pm+pt		Perm		pm+pt		pm+pt	
Protected Phases	7	4		8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	29.0	29.0	29.0	8.0	28.0	8.0	28.0
Total Split (s)	8.0	38.0	30.0	30.0	8.0	44.0	8.0	44.0
Total Split (%)	8.9%	42.2%	33.3%	33.3%	8.9%	48.9%	8.9%	48.9%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	0.0	2.0	0.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	2.0	5.0	2.0	5.0
Lead/Lag	Lead		Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	C-Max	None	C-Max
v/c Ratio	0.91	0.81	0.33	0.97	0.58	0.82	0.36	0.89
Control Delay	57.7	29.7	34.9	67.6	26.0	27.8	13.6	39.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.7	29.7	34.9	67.6	26.0	27.8	13.6	39.0
Queue Length 50th (m)	17.3	67.1	5.1	77.8	8.7	61.0	6.3	101.4
Queue Length 95th (m)	m#44.9	m#110.0	14.0	#135.3	m18.5	#150.5	12.4	#165.6
Internal Link Dist (m)		1213.0		222.3		775.1		164.8
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	214	683	121	513	208	845	248	805
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.81	0.33	0.97	0.58	0.82	0.36	0.89

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 21 (23%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

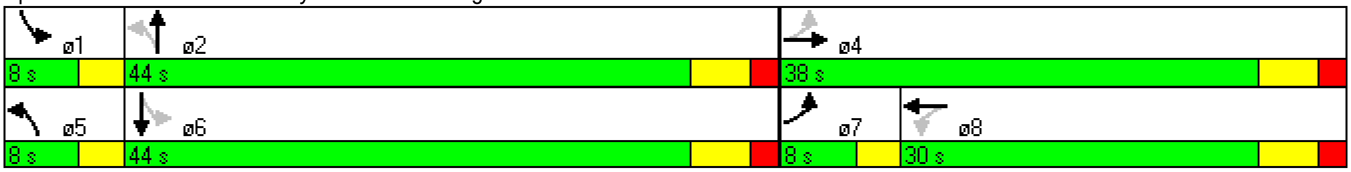
Natural Cycle: 90

Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	480	75	40	445	55	120	660	30	90	610	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0		5.0	5.0		2.0	5.0		2.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	1846		1805	1830		1787	1870		1805	1841	
Flt Permitted	0.15	1.00		0.23	1.00		0.10	1.00		0.14	1.00	
Satd. Flow (perm)	281	1846		437	1830		188	1870		273	1841	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	195	480	75	40	445	55	120	660	30	90	610	110
RTOR Reduction (vph)	0	6	0	0	5	0	0	2	0	0	7	0
Lane Group Flow (vph)	195	549	0	40	495	0	120	688	0	90	713	0
Confl. Peds. (#/hr)	4					4						
Heavy Vehicles (%)	0%	1%	0%	0%	2%	0%	1%	1%	0%	0%	1%	0%
Turn Type	pm+pt			Perm			pm+pt			pm+pt		
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	32.0	32.0		24.0	24.0		44.0	39.0		42.0	38.0	
Effective Green, g (s)	33.0	33.0		25.0	25.0		46.0	40.0		44.0	39.0	
Actuated g/C Ratio	0.37	0.37		0.28	0.28		0.51	0.44		0.49	0.43	
Clearance Time (s)	3.0	6.0		6.0	6.0		3.0	6.0		3.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	205	677		121	508		203	831		219	798	
v/s Ratio Prot	c0.06	0.30			c0.27		c0.04	0.37		0.02	c0.39	
v/s Ratio Perm	0.29			0.09			0.26			0.18		
v/c Ratio	0.95	0.81		0.33	0.97		0.59	0.83		0.41	0.89	
Uniform Delay, d1	25.4	25.7		25.8	32.2		17.5	22.0		16.3	23.6	
Progression Factor	0.87	0.81		1.00	1.00		1.53	0.91		1.00	1.00	
Incremental Delay, d2	42.3	5.8		1.6	33.1		3.4	7.1		1.3	14.5	
Delay (s)	64.5	26.5		27.5	65.3		30.1	27.1		17.6	38.0	
Level of Service	E	C		C	E		C	C		B	D	
Approach Delay (s)		36.4			62.5			27.6			35.8	
Approach LOS		D			E			C			D	

Intersection Summary			
HCM Average Control Delay	38.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	98.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	60	305	120	340	45	705	40	730
Lane Group Flow (vph)	60	345	120	400	45	770	40	775
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	55.0	55.0	55.0	55.0
Total Split (s)	33.0	33.0	33.0	33.0	57.0	57.0	57.0	57.0
Total Split (%)	36.7%	36.7%	36.7%	36.7%	63.3%	63.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.52	0.69	0.78	0.81	0.17	0.68	0.15	0.67
Control Delay	44.1	36.0	62.9	43.0	9.0	24.6	4.9	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.1	36.0	62.9	43.0	9.0	24.6	4.9	6.3
Queue Length 50th (m)	7.9	47.1	17.3	56.7	2.2	73.4	1.3	25.4
Queue Length 95th (m)	19.8	70.6	#41.1	83.9	m6.0	107.6	m1.7	m30.0
Internal Link Dist (m)		842.2		241.7		111.7		775.1
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	132	571	177	565	270	1135	268	1163
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.60	0.68	0.71	0.17	0.68	0.15	0.67

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 70 (78%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	305	40	120	340	60	45	705	65	40	730	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		0.97	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1754	1817		1721	1794		1798	1833		1760	1880	
Flt Permitted	0.23	1.00		0.31	1.00		0.23	1.00		0.23	1.00	
Satd. Flow (perm)	425	1817		569	1794		438	1833		434	1880	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	305	40	120	340	60	45	705	65	40	730	45
RTOR Reduction (vph)	0	6	0	0	7	0	0	3	0	0	2	0
Lane Group Flow (vph)	60	339	0	120	393	0	45	767	0	40	773	0
Confl. Peds. (#/hr)	10		25	25		10	16		22	22		16
Heavy Vehicles (%)	2%	2%	0%	2%	3%	2%	0%	2%	2%	2%	0%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	23.4	23.4		23.4	23.4		54.6	54.6		54.6	54.6	
Effective Green, g (s)	24.4	24.4		24.4	24.4		55.6	55.6		55.6	55.6	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.62	0.62		0.62	0.62	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	115	493		154	486		271	1132		268	1161	
v/s Ratio Prot		0.19			c0.22			c0.42			0.41	
v/s Ratio Perm	0.14			0.21			0.10			0.09		
v/c Ratio	0.52	0.69		0.78	0.81		0.17	0.68		0.15	0.67	
Uniform Delay, d1	27.8	29.4		30.3	30.6		7.3	11.3		7.2	11.2	
Progression Factor	1.00	1.00		1.00	1.00		0.84	1.70		0.45	0.35	
Incremental Delay, d2	4.2	4.0		21.6	9.5		1.2	3.1		0.7	1.9	
Delay (s)	32.1	33.4		51.9	40.2		7.4	22.3		4.0	5.8	
Level of Service	C	C		D	D		A	C		A	A	
Approach Delay (s)		33.2			42.9			21.5			5.7	
Approach LOS		C			D			C			A	

Intersection Summary			
HCM Average Control Delay	22.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	890	210	240	1105	80	205	685	170	55	765	65
Lane Group Flow (vph)	50	890	210	240	1105	80	205	685	170	55	765	65
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	32.0	32.0	32.0	12.0	44.0	44.0	9.0	46.0	46.0	37.0	37.0	37.0
Total Split (%)	35.6%	35.6%	35.6%	13.3%	48.9%	48.9%	10.0%	51.1%	51.1%	41.1%	41.1%	41.1%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.48	0.89	0.34	0.82	0.74	0.11	0.66	0.42	0.21	0.21	0.60	0.11
Control Delay	43.5	43.1	5.2	41.7	25.2	5.1	25.5	17.3	3.7	14.0	16.2	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.5	43.1	5.2	41.7	25.2	5.1	25.5	17.3	3.7	14.0	16.2	1.7
Queue Length 50th (m)	6.5	70.5	0.0	22.7	74.6	0.7	18.0	37.3	1.0	3.7	34.1	0.2
Queue Length 95th (m)	#19.8	#101.1	13.8	#56.1	96.4	7.8	#33.3	49.9	10.6	m6.2	51.8	m0.8
Internal Link Dist (m)		464.5			263.2			253.7			89.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	106	1012	632	291	1504	734	311	1644	804	258	1271	596
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.88	0.33	0.82	0.73	0.11	0.66	0.42	0.21	0.21	0.60	0.11

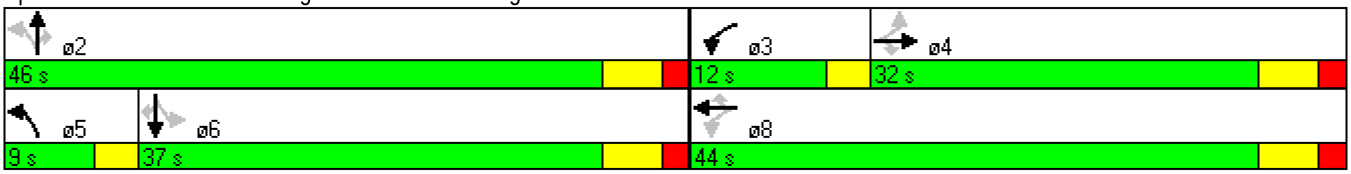
Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 8 (9%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	890	210	240	1105	80	205	685	170	55	765	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	2.0	5.0	5.0	2.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3374	1615	1787	3471	1599	1769	3574	1563	1762	3574	1562
Flt Permitted	0.19	1.00	1.00	0.14	1.00	1.00	0.22	1.00	1.00	0.39	1.00	1.00
Satd. Flow (perm)	352	3374	1615	263	3471	1599	402	3574	1563	726	3574	1562
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	50	890	210	240	1105	80	205	685	170	55	765	65
RTOR Reduction (vph)	0	0	148	0	0	41	0	0	85	0	0	41
Lane Group Flow (vph)	50	890	62	240	1105	39	205	685	85	55	765	24
Confl. Peds. (#/hr)							2		12	12		2
Heavy Vehicles (%)	0%	7%	0%	1%	4%	1%	2%	1%	1%	2%	1%	2%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	25.6	25.6	25.6	37.6	37.6	37.6	40.4	40.4	40.4	31.0	31.0	31.0
Effective Green, g (s)	26.6	26.6	26.6	38.6	38.6	38.6	41.4	41.4	41.4	32.0	32.0	32.0
Actuated g/C Ratio	0.30	0.30	0.30	0.43	0.43	0.43	0.46	0.46	0.46	0.36	0.36	0.36
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	104	997	477	282	1489	686	297	1644	719	258	1271	555
v/s Ratio Prot		c0.26		c0.09	0.32		c0.06	0.19			c0.21	
v/s Ratio Perm	0.14		0.04	0.27		0.02	0.26		0.05	0.08		0.02
v/c Ratio	0.48	0.89	0.13	0.85	0.74	0.06	0.69	0.42	0.12	0.21	0.60	0.04
Uniform Delay, d1	26.0	30.3	23.2	19.9	21.5	15.0	16.3	16.2	13.9	20.2	23.8	19.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.60	0.61	0.25
Incremental Delay, d2	3.5	10.2	0.1	21.1	2.0	0.0	6.7	0.8	0.3	1.4	1.6	0.1
Delay (s)	29.5	40.5	23.3	41.0	23.6	15.1	23.1	17.0	14.2	13.4	16.0	4.8
Level of Service	C	D	C	D	C	B	C	B	B	B	B	A
Approach Delay (s)		36.9			26.0			17.7			15.0	
Approach LOS		D			C			B			B	

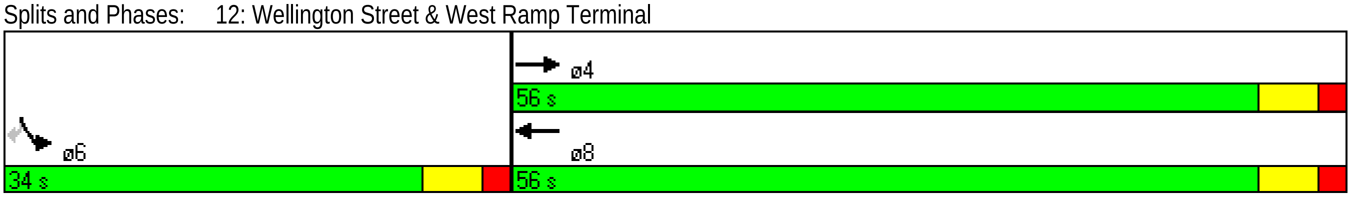
Intersection Summary			
HCM Average Control Delay	24.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	90.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1155	1720	180	110
Lane Group Flow (vph)	1255	1870	196	120
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	38.0	38.0	33.0	33.0
Total Split (s)	56.0	56.0	34.0	34.0
Total Split (%)	62.2%	62.2%	37.8%	37.8%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.36	0.53	0.36	0.49
Control Delay	5.0	6.2	28.7	31.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	5.0	6.2	28.7	31.7
Queue Length 50th (m)	18.7	33.1	11.4	12.5
Queue Length 95th (m)	31.2	53.9	19.3	25.9
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3522	3557	1326	581
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.36	0.53	0.15	0.21

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 73
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1155	1720	0	180	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5036	5085		3335	1442
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5036	5085		3335	1442
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1255	1870	0	196	120
RTOR Reduction (vph)	0	0	0	0	0	10
Lane Group Flow (vph)	0	1255	1870	0	196	110
Heavy Vehicles (%)	0%	3%	2%	0%	5%	12%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		50.1	50.1		10.9	10.9
Effective Green, g (s)		51.1	51.1		11.9	11.9
Actuated g/C Ratio		0.70	0.70		0.16	0.16
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3525	3560		544	235
v/s Ratio Prot		0.25	c0.37		0.06	
v/s Ratio Perm						c0.08
v/c Ratio		0.36	0.53		0.36	0.47
Uniform Delay, d1		4.4	5.2		27.2	27.7
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.3	0.6		0.4	1.5
Delay (s)		4.7	5.8		27.6	29.2
Level of Service		A	A		C	C
Approach Delay (s)		4.7	5.8		28.2	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	7.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	185	845	1115	255	370	290	105	200	710
Lane Group Flow (vph)	201	918	1212	277	350	367	114	217	772
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	9.0	37.0	28.0	28.0	27.0	27.0	27.0	26.0	35.0
Total Split (%)	10.0%	41.1%	31.1%	31.1%	30.0%	30.0%	30.0%	28.9%	38.9%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.87	0.52	0.94	0.45	0.89	0.87	0.25	0.91	0.82
Control Delay	57.7	24.0	48.2	6.0	59.4	55.3	7.1	75.6	36.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.7	24.0	48.2	6.0	59.4	55.3	7.1	75.6	36.3
Queue Length 50th (m)	21.7	41.7	69.6	0.0	56.4	58.7	0.0	33.9	63.6
Queue Length 95th (m)	#51.5	53.0	#95.5	16.5	#102.0	#103.2	11.4	#71.9	#93.2
Internal Link Dist (m)		150.3	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	230	1771	1286	622	406	436	469	238	937
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	0.87	0.52	0.94	0.45	0.86	0.84	0.24	0.91	0.82

Intersection Summary

Cycle Length: 90

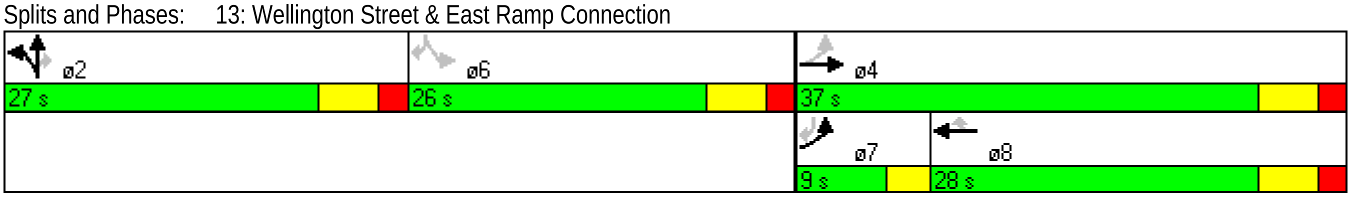
Actuated Cycle Length: 89.3

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

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

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	845	0	0	1115	255	370	290	105	200	0	710
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0			5.0	5.0	5.0	5.0	5.0	5.0		5.0
Lane Util. Factor	1.00	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.99	1.00	0.95		1.00
Satd. Flow (prot)	1752	4940			4988	1615	1649	1767	1553	1805		2787
Flt Permitted	0.16	1.00			1.00	1.00	0.95	0.99	1.00	0.53		1.00
Satd. Flow (perm)	295	4940			4988	1615	1649	1767	1553	1013		2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	918	0	0	1212	277	402	315	114	217	0	772
RTOR Reduction (vph)	0	0	0	0	0	206	0	0	87	0	0	0
Lane Group Flow (vph)	201	918	0	0	1212	71	350	367	27	217	0	772
Heavy Vehicles (%)	3%	5%	0%	0%	4%	0%	4%	1%	4%	0%	0%	2%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	31.0	31.0			22.0	22.0	20.3	20.3	20.3	20.0		32.0
Effective Green, g (s)	32.0	32.0			23.0	23.0	21.3	21.3	21.3	21.0		33.0
Actuated g/C Ratio	0.36	0.36			0.26	0.26	0.24	0.24	0.24	0.24		0.37
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	220	1770			1285	416	393	421	370	238		1030
v/s Ratio Prot	0.07	0.19			c0.24		c0.21	0.21				
v/s Ratio Perm	0.26					0.04			0.02	c0.21		c0.28
v/c Ratio	0.91	0.52			0.94	0.17	0.89	0.87	0.07	0.91		0.75
Uniform Delay, d1	24.0	22.6			32.5	25.7	32.9	32.7	26.4	33.2		24.5
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	41.7	1.1			14.7	0.9	21.4	17.6	0.1	35.4		3.0
Delay (s)	65.7	23.7			47.3	26.6	54.3	50.3	26.4	68.6		27.6
Level of Service	E	C			D	C	D	D	C	E		C
Approach Delay (s)		31.2			43.4			48.7			36.6	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM Average Control Delay	39.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	89.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			303							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

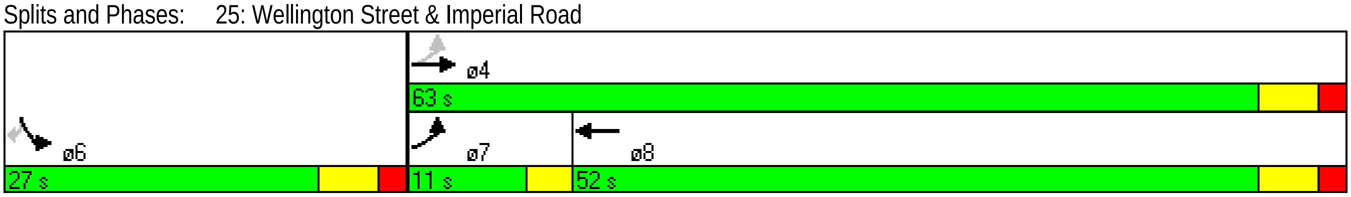
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	120	950	1405	415	35
Lane Group Flow (vph)	120	950	1745	415	35
Turn Type	pm+pt				Perm
Protected Phases	7	4	8	6	
Permitted Phases	4			6	6
Detector Phase	7	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	41.0	41.0	24.0	24.0
Total Split (s)	11.0	63.0	52.0	27.0	27.0
Total Split (%)	12.2%	70.0%	57.8%	30.0%	30.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?	Yes		Yes		
Recall Mode	None	C-Max	C-Max	None	None
v/c Ratio	0.47	0.81	0.96	0.95	0.09
Control Delay	14.7	19.3	35.1	67.5	10.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.7	19.3	35.1	67.5	10.1
Queue Length 50th (m)	5.8	101.3	130.8	65.2	0.0
Queue Length 95th (m)	17.4	157.4	#186.9	#115.6	6.5
Internal Link Dist (m)		188.7	176.5	303.2	
Turn Bay Length (m)	100.0				
Base Capacity (vph)	268	1166	1811	437	373
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.45	0.81	0.96	0.95	0.09

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 25: Wellington Street & Imperial Road



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	120	950	1405	340	415	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	0.95		1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	1810	3372		1787	1417
Flt Permitted	0.08	1.00	1.00		0.95	1.00
Satd. Flow (perm)	153	1810	3372		1787	1417
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	120	950	1405	340	415	35
RTOR Reduction (vph)	0	0	23	0	0	26
Lane Group Flow (vph)	120	950	1722	0	415	9
Confl. Peds. (#/hr)	4			4		
Heavy Vehicles (%)	0%	5%	4%	1%	1%	14%
Turn Type	pm+pt					Perm
Protected Phases	7	4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)	57.0	57.0	46.7		21.0	21.0
Effective Green, g (s)	58.0	58.0	47.7		22.0	22.0
Actuated g/C Ratio	0.64	0.64	0.53		0.24	0.24
Clearance Time (s)	3.0	6.0	6.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	251	1166	1787		437	346
v/s Ratio Prot	0.04	c0.52	c0.51		c0.23	
v/s Ratio Perm	0.26					0.01
v/c Ratio	0.48	0.81	0.96		0.95	0.02
Uniform Delay, d1	16.9	12.0	20.3		33.5	25.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.4	6.3	14.3		30.9	0.1
Delay (s)	18.4	18.3	34.6		64.4	25.9
Level of Service	B	B	C		E	C
Approach Delay (s)		18.3	34.6		61.4	
Approach LOS		B	C		E	

Intersection Summary			
HCM Average Control Delay	32.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	91.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	935	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	935	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		327	174			
pX, platoon unblocked						
vC, conflicting volume	0				312	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				312	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				656	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	312	312	312	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.18	0.18	0.18	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	115	365	175	175	420	300	1560	265	105	1660	80
Lane Group Flow (vph)	125	397	190	190	533	326	1696	288	114	1804	87
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	59.0	59.0	9.0	57.0	57.0
Total Split (s)	11.0	35.0	0.0	12.0	36.0	17.0	77.0	77.0	20.0	80.0	80.0
Total Split (%)	7.6%	24.3%	0.0%	8.3%	25.0%	11.8%	53.5%	53.5%	13.9%	55.6%	55.6%
Yellow Time (s)	3.0	4.5		3.0	4.5	3.0	5.5	5.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	2.5	1.0	1.5	1.5	1.0	1.5	1.5
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	3.0	6.0	3.0	3.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.71	0.61	0.12	0.81	0.81	0.84	0.92	0.31	0.64	0.99	0.10
Control Delay	62.4	58.3	0.2	68.5	64.8	81.0	41.0	8.0	77.9	52.8	11.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.4	58.3	0.2	68.5	64.8	81.0	41.0	8.0	77.9	52.8	11.8
Queue Length 50th (m)	25.2	50.7	0.0	39.8	69.3	43.9	215.1	13.4	29.0	~244.3	7.1
Queue Length 95th (m)	#43.2	65.5	0.0	#66.7	86.8	#72.3	#279.8	31.4	47.7	#297.3	15.6
Internal Link Dist (m)		119.3			205.7		653.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	176	727	1594	236	732	390	1842	933	209	1824	844
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.55	0.12	0.81	0.73	0.84	0.92	0.31	0.55	0.99	0.10

Intersection Summary

Cycle Length: 144
Actuated Cycle Length: 144
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated
~ 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.

Splits and Phases: 35: Paisley Road & Hanlon Parkway

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	115	365	175	175	420	70	300	1560	265	105	1660	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.0	3.0	3.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3610	1594	1786	3467		3502	3471	1594	1770	3505	1593
Flt Permitted	0.20	1.00	1.00	0.32	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	378	3610	1594	595	3467		3502	3471	1594	1770	3505	1593
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	125	397	190	190	457	76	326	1696	288	114	1804	87
RTOR Reduction (vph)	0	0	0	0	10	0	0	0	87	0	0	15
Lane Group Flow (vph)	125	397	190	190	523	0	326	1696	201	114	1804	72
Confl. Peds. (#/hr)	1		3	3		1	2		1	1		2
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	4%	0%	2%	3%	0%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	32.0	25.0	144.0	34.0	26.0		15.1	75.4	75.4	13.6	73.9	73.9
Effective Green, g (s)	34.0	26.0	144.0	36.0	27.0		16.1	76.4	76.4	14.6	74.9	74.9
Actuated g/C Ratio	0.24	0.18	1.00	0.25	0.19		0.11	0.53	0.53	0.10	0.52	0.52
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	169	652	1594	223	650		392	1842	846	179	1823	829
v/s Ratio Prot	0.04	0.11		c0.05	0.15		c0.09	0.49		0.06	c0.51	
v/s Ratio Perm	0.13		c0.12	c0.16					0.13			0.04
v/c Ratio	0.74	0.61	0.12	0.85	0.80		0.83	0.92	0.24	0.64	0.99	0.09
Uniform Delay, d1	46.3	54.3	0.0	49.2	56.0		62.6	31.0	18.2	62.2	34.2	17.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	15.5	1.6	0.2	25.5	7.2		13.9	9.1	0.7	7.2	18.8	0.2
Delay (s)	61.9	55.9	0.2	74.7	63.2		76.6	40.1	18.8	69.4	52.9	17.6
Level of Service	E	E	A	E	E		E	D	B	E	D	B
Approach Delay (s)		42.1			66.2			42.6			52.3	
Approach LOS		D			E			D			D	

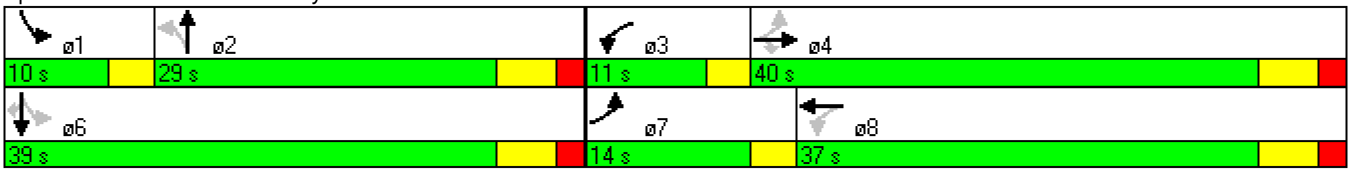
Intersection Summary			
HCM Average Control Delay	48.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	144.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	92.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	290	375	60	210	295	80	135	235	135	305
Lane Group Flow (vph)	290	375	60	210	485	80	320	235	135	305
Turn Type	pm+pt		Perm	pm+pt		Perm		pm+pt		Perm
Protected Phases	7	4		3	8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	3	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	8.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	14.0	40.0	40.0	11.0	37.0	29.0	29.0	10.0	39.0	39.0
Total Split (%)	15.6%	44.4%	44.4%	12.2%	41.1%	32.2%	32.2%	11.1%	43.3%	43.3%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	0.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	2.0	5.0	5.0	2.0	5.0	5.0	5.0	2.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None
v/c Ratio	0.62	0.46	0.08	0.37	0.66	0.30	0.77	0.85	0.22	0.42
Control Delay	16.1	21.5	5.3	7.3	13.5	31.3	38.0	50.0	21.9	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.1	21.5	5.3	7.3	13.5	31.3	38.0	50.0	21.9	4.3
Queue Length 50th (m)	21.0	43.1	0.0	8.7	25.9	10.7	36.7	26.9	15.3	0.0
Queue Length 95th (m)	37.8	68.1	6.7	m11.7	m29.2	20.8	59.9	#51.4	25.5	14.1
Internal Link Dist (m)		205.7			1213.0		75.2		126.1	
Turn Bay Length (m)			35.0	35.0		25.0		65.0		65.0
Base Capacity (vph)	474	819	723	566	734	330	497	276	704	794
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.46	0.08	0.37	0.66	0.24	0.64	0.85	0.19	0.38

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 50 (56%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	290	375	60	210	295	190	80	135	185	235	135	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0		2.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	0.99		1.00	0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1735	1881	1583	1770	1744		1751	1660		1769	1863	1599
Flt Permitted	0.28	1.00	1.00	0.45	1.00		0.67	1.00		0.24	1.00	1.00
Satd. Flow (perm)	505	1881	1583	845	1744		1236	1660		442	1863	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	290	375	60	210	295	190	80	135	185	235	135	305
RTOR Reduction (vph)	0	0	34	0	24	0	0	59	0	0	0	206
Lane Group Flow (vph)	290	375	26	210	461	0	80	261	0	235	135	99
Confl. Peds. (#/hr)	2					2			2	2		
Heavy Vehicles (%)	4%	1%	2%	2%	2%	1%	0%	0%	0%	2%	2%	1%
Turn Type	pm+pt		Perm	pm+pt			Perm			pm+pt		Perm
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	49.4	38.2	38.2	44.2	35.6		18.2	18.2		28.2	28.2	28.2
Effective Green, g (s)	50.8	39.2	39.2	46.2	36.6		19.2	19.2		29.2	29.2	29.2
Actuated g/C Ratio	0.56	0.44	0.44	0.51	0.41		0.21	0.21		0.32	0.32	0.32
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	452	819	689	532	709		264	354		261	604	519
v/s Ratio Prot	c0.09	0.20		0.04	c0.26			c0.16		c0.08	0.07	
v/s Ratio Perm	0.28		0.02	0.16			0.06			0.21		0.06
v/c Ratio	0.64	0.46	0.04	0.39	0.65		0.30	0.74		0.90	0.22	0.19
Uniform Delay, d1	12.5	17.9	14.6	12.3	21.5		29.8	33.0		26.3	22.1	21.9
Progression Factor	1.00	1.00	1.00	0.66	0.50		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.1	1.8	0.1	0.2	2.2		0.7	7.8		31.0	0.2	0.2
Delay (s)	15.7	19.8	14.7	8.4	13.0		30.4	40.8		57.3	22.3	22.1
Level of Service	B	B	B	A	B		C	D		E	C	C
Approach Delay (s)		17.7			11.6			38.8			34.4	
Approach LOS		B			B			D			C	

Intersection Summary			
HCM Average Control Delay	23.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	89.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Right Turn Channelized						
Volume (veh/h)	125	545	145	130	530	150
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	125	545	145	130	530	150
Approach Volume (veh/h)	670			275	680	
Crossing Volume (veh/h)	145			530	125	
High Capacity (veh/h)	1236			911	1256	
High v/c (veh/h)	0.54			0.30	0.54	
Low Capacity (veh/h)	1026			735	1044	
Low v/c (veh/h)	0.65			0.37	0.65	

Intersection Summary			
Maximum v/c High	0.54		
Maximum v/c Low	0.65		
Intersection Capacity Utilization	103.5%	ICU Level of Service	G

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	115	370	50	340	55	565	50	535
Lane Group Flow (vph)	115	450	50	385	55	600	50	650
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	29.0	29.0	29.0	29.0	28.0	28.0	28.0	28.0
Total Split (s)	38.0	38.0	38.0	38.0	52.0	52.0	52.0	52.0
Total Split (%)	42.2%	42.2%	42.2%	42.2%	57.8%	57.8%	57.8%	57.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.65	0.77	0.39	0.66	0.17	0.55	0.14	0.59
Control Delay	34.9	28.6	32.2	31.0	5.1	6.7	11.1	15.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.9	28.6	32.2	31.0	5.1	6.7	11.1	15.0
Queue Length 50th (m)	12.9	55.0	6.1	50.6	1.5	17.2	3.3	59.1
Queue Length 95th (m)	m25.0	m77.5	15.1	71.3	m3.9	37.3	9.6	102.1
Internal Link Dist (m)		1197.0		206.3		775.8		167.4
Turn Bay Length (m)	40.0		105.0		55.0		85.0	
Base Capacity (vph)	210	692	152	695	325	1099	362	1097
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.65	0.33	0.55	0.17	0.55	0.14	0.59

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 36 (40%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Paisley Road & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	115	370	80	50	340	45	55	565	35	50	535	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1790	1810		1800	1826		1805	1847		1802	1834	
Flt Permitted	0.30	1.00		0.21	1.00		0.29	1.00		0.32	1.00	
Satd. Flow (perm)	556	1810		401	1826		547	1847		609	1834	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	115	370	80	50	340	45	55	565	35	50	535	115
RTOR Reduction (vph)	0	10	0	0	6	0	0	2	0	0	7	0
Lane Group Flow (vph)	115	440	0	50	379	0	55	598	0	50	643	0
Confl. Peds. (#/hr)	10		4	4		10			4	4		
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	2%	0%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	26.5	26.5		26.5	26.5		51.5	51.5		51.5	51.5	
Effective Green, g (s)	28.5	28.5		28.5	28.5		53.5	53.5		53.5	53.5	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.59	0.59		0.59	0.59	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	176	573		127	578		325	1098		362	1090	
v/s Ratio Prot		c0.24			0.21			0.32			c0.35	
v/s Ratio Perm	0.21			0.12			0.10			0.08		
v/c Ratio	0.65	0.77		0.39	0.66		0.17	0.54		0.14	0.59	
Uniform Delay, d1	26.5	27.8		24.0	26.5		8.2	10.9		8.1	11.4	
Progression Factor	0.77	0.78		1.00	1.00		0.38	0.39		1.00	1.00	
Incremental Delay, d2	7.1	5.2		2.0	2.7		1.1	1.8		0.8	2.3	
Delay (s)	27.4	26.8		26.0	29.2		4.2	6.1		8.9	13.7	
Level of Service	C	C		C	C		A	A		A	B	
Approach Delay (s)		26.9			28.8			6.0			13.4	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	40	165	75	220	20	500	30	550
Lane Group Flow (vph)	40	220	75	245	20	565	30	585
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	57.0	57.0	57.0	57.0
Total Split (s)	26.0	26.0	26.0	26.0	64.0	64.0	64.0	64.0
Total Split (%)	28.9%	28.9%	28.9%	28.9%	71.1%	71.1%	71.1%	71.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	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	C-Max	C-Max	C-Min	C-Min
v/c Ratio	0.30	0.58	0.48	0.65	0.04	0.43	0.06	0.44
Control Delay	35.2	35.2	41.2	40.2	1.7	4.6	3.7	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.2	35.2	41.2	40.2	1.7	4.6	3.7	4.8
Queue Length 50th (m)	5.4	28.9	10.5	34.9	0.3	25.1	0.9	23.7
Queue Length 95th (m)	13.4	47.1	22.3	54.6	0.8	35.9	m1.7	30.4
Internal Link Dist (m)		218.2		241.7		109.7		775.8
Turn Bay Length (m)	35.0		30.0		55.0		45.0	
Base Capacity (vph)	160	454	188	447	514	1317	530	1319
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.48	0.40	0.55	0.04	0.43	0.06	0.44

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 69 (77%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Waterloo & Edinburgh

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	165	55	75	220	25	20	500	65	30	550	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1698	1803		1744	1810		1803	1856		1804	1863	
Flt Permitted	0.37	1.00		0.42	1.00		0.38	1.00		0.39	1.00	
Satd. Flow (perm)	655	1803		770	1810		727	1856		749	1863	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	165	55	75	220	25	20	500	65	30	550	35
RTOR Reduction (vph)	0	14	0	0	5	0	0	5	0	0	2	0
Lane Group Flow (vph)	40	206	0	75	240	0	20	560	0	30	583	0
Confl. Peds. (#/hr)	2		3	3		2	3		2	2		3
Heavy Vehicles (%)	6%	1%	0%	3%	3%	4%	0%	0%	3%	0%	1%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	16.4	16.4		16.4	16.4		61.6	61.6		61.6	61.6	
Effective Green, g (s)	18.4	18.4		18.4	18.4		63.6	63.6		63.6	63.6	
Actuated g/C Ratio	0.20	0.20		0.20	0.20		0.71	0.71		0.71	0.71	
Clearance Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	134	369		157	370		514	1312		529	1317	
v/s Ratio Prot		0.11			c0.13			0.30			c0.31	
v/s Ratio Perm	0.06			0.10			0.03			0.04		
v/c Ratio	0.30	0.56		0.48	0.65		0.04	0.43		0.06	0.44	
Uniform Delay, d1	30.3	32.1		31.6	32.8		4.0	5.5		4.0	5.6	
Progression Factor	1.00	1.00		1.00	1.00		0.32	0.59		0.70	0.62	
Incremental Delay, d2	1.3	1.8		2.3	3.9		0.1	1.0		0.2	0.9	
Delay (s)	31.6	34.0		33.8	36.7		1.4	4.3		3.0	4.4	
Level of Service	C	C		C	D		A	A		A	A	
Approach Delay (s)		33.6			36.1			4.2			4.3	
Approach LOS		C			D			A			A	

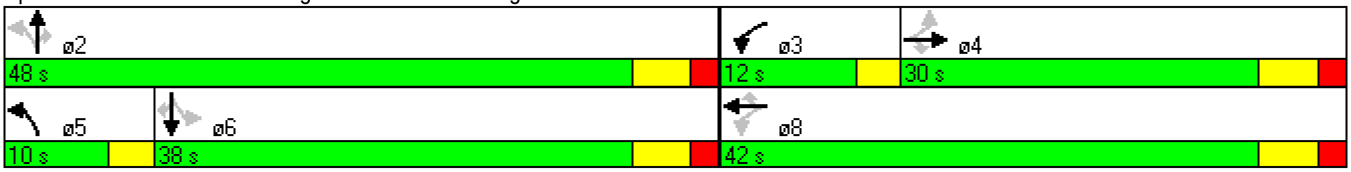
Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	785	160	210	725	45	200	505	185	65	570	45
Lane Group Flow (vph)	35	785	160	210	725	45	200	505	185	65	570	45
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	30.0	30.0	30.0	8.0	30.0	30.0	8.0	37.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	30.0	12.0	42.0	42.0	10.0	48.0	48.0	38.0	38.0	38.0
Total Split (%)	33.3%	33.3%	33.3%	13.3%	46.7%	46.7%	11.1%	53.3%	53.3%	42.2%	42.2%	42.2%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	1.0	-2.0	-2.0	1.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lag	Lead			Lead			Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max
v/c Ratio	0.18	0.80	0.28	0.83	0.50	0.07	0.55	0.28	0.21	0.19	0.41	0.07
Control Delay	27.0	37.1	5.6	45.8	20.8	5.2	19.9	13.9	2.7	20.4	22.6	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.0	37.1	5.6	45.8	20.8	5.2	19.9	13.9	2.7	20.4	22.6	7.8
Queue Length 50th (m)	4.2	60.0	0.0	21.3	42.9	0.0	17.5	24.0	0.0	6.8	38.5	1.1
Queue Length 95th (m)	11.2	79.4	12.4	#49.2	57.2	5.5	29.5	33.4	9.1	15.3	47.0	m5.9
Internal Link Dist (m)		464.5			263.2			253.7			91.1	
Turn Bay Length (m)	50.0		65.0	40.0		45.0	30.0		25.0	40.0		50.0
Base Capacity (vph)	200	1013	580	254	1494	698	363	1780	878	334	1375	614
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.77	0.28	0.83	0.49	0.06	0.55	0.28	0.21	0.19	0.41	0.07

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 64 (71%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Wellington Street & Edinburgh



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	785	160	210	725	45	200	505	185	65	570	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1751	3505	1615	1805	3539	1592	1769	3574	1576	1767	3574	1526
Flt Permitted	0.38	1.00	1.00	0.15	1.00	1.00	0.30	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)	693	3505	1615	290	3539	1592	561	3574	1576	868	3574	1526
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	35	785	160	210	725	45	200	505	185	65	570	45
RTOR Reduction (vph)	0	0	115	0	0	26	0	0	93	0	0	28
Lane Group Flow (vph)	35	785	45	210	725	19	200	505	92	65	570	17
Confl. Peds. (#/hr)	2					2	6		3	3		6
Heavy Vehicles (%)	3%	3%	0%	0%	2%	0%	2%	1%	1%	2%	1%	4%
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		Perm
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	23.2	23.2	23.2	35.2	35.2	35.2	42.8	42.8	42.8	32.6	32.6	32.6
Effective Green, g (s)	25.2	25.2	25.2	34.2	37.2	37.2	41.8	44.8	44.8	34.6	34.6	34.6
Actuated g/C Ratio	0.28	0.28	0.28	0.38	0.41	0.41	0.46	0.50	0.50	0.38	0.38	0.38
Clearance Time (s)	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	194	981	452	245	1463	658	344	1779	784	334	1374	587
v/s Ratio Prot		0.22		c0.08	0.20		c0.04	0.14			0.16	
v/s Ratio Perm	0.05		0.03	c0.25		0.01	c0.23		0.06	0.07		0.01
v/c Ratio	0.18	0.80	0.10	0.86	0.50	0.03	0.58	0.28	0.12	0.19	0.41	0.03
Uniform Delay, d1	24.6	30.1	24.0	22.1	19.5	15.7	15.5	13.2	12.1	18.4	20.3	17.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.05	1.30
Incremental Delay, d2	0.4	4.7	0.1	24.3	0.3	0.0	2.5	0.4	0.3	1.2	0.8	0.1
Delay (s)	25.0	34.8	24.1	46.4	19.7	15.7	18.0	13.6	12.4	19.3	22.2	22.4
Level of Service	C	C	C	D	B	B	B	B	B	B	C	C
Approach Delay (s)		32.7			25.3			14.3			21.9	
Approach LOS		C			C			B			C	

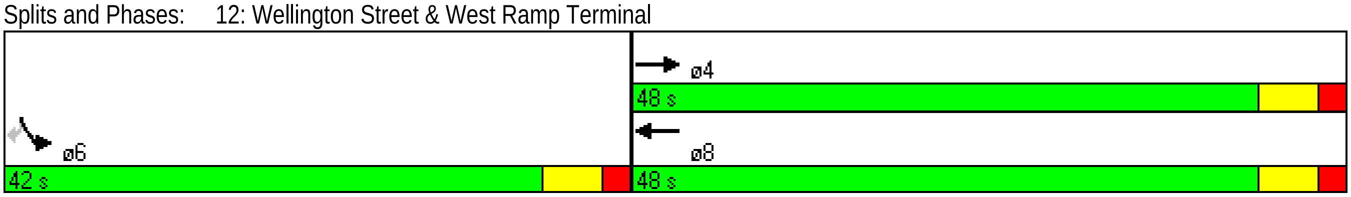
Intersection Summary			
HCM Average Control Delay	23.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	660	845	230	145
Lane Group Flow (vph)	717	918	250	158
Turn Type				Perm
Protected Phases	4	8	6	
Permitted Phases				6
Detector Phase	4	8	6	6
Switch Phase				
Minimum Initial (s)	5.0	5.0	5.0	5.0
Minimum Split (s)	37.0	37.0	37.0	37.0
Total Split (s)	48.0	48.0	42.0	42.0
Total Split (%)	53.3%	53.3%	46.7%	46.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Max	Max	None	None
v/c Ratio	0.21	0.26	0.38	0.45
Control Delay	4.1	4.4	24.3	15.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	4.1	4.4	24.3	15.4
Queue Length 50th (m)	8.2	11.0	12.4	6.4
Queue Length 95th (m)	15.0	19.6	20.5	19.4
Internal Link Dist (m)	66.8	173.5	109.6	
Turn Bay Length (m)				95.0
Base Capacity (vph)	3484	3484	2052	898
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.21	0.26	0.12	0.18

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 64.3
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 12: Wellington Street & West Ramp Terminal



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	660	845	0	230	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		5085	5085		3467	1455
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		5085	5085		3467	1455
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	717	918	0	250	158
RTOR Reduction (vph)	0	0	0	0	0	73
Lane Group Flow (vph)	0	717	918	0	250	85
Heavy Vehicles (%)	0%	2%	2%	0%	1%	11%
Turn Type						Perm
Protected Phases		4	8		6	
Permitted Phases						6
Actuated Green, G (s)		42.1	42.1		10.2	10.2
Effective Green, g (s)		44.1	44.1		12.2	12.2
Actuated g/C Ratio		0.69	0.69		0.19	0.19
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3488	3488		658	276
v/s Ratio Prot		0.14	c0.18		c0.07	
v/s Ratio Perm						0.06
v/c Ratio		0.21	0.26		0.38	0.31
Uniform Delay, d1		3.7	3.9		22.7	22.4
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.1	0.2		0.4	0.6
Delay (s)		3.8	4.1		23.1	23.1
Level of Service		A	A		C	C
Approach Delay (s)		3.8	4.1		23.1	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	64.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	32.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBR
Lane Configurations									
Volume (vph)	160	655	735	235	255	280	125	200	490
Lane Group Flow (vph)	174	712	799	255	249	332	136	217	533
Turn Type	pm+pt			Perm	Split		Perm	custom	custom
Protected Phases	7	4	8		2	2			
Permitted Phases	4			8			2	6	6 7
Detector Phase	7	4	8	8	2	2	2	6	6 7
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	8.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	12.0	38.0	26.0	26.0	25.0	25.0	25.0	27.0	39.0
Total Split (%)	13.3%	42.2%	28.9%	28.9%	27.8%	27.8%	27.8%	30.0%	43.3%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	1.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
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					
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	None	None	None	None	
v/c Ratio	0.68	0.36	0.63	0.44	0.65	0.81	0.29	0.84	0.49
Control Delay	34.3	20.2	32.3	6.5	39.7	49.7	7.2	60.2	22.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.3	20.2	32.3	6.5	39.7	49.7	7.2	60.2	22.6
Queue Length 50th (m)	18.8	29.4	41.9	0.0	37.6	52.5	0.0	32.5	35.6
Queue Length 95th (m)	#35.6	38.4	54.0	16.3	61.3	#91.7	12.4	#66.7	50.1
Internal Link Dist (m)		163.9	264.6			261.7			
Turn Bay Length (m)	120.0			70.0			170.0	85.0	
Base Capacity (vph)	257	1977	1267	578	408	431	480	276	1080
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	0.68	0.36	0.63	0.44	0.61	0.77	0.28	0.79	0.49

Intersection Summary

Cycle Length: 90

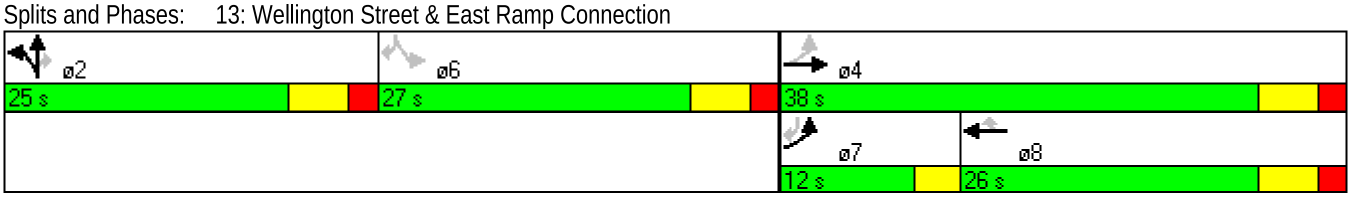
Actuated Cycle Length: 87.7

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

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

Splits and Phases: 13: Wellington Street & East Ramp Connection



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	655	0	0	735	235	255	280	125	200	0	490
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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	0.91			0.91	1.00	0.95	0.95	1.00	1.00		0.88
Frt	1.00	1.00			1.00	0.85	1.00	1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00	0.95		1.00
Satd. Flow (prot)	1770	5085			5036	1538	1698	1796	1568	1805		2814
Flt Permitted	0.17	1.00			1.00	1.00	0.95	1.00	1.00	0.55		1.00
Satd. Flow (perm)	323	5085			5036	1538	1698	1796	1568	1048		2814
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	712	0	0	799	255	277	304	136	217	0	533
RTOR Reduction (vph)	0	0	0	0	0	191	0	0	105	0	0	0
Lane Group Flow (vph)	174	712	0	0	799	64	249	332	31	217	0	533
Heavy Vehicles (%)	2%	2%	0%	0%	3%	5%	1%	0%	3%	0%	0%	1%
Turn Type	pm+pt					Perm	Split		Perm	custom		custom
Protected Phases	7	4			8		2	2				
Permitted Phases	4					8			2	6		6 7
Actuated Green, G (s)	32.1	32.1			20.1	20.1	17.9	17.9	17.9	19.6		34.6
Effective Green, g (s)	31.1	34.1			22.1	22.1	19.9	19.9	19.9	21.6		36.6
Actuated g/C Ratio	0.36	0.39			0.25	0.25	0.23	0.23	0.23	0.25		0.42
Clearance Time (s)	3.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	247	1979			1270	388	386	408	356	258		1176
v/s Ratio Prot	c0.06	0.14			0.16		0.15	c0.18				
v/s Ratio Perm	c0.19					0.04			0.02	c0.21		0.19
v/c Ratio	0.70	0.36			0.63	0.17	0.65	0.81	0.09	0.84		0.45
Uniform Delay, d1	21.4	19.0			29.1	25.6	30.7	32.1	26.7	31.4		18.3
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	15.6	0.5			2.4	0.9	3.7	11.8	0.1	21.2		0.3
Delay (s)	37.0	19.5			31.5	26.5	34.3	43.9	26.8	52.6		18.6
Level of Service	D	B			C	C	C	D	C	D		B
Approach Delay (s)		22.9			30.3			37.3			28.4	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM Average Control Delay	29.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	87.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		198			305							
pX, platoon unblocked												
vC, conflicting volume	0			0			0	0	0	0	0	0
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			0			0	0	0	0	0	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1622			1622			1023	896	1084	1023	896	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	0	0	0	0	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				91		
pX, platoon unblocked						
vC, conflicting volume			0		0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		0	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1622		1023	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	0	0	0	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	0.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	80	655	670	340	80
Lane Group Flow (vph)	0	735	925	340	80
Turn Type	Perm				Perm
Protected Phases		4	8	6	
Permitted Phases	4			6	6
Detector Phase	4	4	8	6	6
Switch Phase					
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	41.0	41.0	41.0	24.0	24.0
Total Split (s)	45.0	45.0	45.0	25.0	25.0
Total Split (%)	64.3%	64.3%	64.3%	35.7%	35.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	C-Max	C-Max	C-Max	None	None
v/c Ratio		0.45	0.44	0.67	0.16
Control Delay		8.8	7.2	29.5	5.8
Queue Delay		0.0	0.0	0.0	0.0
Total Delay		8.8	7.2	29.5	5.8
Queue Length 50th (m)		23.7	24.5	35.0	0.0
Queue Length 95th (m)		34.3	35.3	58.1	7.7
Internal Link Dist (m)		188.7	176.3	303.2	
Turn Bay Length (m)					
Base Capacity (vph)		1651	2101	542	536
Starvation Cap Reductn		0	0	0	0
Spillback Cap Reductn		0	0	0	0
Storage Cap Reductn		0	0	0	0
Reduced v/c Ratio		0.45	0.44	0.63	0.15

Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 25: Wellington Street & Imperial Road

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	80	655	670	255	340	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0
Lane Util. Factor		0.95	0.95		1.00	1.00
Frpb, ped/bikes		1.00	0.99		1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.96		1.00	0.85
Flt Protected		0.99	1.00		0.95	1.00
Satd. Flow (prot)		3523	3378		1805	1599
Flt Permitted		0.77	1.00		0.95	1.00
Satd. Flow (perm)		2724	3378		1805	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	655	670	255	340	80
RTOR Reduction (vph)	0	0	54	0	0	58
Lane Group Flow (vph)	0	735	871	0	340	22
Confl. Peds. (#/hr)	6			6		
Heavy Vehicles (%)	1%	2%	2%	1%	0%	1%
Turn Type	Perm					Perm
Protected Phases		4	8		6	
Permitted Phases	4				6	6
Actuated Green, G (s)		40.4	40.4		17.6	17.6
Effective Green, g (s)		42.4	42.4		19.6	19.6
Actuated g/C Ratio		0.61	0.61		0.28	0.28
Clearance Time (s)		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		5.0	5.0
Lane Grp Cap (vph)		1650	2046		505	448
v/s Ratio Prot			0.26		c0.19	
v/s Ratio Perm		c0.27				0.01
v/c Ratio		0.45	0.43		0.67	0.05
Uniform Delay, d1		7.5	7.3		22.4	18.4
Progression Factor		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.9	0.7		4.6	0.1
Delay (s)		8.3	8.0		26.9	18.5
Level of Service		A	A		C	B
Approach Delay (s)		8.3	8.0		25.3	
Approach LOS		A	A		C	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Volume (veh/h)	0	735	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	735	0	0	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		314	188			
pX, platoon unblocked						
vC, conflicting volume	0				245	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				245	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1622				722	1084

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	245	245	245	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.14	0.14	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

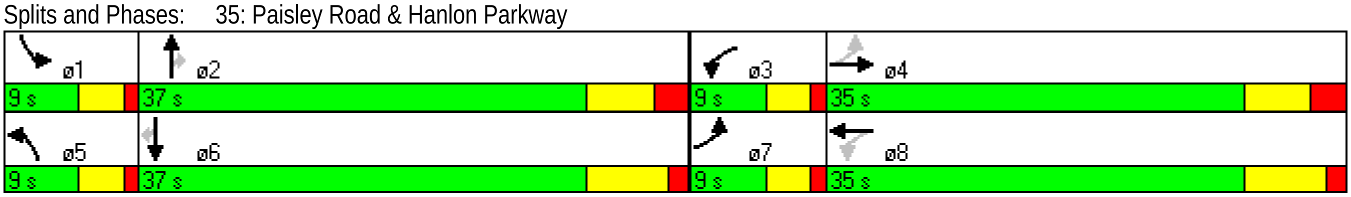
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	140	375	80	135	360	165	1260	170	50	1315	95
Lane Group Flow (vph)	152	408	87	147	451	179	1370	185	54	1429	103
Turn Type	pm+pt		Free	pm+pt		Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8	5	2		1	6	
Permitted Phases	4		Free	8				2			6
Detector Phase	7	4		3	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	5.0	6.0		5.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Minimum Split (s)	9.0	35.0		9.0	35.0	9.0	33.0	33.0	9.0	33.0	33.0
Total Split (s)	9.0	35.0	0.0	9.0	35.0	9.0	37.0	37.0	9.0	37.0	37.0
Total Split (%)	10.0%	38.9%	0.0%	10.0%	38.9%	10.0%	41.1%	41.1%	10.0%	41.1%	41.1%
Yellow Time (s)	3.0	4.5		3.0	5.5	3.0	4.5	4.5	3.0	5.5	5.5
All-Red Time (s)	1.0	2.5		1.0	1.5	1.0	2.5	2.5	1.0	1.5	1.5
Lost Time Adjust (s)	0.0	-3.0	0.0	0.0	-3.0	0.0	-3.0	-3.0	0.0	-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	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None		None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio	0.70	0.52	0.06	0.61	0.59	0.43	0.81	0.21	0.33	0.94	0.14
Control Delay	41.8	33.2	0.1	32.1	30.1	40.0	27.0	3.5	42.9	38.9	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.8	33.2	0.1	32.1	30.1	40.0	27.0	3.5	42.9	38.9	9.5
Queue Length 50th (m)	18.0	30.3	0.0	18.4	31.0	13.8	97.7	0.0	8.2	111.6	4.1
Queue Length 95th (m)	#30.5	40.4	0.0	28.2	42.6	22.4	#159.8	11.3	17.8	#174.5	14.1
Internal Link Dist (m)		119.3			210.1		643.8			107.3	
Turn Bay Length (m)	15.0			45.0		75.0		75.0	105.0		40.0
Base Capacity (vph)	218	1243	1577	240	1213	414	1699	861	165	1525	722
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.33	0.06	0.61	0.37	0.43	0.81	0.21	0.33	0.94	0.14

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 67 (74%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 35: Paisley Road & Hanlon Parkway



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	375	80	135	360	55	165	1260	170	50	1315	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.97	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1786	3610	1577	1804	3482		3467	3539	1594	1805	3539	1599
Flt Permitted	0.29	1.00	1.00	0.34	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	548	3610	1577	646	3482		3467	3539	1594	1805	3539	1599
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	408	87	147	391	60	179	1370	185	54	1429	103
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	98	0	0	33
Lane Group Flow (vph)	152	408	87	147	435	0	179	1370	87	54	1429	70
Confl. Peds. (#/hr)	4		5	5		4			1	1		
Heavy Vehicles (%)	1%	0%	1%	0%	1%	4%	1%	2%	0%	0%	2%	1%
Turn Type	pm+pt		Free	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8					2			6
Actuated Green, G (s)	21.5	16.5	90.0	21.5	16.5		10.7	39.4	39.4	7.1	35.8	35.8
Effective Green, g (s)	21.5	19.5	90.0	21.5	19.5		10.7	42.4	42.4	7.1	38.8	38.8
Actuated g/C Ratio	0.24	0.22	1.00	0.24	0.22		0.12	0.47	0.47	0.08	0.43	0.43
Clearance Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	200	782	1577	219	754		412	1667	751	142	1526	689
v/s Ratio Prot	c0.04	0.11		0.04	0.12		c0.05	c0.39		0.03	c0.40	
v/s Ratio Perm	c0.14		0.06	0.12					0.05			0.04
v/c Ratio	0.76	0.52	0.06	0.67	0.58		0.43	0.82	0.12	0.38	0.94	0.10
Uniform Delay, d1	30.2	31.1	0.0	29.5	31.6		36.8	20.5	13.3	39.4	24.4	15.2
Progression Factor	1.00	1.00	1.00	0.89	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	15.5	0.6	0.1	7.5	1.0		0.7	4.7	0.3	1.7	12.2	0.3
Delay (s)	45.8	31.8	0.1	33.9	29.7		37.6	25.2	13.6	41.1	36.6	15.5
Level of Service	D	C	A	C	C		D	C	B	D	D	B
Approach Delay (s)		30.8			30.7			25.3			35.4	
Approach LOS		C			C			C			D	

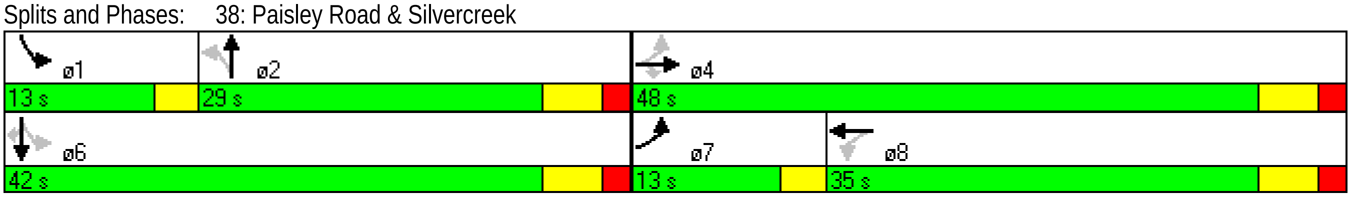
Intersection Summary			
HCM Average Control Delay	30.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	250	255	85	240	250	80	110	245	150	210
Lane Group Flow (vph)	250	255	85	240	405	80	305	245	150	210
Turn Type	pm+pt		Perm	Perm		Perm		pm+pt		Perm
Protected Phases	7	4			8		2	1	6	
Permitted Phases	4		4	8		2		6		6
Detector Phase	7	4	4	8	8	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	35.0	35.0	35.0	35.0	29.0	29.0	8.0	29.0	29.0
Total Split (s)	13.0	48.0	48.0	35.0	35.0	29.0	29.0	13.0	42.0	42.0
Total Split (%)	14.4%	53.3%	53.3%	38.9%	38.9%	32.2%	32.2%	14.4%	46.7%	46.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	1.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	C-Max	C-Max	C-Max	C-Max	None	None	None	None	None
v/c Ratio	0.55	0.24	0.10	0.53	0.55	0.31	0.73	0.89	0.23	0.30
Control Delay	10.4	5.4	0.8	22.6	18.6	31.6	32.0	56.4	20.1	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.4	5.4	0.8	22.6	18.6	31.6	32.0	56.4	20.1	3.7
Queue Length 50th (m)	4.9	5.1	0.0	19.0	27.7	10.8	30.6	28.6	16.4	0.0
Queue Length 95th (m)	45.1	45.6	0.1	41.0	57.8	20.5	51.7	#50.9	25.7	11.1
Internal Link Dist (m)		210.1			1197.0		117.0		126.1	
Turn Bay Length (m)			35.0	35.0		35.0		65.0		65.0
Base Capacity (vph)	462	1050	867	454	740	339	526	275	787	803
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.24	0.10	0.53	0.55	0.24	0.58	0.89	0.19	0.26

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 56 (62%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 38: Paisley Road & Silvercreek



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	255	85	240	250	155	80	110	195	245	150	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			0%			6%			0%	
Total Lost time (s)	4.0	4.0	6.0	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	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1805	1881	1544	1764	1762		1751	1639		1786	1863	1615
Flt Permitted	0.31	1.00	1.00	0.60	1.00		0.66	1.00		0.20	1.00	1.00
Satd. Flow (perm)	585	1881	1544	1116	1762		1219	1639		380	1863	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	250	255	85	240	250	155	80	110	195	245	150	210
RTOR Reduction (vph)	0	0	39	0	23	0	0	78	0	0	0	136
Lane Group Flow (vph)	250	255	46	240	382	0	80	227	0	245	150	74
Confl. Peds. (#/hr)			3	3					3	3		
Heavy Vehicles (%)	0%	1%	2%	2%	2%	1%	0%	0%	0%	1%	2%	0%
Turn Type	pm+pt		Perm	Perm			Perm			pm+pt		Perm
Protected Phases	7	4			8			2		1	6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)	48.2	48.2	48.2	34.6	34.6		16.8	16.8		29.8	29.8	29.8
Effective Green, g (s)	47.2	50.2	48.2	36.6	36.6		18.8	18.8		28.8	31.8	31.8
Actuated g/C Ratio	0.52	0.56	0.54	0.41	0.41		0.21	0.21		0.32	0.35	0.35
Clearance Time (s)	3.0	6.0	6.0	6.0	6.0		6.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	437	1049	827	454	717		255	342		262	658	571
v/s Ratio Prot	c0.06	0.14			0.22			0.14		c0.09	0.08	
v/s Ratio Perm	c0.24		0.03	0.21			0.07			c0.21		0.05
v/c Ratio	0.57	0.24	0.06	0.53	0.53		0.31	0.67		0.94	0.23	0.13
Uniform Delay, d1	13.6	10.2	10.0	20.2	20.2		30.1	32.7		26.4	20.5	19.7
Progression Factor	0.49	0.42	0.18	0.80	0.78		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.8	0.5	0.1	4.0	2.6		0.7	4.8		38.1	0.2	0.1
Delay (s)	8.5	4.8	1.9	20.2	18.4		30.8	37.5		64.6	20.6	19.8
Level of Service	A	A	A	C	B		C	D		E	C	B
Approach Delay (s)		5.9			19.1			36.1			38.1	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM Average Control Delay	23.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX J
Unsignalized Intersection Analysis
& Roundabout

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Volume (veh/h)	15	35	330	20	40	295
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	38	359	22	43	321
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						8
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			54		755	16
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			54		755	16
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			77		85	70
cM capacity (veh/h)			1551		289	1063

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	16	38	359	22	364
Volume Left	0	0	359	0	43
Volume Right	0	38	0	0	321
cSH	1700	1700	1551	1700	1207
Volume to Capacity	0.01	0.02	0.23	0.01	0.30
Queue Length 95th (m)	0.0	0.0	6.3	0.0	9.0
Control Delay (s)	0.0	0.0	8.0	0.0	11.0
Lane LOS			A		B
Approach Delay (s)	0.0		7.6		11.0
Approach LOS					B

Intersection Summary			
Average Delay	8.6		
Intersection Capacity Utilization	34.9%	ICU Level of Service	A
Analysis Period (min)	15		

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Volume (veh/h)	20	15	145	20	30	155
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	16	158	22	33	168
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						8
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			38		359	22
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			38		359	22
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		94	84
cM capacity (veh/h)			1579		574	1058

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	22	16	158	22	201
Volume Left	0	0	158	0	33
Volume Right	0	16	0	0	168
cSH	1700	1700	1579	1700	1263
Volume to Capacity	0.01	0.01	0.10	0.01	0.16
Queue Length 95th (m)	0.0	0.0	2.3	0.0	4.0
Control Delay (s)	0.0	0.0	7.5	0.0	9.5
Lane LOS			A		A
Approach Delay (s)	0.0		6.6		9.5
Approach LOS					A

Intersection Summary			
Average Delay	7.4		
Intersection Capacity Utilization	24.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Volume (veh/h)	15	35	340	20	40	300
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	15	35	340	20	40	300
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						9
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			50		715	15
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			50		715	15
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			78		87	72
cM capacity (veh/h)			1557		311	1065

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	15	35	340	20	340
Volume Left	0	0	340	0	40
Volume Right	0	35	0	0	300
cSH	1700	1700	1557	1700	1206
Volume to Capacity	0.01	0.02	0.22	0.01	0.28
Queue Length 95th (m)	0.0	0.0	5.8	0.0	8.2
Control Delay (s)	0.0	0.0	8.0	0.0	10.7
Lane LOS			A		B
Approach Delay (s)	0.0		7.5		10.7
Approach LOS					B

Intersection Summary			
Average Delay	8.5		
Intersection Capacity Utilization	35.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	↰	↱
Volume (veh/h)	20	15	150	20	30	160
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	20	15	150	20	30	160
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						9
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			35		340	20
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			35		340	20
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		95	85
cM capacity (veh/h)			1576		593	1058

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	20	15	150	20	190
Volume Left	0	0	150	0	30
Volume Right	0	15	0	0	160
cSH	1700	1700	1576	1700	1256
Volume to Capacity	0.01	0.01	0.10	0.01	0.15
Queue Length 95th (m)	0.0	0.0	2.2	0.0	3.7
Control Delay (s)	0.0	0.0	7.5	0.0	9.4
Lane LOS			A		A
Approach Delay (s)	0.0		6.6		9.4
Approach LOS					A

Intersection Summary			
Average Delay	7.4		
Intersection Capacity Utilization	25.0%	ICU Level of Service	A
Analysis Period (min)	15		

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	6.0	6.0	8.0	9.3	5.8	2.9	5.3	6.5

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	77.4	54.0	50.5	70.8	71.0	71.8	64.5	44.4	55.9	100.1	97.6	93.6

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	68.9

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	46.4	28.5	21.0	61.7	38.2	30.4	41.8	24.2	21.0	42.5	14.9	16.3

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	26.4

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	47.9	23.8	3.1	35.0	25.7	10.8	45.9	32.4	14.2	23.7	15.6	1.8

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	24.8

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	3.6	4.2	28.3	9.1	5.5

13: Wellington Street & East Ramp Connection Performance by movement

Movement	WBT	WBR	NBL	NBT	NBR	SBL	SBR	All
Delay / Veh (s)	37.8	8.3	33.0	43.2	6.1	32.8	23.3	30.5

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	39.2	48.9	51.2
Average Queue (m)	14.9	23.2	8.8
95th Queue (m)	29.5	39.8	27.7
Link Distance (m)	69.3	133.2	96.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.4	225.0	111.9	238.9	62.4	325.2	92.4	187.5
Average Queue (m)	33.1	116.3	11.6	107.8	34.8	108.5	39.3	170.2
95th Queue (m)	54.0	196.7	43.6	188.3	68.4	219.5	98.8	217.9
Link Distance (m)		1211.4		235.5		775.9		178.1
Upstream Blk Time (%)				0				33
Queuing Penalty (veh)				0				0
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	2	39		16	0	28		45
Queuing Penalty (veh)	12	67		6	0	30		38

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	B27	SB	SB
Directions Served	L	TR	L	TR	L	TR	T	L	TR
Maximum Queue (m)	42.4	76.7	37.4	124.2	62.1	136.6	65.2	26.7	83.8
Average Queue (m)	12.6	31.1	27.6	70.3	9.4	76.6	3.2	9.3	32.9
95th Queue (m)	26.5	60.4	46.3	114.1	27.9	122.0	23.4	21.0	66.6
Link Distance (m)		845.6		253.4		115.1	90.4		775.9
Upstream Blk Time (%)						3			
Queuing Penalty (veh)						26			
Storage Bay Dist (m)	35.0		30.0		55.0			45.0	
Storage Blk Time (%)	0	9	6	34		21			3
Queuing Penalty (veh)	0	5	22	37		10			1

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	9.0	6.2	6.7	6.9	5.7	0.9	5.4	6.2

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	61.9	33.5	35.9	64.5	25.6	20.8	53.2	26.9	27.3	29.9	21.0	16.2

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	29.5

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	48.2	28.8	17.8	54.1	35.6	27.5	6.3	3.2	1.3	13.0	7.8	7.1

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	14.7

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	36.5	34.5	5.8	39.2	21.1	7.0	36.3	24.8	9.5	37.4	26.1	2.1

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	25.8

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	3.9	4.4	22.3	5.0	6.6

13: Wellington Street & East Ramp Connection Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	25.8	18.1	24.9	7.6	31.4	46.3	7.1	31.5	0.9	17.2	23.1

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	42.9	36.4	35.2
Average Queue (m)	11.8	15.5	14.1
95th Queue (m)	28.5	30.6	31.4
Link Distance (m)	76.7	125.6	81.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.2	143.2	28.5	85.4	62.3	129.0	92.2	136.3
Average Queue (m)	22.0	73.6	12.0	43.9	12.5	63.1	12.1	64.6
95th Queue (m)	45.6	131.5	25.1	73.0	31.2	105.3	38.0	109.1
Link Distance (m)		1196.0		219.7		773.9		180.8
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	1	29				15		3
Queuing Penalty (veh)	4	30				8		1

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	42.4	59.9	37.2	72.9	7.9	26.9	7.9	32.2
Average Queue (m)	8.0	29.8	18.0	37.6	2.0	7.4	4.0	13.3
95th Queue (m)	22.9	55.1	37.5	60.8	7.6	18.5	10.3	25.8
Link Distance (m)		221.6		253.6		113.1		773.9
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	35.0		30.0		55.0		45.0	
Storage Blk Time (%)		6	1	17				
Queuing Penalty (veh)		3	3	13				

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	7.1	8.4	7.6	7.6	5.8	3.3	5.9	7.2

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	195.1	115.7	115.9	102.7	110.4	102.4	68.3	52.6	49.6	51.3	49.1	45.7

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	83.4

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	66.3	33.6	22.2	66.1	44.8	34.9	28.7	25.8	26.4	35.6	17.4	17.7

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	30.1

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	53.2	30.5	3.4	36.7	29.4	12.2	104.0	61.5	23.1	35.5	14.5	2.3

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	36.5

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	4.0	4.7	22.9	7.8	5.7

13: Wellington Street & East Ramp Connection Performance by movement

Movement	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	33.3	12.0	35.7	59.7	6.7	33.5	0.9	25.1	31.4

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	45.0	50.2	58.6
Average Queue (m)	19.6	21.5	12.8
95th Queue (m)	38.9	44.7	34.2
Link Distance (m)	69.3	133.2	96.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.5	329.4	112.2	235.5	62.4	313.9	92.0	182.6
Average Queue (m)	44.5	229.6	17.9	156.2	25.4	129.1	25.3	128.2
95th Queue (m)	56.1	342.2	62.8	232.6	59.4	257.0	62.9	206.2
Link Distance (m)		1211.4		235.5		775.9		178.1
Upstream Blk Time (%)				0				8
Queuing Penalty (veh)				0				0
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	47	40		41	0	38		22
Queuing Penalty (veh)	244	71		16	0	42		20

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	B27	SB	SB
Directions Served	L	TR	L	TR	L	TR	T	L	TR
Maximum Queue (m)	42.3	72.2	37.4	156.3	14.5	115.5	108.4	27.2	75.9
Average Queue (m)	18.9	37.8	23.7	78.2	7.3	82.9	3.6	8.5	40.0
95th Queue (m)	39.1	66.2	43.3	128.5	14.4	115.4	35.7	20.2	70.1
Link Distance (m)		845.6		253.4		115.1	90.4		775.9
Upstream Blk Time (%)						1	0		
Queuing Penalty (veh)						6	1		
Storage Bay Dist (m)	35.0		30.0		55.0			45.0	
Storage Blk Time (%)	0	16	7	35		28			7
Queuing Penalty (veh)	0	9	26	38		13			3

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Delay / Veh (s)	7.3	6.2	8.8	9.6	6.2	5.7	6.7

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	88.7	34.6	46.7	51.4	26.7	26.9	43.7	29.5	18.8	29.1	25.1	19.3

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	32.9

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	44.1	28.7	22.0	61.1	40.1	32.5	6.4	2.5	1.3	12.0	7.3	7.4

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	16.1

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	27.0	31.5	6.5	42.8	20.6	8.9	35.7	24.1	10.3	37.3	26.6	2.0

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	25.5

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	4.4	3.6	22.6	5.0	6.4

13: Wellington Street & East Ramp Connection Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	28.3	20.4	29.7	9.8	33.7	45.4	7.0	29.7	2.7	21.6	25.6

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	42.9	44.4	43.5
Average Queue (m)	14.5	21.4	16.4
95th Queue (m)	34.0	41.0	35.8
Link Distance (m)	76.7	125.6	81.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.5	182.5	27.8	98.9	62.3	103.9	27.8	180.6
Average Queue (m)	36.3	80.9	12.1	54.5	11.1	66.9	8.9	76.1
95th Queue (m)	61.5	136.6	22.4	87.0	36.2	98.5	20.8	135.6
Link Distance (m)		1196.0		219.7		773.9		180.8
Upstream Blk Time (%)								0
Queuing Penalty (veh)								0
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	23	28			0	16		5
Queuing Penalty (veh)	101	31			0	9		2

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	42.4	62.2	37.4	90.8	7.7	19.3	8.0	39.0
Average Queue (m)	6.5	30.3	22.0	47.1	1.6	5.5	3.4	12.7
95th Queue (m)	20.5	50.3	42.6	80.8	6.6	14.9	9.8	27.2
Link Distance (m)		221.6		253.6		113.1		773.9
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	35.0		30.0		55.0		45.0	
Storage Blk Time (%)	0	8	1	24				0
Queuing Penalty (veh)	0	3	3	18				0

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	9.0	9.4	9.8	10.0	6.5	2.4	5.6	8.3

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	113.7	61.4	62.9	185.1	195.4	183.2	60.9	43.5	43.4	82.5	74.1	71.9

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	89.2

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	63.5	25.0	21.7	71.5	45.5	41.5	33.9	27.4	27.0	39.8	16.6	14.0

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	29.3

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	52.8	19.0	2.5	39.2	33.2	16.2	108.2	68.1	24.7	45.5	15.6	1.9

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	38.3

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	4.5	5.1	24.2	11.3	6.3

13: Wellington Street & East Ramp Connection Performance by movement

Movement	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	44.5	10.9	49.6	71.0	6.6	33.3	2.9	21.5	36.8

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	41.0	53.1	37.4
Average Queue (m)	24.3	28.3	13.3
95th Queue (m)	42.9	45.5	30.2
Link Distance (m)	69.3	133.2	96.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.4	260.7	112.4	240.1	62.4	299.2	92.4	182.6
Average Queue (m)	40.7	132.4	36.1	215.3	34.5	106.3	22.4	133.8
95th Queue (m)	57.4	229.7	106.7	280.2	72.3	185.2	63.9	213.0
Link Distance (m)		1211.4		235.5		775.9		178.1
Upstream Blk Time (%)				29				16
Queuing Penalty (veh)				0				0
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	22	39	0	63	0	38		27
Queuing Penalty (veh)	119	71	0	25	0	42		25

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	42.1	66.4	37.4	136.4	62.2	121.6	33.2	95.6
Average Queue (m)	14.3	33.4	23.7	82.0	13.9	85.7	9.6	42.4
95th Queue (m)	31.5	58.9	43.0	127.3	46.3	116.2	23.8	78.3
Link Distance (m)		845.6		253.4		115.1		775.9
Upstream Blk Time (%)						1		
Queuing Penalty (veh)						9		
Storage Bay Dist (m)	35.0		30.0		55.0		45.0	
Storage Blk Time (%)	2	12	7	41		31		7
Queuing Penalty (veh)	6	7	28	45		14		3

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	6.9	6.0	10.1	8.6	6.3	2.2	6.2	6.7

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	92.3	41.3	50.3	62.3	28.2	23.6	41.2	17.2	12.9	41.9	26.1	23.2

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	32.4

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	47.6	34.1	23.8	51.7	35.9	30.6	8.9	3.3	1.6	17.8	12.6	8.2

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	17.1

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	40.1	33.9	6.1	49.9	22.3	8.3	36.7	22.5	9.2	44.5	24.4	2.5

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	26.4

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	4.7	3.8	21.2	4.3	6.4

13: Wellington Street & East Ramp Connection Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	31.2	19.8	32.6	10.7	30.8	43.8	7.4	32.2	0.7	18.2	25.6

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	29.4	42.5	41.4
Average Queue (m)	12.3	22.0	19.8
95th Queue (m)	24.1	40.8	38.8
Link Distance (m)	76.7	125.6	81.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.3	183.0	27.6	92.2	62.4	78.4	92.4	185.4
Average Queue (m)	31.8	103.6	12.2	53.4	11.7	39.4	21.4	84.9
95th Queue (m)	56.2	175.1	24.1	88.0	31.0	69.8	68.6	147.5
Link Distance (m)		1196.0		219.7		773.9		180.8
Upstream Blk Time (%)								0
Queuing Penalty (veh)								0
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	8	42				3		6
Queuing Penalty (veh)	36	48				1		3

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	20.2	62.9	37.3	97.6	8.0	31.8	13.7	91.5
Average Queue (m)	6.0	38.0	15.8	42.4	2.4	7.9	4.3	34.6
95th Queue (m)	14.2	58.1	31.7	72.7	8.1	20.1	11.2	64.7
Link Distance (m)		221.6		253.6		113.1		773.9
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	35.0		30.0		55.0		45.0	
Storage Blk Time (%)		14	0	20				3
Queuing Penalty (veh)		6	0	15				1

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	8.5	7.1	10.1	9.3	6.1	2.9	5.7	7.6

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	156.1	94.8	96.0	158.7	173.5	147.9	80.0	65.7	60.3	112.7	119.2	117.6

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	111.4

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	45.4	27.7	22.1	131.2	124.0	126.7	45.7	23.3	28.1	31.2	15.7	11.4

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	44.7

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	44.0	18.8	3.5	49.3	37.7	17.7	66.3	42.2	16.1	47.6	17.7	1.9

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	32.8

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	4.4	5.3	27.6	11.1	6.6

13: Wellington Street & East Ramp Connection Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	23.7	7.3	40.5	12.4	36.9	57.1	6.8	36.4	1.1	23.5	33.3

5 year after PH3 opening

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	50.5	56.8	36.5
Average Queue (m)	20.2	28.8	11.4
95th Queue (m)	38.6	49.4	29.4
Link Distance (m)	69.3	133.2	96.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.5	409.8	112.5	245.9	62.4	299.2	92.4	182.6
Average Queue (m)	40.8	185.7	17.9	201.8	26.9	158.0	34.1	154.2
95th Queue (m)	57.9	366.9	61.2	292.1	60.4	272.6	87.9	229.0
Link Distance (m)		1211.4		235.5		775.9		178.1
Upstream Blk Time (%)				28				31
Queuing Penalty (veh)				0				0
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	28	38		57	0	41		39
Queuing Penalty (veh)	148	68		23	0	47		35

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	42.4	89.8	37.4	258.0	62.1	114.6	52.3	83.7
Average Queue (m)	9.4	34.6	27.1	164.9	13.0	74.2	9.3	37.5
95th Queue (m)	23.8	60.7	47.6	302.5	40.9	104.7	29.8	64.4
Link Distance (m)		845.6		253.4		115.1		775.9
Upstream Blk Time (%)				18		0		
Queuing Penalty (veh)				0		1		
Storage Bay Dist (m)	35.0		30.0		55.0		45.0	
Storage Blk Time (%)		11	14	50	0	28		2
Queuing Penalty (veh)		6	57	58	0	13		1

5 year after PH3 opening

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Delay / Veh (s)	6.6	6.0	7.5	7.4	8.0	8.4	7.2

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	73.6	26.5	32.0	47.4	29.7	25.1	54.0	28.0	24.2	33.0	22.6	18.6

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	29.8

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	43.8	29.6	21.9	69.5	35.7	28.0	6.6	2.5	1.2	21.5	7.7	7.0

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	15.4

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	39.4	37.3	7.3	44.5	23.2	8.0	34.2	23.7	10.0	44.7	26.0	2.0

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	27.2

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	4.6	4.8	22.9	4.9	6.9

13: Wellington Street & East Ramp Connection Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	31.5	20.2	32.0	12.1	35.6	58.9	7.3	33.3	3.7	19.5	28.1

5 year after PH3 opening

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	40.0	36.7	62.2
Average Queue (m)	13.4	18.2	28.9
95th Queue (m)	31.0	33.8	55.4
Link Distance (m)	76.7	125.6	81.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.2	118.1	27.9	85.5	60.3	119.9	21.3	184.8
Average Queue (m)	33.9	62.5	12.6	55.2	13.1	75.4	9.2	73.2
95th Queue (m)	54.2	107.0	24.5	82.7	32.5	108.5	19.1	135.1
Link Distance (m)		1196.0		219.7		773.9		180.8
Upstream Blk Time (%)								1
Queuing Penalty (veh)								0
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	5	23				19		6
Queuing Penalty (veh)	22	25				10		3

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	42.4	60.6	37.2	104.0	8.0	20.2	14.2	31.6
Average Queue (m)	12.2	32.8	16.9	42.1	2.6	4.9	4.5	13.0
95th Queue (m)	31.2	54.9	35.5	80.6	8.7	14.0	11.8	24.5
Link Distance (m)		221.6		253.6		113.1		773.9
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	35.0		30.0		55.0		45.0	
Storage Blk Time (%)		9	5	15				
Queuing Penalty (veh)		4	12	11				

5 year after PH3 opening

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	7.8	7.0	11.8	12.3	6.0	2.1	5.7	7.9

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	515.3	396.7	378.0	254.1	287.1	275.1	57.8	41.6	45.1	130.1	150.5	139.6

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	213.4

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	59.5	27.7	23.0	62.2	42.2	33.5	42.5	21.1	22.6	23.1	15.9	13.7

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	26.7

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	43.9	26.2	3.6	52.2	38.2	20.8	156.7	90.9	29.3	43.7	18.5	2.0

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	49.1

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	4.3	5.0	25.4	11.9	6.2

13: Wellington Street & East Ramp Connection Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	17.3	15.3	30.4	7.7	41.8	82.4	6.7	34.5	3.0	26.6	33.7

5 years after PH3 opening

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	39.3	73.1	29.0
Average Queue (m)	19.9	36.6	12.8
95th Queue (m)	38.8	63.1	26.2
Link Distance (m)	69.3	133.2	96.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.5	1212.2	112.5	247.4	62.4	160.3	92.4	182.7
Average Queue (m)	44.3	670.2	33.9	230.7	30.4	100.9	38.1	168.8
95th Queue (m)	59.2	1327.7	105.3	280.8	63.8	141.4	96.7	225.4
Link Distance (m)		1211.4		235.5		775.9		178.1
Upstream Blk Time (%)		3		58				40
Queuing Penalty (veh)		27		0				0
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	68	26	0	65	0	33	0	45
Queuing Penalty (veh)	371	50	0	26	0	38	0	41

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	42.1	85.3	37.4	133.1	20.8	106.3	21.6	134.3
Average Queue (m)	13.1	41.7	24.8	71.9	8.9	64.5	5.0	36.1
95th Queue (m)	30.2	70.5	42.8	125.1	17.6	98.2	15.5	77.9
Link Distance (m)		845.6		253.4		115.1		775.9
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	35.0		30.0		55.0		45.0	
Storage Blk Time (%)	1	14	7	36		20		4
Queuing Penalty (veh)	5	9	26	41		9		2

5 years after ph3 opening

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	6.0	5.7	10.3	10.5	6.7	0.4	6.2	7.0

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	71.8	30.0	32.3	48.1	27.9	24.2	40.9	16.4	16.5	33.5	21.1	17.8

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	26.4

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	54.3	32.3	23.8	60.0	45.3	37.4	6.4	3.1	1.2	22.5	11.0	11.1

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	18.5

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	26.8	33.6	7.1	45.8	22.8	8.1	33.5	25.7	10.3	41.6	22.9	1.9

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	26.3

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	4.5	5.2	20.0	4.7	6.9

13: Wellington Street & East Ramp Connection Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	28.7	20.2	35.6	11.2	28.6	41.8	7.8	32.2	1.7	19.1	26.0

5 Years after PH3 opening

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	42.9	46.8	41.6
Average Queue (m)	12.0	24.5	19.1
95th Queue (m)	27.8	44.6	38.8
Link Distance (m)	76.7	125.6	81.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.2	129.8	21.9	97.9	26.5	98.8	28.3	157.7
Average Queue (m)	21.5	70.5	11.6	52.1	8.6	40.5	10.0	71.5
95th Queue (m)	41.9	116.8	22.8	82.8	20.1	71.1	22.0	120.4
Link Distance (m)		1196.0		219.7		773.9		180.8
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	3	28				2		4
Queuing Penalty (veh)	14	33				1		2

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	42.4	72.8	37.3	102.0	8.0	24.8	14.2	69.9
Average Queue (m)	9.1	31.5	17.7	50.9	2.3	5.7	3.4	27.5
95th Queue (m)	23.0	56.1	38.9	91.3	8.2	15.9	10.2	50.5
Link Distance (m)		221.6		253.6		113.1		773.9
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	35.0		30.0		55.0		45.0	
Storage Blk Time (%)		8	2	27				2
Queuing Penalty (veh)		3	6	20				1

5 years after PH3 opening

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	7.7	6.1	10.2	10.2	5.4	2.1	5.3	7.0

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	132.6	92.7	85.5	160.7	165.8	159.4	44.4	34.7	32.2	66.9	78.0	73.0

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	88.8

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	59.9	26.3	20.9	101.3	89.1	79.0	39.4	24.5	21.2	39.1	16.9	12.2

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	38.5

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	34.6	23.6	3.6	75.8	71.2	51.4	314.8	243.0	143.1	65.9	19.4	3.0

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	100.8

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	4.6	5.3	24.1	10.6	6.2

13: Wellington Street & East Ramp Connection Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	20.6	18.9	35.3	10.5	33.7	56.4	6.5	34.7	5.3	26.1	31.4

10 Years after PH3 Opening

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	39.2	61.8	30.7
Average Queue (m)	16.2	33.0	11.2
95th Queue (m)	30.7	54.9	24.7
Link Distance (m)	69.3	133.2	96.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.2	352.3	112.3	240.1	62.4	169.0	92.4	182.6
Average Queue (m)	37.9	186.8	28.4	190.5	24.5	84.5	39.7	169.6
95th Queue (m)	56.4	303.9	91.2	277.3	57.8	129.3	101.9	221.4
Link Distance (m)		1211.4		235.5		775.9		178.1
Upstream Blk Time (%)				17				25
Queuing Penalty (veh)				0				0
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	22	43		55	0	26		45
Queuing Penalty (veh)	121	80		22	0	31		40

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	B27	SB	SB
Directions Served	L	TR	L	TR	L	TR	T	L	TR
Maximum Queue (m)	42.4	85.9	37.3	258.0	62.3	110.9	112.2	52.3	71.5
Average Queue (m)	12.9	35.6	28.4	143.3	12.0	77.2	7.5	11.3	38.6
95th Queue (m)	33.0	69.1	44.8	263.2	39.5	105.3	53.5	32.7	67.2
Link Distance (m)		845.6		253.4		115.1	90.4		775.9
Upstream Blk Time (%)				0		0	0		
Queuing Penalty (veh)				0		0	1		
Storage Bay Dist (m)	35.0		30.0		55.0			45.0	
Storage Blk Time (%)	1	10	9	53	0	24			6
Queuing Penalty (veh)	3	6	34	64	0	11			2

10 years after PH3 opening

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	7.5	7.6	9.1	7.7	7.5	0.7	6.3	7.6

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	70.3	27.8	32.3	52.3	27.5	21.2	41.4	21.5	16.7	34.8	18.2	16.6

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	26.1

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	55.3	30.3	21.0	60.0	35.6	24.8	8.8	3.8	2.3	20.2	12.5	13.4

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	17.4

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	64.5	48.6	11.8	44.1	22.3	9.0	41.7	26.2	10.2	45.3	22.5	2.1

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	30.5

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	4.5	5.0	20.8	5.4	6.8

13: Wellington Street & East Ramp Connection Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	29.9	21.1	31.4	12.2	32.6	48.4	7.5	38.8	1.4	18.5	26.8

10 Years after PH3 opening

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	43.0	49.3	50.9
Average Queue (m)	11.9	20.6	20.7
95th Queue (m)	30.9	37.2	40.8
Link Distance (m)	76.7	125.6	81.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.2	167.3	27.8	97.7	26.4	125.2	21.8	113.4
Average Queue (m)	24.0	65.4	12.5	51.0	8.5	55.0	10.5	55.7
95th Queue (m)	48.5	125.1	26.7	80.1	20.1	102.4	18.6	95.6
Link Distance (m)		1196.0		219.7		773.9		180.8
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	2	22				8		1
Queuing Penalty (veh)	10	25				4		1

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	29.1	72.8	37.5	98.2	13.9	26.1	14.2	85.2
Average Queue (m)	9.2	34.0	19.5	44.6	2.3	8.9	4.0	32.7
95th Queue (m)	21.1	63.8	37.9	77.7	8.7	19.3	10.9	64.1
Link Distance (m)		221.6		253.6		113.1		773.9
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	35.0		30.0		55.0		45.0	
Storage Blk Time (%)	0	9	1	16				5
Queuing Penalty (veh)	0	4	2	12				2

10 years after PH3 opening

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	8.6	8.2	10.7	10.4	5.9	3.6	5.8	8.0

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	170.9	116.4	114.8	297.3	383.2	377.0	62.6	46.3	52.8	49.5	48.5	39.5

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	128.7

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	52.0	33.0	29.5	72.0	56.5	49.7	52.8	25.4	19.0	47.3	19.5	20.8

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	32.8

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	36.4	19.0	3.7	49.2	39.6	22.6	195.9	129.9	60.1	65.9	18.6	2.6

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	57.6

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	4.3	6.1	24.4	13.7	6.7

13: Wellington Street & East Ramp Connection Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	22.6	20.8	50.3	16.0	41.1	62.4	6.8	34.5	2.9	23.9	38.2

10 years after PH3 opening

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	41.1	53.4	36.6
Average Queue (m)	22.7	29.4	12.2
95th Queue (m)	40.0	51.4	29.1
Link Distance (m)	69.3	133.2	96.5
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.5	590.4	112.3	245.9	62.4	208.3	92.3	184.2
Average Queue (m)	41.9	238.5	32.2	212.2	36.2	112.8	27.8	135.6
95th Queue (m)	55.6	434.8	98.6	304.0	71.1	192.9	71.5	197.0
Link Distance (m)		1211.4		235.5		775.9		178.1
Upstream Blk Time (%)				50				5
Queuing Penalty (veh)				0				0
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	20	51		60	0	33		26
Queuing Penalty (veh)	111	100		24	0	40		23

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	40.4	146.9	37.4	180.6	62.3	109.5	20.9	88.0
Average Queue (m)	12.5	42.6	24.1	99.1	11.6	75.0	9.5	49.5
95th Queue (m)	26.5	87.7	43.2	166.3	36.3	103.6	18.1	86.3
Link Distance (m)		845.6		253.4		115.1		775.9
Upstream Blk Time (%)						0		
Queuing Penalty (veh)						0		
Storage Bay Dist (m)	35.0		30.0		55.0		45.0	
Storage Blk Time (%)		14	4	51		27		11
Queuing Penalty (veh)		8	15	61		12		4

10 years after PH3 opening

1: Silvercreek & East Ramp Connection Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBT	NBR	All
Delay / Veh (s)	5.6	5.8	10.0	9.6	7.0	1.6	6.6	7.0

4: Paisley Road & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	63.0	32.5	41.3	55.7	27.1	16.7	39.3	18.5	13.0	31.3	23.1	19.4

4: Paisley Road & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	27.2

5: Waterloo & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	51.0	34.8	20.2	98.8	58.0	46.7	8.3	3.6	1.8	22.1	11.1	14.0

5: Waterloo & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	22.0

9: Wellington Street & Edinburgh Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay / Veh (s)	74.9	69.8	27.2	56.4	24.0	8.9	42.1	26.4	10.1	51.6	22.1	2.1

9: Wellington Street & Edinburgh Performance by movement

Movement	All
Delay / Veh (s)	37.3

12: Wellington Street & West Ramp Terminal Performance by movement

Movement	EBT	WBT	SBL	SBR	All
Delay / Veh (s)	5.0	5.5	23.6	4.5	7.4

13: Wellington Street & East Ramp Connection Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	27.7	20.8	33.5	12.6	35.4	56.7	7.7	33.3	2.0	18.9	27.8

10 years after PH3 opening

Intersection: 1: Silvercreek & East Ramp Connection

Movement	EB	WB	NB
Directions Served	TR	LT	LR
Maximum Queue (m)	42.9	53.3	48.6
Average Queue (m)	12.5	24.3	20.9
95th Queue (m)	32.0	47.2	42.3
Link Distance (m)	76.7	125.6	81.6
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: Paisley Road & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	47.3	200.8	40.7	91.4	62.4	99.1	92.1	185.4
Average Queue (m)	21.9	76.5	14.6	43.3	14.8	45.8	12.2	77.7
95th Queue (m)	45.5	146.1	29.6	76.9	41.8	85.2	38.6	148.2
Link Distance (m)		1196.0		219.7		773.9		180.8
Upstream Blk Time (%)								1
Queuing Penalty (veh)								0
Storage Bay Dist (m)	40.0		105.0		55.0		85.0	
Storage Blk Time (%)	2	29			0	5		5
Queuing Penalty (veh)	7	33			0	3		3

Intersection: 5: Waterloo & Edinburgh

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	42.2	79.7	37.4	119.4	7.9	26.3	21.3	51.8
Average Queue (m)	8.5	33.0	24.3	62.1	2.0	8.5	4.6	28.1
95th Queue (m)	23.0	59.5	44.4	111.8	7.6	18.5	13.6	52.9
Link Distance (m)		221.6		253.6		113.1		773.9
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	35.0		30.0		55.0		45.0	
Storage Blk Time (%)	0	12	12	34				2
Queuing Penalty (veh)	0	5	30	25				1

10 years after PH3 opening

APPENDIX C

PRELIMINARY DESIGN DRAWINGS & CROSS SECTIONS

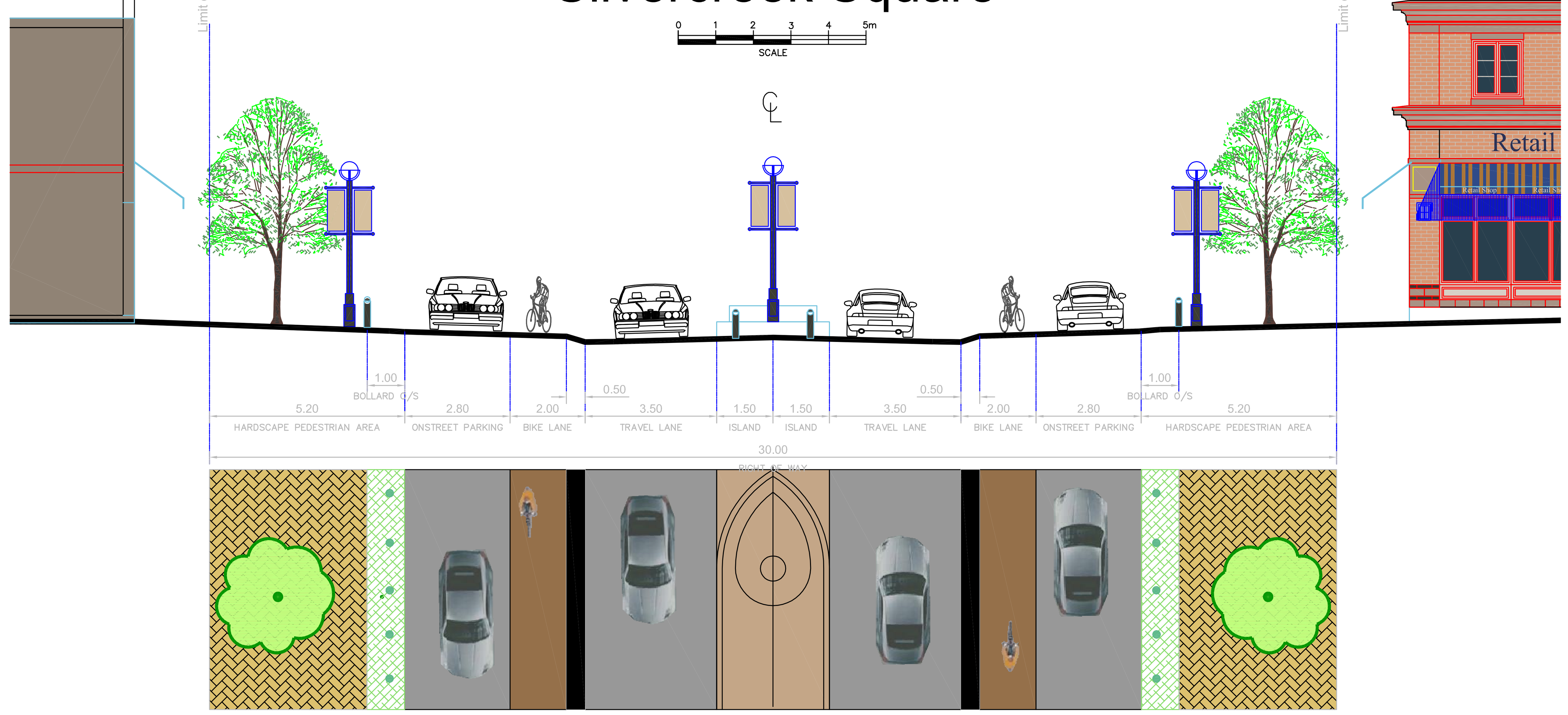
CITY OF Guelph
Making a Difference

SILVERCREEK PARKWAY EA STUDY
RECOMMENDED SOLUTION - CONCEPT PLAN TO TAC STANDARDS
FROM PAISLEY ROAD TO WATERLOO STREET

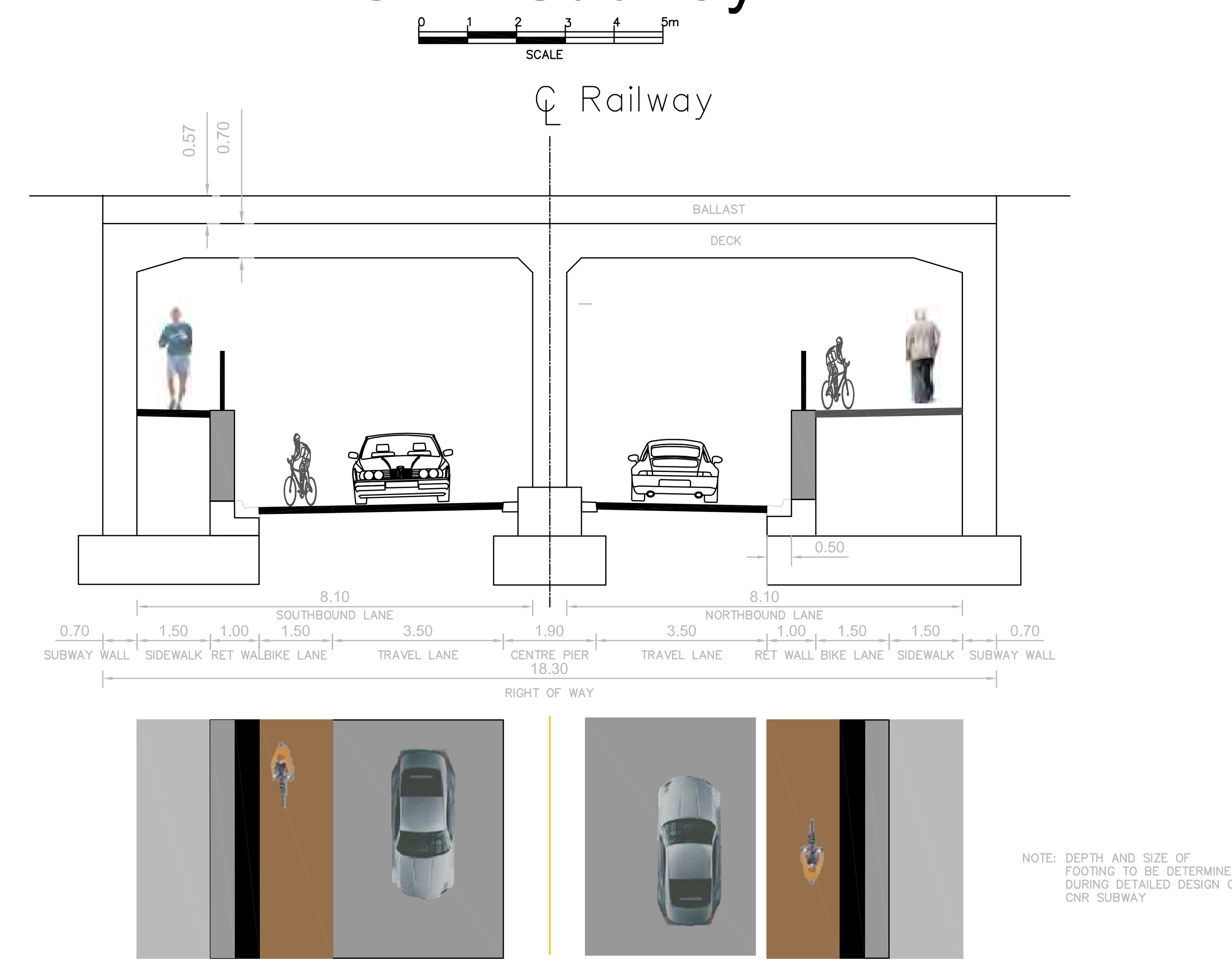
SCALE: 1:500 DATE: FEBRUARY 15, 2012

Delcan
TRANSPORTATION INFORMATION TECHNOLOGY WATER

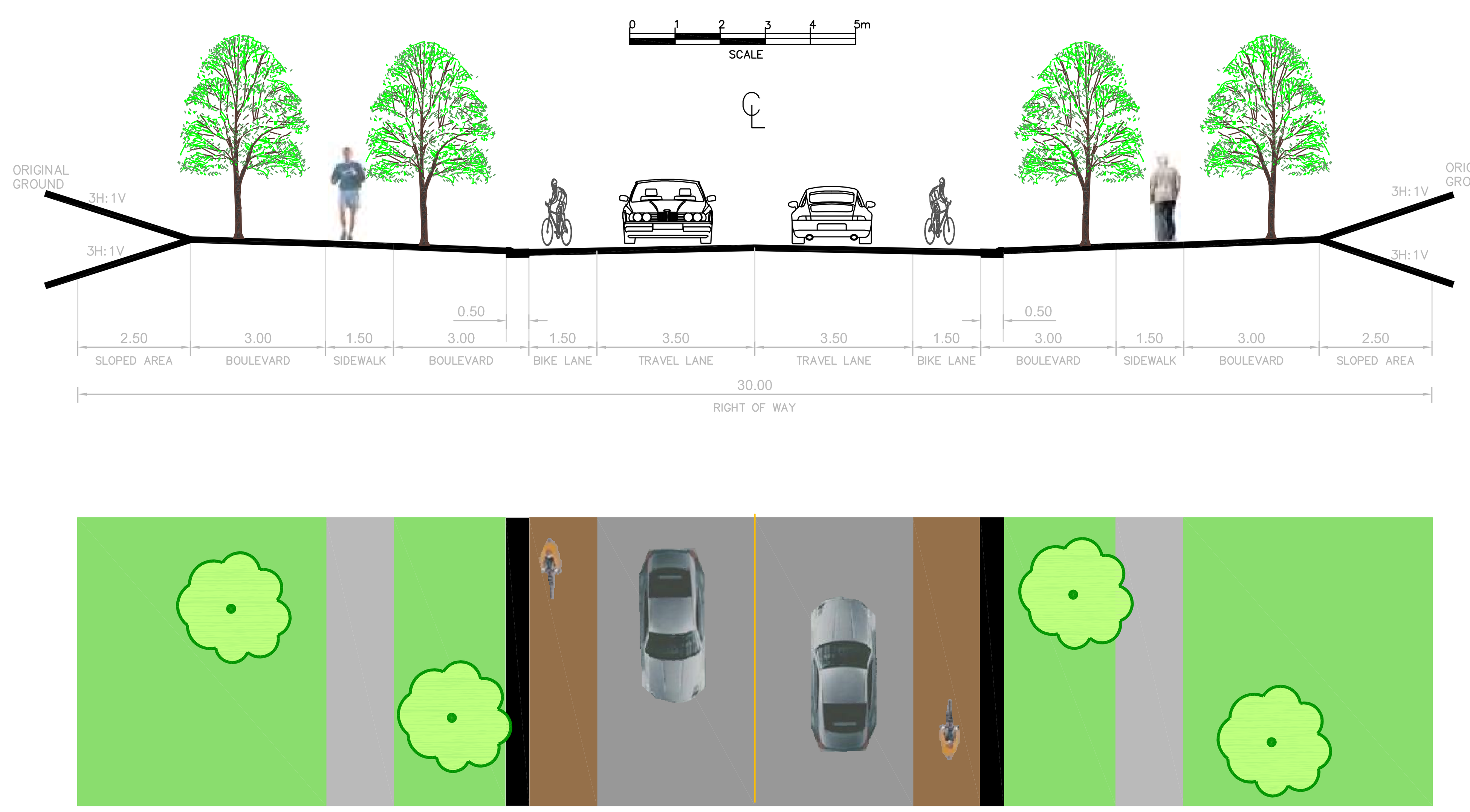
Silvercreek Square



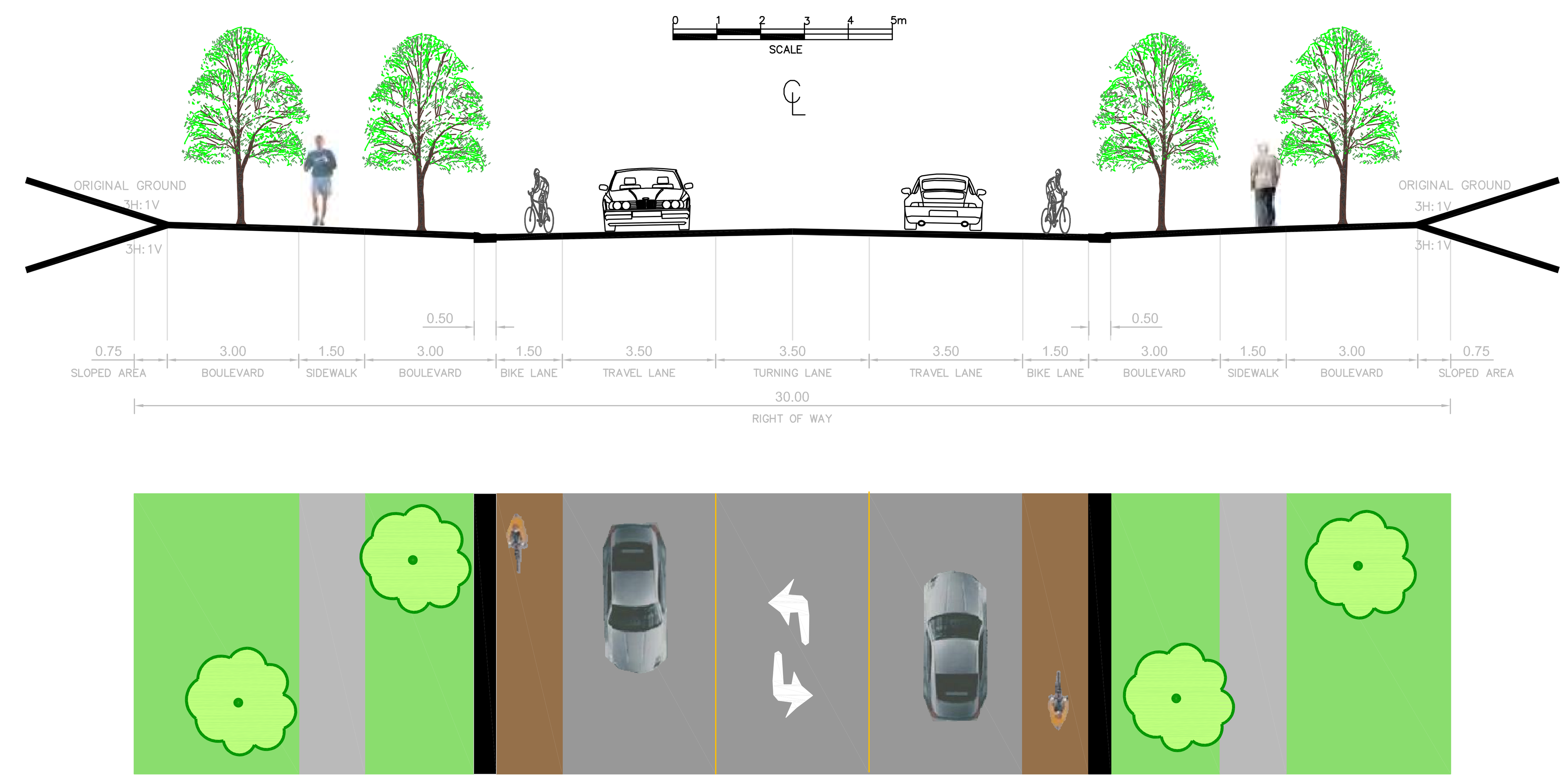
CNR Subway



Outside Silvercreek Square



Outside Silvercreek Square with Turning Lane



CITY OF Guelph
Making a Difference

SILVERCREEK PARKWAY EA STUDY
TYPICAL CROSS-SECTIONS

Delcan
TRANSPORTATION · INFORMATIOIN TECHNOLOGY · WATER

SCALE: 1:100 DATE: FEBRUARY 15, 2012

DRAWING NAME: J:\2011\PROJECTS\TW1366 - Silvercreek Rail Grade Separation, City of Guelph\MF#5 General\PreliminaryDrawing\2nd PIC\2012-Feb-07 - TW1366 -PIC#2.dwg

APPENDIX D

STRUCTURAL DESIGN REPORT

City of Guelph
Transportation

Structural Design Report

Silvercreek Parkway / CN Grade Separation

CN Guelph Subdivision - Mileage 50.24

November 7, 2011

Table of Contents

APPENDICES

1.0 Introduction

The City of Guelph is moving forward with plans to reconstruct and widen the existing Silvercreek Parkway South between Paisley Road and Waterloo Ave in the City of Guelph, located in the Regional Municipality of Wellington County. The project includes a new railway/roadway grade separation at the intersection of Silvercreek Parkway and the existing CN Guelph Subdivision.

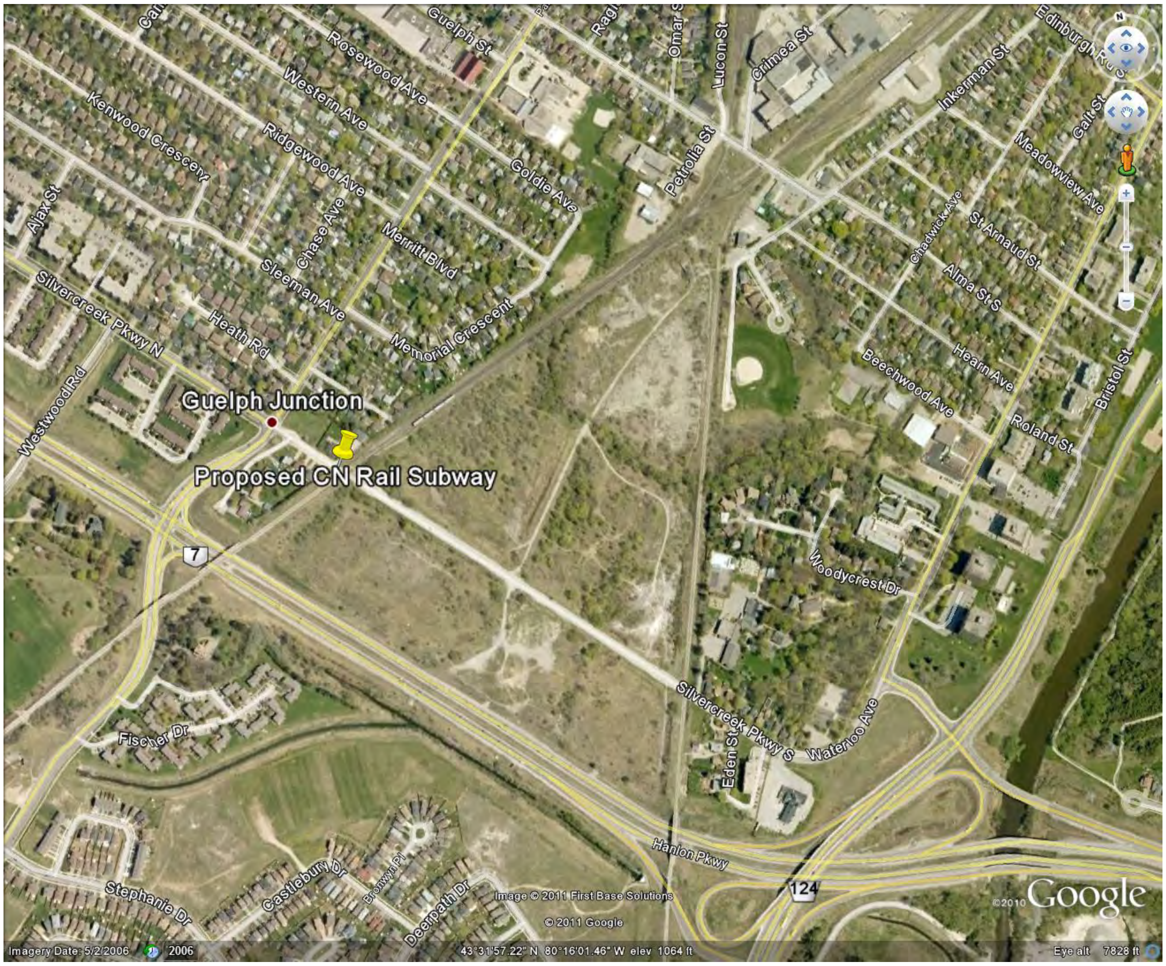
This report presents the preferred structural design for a new subway structure to allow Silvercreek Parkway to pass underneath the CN Guelph Subdivision track. The proposed bridge will be designed to accommodate the existing track as well as a future track located to the north of the existing. The span of the proposed bridge will be sufficient to accommodate two traffic lanes, as well as a bike lane and sidewalk on both sides. The existing CN track will be maintained at all times during construction of the new bridge by means of incorporating a track diversion around the bridge construction and utilizing railway protection to support the track diversion.

Various options to replace the existing bridge are discussed in this report based on conventional bridge construction techniques. The report however covers the design and construction staging of only the preferred option.

For the purpose of this report, and for design and construction, the bridge is considered to be orientated in the east-west direction.

2.0 Project Location

The bridge is located on the CN Guelph Subdivision at mileage 50.24, approximately 0.12 km south of Paisley Road on Silvercreek Parkway South, in the city of Guelph as shown on the Key Plan.



<u>Key Plan</u>

2.1 Geometrics

The horizontal alignment of Silvercreek Parkway in the vicinity of the existing CN track will be slightly shifted to the east to allow for an at grade access road to private properties on the south-west corner of Silvercreek Parkway and Paisley Road, since access from Silvercreek Parkway will not be feasible due to the proposed lowering of Silvercreek Parkway below the existing CN Subdivision track.

The centreline of the proposed Silvercreek Parkway, at the structure is located on a tangent and intersects the centerline of the existing CN track on a 21.567^{o} skew at STA 10+585.38.

The vertical alignment of Silvercreek Parkway will be developed to accommodate the existing railway track based on the existing vertical profile of the track without the need for a track lift. It is understood that a track lift would not be feasible due to the close proximity of the existing railway structure crossing the Hanlon Parkway which is approximately 250m west of the proposed bridge. In addition, due to the close proximity of Paisley Road to the railway track and proposed bridge, obtaining suitable vertical clearance and acceptable grades on Silvercreek Parkway has been identified as a defining constraint for the project.

A minimum vertical cleance of 5.3m is understood to be required between the roadway and the bridge soffit per CN Guidelines for Design of Railway Structures.

3.0 Design Criteria

Design Criteria for the proposed structure is as follows:

- AREMA 2010
- CN Guidelines for Design of Railway Structures, January 2006
- CSA S6-06, Canadian Highway Bridge Design Code (pertaining to the roadway portion)

4.0 Evaluation of Alternatives

4.1 Structure Alternatives

Due to the railway tracks close proximity to Paisley Road, we have reviewed several alternatives for the structure, with the aim to reduce the structure depth as much as possible thus minimizing the impacts to Paisley Road and nearby residential properties.

The following bridge options were considered during the preliminary design stage:

- Option 1 – Single span, Side-by-side prestressed concrete box beams (twin structures)
- Option 2 – Single span, Double track steel plate girder
- Option 3 – Single span, Reinforced concrete deck slab

- Option 4 – Single Span, Skewed reinforced concrete rigid frame
- Option 5 – Single Span, Reinforced concrete rigid frame
- Option 6 - 2 span, Skewed reinforced concrete rigid frame
- Option 7 – 2 span, Reinforced concrete rigid frame

Single track TPG structures were also considered but were not feasible since the track centre's could not be increased over Silvercreek Parkway and still respect the existing structure over the Hanlon Parkway without an unacceptable reduction to the track design speeds.

Geometric details of the options considered can be found in **Appendix A**. The following table summarizes the characteristics of the structure for each of the alternatives.

Table 1: Summary of Structure Options

Option	No. of Spans	Structure Span (m)	Skewed Deck Ends (relative to track)	Deck thickness (B/R to soffit) (m)	Approach Slabs	Deck Plan Area (m^2)	Staging Req'd?
1	1	18.5	No	1.78	No	141	No
2	1	21.8	No	1.40	No	202	No
3	1	19.6	No	1.96	No	165	No
4	1	16.2	Yes	1.86	Yes	294	No
5	1	15.0	Yes	1.70	Yes	152	Yes
6	2	8.7	Yes	1.16	Yes	163	No
7	2	8.1	Yes	1.11	Yes	256	Yes

4.2 Preferred Alternative

In order to respect the above noted geometric constraints, it is preferable from a road design perspective to have a structure which exhibits a shallow superstructure depth while allowing for a conventional construction staging approach. Hence, we have identified the preferred option for the Silvercreek Parkway bridge as Option 6 - the 2-span skewed rigid frame structure. The advantages and disadvantages for this option have been identified as follows:

Advantages:

- The railway structure can be constructed without staging, adjacent to railway protection supporting the diverted CN track.

- The structure requires a shallow depth of deck thickness thus keeping the impacts on Paisley Road to a minimum.
- Minimal impact on railway operations during the bridge construction once the track diversion is in place.
- The cast-in-place reinforced concrete rigid frame type of superstructure is recommended per CN Design Guidelines for Concrete Bridges.
- Deck joints and bearings will be eliminated through the use of the rigid frame abutments thus reducing maintenance disruptions to the railway.
- The bridge can be constructed to accommodate the existing track and future track in one stage providing greater flexibility for future track configurations without disruption to the roadway below.

Disadvantages:

- Due to the two span configuration, the tracks will be skewed to the ends of the bridge deck. It is proposed to incorporate reinforced concrete approach slabs to mitigate against this disadvantage.

Although the preferred option is based on a shallow deck thickness to reduce the impacts of the vertical alignment at Paisley Road, the impact is such that Paisley Road would still be required to be lowered from its present elevation. As a further measure to reducing the impact to Paisley Road, it is requested that the minimum vertical clearance to the structure be reduced from the 5.3m specified to 5.0m. It is understood that if a reduced vertical clearance is permitted for this site, measures for providing a sacrificial crash beam structure may be requested by the railway. The preferred option being a concrete rigid frame is very robust and more crash resilient than a girder type structure and so it is expected that the crash protection would be detailed to prevent local damage to the structure as a result of a vehicular impact. Reducing the vertical cleance will allow for improved vertical grades and the possibility of eliminating the need for lowering Paisley Avenue, reducing the overall construction costs of the project.

5.0 Proposed Bridge

5.1 General

Refer to the Preliminary GA Drawing in **Appendix B** for bridge details.

5.2 Cross-section

The proposed cross-sections is as follows:

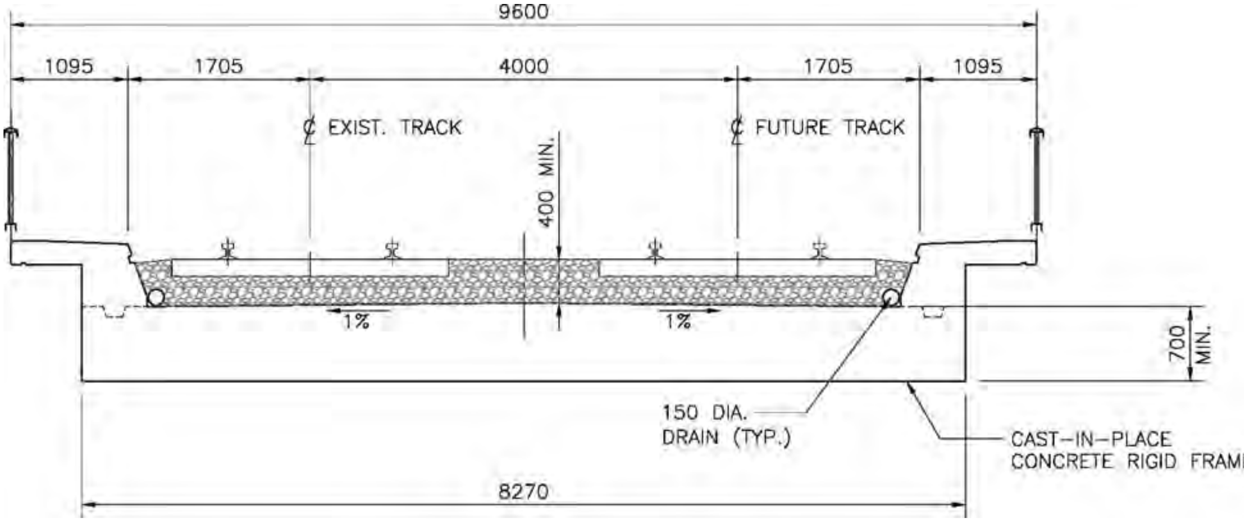


Figure 1: Silvercreek Subway - Proposed Cross-Section

5.3 Rigid Frame Structure

All cast-in-place elements of the rigid frame structure will be constructed using 35 MPa concrete. The deck will be haunched with a minimum thickness of 700 mm and integral with the pier and abutments.

5.4 Retaining Walls

All cast-in-place elements of the retaining walls supporting railway surcharge will be constructed using 35 MPa concrete.

5.5 Foundations

It is understood that the proposed roadway will be below the elevation of bedrock at this site. The new pier, abutments and retaining walls are planned to be supported on strip/spread footings, subject to the findings of the proposed geotechnical investigation.

5.6 Approaches

Cast-in-place approach slabs will be detailed in accordance with the CN Standard Drawing C4m.

5.7 Deck Drainage

Deck will be cast with 0.5% minimum longitudinal slope and a transverse crossfall of 1%. Deck drains are not required.

5.8 Curbs and Railing

Cast in place curbs will be detailed in accordance with the CN standard Drawing C2m. Railing will conform to City of Guelph and railway standards.

5.9 Bridge Deck Waterproofing

Bridge deck waterproofing will be detailed in accordance with CN standard Drawing C3m. An approved manufacture will be specified in accordance with CN's Waterproofing Guidelines for Railway Bridges. A drainage sheet membrane will be specified on the vertical back face of the abutments.

6.0 Construction Staging

A detour of the existing track to the south of the proposed bridge will allow the bridge and retaining walls to the north to be constructed in a single stage. Retaining walls on the south side of the structure, if required, will be constructed after the CN track has been shifted back onto the new bridge.

Since the existing Silvercreek Parkway road is currently terminated at the existing track, the road will remain closed to traffic until the structure and retaining walls are completed. Hence no traffic staging will be required for Silvercreek Parkway.

7.0 Summary

A two span skewed concrete rigid frame structure is the preferred option for the proposed CN Rail / Silvercreek Parkway Subway structure. The proposed structure has a shallow deck thickness to meet the tight constraints of the vertical roadway alignment, and allows for the bridge to be constructed during a single stage, thus reducing construction costs and impacts to the railway.

Due to the additional benefits which can be achieved to the vertical roadway alignment, by incorporating a reduced vertical cleance for the bridge, it is requested that CN allow the minimum vertical clearance to be reduced from 5.3m to 5.0m.

We trust that upon review of the preliminary general arrangement drawing, CN will find the proposed bridge option acceptable for this site and meeting all relevant criteria for railway approval.

Report prepared by:

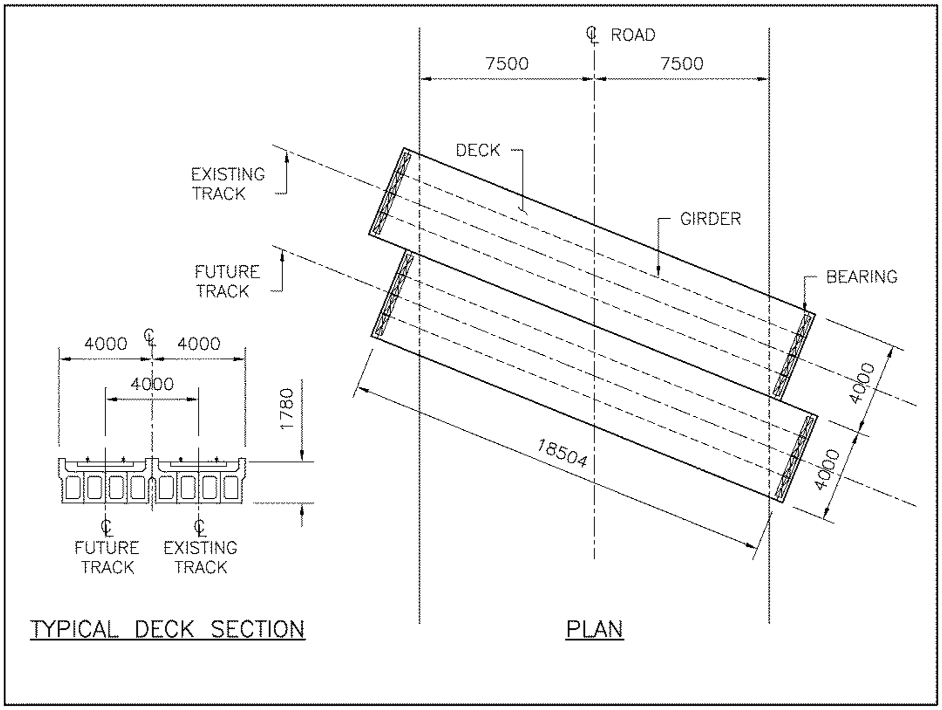
Brent Archibald, P.Eng.
Technical Director
Delcan Corporation

Report reviewed by:

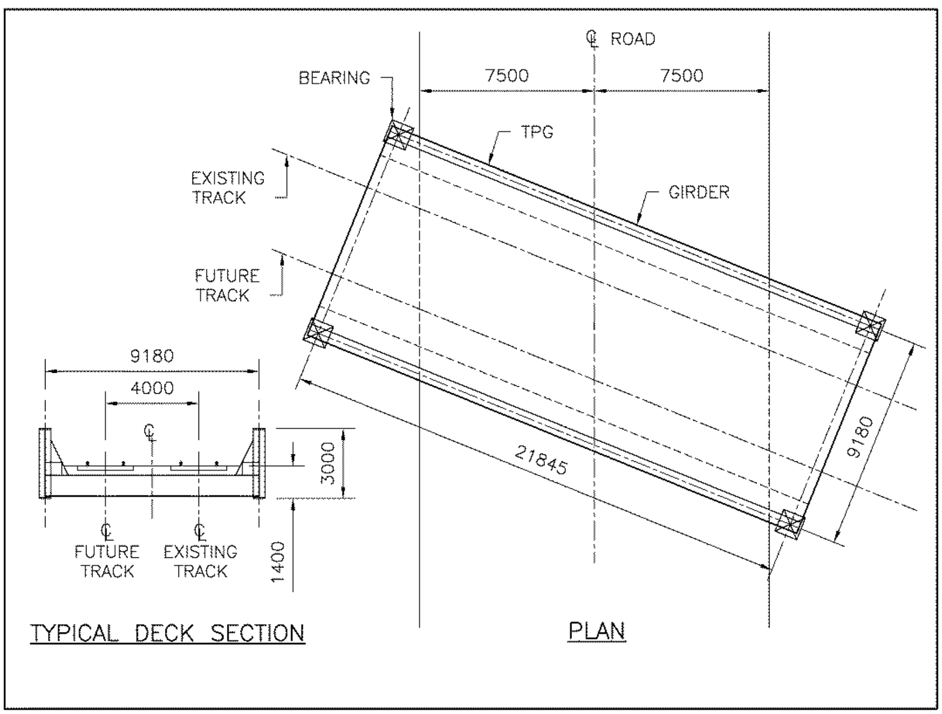
Jonathan Werner, P.Eng.
Senior Principal & Division Manager
Delcan Corporation

APPENDIX A

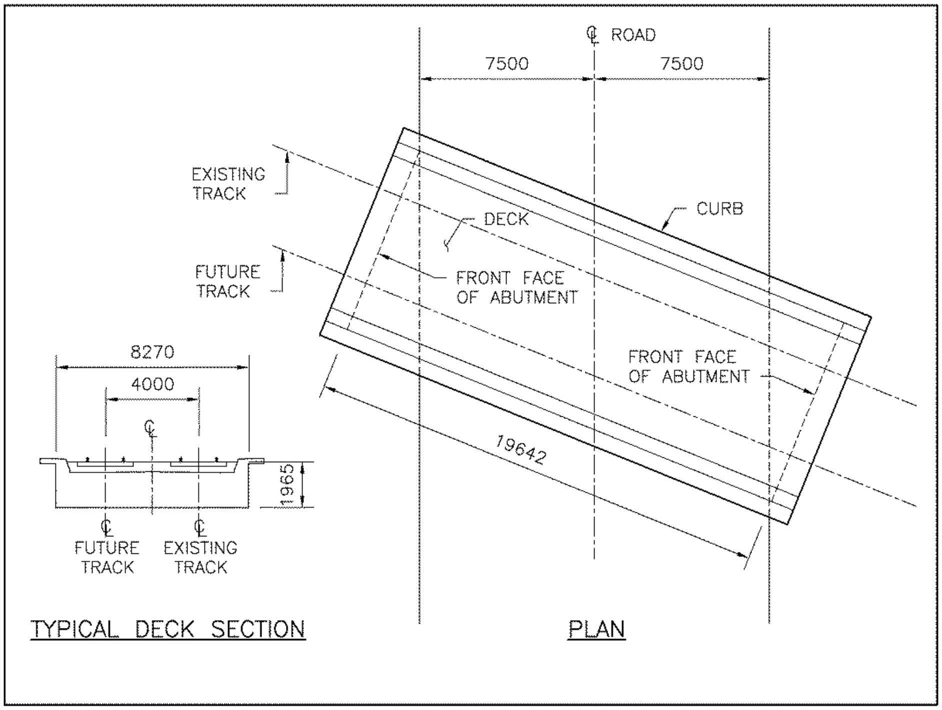
Bridge Options



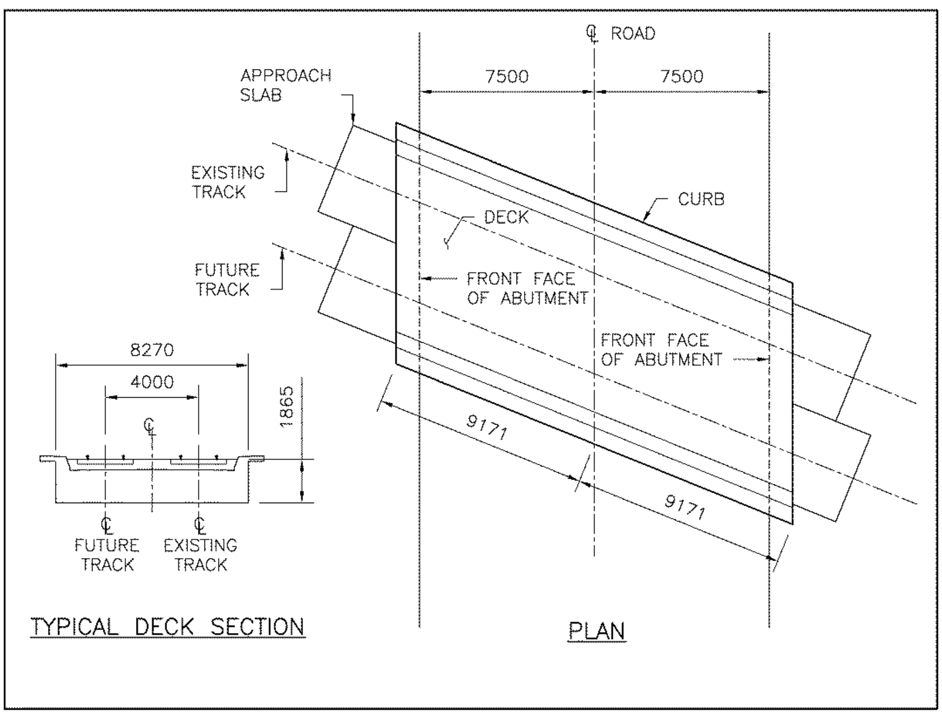
Option 1 – Single span, Side-by-side precast concrete box beams (twin structures)



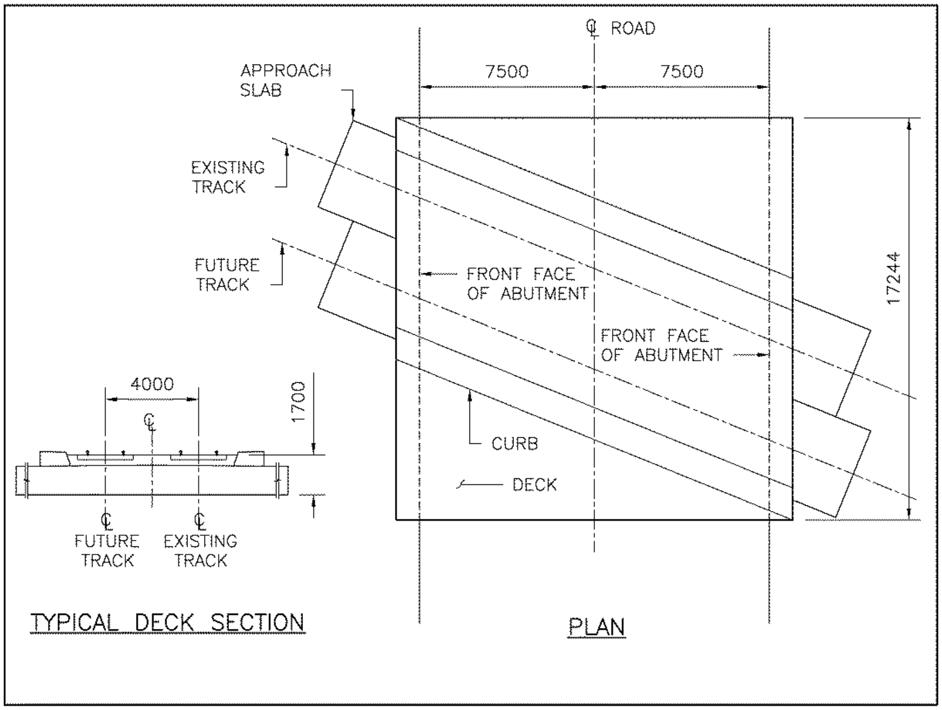
Option 2 – Single span, Double track steel plate girder



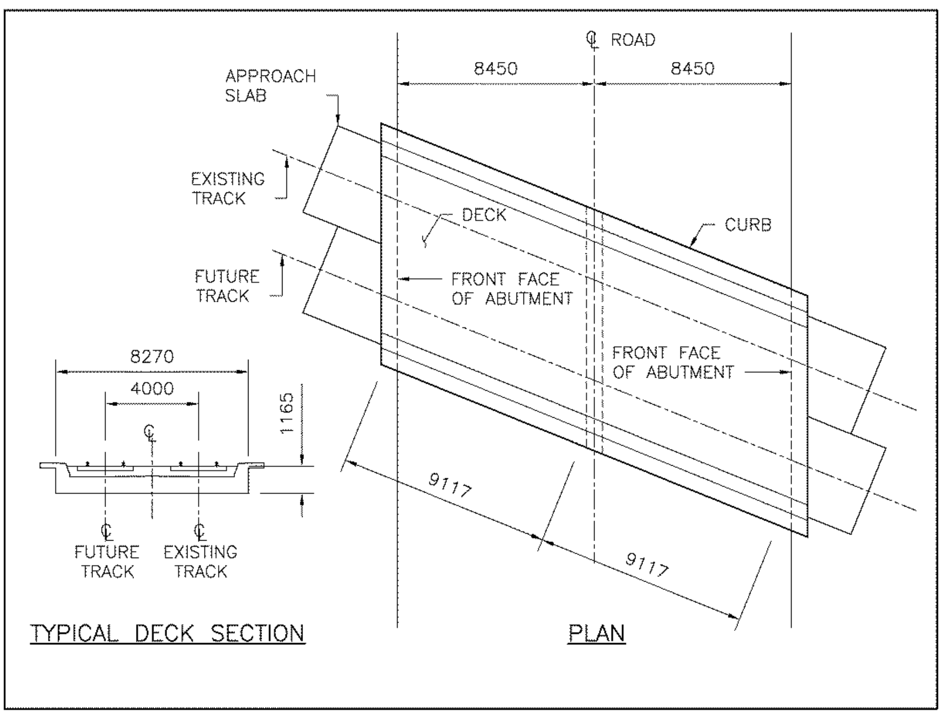
Option 3 – Single span, Reinforced concrete deck slab



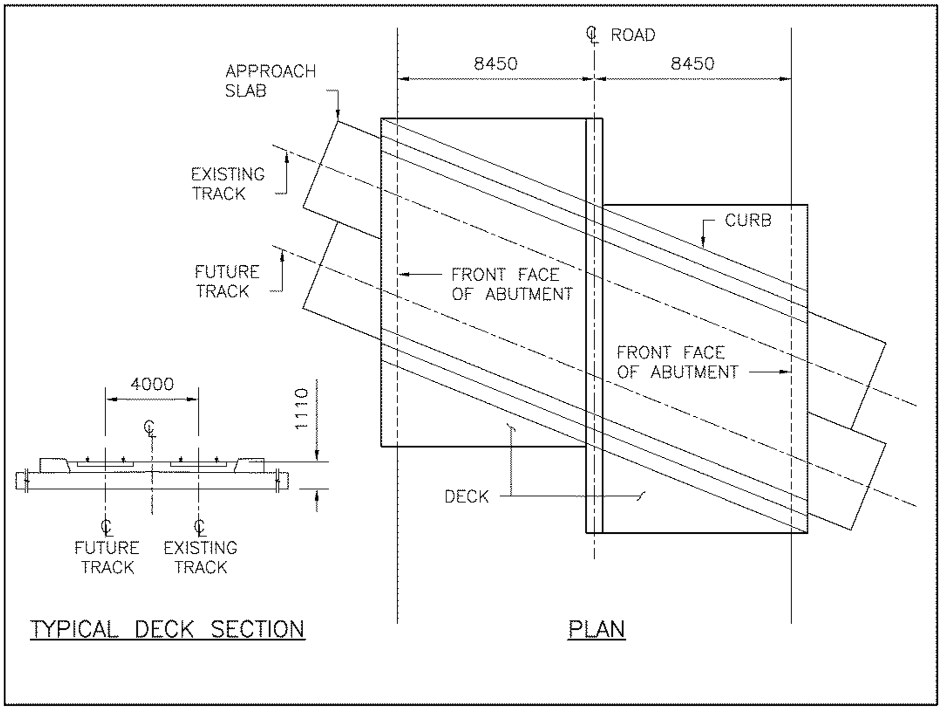
Option 4 – Single Span, Skewed reinforced concrete rigid frame



Option 5 – Single Span, Reinforced concrete rigid frame



Option 6 - 2 span, Skewed reinforced concrete rigid frame



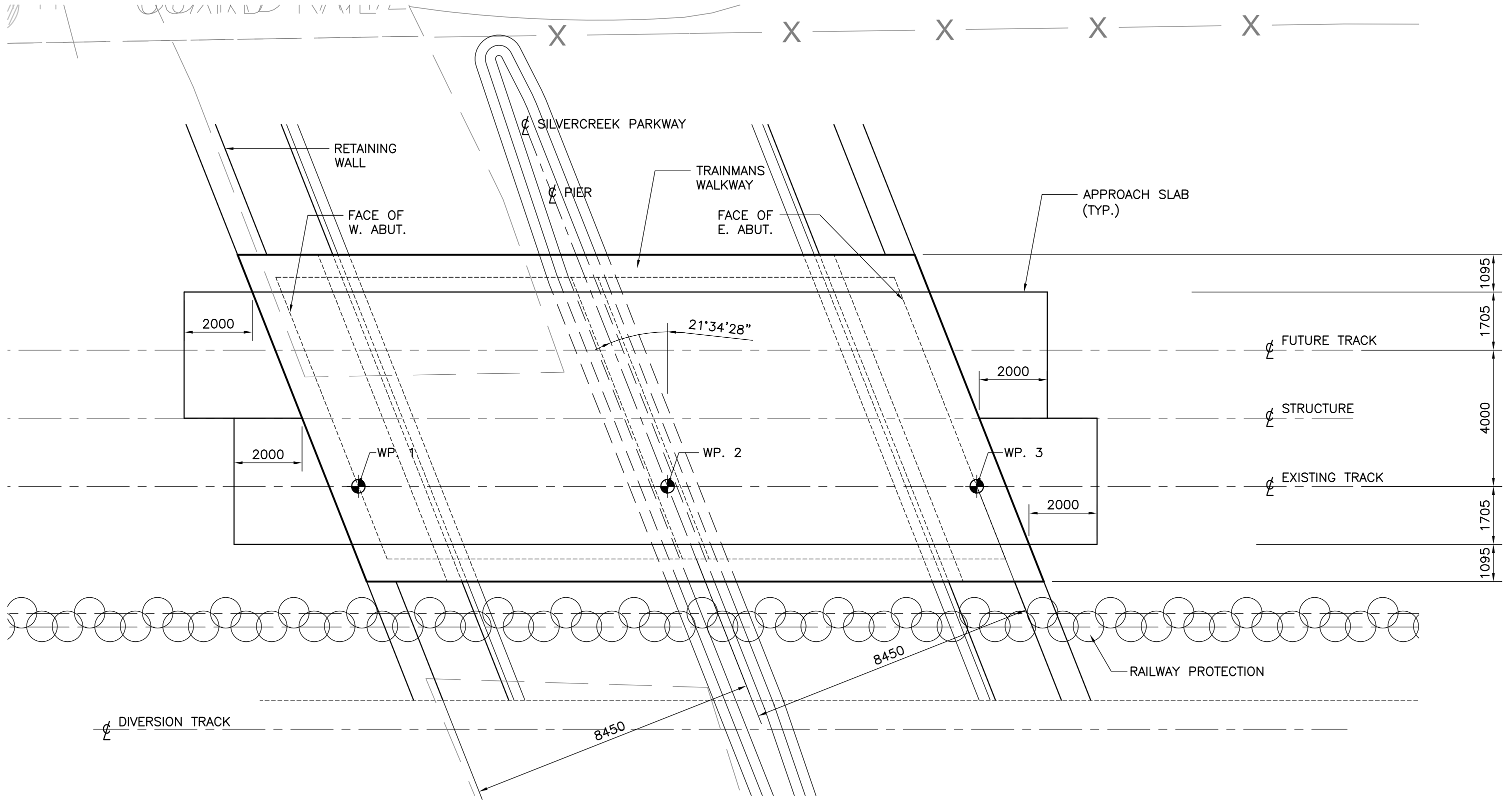
Option 7 – 2 span, Reinforced concrete rigid frame

APPENDIX B

General Arrangement Drawing

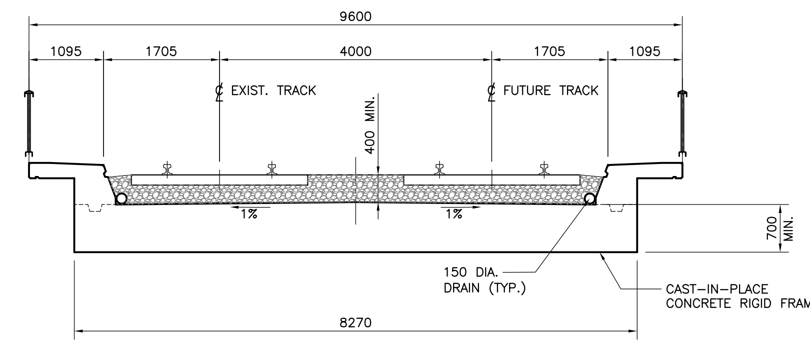
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN



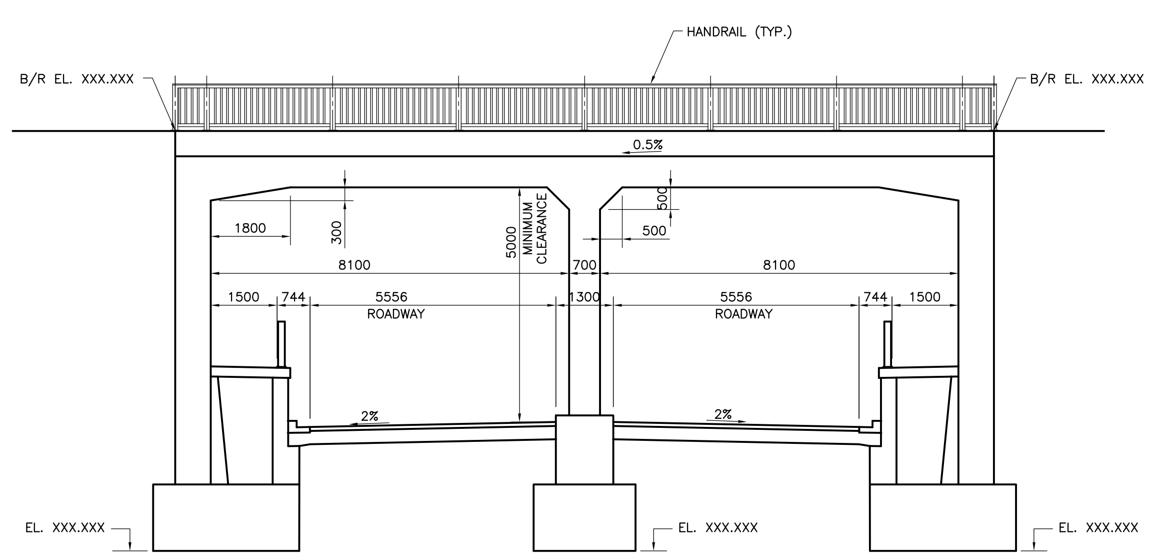
PROPOSED BRIDGE LAYOUT

1:100



TYPICAL DECK SECTION

1:50



PROPOSED BRIDGE ELEVATION

1:75

PRELIMINARY

GENERAL NOTES:

MATERIAL SPECIFICATIONS

DESIGN AND WORKMANSHIP:

A.R.E.M.A. MANUAL 2010 FOR RAILWAY ENGINEERING, CHAPTERS 8, 15, 19 & 29.

CN GUIDELINES FOR DESIGN OF RAILWAY STRUCTURES (JAN. 2006).

REINFORCING STEEL: C.S.A./CAN-G30.19-M92
STRUCTURAL STEEL: C.S.A./CAN-G40.21-M92
CONCRETE: C.S.A./CAN-A23.1 & a23.2-M04

DESIGN LOADS:

LIVE LOAD: COOPER E90 WITH DIESEL IMPACT FOR SUPERSTRUCTURE.

DESIGN BALLAST DEPTH: 400mm (MIN.) + 305mm FUTURE

FOUNDATIONS:

GEOTECHNICAL INFORMATION TAKEN FROM GEOTECHNICAL INVESTIGATION REPORT BY XXXXXXXXXXXX, MM/DD/YYYY FILE.

CLASS OF CONCRETE:

FOOTINGS	35MPa
ABUTMENTS AND RETAINING WALLS	35MPa
DECK SLAB	35MPa
REMAINDER	35MPa

CLEAR COVER TO REINFORCING STEEL

MINIMUM CLEAR COVER TO REINFORCING STEEL (mm)

FOOTINGS		100 ± 20
ABUTMENTS AND RETAINING WALLS		70 ± 20
SLAB	TOP	70 ± 20
	BOTTOM	50 ± 10
REMAINDER		70 ± 20

REINFORCING STEEL

REINFORCING STEEL SHALL BE GRADE 400W BILLET STEEL DEFORMED BARS.

BARS MARKED WITH 'C' DENOTES COATED BARS.

UNLESS SHOWN OTHERWISE, TENSION LAP LENGTHS NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS B.

HOOKS AND BENDS FOR REINFORCING STEEL SHALL BE DETAILED ACCORIDNG TO AREMA-CHAPTER 8 SECTION 2.4. UNLESS SHOWN, THE FOLLOWING SHALL APPLY:
-STANDARD HOOKS WITH MINIMUM BEND DIAMETERS SHALL BE USED FOR STIRRUPS AND TIES, ACCORDING TO CLAUSE 2.4.2.
-OTHER BARS SHALL HAVE STANDARD HOOKS WITH BEND DIAMETERS ACCORDING TO CLAUSE 2.4.1.

CONSTRUCTION NOTES

ALL ELEVATIONS ARE TO GEODETIC DATUM.

TEMPORARY RAILWAY PROTECTION SHALL BE DESIGNED BY THE CONTRACTOR. LIMITS OF PROTECTION TO BE DETERMINED BY THE CONTRACTOR.

construction NORTH | true NORTH

THE POSITION OF THE POLE LINES, CONDUITS, WATERMAINS, SEWERS, AND OTHER UTILITIES AND STRUCTURES ARE N O T NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED.

BEFORE STARTING WORK

THE CONTRACTOR SHALL CONFIRM THE POSITION AND EXACT LOCATION OF ALL SUCH UTILITIES, AND SHALL ASSUME ALL LIABILITY FOR ANY DAMAGE TO THEM MADE DURING THE COURSE OF THE CONTRACT WORK.

NOTES:

XXXX XXXX

TOPOGRAPHIC SURVEY

CONDITION SURVEY BY XXX XXX LTD. (B.SMITH/ R.JONES/ T.COOPER) Nov./Dec. 20XX
FIELDBOOK #XX-XXX

BENCHMARK

SURVEY TABLET SET IN XXXXXXX, BEING X.X METERS FROM XXX AND X.X METERS FROM XXXXXX
REF. No. XXXX-XXXX

ELEV. = 3XX.XXXm.

No.	REVISION	By	DATE
1.	FOR RAILWAY REVIEW	FDZ	Oct 11/11

City Logo here

City department or Owner Logo here

Delcan
TRANSPORTATION • INFORMATIOIN TECHNOLOGY • WATER

GENERAL ARRANGEMENT

SILVERCREEK PARKWAY

DESIGN BY: X.X.XXXXX (stamp)	APPROVED BY: X.X.XXXXX (stamp)	DRAWN BY: ABM. / DESIGNED BY: B.I.A. / CHECKED BY: / DATE: OCT 31, 2011 / SCALE: AS NOTED
FILE NAME: XXXX	SHEET No.: X of X	DWG. No.: S-001

DRAWING NAME: J:\TOR\TW1366\BT\Drawings\TW1366_Silvercreek Bridge GA.dwg MODIFIED: Nov 07, 2011 - 10:51am
REVISED BY: ABM

APPENDIX E

DETAILED SAFETY ASSESSMENT

SILVERCREEK PARKWAY
DETAILED SAFETY ASSESSMENT

Detailed Safety Assessment of the proposed reconstruction of Silvercreek Parkway over the Goderich-Exeter Railway (GEXR) tracks at mileage 29.51 of their Fergus Spur in Guelph, Canada

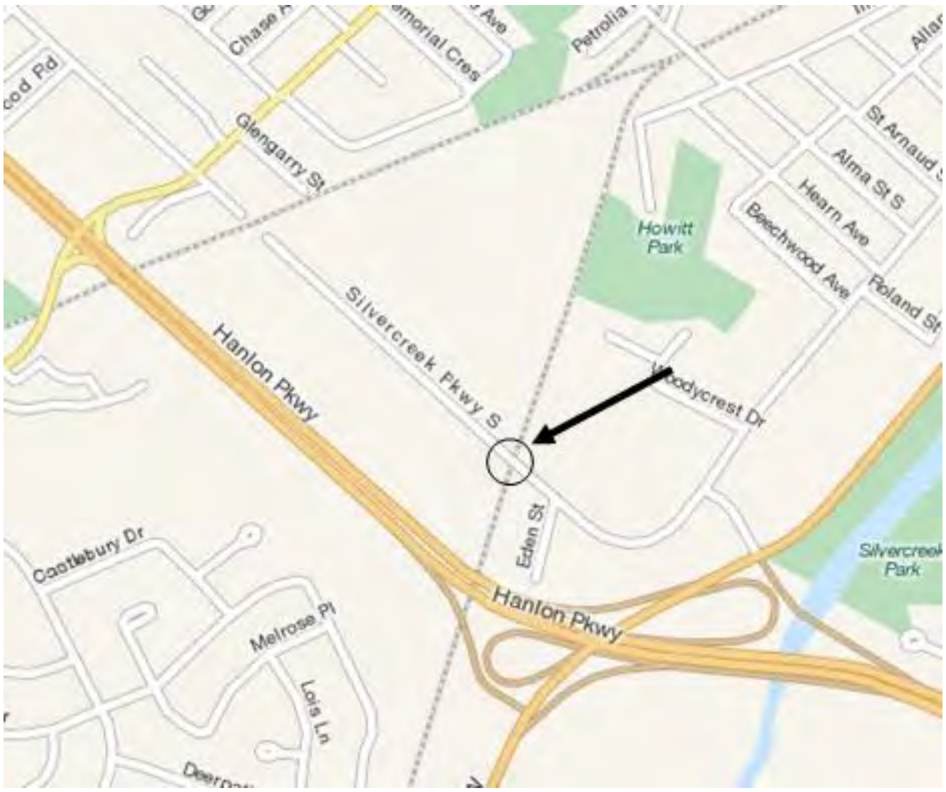
March 01, 2012

R. J. Fish, P.Eng.
Jock Valley Engineering Ltd.

Table of Contents

1.0 INTRODUCTION

This Detailed Safety Assessment (DSA) was conducted as part of a Class Environmental Assessment for undertaking improvements to Silvercreek Parkway, from north of Paisley Road to south of the Goderich-Exeter Railway (GEXR) spur line. Silvercreek Parkway is being improved as part of a project to serve the proposed development of vacant land bounded by GEXR tracks to the north and south and by the Hanlon Parkway to the west as shown on Drawing 01 in Appendix "A". It is proposed to reconstruct Silvercreek Parkway as a two-lane urban road across the GEXR tracks at mileage 29.51 of their Fergus Spur.



Crossing Location

Project Description

The Detailed Safety Assessment (DSA) was undertaken on the proposed reconstruction of the Silvercreek Parkway crossing of the GEXR tracks at mileage 29.51 of their Fergus Spur. The assessment was conducted using the draft "Canadian Road/Railway Grade Crossing Detailed Safety Assessment Field Guide", dated April 2005, for guidance.

Detailed design for the proposed crossing was not complete and, as a result, a number of assumptions were made, including that any modifications to the crossing surface and crossing warning system would be in compliance with Transport Canada's "Canadian Railway-Roadway Grade Grossing Standards" (CRRGCS) dated January 10, 2010.

The railways in Canada operate their trains in miles per hour (mph) and this system is used in the report. Miles per hour can be converted to kilometres per hour by multiplying by 1.6.

Objectives

In general, the fundamental objectives of a DSA are to:

1) Reduce crash risk within the grade crossing environment.
2) Minimize the frequency and severity of preventable crashes.
3) Consider the safety of all grade crossing users.
4) Verify compliance with the technical standards referred to in Transport Canada's draft Railway-Roadway Grade Crossings Policy dated January 10, 2012 and contained in the draft "Canadian Railway-Roadway Grade Grossing Standards".
5) Ensure that all crash mitigation measures/factors aimed to eliminate or reduce the identified safety problems are fully considered, evaluated and documented, and appropriate recommendations were made.

Assessment Scope

The DSA was limited to an assessment of the crossing safety issues related to the proposed reconstruction of Silvercreek Parkway including the sidewalks on each side as shown on drawing Nos. 02 and 03 in Appendix "A". The DSA was based on the proposed reconstruction in the vicinity of the tracks and does not attempt to assess the existing crossing.

Process

The City of Guelph engaged Delcan to conduct the Class Environmental Assessment and engineering design of the proposed reconstruction of Silvercreek Parkway, from north of Paisley Road to south of the Goderich-Exeter Railway (GEXR) spur line. This Detailed Safety Assessment was conducted by R. J. Fish, P.Eng., of Jock Valley Engineering Ltd., who has an Independent Services Agreement with Delcan, supported by Delcan.

Projected road traffic volumes, speeds, design vehicle, proposed design and queuing analysis, along with railway data, were provided by Delcan. Railway data, including train speeds and volumes was provided to Delcan by GEXR.

2.0 GENERAL

Road Classification

In the area under consideration, Silvercreek Parkway currently has a four lane urban cross section south of the crossing and a two lane rural cross section north of the crossing and it is proposed to be reconstructed over the crossing as a two lane urban road with bicycle lanes and sidewalks.

Traffic

2.1.1 Railway

The rail traffic at this location currently consists of four freight trains in each direction per week. No passenger trains operate on this section of track.

2.1.2 Road

The current AADT (2011) is 350 forecast to increase to 12,000 by the year 2021.

Crash History

2.1.3 Transportation Safety Board

The Transportation Safety Board of Canada (TSB) database does not show any crossing accidents at this location in the past five years.

Land uses

Northwest quadrant – Currently vacant with proposed commercial / big box store development.
Northeast quadrant – Currently vacant with proposed commercial and residential (condo) development.
Southeast quadrant – Single family residential & institutional (Guelph Bible Conference Centre).
Southwest quadrant – Commercial & mixed residential.

Northwest Quadrant

Northeast Quadrant

Southwest Quadrant

Southeast Quadrant

Nearby Intersections

North
A signalized intersection for the entrance to the commercial areas in the northeast and northwest quadrants is proposed at 170 m north of the crossing.

South
There are no nearby signalized intersections to the south of the crossing. Eden Street intersects Silvercreek Parkway from the west 75 m south of the crossing. A service entrance to the Guelph Bible Conference Centre is located 15 m south of the crossing in the southeast quadrant and is gated and locked.

Lighting

Silvercreek Parkway is currently illuminated by street lights south of the crossing. The crossing and road to the north will be illuminated as part of the urban road design.

3.0 GEOMETRIC DESIGN AND OPERATIONS (RAILWAY)

Alignment

The crossing is on a tangent section of track with curves beginning approximately 600 m east and 2000 m west of the crossing. The track intersects Silvercreek Parkway at an angle of 62 degrees.

Looking West

Looking East

Train Operations

3.1.1 Volume

The rail traffic at this location consists of a total of 8 freight trains per week.

3.1.2 Operations and Speeds

The maximum speed on this section of track is 15 mph for freight trains. There is no switching or other operations in the area that would cause trains to regularly proceed more slowly over the crossing.

4.0 GEOMETRIC DESIGN AND OPERATIONS (ROAD)

Location

The crossing is located on Silvercreek Parkway, with the closest intersections located 75 m to the south (Eden Street) and 170 m to the north (proposed).

Alignment

4.1.1 Road

4.1.1.1 Horizontal

The horizontal alignment within the Safe Stopping Sight Distance (SSD) will be straight south of the crossing with a curve beginning approximately 10 m to the north of the crossing.

4.1.1.2 Vertical

The vertical alignment of Silvercreek Parkway in the vicinity of the crossing will be similar to the existing alignment. Within the sight stopping distance (SSD) the grade from the north will be substantially level. From the south, within the SSD, the grade will ascend toward the crossing at an average of approximately 2% and less than 1% within 30 m of the crossing.

Crossing Surface

All crossing surfaces will be constructed in accordance with the requirements of Section 6 of draft CRRGCS and designed in consultation with GEXR.

Lanes

4.1.2 Road

The Silvercreek Parkway crossing will consist of one 3.5 m lane and a 1.5 m bicycle lane in each direction with the southbound lane transitioning to two lanes south of the as shown on drawings 02 and 03 in Appendix “A”.

4.1.3 Recreational / Pedestrian

A 1.5 m sidewalk will be constructed on each side of the roadway separated by a 0.5 m curb and a 3.0 m boulevard.

Traffic Operations

4.1.4 Design Vehicle

Tractor-semitrailer (WB-20)

4.1.5 Vehicle Speed

4.1.5.1 Posted

The posted speed for vehicles using this section of Silvercreek Parkway will be 50 km/h.

4.1.5.2 Design

The design speed for the reconstructed Silvercreek Parkway in the vicinity of the crossing will be 60 km/h.

4.1.6 Traffic Volumes & Queuing

The AADT is forecast to increase to 10,900 by the year 2031. A queuing analysis indicates that queues from the proposed signalized intersection to the north of the crossing will not routinely reach the crossing. There are no signalized intersections within 300 m to the south of the crossing.

Critical Distances

4.1.7 Stopping Sight Distance

4.1.7.1 Road

Based on a design speed of 50 km/h the Stopping Sight Distance (SSD) is 65 m for cars and 110 m for trucks.

4.1.8 Grade Crossing Clearance Distance

The Grade Crossing Clearance Distance is the distance from the stop bar in front of the gate to a point 2.4m beyond the furthest rail.

4.1.8.1 Road

Based on the angle of the crossing and the road width, the Grade Crossing Clearance Distance is estimated to be 12 m.

4.1.9 Vehicle Travel Distance

The Vehicle Travel Distance is the total distance that the design vehicle must move from a stopped position in front of the crossing stop bars to the point at which the rear of the vehicle is safely clear of the crossing. This distance (s) is the sum of the Grade Crossing Clearance Distance (cd) and the length of the design vehicle (l)

$s = cd + l$

4.1.9.1 Road

The estimated travel distance for the proposed Silvercreek Parkway crossing is 34.7 m.

4.1.9.2 Sidewalk

The Travel Distance for the sidewalk / pedestrian pathway is estimated to be 12 m.

4.1.10 Departure Time

The Vehicle Departure Time is the time it takes the design vehicle to move from a stopped position in front of the crossing gate arm through the Vehicle Travel Distance and includes a perception reaction time.

4.1.10.1 Road

The Departure time for a northbound design vehicle (worst case scenario) is 13.5 seconds and is well within the time provided by the crossing warning system.

4.1.10.2 Sidewalk

The Departure time for the sidewalk / pedestrian pathway is 12 seconds and is well within the time provided by the crossing warning system

Sight Lines (along track)

The CRRGCS requires that, where practicable, drivers have a clear view of approaching trains from a stopped position.

The maximum speed of trains approaching the crossing is 15 mph. For a departure time of 13.5 seconds and a maximum train speed of 15 mph a motorist stopped at the stop bars would be required to see a train from 92 m in order to safely cross.

Based on the existing crossing, the sightlines, with brush clearing on railway right-of-way, will be:
Northwest Quadrant – 200+ m
Northeast Quadrant – 200+ m
Southwest Quadrant – 200+ m
Southeast Quadrant – 200+ m

4.1.11 East

Sightlines to the east meet the standards in the CRRGCS with the exception of a small tree on the railway right of way in the southeast quadrant.

Northbound Driver's View to East

Southbound Driver's View to East

4.1.12 West

A northbound motorist's view of an approaching train is slightly obstructed by the signal bungalow in the southwest quadrant.
The sightlines in the northwest quadrant are marginal and could be greatly improved with minimal clearing of brush.

Northbound Driver's View to West

Southbound Driver's view to West

Sight Lines (along road)

Motorists must be able to see the grade crossing warning signal from a distance that would allow them to stop safely. In this case motorists must have a clear view of the signal for 110 m.

4.1.13 South Approach

The vertical curve in the road south of the crossing reduces the apparent elevation of the signals and it is recommended that cantilever signals be included in the design.

4.1.14 North Approach

The proposed horizontal curvature in the road would limit motorist's view of the signals from the north. Trucks in the opposing lane could completely block the view of the signals from the stopping sight distance (SSD). It is recommended that an active "Prepare to Stop at Railway Crossing" sign be installed on the north approach

North from SSD (existing)

South from SSD (existing)

5.0 CONTROL DEVICES

Signs

Railway Advance Warning Signs will be installed in accordance with the requirements of the CRRGCS and should indicate the skew of the crossing.

The following additional signs are recommended:

- “No Train Whistles at This Crossing” signs.
- “Pedestrians Stop Here When Lights are Flashing” signs.
- “Prepare to Stop at Railway Crossing” sign on north approach.

Pavement Markings

Pavement markings in compliance with the CRRGCS, the *Traffic Control Devices Manual* and the *Ontario Traffic Manual* will be included in the design.
It is recommended that stop bars be painted on the sidewalks and that the edge of the sidewalk be delineated with paint on the approach to the crossing.

Crossing Warning Signals

The existing automated warning system consisting of flashing lights, cantilevers and bell will be modified as necessary to suit the reconstructed road in accordance with the CRRGCS. It is recommended that the warning system include cantilevers and, for the north approach, an active “Prepare to Stop at Railway Crossing” sign,

It is recommended that the existing light units be replaced with the 12 inch LED light units and that one set be aligned toward the service entrance to the Guelph Bible Conference Centre.

The pedestrian sidewalks on both sides of the roadway are expected to be within 3.6 m of the crossing signals and would not require separate warning systems. However, front and back lights on the signal masts will be required for pedestrians and it is recommended that a bell be installed for each sidewalk.

6.0 WHISTLING

Trains are not required to routinely whistle for this crossing. If the recommendations contained in this report are implemented, the crossing will continue to meet the “Requirements for Public Grade Crossings Within an Area Without Train Whistling” contained in the CRRGCS.

7.0 HUMAN FACTORS

Visibility and Background Clutter

The crossing is located in an urban area and is expected to have some commercial background clutter for northbound motorists. Background clutter is expected to be minimal for southbound motorists. The traffic lights at the proposed intersection north of the crossing are expected to be visible to northbound motorists as they approach the crossing.

Looking South

Driver workload

Driver workload in the vicinity of the crossing will be moderate for an urban area. The closest signalized intersection will be 170 m to the north.

The curve immediately north of the crossing will contribute to increased driver workload in the area.

8.0 RECOMMENDATIONS

Construction

The construction phase will place an added workload on the driver. Care should be taken during this phase to ensure that the users of the crossing (motorists, cyclists, pedestrians et cetera) receive clear and unambiguous directions on how to safely proceed.

Roadway

It is recommended that:

1. The reconstructed crossing include a crossing warning system consisting of flashing lights, two bells and cantilevers designed and installed in accordance with the CRRGCS.
2. One set of lights be directed to provide coverage of the Guelph Bible Conference Centre service entrance in the southeast quadrant.
3. An active "Prepare to Stop at Railway Crossing" sign be installed on the north approach.
4. Twelve inch LED light units be used in the crossing warning system.
5. "No Train Whistles at This Crossing" signs be installed.
6. "Railway Advance Warning Signs" indicating a skewed crossing be installed.

Sidewalks

It is recommended that:

1. The sidewalk travelled surface be delineated within 8 m of the nearest rail with a solid white line on both edges of the travelled surface.
2. Stop lines be painted on the sidewalks to indicate where pedestrians should stop.
3. "Pedestrians Stop Here When Lights are Flashing" signs be installed.
4. A bell be installed on the closest signal mast to each sidewalk.
5. Both front and back lights on the signal masts be included to provide coverage for pedestrians.
6. Consideration be given to the use of coloured detectable tactile strips at the sidewalk cross bars to assist the visually impaired.

9.0 CONCLUSION

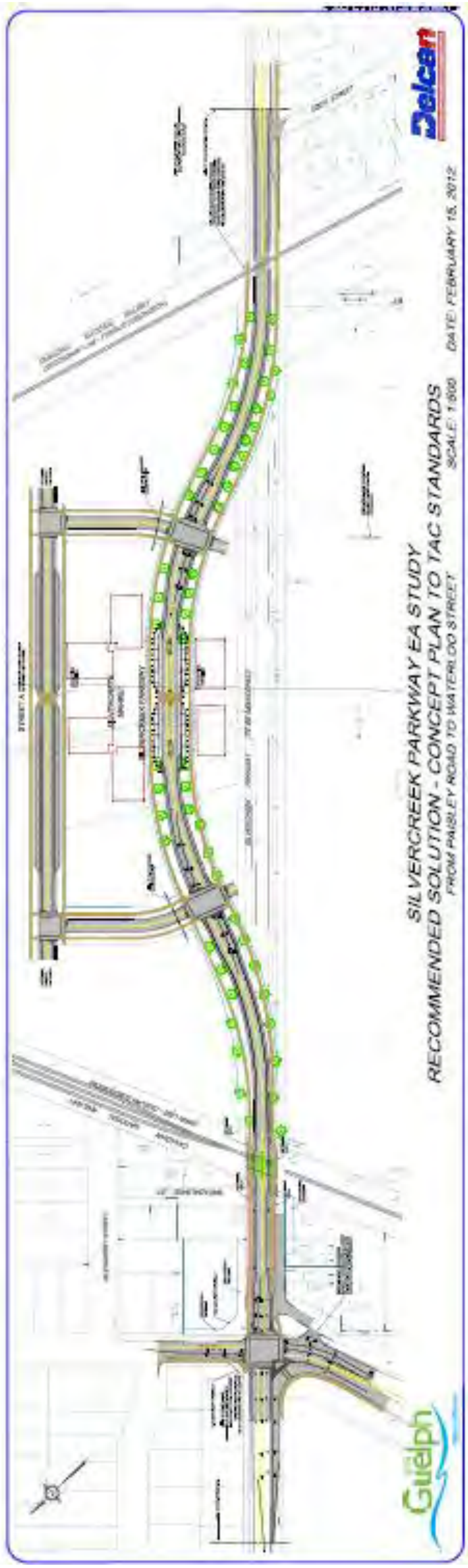
While safety cannot be guaranteed, if the recommendations contained in this Detailed Safety Assessment are implemented, and the detailed design is carried out in accordance with the draft CRRGCS, the reconstructed crossing should continue to have a high level of safety.

R. J. Fish, P.Eng.

APPENDIX A

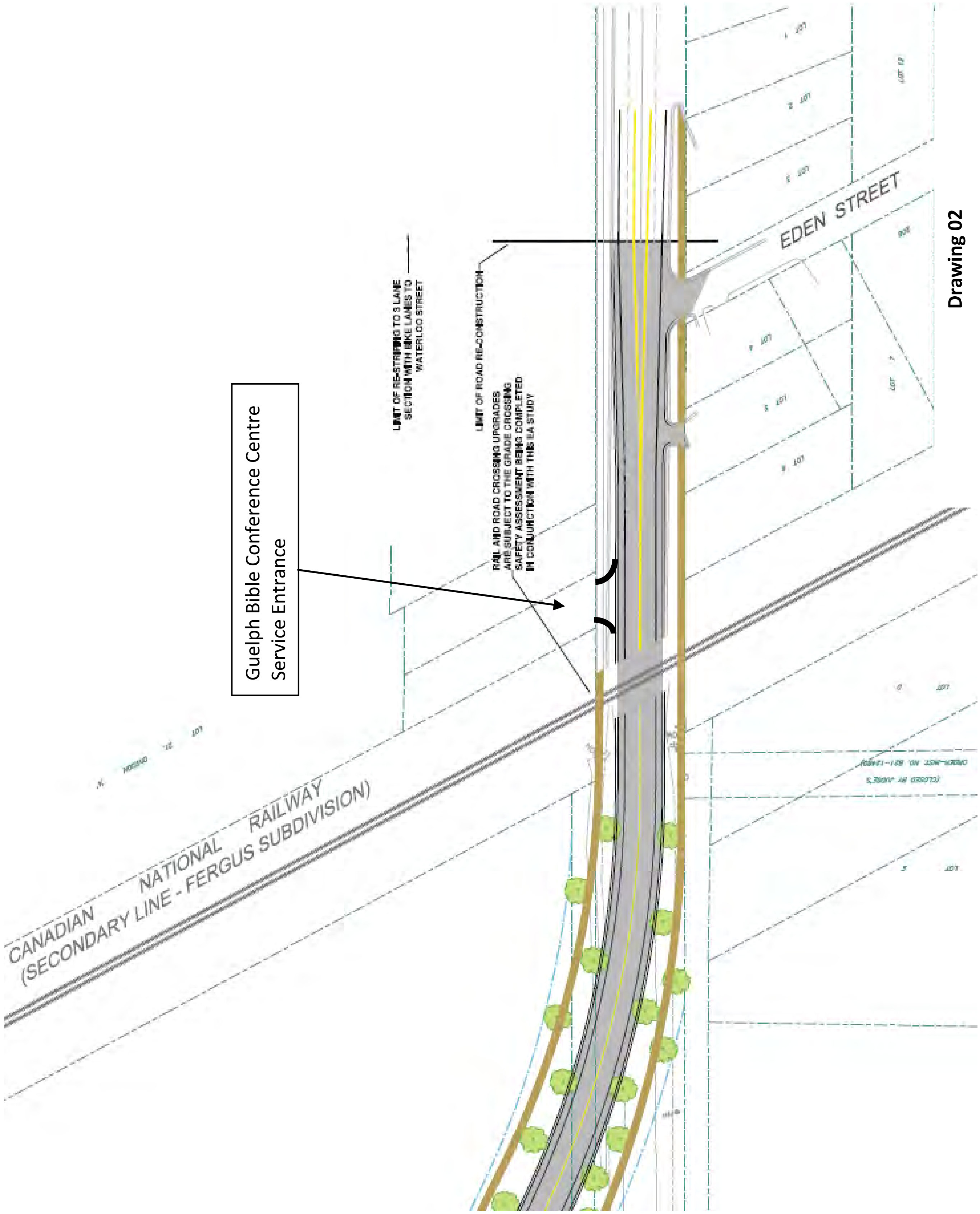
DRAWINGS

Appendix "A"



Drawing 01

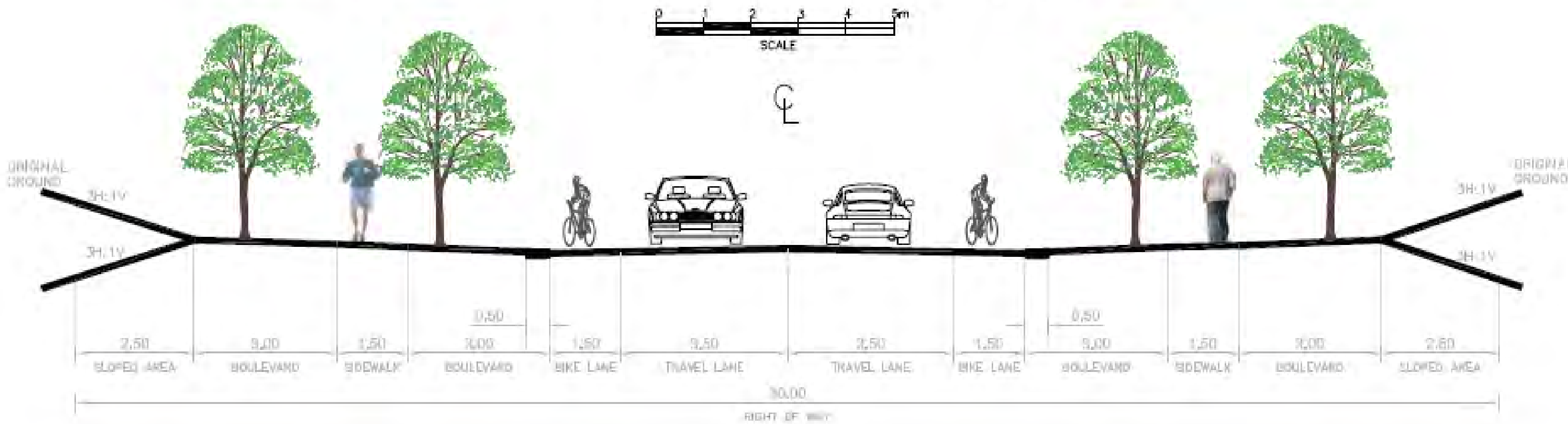
Appendix “A”

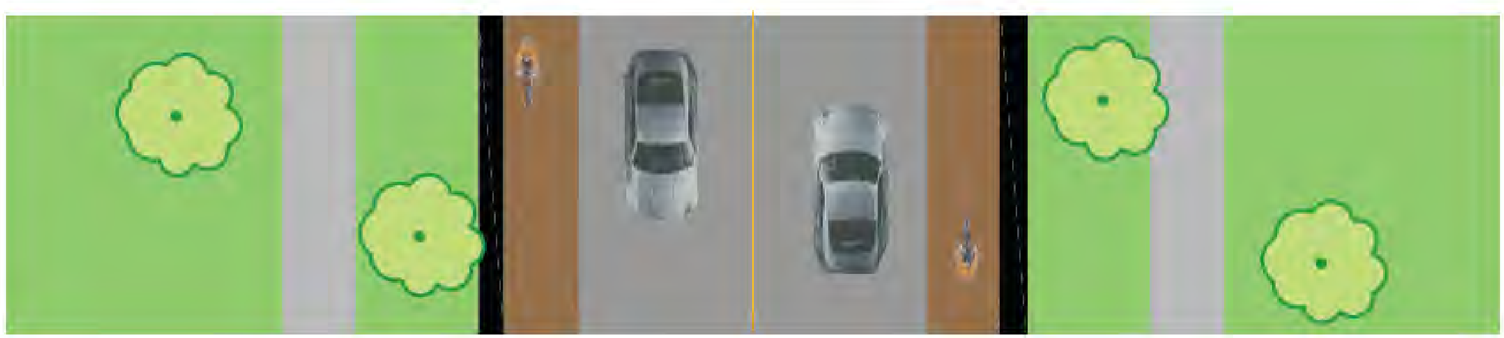


Drawing 02

Appendix "A"

Outside Silvercreek Square





Drawing 03

APPENDIX B

GRADE CROSSING FIELD DATA SHEETS

Safety Assessment Data Form
Road/Rail Grade Crossing - Active

Crossing Location	
Railway: **GEXR**	Road Authority: **City of Guelph**
Subdivision: **Fergus Spur**	Municipality: **City of Guelph**
Mileage: **29.51**	Road Name: **Silvercreek Parkway**
Crossing Number: **7193**	Road Classification: **Urban Arterial**

Collision History (5 Year)	
Property Damage (**0**)	Details:
Personal Injury (**0**)	
Fatal Injury (**0**)	
Total (**0**)	

Rail Data			
Daily Train Volume:	Freight (**1**)	Passenger (**0**)	Switching (**No**) Day/Night
Timetable Speed (mph)	Freight (**15**)	Passenger ( )mph	
Forecast:			

Road Data				
AADT (**350**)	Year of Count (**2011**)		10 Year Forecast (**12,000**)	
Road Speed (km/h)	Design (**60**)	Posted (**50**)	Advisory (**na**)	Actual (**uk**)
Pedestrian Volume: (**uk**) /day		Cyclist Volume: (**uk**) /day		
Dangerous Goods Trucks **Yes**		School Buses? **uk**	Truck Route? **Yes**	

Surrounding Land Use:			
NE: **Commercial**	NW: **Retail**	SE: **Residential**	SW: **Residential**
Schools, retirement homes etc. nearby: **No**			
Road Surface: **Asphalt**			
Road Illumination: **Streetlights**			

Design Vehicle	
Type: **WB-20**	Length (L): **22.7 m**
Stopping Sight Distance (SSD): **110**	Clearance Distance (cd): **12**
Vehicle Travel Distance (S=L+cd): 34.7	Vehicle Departure Time (t): **11.5**
Maximum Grade Within “S”: **0.5**	Grade Adjustment Factor: **1.0**
T = t x adjustment factor: (**11.5**) sec.	
Design Vehicle Departure Time, Td = J + T + K = (**13.5**) sec. where J = 2 sec perception & reaction and K = additional time due to crossing conditions	
Do field acceleration times exceed Td? (**uk**)	

Pedestrian, cyclist & Assistive Devices	
Departure Time Tp (**12**) sec	Pedestrian Clearance Distance (**12**)m

Queuing	
Distance to intersection D = (**?**) m	
"**D**" should not be less than 30m for either approach if the train speed exceeds 15 mph.	Are there pedestrian crossings on either road approach that could cause vehicles to queue back to the tracks? (**No**)
Is "D" insufficient such that road vehicles might queue onto the rail tracks? (**No**)	
Is "D" insufficient such that road vehicles turning from a side street might not see warning devices for the crossing? (**Private Road**)	
Comments: **Service entrance to Guelph Bible Conference Centre located 15 m south in southwest quadrant – gated and locked.**	

Safety Assessment Data Form
Road/Rail Grade Crossing - Active

Grade Crossing Surface			
Is the crossing smooth enough to allow road vehicles, pedestrians, cyclists, and other road users to cross at their normal speed without consequence? (**Yes**)			
Crossing Surface Material: **uk**		Condition: **New**	
Crossing Width: (**New**) m	Extension beyond travelled lanes:		
	N/E approach (**New**) m	S/W approach (**New**) m	
Cross-Section:			
Flangeway width (**New**) mm	Flangeway depth (**New**) mm		
Side Grinding width (**New**) mm	Side Grinding depth (**New**) mm		
Elevation of Top of Rail (**New**) mm (Above / Below) road surface			
Sidewalk/Path/Trail crossing width (New) m			
Sidewalk/Path/Trail extension beyond sidewalk	N/E (**New**) m	S/W (**New**) m	
Distance Between Travel Lane and Sidewalk (**3.5**) m			
Comments: **New crossing surface to be constructed to standard**			
Road Geometry			
Are horizontal and vertical alignments smooth and continuous throughout SSD?			
N/E Approach (**Yes**)	S/W Approach (**Yes**)		
Is horizontal alignment straight beyond rails for a distance design vehicle length, L?			
N/E Approach (**Yes**)	S/W Approach (**Yes**)		
Are the road lanes at least the same width on the crossing as on the road approaches?			
N/E Approach (**Yes**)	S/W Approach (**Yes**)		
Slope within 8m of nearest rail	N/E Approach (**< 1**)%	S/W Approach (**< 1**)%	
Slope between 8m & 18m	N/E Approach (**< 1**)%	S/W Approach (**< 1**)%	
If crossing is only for pedestrians, cyclists, or persons using assistive devices: slope within 5m of nearest rail N/E Approach (**na**)% S/W Approach (**na**)%			
General approach grade	N/E Approach (**0**)%	S/W Approach (**2**)%	
Are rail tracks super-elevated? (**No**)			
Angle between the crossing and the roadway (**62**) º			
Is there any evidence that "low bed" trucks have difficulty negotiating the crossing (**No**)			
Condition of Road Approaches: **New Construction**			
Sightlines			
Are sightlines within the rail R.O.W. clear of bushes/vegetation; 15 m on each side of the track and, 30 m along the track, on each side of the crossing? (**No**)			
Are sightlines on the road R.O.W. within 15m of the rail crossing clear of bushes/vegetation? (**Yes**)			
SSD minimum (**110**) m	Actual N/E Approach (**na**) m S/W Approach (**na**) m		
Dstopped minimum	Feet (**300**)	Metres (**92**)	
Dstopped actual			
	N/E Approach	Drivers left (**200+**) m	Drivers right (**200+**) m
	S/W Approach	Drivers left (**200+**) m	Drivers right (**100**) m
Ped./Cyclist Dstopped minimum: Feet (**265**) Metres (**80**)			
Ped./Cyclist Dstopped Actual:			
	N/E Approach	Pedestrians left (**uk**)m	Pedestrians right (**uk**)m
	S/W Approach	Pedestrians left (**uk**)m	Pedestrians right (**uk**)m

Safety Assessment Data Form
Road/Rail Grade Crossing - Active

Are there any obstacles within the sight triangles (Figure 8-2) other than traffic signs/utility poles that might affect visibility? (**Yes**)		
Comments: **Small tree in southeast quadrant will limit visibility when leaves are out.**		
Road Signs		
Railway Crossing Sign	N/E (**New**)	S/W (**New**)
Height	(**New**) m	(**New**) m
Distance from closest rail	(**New**) m	(**New**) m
Distance from road	(**New**) m	(**New**) m
Condition	(**New**)	(**New**)
Number of Tracks sign	(**na**)	(**na**)
Do Not Stop on Tracks Sign		
Does queued traffic routinely encroach closer than 5m from the crossing surface? (**No**)		
Are these signs present on either approach? (**na**)		
Railway Crossing Ahead Sign (WA18-20)		
Is AADT > 100? (**Yes**)	Is area urban such that WA18-20 is **not** required? (**No**)	
Appropriate orientation of symbol (**No**)	N/E Approach	S/W Approach
Actual distance from nearest rail to sign:	(**130**) m	(**150**) m
Required distance from nearest rail to sign:	(**110**) m	(**110**) m
Advisory Speed Sign		
Are they present on both approaches? (**No**)	Are they required on either approach? (**No**)	
Pavement Markings		
Are pavement markings consistent with those from the MUTCD Manual? (**New**)		
Are there lines to delineate sidewalks/paths? (**New**)		
Comments: **To be constructed in accordance with Manual**		
Warning System Warrants		
Cross-Product (**12,000**)	Number of Tracks (**1**)	Sightlines Obscured (**Yes**)
Maximum Rail Operating Speed (**15**) mph	Any proximity conditions met? (**No**)	
Warrants for Gates		
Cross-Product > 50,000 (**12,000**)		
Maximum Rail Operating Speed > 50 mph (**15**)		
Number of Tracks (2 or more if trains can pass) (**1**)		
Dstopped is insufficient (**No**)		
Proximity conditions are met (**No**)		
Warning System		
Light Units (**Yes**)	Condition (**New**)	
Bells (**Yes**)	Condition (**New**)	
Cantilevers (**Yes**)	Condition (**New**)	
Are warning signal assemblies and cantilevers are in accordance with Figures 18-1 and 18-3 (**New**)		
Is warning system housing at least 9m from traveled way of the road and 8m from the nearest rail? (**New**)		
If there is a sidewalk, is a bell on the adjacent assembly? (**New**)		
Design Approach Warning Time: N/E Approach (**24**)sec S/W Approach (**24**)sec		

Safety Assessment Data Form
Road/Rail Grade Crossing - Active

Is warning time less than 35 sec (without gates) or 55 sec (with gates) (**No**)			
Gate Operation			
Gate arm clearance time (**na**)	Required	Actual	Complies
Gate arm delay time	( ) sec		
Gate descent time	10 to 15 sec		
Gate assent time	6 to 12 sec		
Do gates conform to standards depicted in Figure 18-2? ( )			
Light Units			
Distance for Primary Light Units	Minimum (**110**) m	Recommended (**125**) m	
Are flashing light units located within 5^{o} horizontally of the centerline of the road (throughout the approach distance above)? (**Yes**)			
Does horizontal / vertical curvature necessitate supplemental units? **(Yes)**			
Can back lights be seen by all stopped drivers? (**Yes**)			
Are lights obscured by vehicles stopped on adjacent intersections? (**No**)			
Are additional light units required for drivers as they begin to turn onto an approach road from an intersecting road/lane/parking lot, etc. (**Yes**)			
Cantilevered Light Units			
Does Dr exceed 7.7m? (**New**)	Does Dl exceed 8.7m? (**New**)		
Multiple Lanes			
Can front light units be seen by drivers in all lanes (….would T/T obscure?)? (**No**)			
Can back light units be seen by all stopped drivers in all lanes? (**Yes**)			
Sidewalks, paths, trails, etc.			
Distance from path centerline to signal to signal mast (**uk**) m			
Are separate light units required? (**No**)			
Comments:			
Active Advance Warning Signs			
Are signs present?	N/E Approach (**No**)	S/W Approach (**No**)	
Minimum Distance for Primary Light Units: (**110**) m			
Recommended distance for Primary Light Units: (**125**) m			
Warrants			
All front light units obscured within minimum distance above (**Yes**)			
The facility designated a "freeway" or "expressway" (**No**)			
Environmental conditions frequently obscure signal visibility (**No**)			
Field Checks			
Does sign flash during operation of grade crossing warning system? (**na**)			
Distance from the sign to 2.4m beyond the furthest rail ( ) m			
Does the sign flash before the actuation of the crossing warning system by the time required to travel from the sign to clear the crossing? ( )			
Distance from the sign to the closest gate ( ) m			
Does the flashing sign precede the actuation of the descent of the gate arms by the time required to travel from the sign to clear the closest gate? ( )			
Time required for all queued vehicles to resume to maximum road operating speed ( ) sec			

Safety Assessment Data Form
Road/Rail Grade Crossing - Active

Comments:
Preemption
Are adjacent traffic signals preempted by a grade crossing warning system? (**na**)
Date of last preemption check? (   )
Warrants
Less than 60m between stop line at traffic signal and nearest rail (**No**)
Vehicles queued for traffic signal regularly encroach closer than 2.4m to the nearest rail (**No**)
Field Checks:
Does preemption provide adequate time to clear traffic from grade crossing before train's arrival? (**na**)
Does preemption prohibit road traffic from moving from the street intersection toward the grade crossing? (**na**)
Any known queuing problems on the tracks? (**No**)
Are pedestrians accommodated during preemption? (**na**)
Have longer/slower vehicles been considered? (**na**)
Are supplemental signs needed for motorists (no right turn on red light, etc)? (**na**)
Train Whistling
Is train whistling prohibited at this crossing? (**Yes**) 24 hours? (**Yes**)
Is there evidence of routine unauthorized access (trespassing) on the rail line in the area of the crossing? (**No**)
Are the requirements for whistle prohibition met (Table 16-1 of RTD10) met? **Yes**
Comments:
Comments and Recommendations
New crossing warning system to be installed in conjunction with road and crossing reconstruction.

Date: February 16, 2012

APPENDIX F

STAKEHOLDER NOTIFICATION SUMMARY

NOTICE

CITY OF Guelph
Making a Difference

November 10, 2011

Public Information Centre No. 1

Class Environmental Assessment
Silvercreek Parkway South Improvements

FIND OUT WHAT'S HAPPENING IN YOUR NEIGHBOURHOOD

The Project

The City of Guelph is intiating a Class Environmental Assessment study for undertaking improvements to Silvercreek Parkway, from north of Paisley Road to south of Canadian National Railway (CNR) secondary line including: (1) grade separation at the CNR mainline; (2) the reconnection of Silvercreek Parkway between the two CN rail lines; (3) a new roadway to the east of Silvercreek Parkway, as shown in the concept plan (Figure 1); and (4) the upgrading of underground services and utilities within the road allowance, including the drainage of the reconnected roadway and underpass.

Figure 1 – Concept Plan

Figure 2 shows the Study Area.

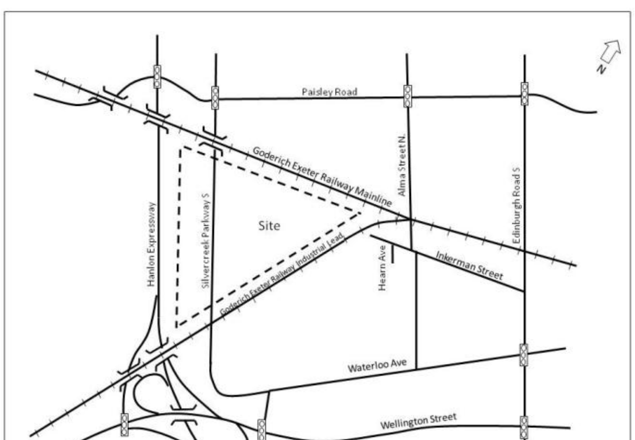


Figure 2 – Study Area

The Process

The Environmental Assessment will be conducted as a Schedule C project in accordance with the Municipal Class Environmental Assessment process (Municipal Engineers Association, 2000 as amended in 2007) under the Ontario Environmental Assessment Act. The Class Environmental Assessment process includes public and

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Canada
N1H 3A1

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TTY 519-826-9771

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NOTICE

review agency consultation, an evaluation of alternatives, an assessment of potential environmental effects of the proposed improvements, and identification of reasonable measures to mitigate any adverse impacts that may result.

How to Participate

As part of the consultation process, a Public Information Centre is being planned to provide background information on the study and the various alternatives that are being considered for the proposed undertakings. Representatives from the City and its consultant will be present at the Public Information Centre to answer questions and discuss the next steps in the study.

The Public Information Centre will be held:

November 24, 2011
6 - 8 p.m.
City Hall Galleria, 1 Carden Street, Guelph

You are encouraged to attend the Public Information Centre and provide your comments for consideration. Comments and information regarding this project will be collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act* for the purpose of meeting environmental assessment requirements. With the exception of personal information, all comments will become part of the public record. Opportunities for public input will continue throughout the Class Environmental Assessment process. Future consultation opportunities will be publicized in this newspaper and posted on the City's website at **guelph.ca.**

For more information

Please contact either of the following project team members if you have any questions or comments, or would like to be added to the project mailing list:

Rajan Philips, P. Eng.
Manager, Transportation
Planning and Development Engineering
Planning & Building, Engineering and Environment
City of Guelph
1 Carden Street
Guelph ON N1H 3A1
T **519-822-1260 x 2369**
E **rajan.philips@guelph.ca**

Peter Jefford, P.Eng.
Project Manager
Delcan Corporation
675 Queen Street South, Suite 201
Kitchener ON N2M 1A1
T **519-744-4509**
E **p.jefford@delcan.com**

(Notice first issued November 10, 2011.)

NOTICE

Public Information Centre No. 2

Class Environmental Assessment
Silvercreek Parkway South Improvements

February 2, 2012

The project

The City of Guelph has initiated a Class Environmental Assessment study for undertaking improvements to Silvercreek Parkway, from north of Paisley Road to south of Canadian National Railway (CNR) secondary line including: (1) grade separation at the CNR mainline; (2) the reconnection of Silvercreek Parkway between the two CN rail lines; (3) a new roadway to the east of Silvercreek Parkway as shown in the concept plan (Figure 1); and (4) the upgrading of underground services and utilities within the road allowance, including the drainage of the reconnected roadway and underpass. Figure 2 shows the Study Area.

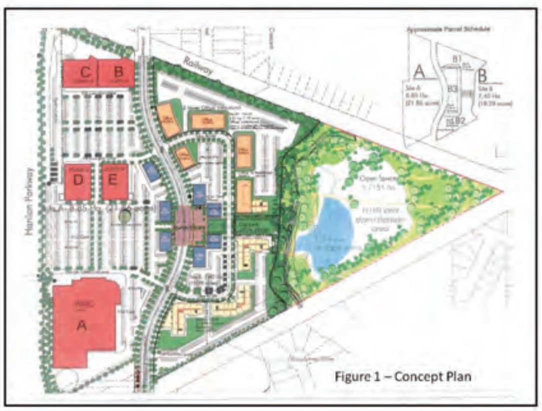

Figure 1 – Concept Plan

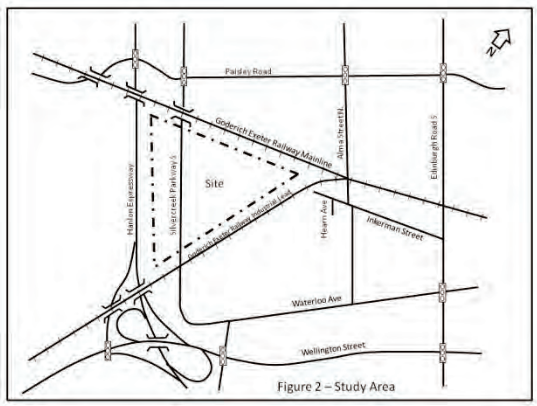

Figure 2 – Study Area

The process

Following a review of the Class Environmental Assessment requirements, the City has decided to proceed with the Environmental Assessment as a Schedule B project in accordance with the Municipal Class Environmental Assessment process (Municipal Engineers Association, October 2000 as amended in 2007) under the Ontario Environmental Assessment Act. The Class Environmental Assessment process includes public and review agency consultation, an evaluation of alternatives, an assessment of potential environmental effects of the proposed improvements and identification of reasonable measures to mitigate any adverse impacts that may result.

How to participate

As part of the consultation process, a Public Information Centre is being planned to provide background information on the study, and the evaluation and selection of the project team's recommended solution(s). Representatives from the City and its consultant will be available to answer questions and discuss the next steps in the study. The Public Information Centre will be held:

Wednesday, February 15
6 - 8 p.m.
City Hall Galleria, 1 Carden Street

You are encouraged to attend the Public Information Centre and provide your comments for consideration. Comments and information regarding this project will be collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act* for the purpose of meeting environmental assessment requirements.

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1 Carden St
Guelph, ON
Canada
N1H 3A1

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With the exception of personal information, all comments will become part of the public record.

Opportunities for public input will continue throughout the Class Environmental Assessment process. Future consultation opportunities will be posted on the City's website at **guelph.ca.**

For more information

Please contact either of the following project team members if you have any questions or comments, wish to obtain more information on the project, or if you would like to be added to the project mailing list:

Mr. Rajan Philips, P. Eng., Manager
Transportation Planning & Development Engineering
Planning & Building, Engineering and Environment
City of Guelph
1 Carden Street
Guelph ON N1H 3A1
T **519-822-1260 x 2369**
E **rajan.philips@guelph.ca**

Mr. Peter Jefford, P.Eng., Project Manager
Delcan Corporation
675 Queen Street South, Suite 201
Kitchener ON N2M 1A1
T **519-744-4509**
E **p.jefford@delcan.com**

(Notice first issued February 2, 2012)

C: Mayor and Councillors

APPENDIX G

PUBLIC CONSULTATION CENTRE NO. 1 SUMMARY REPORT

Public Information Centre No. 1
Summary Report

Silvercreek Parkway South Improvements
Including Grade Separation at the CN North Mainline
Class Environmental Assessment

Prepared for:
City of Guelph

December 2011

TRANSPORTATION • INFORMATION TECHNOLOGY • WATER

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Appendices

1.0 Background

Public Information Centre (PIC) No. 1 for the Silvercreek Parway South Improvements Class Environmental Assessment (EA) Study was held on November 24th, 2011 from 6:00 p.m. to 8:00 p.m. at Guelph City Hall Galleria, located at 1 Carden Street, Guelph, Ontario.

The PIC was held as a forum for the public to convey their issues/concerns and suggestions to the project team on the obtain comments on the study problem/opportunity statement, local issues and area constraints, and alternative solutions being considered.

Local area residents, special interest groups and technical agencies were invited to attend via regular mail, hand delivered notice (to local residents), the City of Guelph's website and newspaper publications in the *Guelph Tribune* on November 10th and 17th, 2011.

All PIC notification materials are provided in **Appendix A**.

The PIC followed an "Open House" format with information pertaining to the study on display and members of the project team on hand to discuss the study with those in attendance. During the PIC, participants were encouraged to view the boards on display and to address their questions and concerns to members of the project team.

Local area residents that were determined to be directly impacted by the project works were invited to meet the project team and discuss project-related issues and potential impacts prior to the actual start of the PIC.

2.0 Display Materials

Information displays presented at the PIC are provided in **Appendix B.**

In addition to the display materials presented, an information package was distributed which included an 8.5" x 11" booklet version of the materials presented at the PIC.

3.0 Attendance and Comments Received

Those attending the PIC were requested to sign an attendance booklet and were encouraged to provide their written comments to the material presented. Attendance at the PIC included 36 individuals signing the attendance booklet. A summary of the comments submitted at, and following the PIC, is provided in **Table 3.1**. Only those comments received that were within the scope of the EA Study are summarized. The submitted comments are provided in **Appendix C**.

Table 1 - Public Information Centre No. 1 Comment Summary

No.	Key Issue	Comment Summary	Project Team's Consideration of Comments
1	**Support for Alternative "C-2"**	Of the total written comments received, the majority (4 comments) were in support of reconstructing Silvercreek Parkway on a new alignment as per the Silvercreek development concept plan, refined to meet Transportation Association of Canada (TAC) engineering standards, including a Subway at the CNR Mainline.	Comments noted.
2	**Support for Alternative "B"**	Of the total written comments received, 3 of the comments were in support of reconstructing Silvercreek Parkway on the existing alignment, including a new Subway at the CNR Mainline. Comments in support of this alternative were submitted by residents of Woodycrest Drive and alluded to the loss of green space behind their properties as the reason.	The alignment to be selected for the subject portion of Silvercreek Parkway would have no bearing on the loss of green space resulting from development of the Silvercreek lands.
3	**Other**	Additional comments were received that identified the following issues and concerns:	
		• Grade issues at Eden Street (potential for vehicles sliding through the stop sign and into traffic at Eden Street/Silvercreek Parkway).	With the exception of repainting Silvercreek Parkway to accommodate additional 1.5 metre bicycle lanes, the limits of roadway reconstruction do not extend to Eden Street. City to forward comment to Operational Department for increased salt maintenance.
		• Shed inhibiting sightlines at the NW corner of Eden Street/Silvercreek Parkway.	Structures on lands designated as private property are subject to City Bylaws. This issue has been forwarded to the City's Building Department for review and potential follow up.
		• Separate cyclists and pedestrians from vehicular traffic.	Dedicated bicycle lanes and separate sidewalks will be provided in the preferred design of the roadway.

No.	Key Issue	Comment Summary	Project Team's Consideration of Comments
		• Raise bicycle and pedestrian grade under the rail bridge.	Alternative bicycle and pedestrian grades under the CN Subway are currently being investigated by the project team.
		• Lighting for the new road should be considerate of the surrounding neighbourhoods.	Street lighting will be provided in accordance with City standards.
		• Provision of left and right turn access in out of Paisley Service Road.	Access in and out of Paisley Road is anticipated to be provided via a right-in, right-out movement. This movement will be subject to MTO approval.
		• No road incline onto Paisley Road.	The connection to Paisley Road will be shifted to the east, closer to the Silvercreek Parkway intersection to reduce the current profile grade to City standards (6% grade).
		• Allow truck entrance / exit onto Silvercreek Parkway from Waterloo Avenue only.	Commercial trucks will be permitted to service the commercial development planned for the Silver Creek Lands. Trucks will be encouraged to use Waterloo Avenue, rather than Paisley Road.

4.0 Recommendations

Where applicable, the comments received at the PIC are to be incorporated into the evaluation and selection of the preferred solution.

APPENDIX A

Public Information Centre Notification Materials

Woodside Business Centre
675 Queen Street South, Suite 201
Kitchener, Ontario N2M 1A1
Tel: 519.744.4509 ● Fax: 519.744.2822
www.delcan.com

10 November, 2011

OUR REF: TW-1366

Dear Sir/Madam,

Subject: **Notice of Public Information Centre**
Class Environmental Assessment - Silvercreek Parkway South Improvements

The City of Guelph is currently undertaking a Class Environmental Assessment (EA) Study for the Silvercreek Parkway Road South improvements including grade separation at CN North mainline, in the City of Guelph.

A Notice containing details of the study and upcoming Public Information Centre (PIC) is enclosed.

If you have any questions or require additional information, please contact the undersigned at 519-744-4509. Thank you for your assistance with this project.

Yours very truly,

Peter Jefford

Peter Jefford, P. Eng.
Project Manager, Delcan Corporation

c.c. Rajan Philips – City of Guelph
Andrew McGregor – Delcan Corporation

Encls.

NOTICE

November 10, 2011

Public Information Centre No. 1

Class Environmental Assessment
Silvercreek Parkway South Improvements

FIND OUT WHAT'S HAPPENING IN YOUR NEIGHBOURHOOD

The Project

The City of Guelph is intiating a Class Environmental Assessment study for undertaking improvements to Silvercreek Parkway, from north of Paisley Road to south of Canadian National Railway (CNR) secondary line including: (1) grade separation at the CNR mainline; (2) the reconnection of Silvercreek Parkway between the two CN rail lines; (3) a new roadway to the east of Silvercreek Parkway, as shown in the concept plan (Figure 1); and (4) the upgrading of underground services and utilities within the road allowance, including the drainage of the reconnected roadway and underpass.

Figure 1 – Concept Plan

Figure 2 shows the Study Area.

Figure 2 – Study Area

The Process

The Environmental Assessment will be conducted as a Schedule C project in accordance with the Municipal Class Environmental Assessment process (Municipal Engineers Association, 2000 as amended in 2007) under the Ontario Environmental Assessment Act. The Class Environmental Assessment process includes public and

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review agency consultation, an evaluation of alternatives, an assessment of potential environmental effects of the proposed improvements, and identification of reasonable measures to mitigate any adverse impacts that may result.

How to Participate

As part of the consultation process, a Public Information Centre is being planned to provide background information on the study and the various alternatives that are being considered for the proposed undertakings. Representatives from the City and its consultant will be present at the Public Information Centre to answer questions and discuss the next steps in the study.

The Public Information Centre will be held:

November 24, 2011
6 - 8 p.m.
City Hall Galleria, 1 Carden Street, Guelph

You are encouraged to attend the Public Information Centre and provide your comments for consideration. Comments and information regarding this project will be collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act* for the purpose of meeting environmental assessment requirements. With the exception of personal information, all comments will become part of the public record. Opportunities for public input will continue throughout the Class Environmental Assessment process. Future consultation opportunities will be publicized in this newspaper and posted on the City's website at **guelph.ca.**

For more information

Please contact either of the following project team members if you have any questions or comments, or would like to be added to the project mailing list:

Rajan Philips, P. Eng.
Manager, Transportation
Planning and Development Engineering
Planning & Building, Engineering and Environment
City of Guelph
1 Carden Street
Guelph ON N1H 3A1
T **519-822-1260 x 2369**
E **rajan.philips@guelph.ca**

Peter Jefford, P.Eng.
Project Manager
Delcan Corporation
675 Queen Street South, Suite 201
Kitchener ON N2M 1A1
T **519-744-4509**
E **p.jefford@delcan.com**

(Notice first issued November 10, 2011.)

FEDERAL & PROVINCIAL AGENCIES	
Mr. Mike Stone District Planner	Ministry of Natural Resources Guelph District Office 1 Stone Road West Guelph, ON N1G 4Y2
Ms. Barb Slattery Environmental Resource Planner / EA Coordinator	Ministry of the Environment Air, Pesticides and Environmental Planning 119 King Street West 12th Floor Hamilton, ON L8P 4Y7
Mr. Barry Duffey Manager	Ministry of the Environment Air, Pesticides and Environmental Planning 119 King Street West 12th Floor Hamilton, ON L8P 4Y7
Ms. Dolly Goyette Director	Ministry of the Environment Guelph District Office 1 Stone Road West 4th Floor Guelph, ON N1G 4Y2
Mr. Kevin Bentley Manager	Ministry of Transportation Southwestern Region 659 Exeter Road 4th Floor London, ON N6E 1L3
Mr. Ian Smyth Corridor Management Planner	MTO 659 Exeter Road 4th Floor London, ON N6E 1L3 Ian.C.Smyth@ontario.ca
Mr. Robert Bakalarczyk Project Engineer, Planning & Design Section	Ministry of Transportation Southwestern Region 659 Exeter Road 4th Floor London, ON N6E 1L3 Robert.Bakalarczyk@ontario.ca
Mr. Alan Sawyer Environmental Assessement Facilitator	Ontario Realty Corporation Southwest Region 1 Stone Road West 4th Floor Guelph, ON N1G 4Y2
Environmental Assessment Coordinator	Transport Canada, Ontario Region 4900 Yonge St. 4th Floor Toronto, ON M2N 6A5
CONSERVATION AUTHORITY	

Mr. Fred Natolochny Supervisor Of Resource Planning	Grand River Conservation Authority 400 Clyde Road PO Box 729 Cambridge, ON N1R 5W6
Mr. John Palmer Senior Water Resources Engineer	Grand River Conservation Authority 400 Clyde Road PO Box 729 Cambridge, ON N1R 5W6
Mr. Jamie Ferguson	Grand River Conservation Authority 400 Clyde Road PO Box 729 Cambridge, ON N1R 5W6
SCHOOL BOARDS	
Ms. Heather Imm Senior Planner	Upper Grand District School Board Planning Department 500 Victoria Road North Guelph, ON N1E 6K2
ABORIGINAL AGENCIES	
Grand Chief Randall Philips	Association of Iroquois and Allied Indians 387 Princess Avenue London, ON N6B 2A7
Ms. Heather Levecque Manager, Consultation Unit	Ministry of Aboriginal Affairs Consultation Unit 160 Bloor Street East 9th Floor Toronto, ON M7A 2E6
Chief Bryan LaForme	Mississaugas of the New Credit First Nation 2789 Mississauga Road RR#6 Hagersville, ON N0A 1H0
Mr. Leroy Hill Secretary	Six Nations Haudenosaunee Confederacy Council 2634 6th Line RR#2 Ohsweken, ON N0A 1M2
Chief William K. Montour	Six Nations of the Grand River PO Box 5000 1695 Chiefswood Road Oshweken, ON N0A 1M0
UTILITIES	

Mr. Brad Boulton	Bell Canada 575 Riverbend Dr. Floor 1 Kitchener, Ontario N2K 3S3 bradley.boulton@bell.ca
Mr. Ian Bolton	Guelph Hydro 395 Southgate Drive Guelph, ON N1G 4Y1
Mr. Charles S. Esendal Sustainment Manager	Hydro One Networks Lines Information Systems and Programs 483 Bay Street TCT15-A11 North Tower Toronto, ON M5G 2P5
Ms. Cara Clairman Vice President, Sustainable Development	Ontario Power Generation Inc. 700 University Ave. Toronto, ON L5G 1X6
Mr. Brian Murray	Rogers Cable 85 Grand Crest Place PO Box 488 Kitchener, ON N2G 4A8
Mr. Kevin Schimus	Union Gas 603 Kumpf Drive PO Box 340 Waterloo, ON L2J 4A4
Ms. Dana Moffatt	Telus Access Engineering TELUS Central Region 25 York Street 22nd Floor Toronto, Ontario M5J 2V5
	Ontario One Call 335 Laird Rd Unit 8 Guelph, Ontario N1G 4P7
RAILWAY AGENCIES	
Ms. Marissa Crawford Manager, Design & Construction	CN Rail 4 Welding Way PO Box 1000 Concord, Ontario L4K 1B9 marissa.crawford@cn.ca

Mr. Mike Cyr Director, Rail Services	Go Transit 20 Bay St. Suite 600 Toronto, ON M5J 2W3
Mr. Daryl J. Barnett Director, Railway Corridor Infrastructure	Go Transit 20 Bay St. Suite 600 Toronto, ON M5J 2W3
Mr. Doug MacKenzie General Manager	Rail America 101 Shakespeare Street 2nd Floor Stratford, Ontario N5A 3W5 douglas.mackenzie@railamerica.com
Ms. Kathy Petroglou Administrator - Real Estate	Rail America 7411 Fullerton Street Suite 110 Jacksonville, Florida 32256 kathy.petroglou@railamerica.com
Ms. Donna Killingsworth Real Estate Manager	Rail America 7411 Fullerton Street Suite 110 Jacksonville, Florida 32256 donna.killingsworth@railamerica.com
Mr. Larry Romaine AVP Engineering Services	Rail America 7411 Fullerton Street Suite 110 Jacksonville, Florida 32256 larry.romaine@railamerica.com
Mr. Benoit Filion Project Manager Infrastructure	Via Rail Canada Inc. 3 Place Ville Marie Suite 500 Montreal, Quebec H3B 2C9 Benoit_Filion@viarail.ca
Mr. Kenneth Rose Sr. Manager Real Estate Southwestern Ontario & West	Via Rail Canada Inc. 50 Drummond Street Unit C Etobicoke, Ontario M8V 4B5 Kenneth_Rose@viarail.ca
DEVELOPER CIRCULATION	

Mr. Matthew West Fieldgate Commercial Director of Development	Silvercreek Developments 5400 Yonge Street 5th Floor Toronto, Ontario M2N 5R5 mattw@fieldgatecommercial.com
Mr. Neil Robinson President	Neil Robinson Real Estate Consultants ltd. 38 Hogarth Avenue Toronto, Ontario M4K 1K1 neil@neilrrealestate.com
COMMUNITY CIRCULATION	
Mr. Ron Foley	Howitt Park Neighbourhood Residents Association 67 Watson Road South Guelph, Ontario N1L 1E3 info@hpng.ca
Mr. Hudson Merritt	CB Richards Limited 100 Frederick Street Suite 810 Kitchener, Ontario N2H 6R2

NOTICE

November 10, 2011

Public Information Centre No. 1

Class Environmental Assessment
Silvercreek Parkway South Improvements

FIND OUT WHAT'S HAPPENING IN YOUR NEIGHBOURHOOD

The Project

The City of Guelph is intiating a Class Environmental Assessment study for undertaking improvements to Silvercreek Parkway, from north of Paisley Road to south of Canadian National Railway (CNR) secondary line including: (1) grade separation at the CNR mainline; (2) the reconnection of Silvercreek Parkway between the two CN rail lines; (3) a new roadway to the east of Silvercreek Parkway, as shown in the concept plan (Figure 1); and (4) the upgrading of underground services and utilities within the road allowance, including the drainage of the reconnected roadway and underpass.

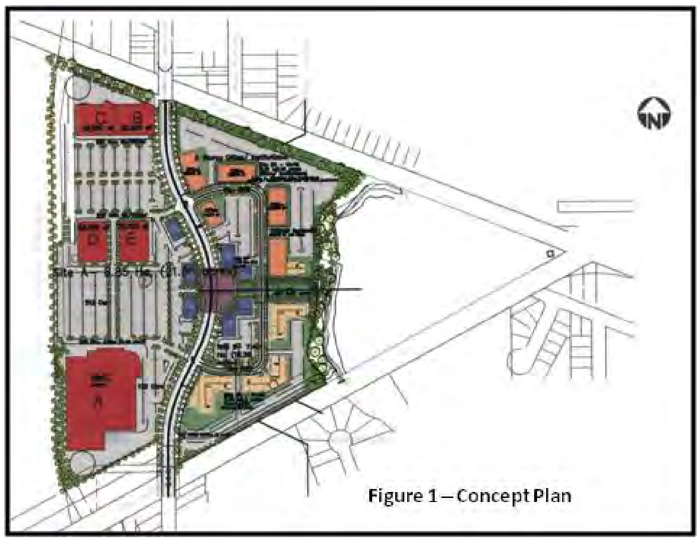


Figure 1 – Concept Plan

Figure 2 shows the Study Area.

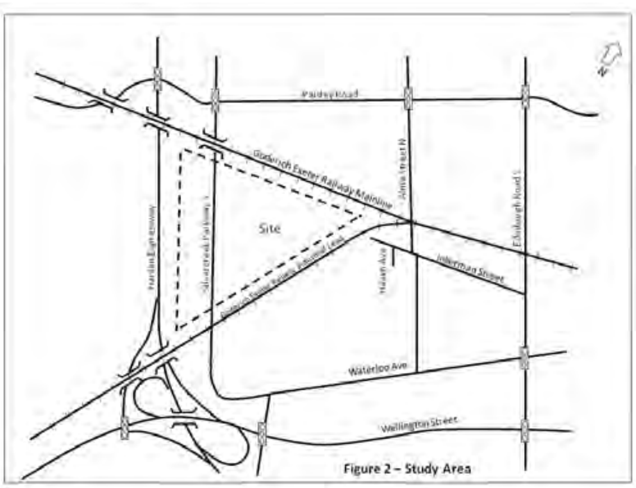


Figure 2 – Study Area

The Process

The Environmental Assessment will be conducted as a Schedule C project in accordance with the Municipal Class Environmental Assessment process (Municipal Engineers Association, 2000 as amended in 2007) under the Ontario Environmental Assessment Act. The Class Environmental Assessment process includes public and

City Hall
1 Carden St
Guelph, ON
Canada
N1H 3A1

T 519-822-1260
TTY 519-826-9771

guelph.ca

NOTICE

review agency consultation, an evaluation of alternatives, an assessment of potential environmental effects of the proposed improvements, and identification of reasonable measures to mitigate any adverse impacts that may result.

How to Participate

As part of the consultation process, a Public Information Centre is being planned to provide background information on the study and the various alternatives that are being considered for the proposed undertakings. Representatives from the City and its consultant will be present at the Public Information Centre to answer questions and discuss the next steps in the study.

The Public Information Centre will be held:

November 24, 2011
6 - 8 p.m.
City Hall Galleria, 1 Carden Street, Guelph

You are encouraged to attend the Public Information Centre and provide your comments for consideration. Comments and information regarding this project will be collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act* for the purpose of meeting environmental assessment requirements. With the exception of personal information, all comments will become part of the public record. Opportunities for public input will continue throughout the Class Environmental Assessment process. Future consultation opportunities will be publicized in this newspaper and posted on the City's website at **guelph.ca.**

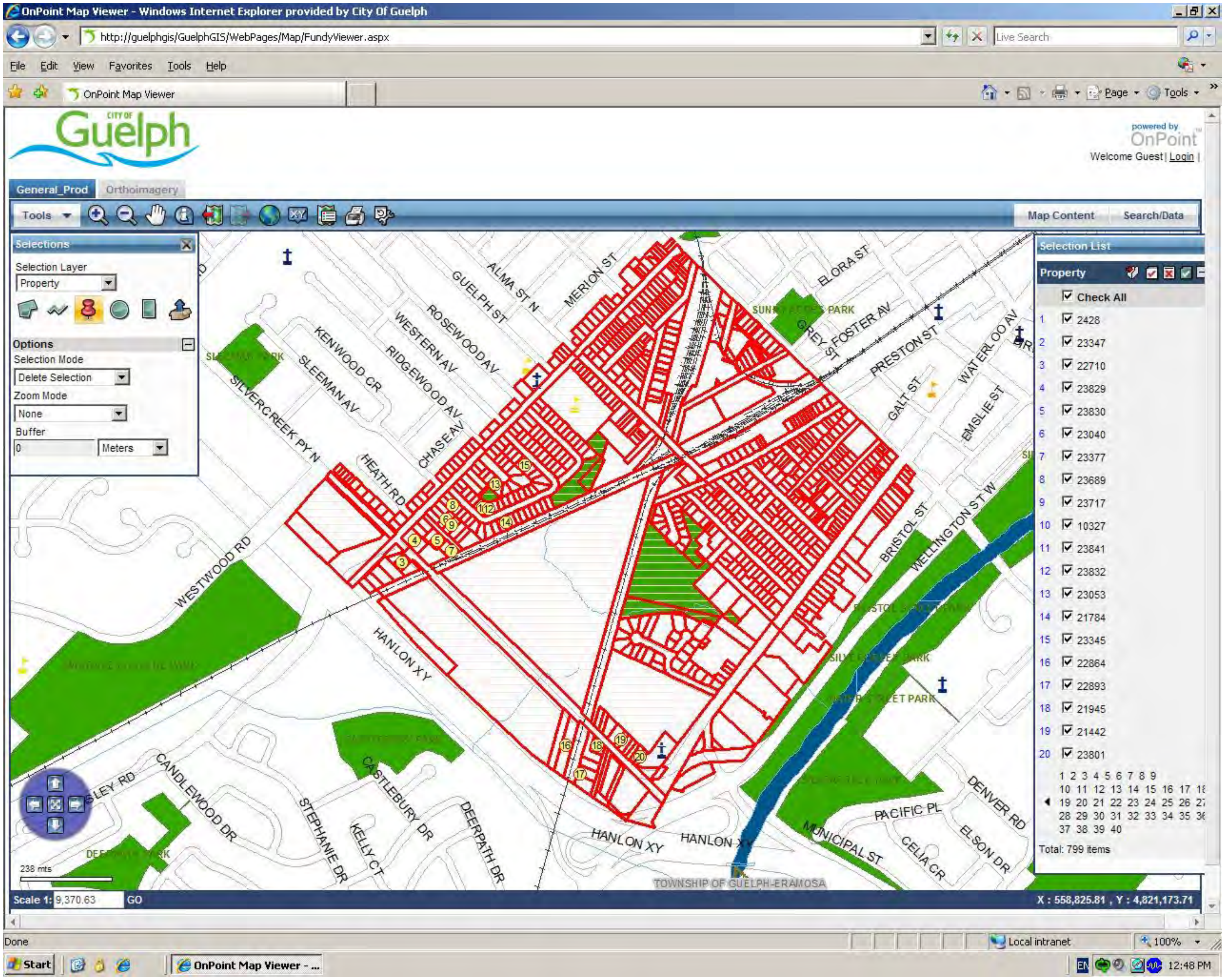
For more information

Please contact either of the following project team members if you have any questions or comments, or would like to be added to the project mailing list:

Rajan Philips, P. Eng.
Manager, Transportation
Planning and Development Engineering
Planning & Building, Engineering and Environment
City of Guelph
1 Carden Street
Guelph ON N1H 3A1
T **519-822-1260 x 2369**
E **rajan.philips@guelph.ca**

Peter Jefford, P.Eng.
Project Manager
Delcan Corporation
675 Queen Street South, Suite 201
Kitchener ON N2M 1A1
T **519-744-4509**
E **p.jefford@delcan.com**

(Notice first issued November 10, 2011.)


OnPoint Map Viewer - Windows Internet Explorer provided by City Of Guelph
http://guelphgis/GuelphGIS/WebPages/Map/FundyViewer.aspx
Live Search
File Edit View Favorites Tools Help
OnPoint Map Viewer
Page Tools
City of Guelph
powered by OnPoint
Welcome Guest | Login |
General_Prod
Orthoimagery
Tools
Map Content
Search/Data
Selections
Selection Layer
Property
Options
Selection Mode
Delete Selection
Zoom Mode
None
Buffer
0
Meters
Selection List
Property
Check All
1 2428
2 23347
3 22710
4 23829
5 23830
6 23040
7 23377
8 23689
9 23717
10 10327
11 23841
12 23832
13 23053
14 21784
15 23345
16 22864
17 22893
18 21945
19 21442
20 23801
1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17 18
19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36
37 38 39 40
Total: 799 items
ALMA ST N
MERION ST
GUELPH ST
ROSEWOOD AV
WESTERN AV
KENWOOD CR
RIDGEWOOD AV
SLEEMAN AV
SILVERCREEK PY N
HEATH RD
CHASE AV
ELORA ST
SUNNY ACRES PARK
FOSTER AV
GREY ST
PRESTON ST
WATERLOO AV
GALT ST
EMSLIE ST
BRISTOL ST
WELLINGTON ST W
WESTWOOD RD
HANLON XY
CANDLEWOOD DR
STEPHANIE DR
KELLY CT
CASTLEBURY DR
DEERPATH DR
PACIFIC PL
DENVER RD
ELSON DR
MUNICIPAL ST
CELIA CR
TOWNSHIP OF GUELPH-ERAMOSA
238 mts
Scale 1: 9,370.63
GO
X : 558,825.81 , Y : 4,821,173.71
Done
Local intranet
100%
Start
OnPoint Map Viewer - ...
12:48 PM

APPENDIX B

Presentation Materials

WELCOME

Class Environmental Assessment Study

Silvercreek Parkway South Improvements
From North of Paisley Road to South of the CNR Secondary Line

Public Information Centre No. 1
November 24th, 2011
6:00 p.m. to 8:00 p.m.

Please sign in so we can keep you updated on this study.
Please provide your comments by December 8th, 2011.

Delcan
TRANSPORTATION • INFORMATION TECHNOLOGY • WATER

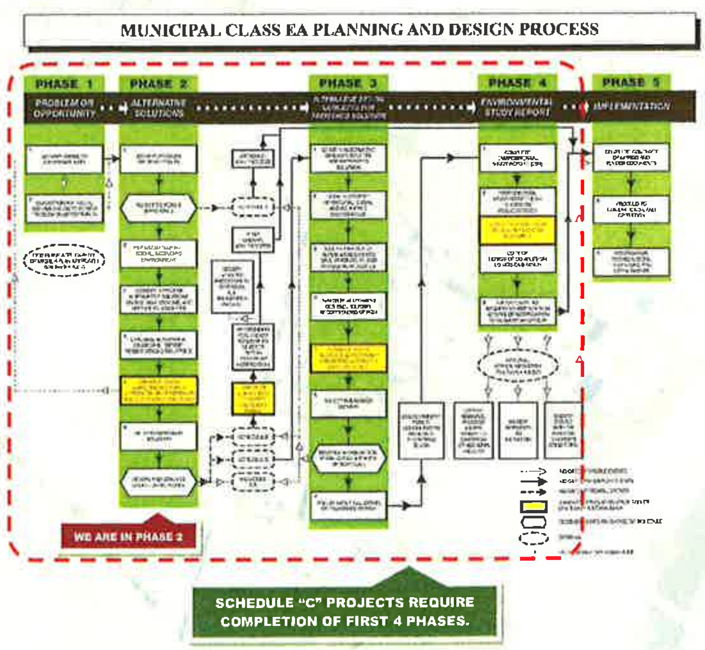
CITY OF Guelph
Making a Difference

STUDY AREA

- ⇨ The project limits extend from north of Paisley Road to south of the CNR secondary line in the City of Guelph, Ontario.
- ⇨ The subject portion of Silvercreek Parkway is situated primarily within the Silvercreek lands (35 and 40 Silvercreek Parkway South), a former quarry site that is presently undeveloped and unused. Silvercreek Guelph Developments Limited has obtained necessary approvals to develop the property as a mixed-use development.
- ⇨ The northerly section of Silvercreek Parkway terminates at the CN Mainline, and has a signalized intersection at Paisley Road. The southerly section starts from south of the CN Mainline and proceeds to Waterloo Avenue.

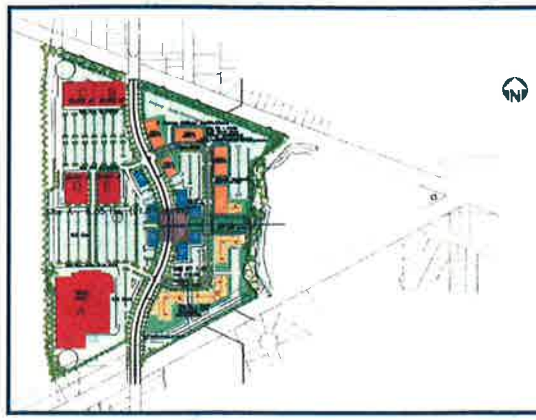
THE CLASS ENVIRONMENTAL ASSESSMENT PROCESS

- ⇨ Formal planning process approved under the Ontario Environmental Assessment (EA) Act that must be undertaken in advance of road, water and wastewater construction projects.
- ⇨ Ensures that all reasonable alternatives are considered and that a selected alternative would have minimal impact on the surrounding environment.
- ⇨ This project is being planned as a "Schedule C" Class EA project.



CLASS EA PHASE 1: BACKGROUND (SILVERCREEK PARKWAY)

- Until 1975, Silvercreek Parkway was a continuous road between Waterloo Avenue and Paisley Road with at-grade crossings at the CNR Mainline and the CNR Secondary Line.
- In 1975, Silvercreek Parkway was closed at the CNR Mainline in conjunction with the construction of the Hanlon Expressway to the West.
- In 2009, the City of Guelph and Silvercreek Guelph Developments entered into a Minutes of Settlement for the Development of the Silvercreek Lands based on the following:
  - Reconnection of Silvercreek Parkway as a continuous roadway between Waterloo Avenue and paisley Road.
  - Grade Separation at the CNR Mainline.
  - A new road to the east of Silvercreek Parkway as shown in the development concept plan.



CLASS EA PHASE 1: PURPOSE OF THE STUDY

A Class Environmental Assessment study has been initiated to address the following undertakings:

1. Grade Separation of the Silvercreek Parkway at the CNR Mainline;
2. The alignment of Silvercreek Parkway between the CNR Mainline and the CNR Secondary Line;
3. A new road to the east of Silvercreek Parkway.

CLASS EA PHASE 1: NEED & JUSTIFICATION

(1) Silvercreek Parkway / CNR Grade Separation:

- Reconnection of Silvercreek Parkway is required to accommodate the Silvercreek lands, with access to both Paisley Road and Waterloo Avenue/Wellington Road.
- Silvercreek Parkway reconnection requires a grade separation at the CNR Mainline.
- The City of Guelph Official Plan identifies Silvercreek Parkway as a continuous roadway with a grade separation at the CNR Mainline.
- The projected traffic volumes on Silvercreek Parkway and the number of trains per day on the CNR Mainline justify the need for grade separation.
- There will not be a need for grade separation at the CNR Secondary Line.

(2) Silvercreek Parkway Alignment: The proposed curvilinear alignment is based on the development Concept Plan to meet intensification, mixed-use and urban design requirements.

(3) New Development Road: The development Concept Plan includes a new municipal road to the east of Silvercreek Parkway to provide access within the mixed-use development area.

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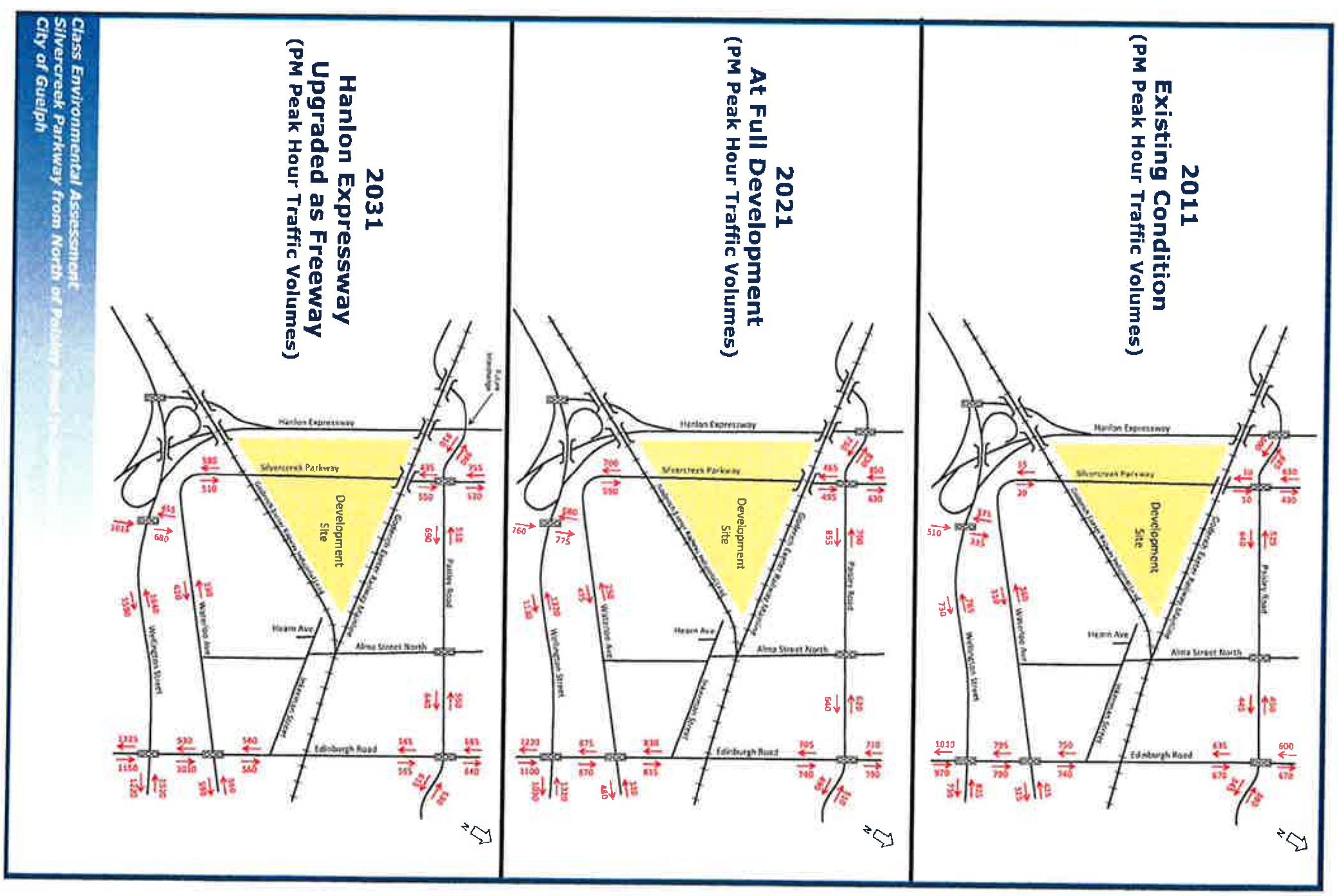
Guelph



OPERATIONAL (TRANSPORTATION) ENVIRONMENT

Railway Crossing	2011 Existing*			2021 Full Development			2031 Hanlon Expressway Upgraded as Freeway		
	AADT	Train/Day	Cross Product	AADT	Train/Day	Cross Product	AADT	Train/Day	Cross Product
Main Line	0	14	0	9,600	22	211,200	9,800	34	333,200
Secondary Line	0	1	0	12,900	1	12,900	10,900	6	65,400

2011 Existing Rail Traffic*

- 6 (3x2) Passenger Trains
- 4 (2x2) Freight Trains
- 4 (2x2) GO Trains (Starting Dec 2011)
- TOTAL = 14 Existing

Cross-Product

- The Road / Rail Cross Product is one of many factors used in the determination of crossing safety improvements.
- The City will undertake a Grade Crossing Safety Assessment in accordance with Transport Canada guidelines to determine the extent of crossing improvements required at the Silvercreek crossing of the CNR Secondary Line.

NATURAL ENVIRONMENT

⇨ Four vegetation communities, including one wetland community have been identified on the site. The vegetation communities do not provide habitat for significant populations of wildlife and no regionally or provincially significant plant species were found.

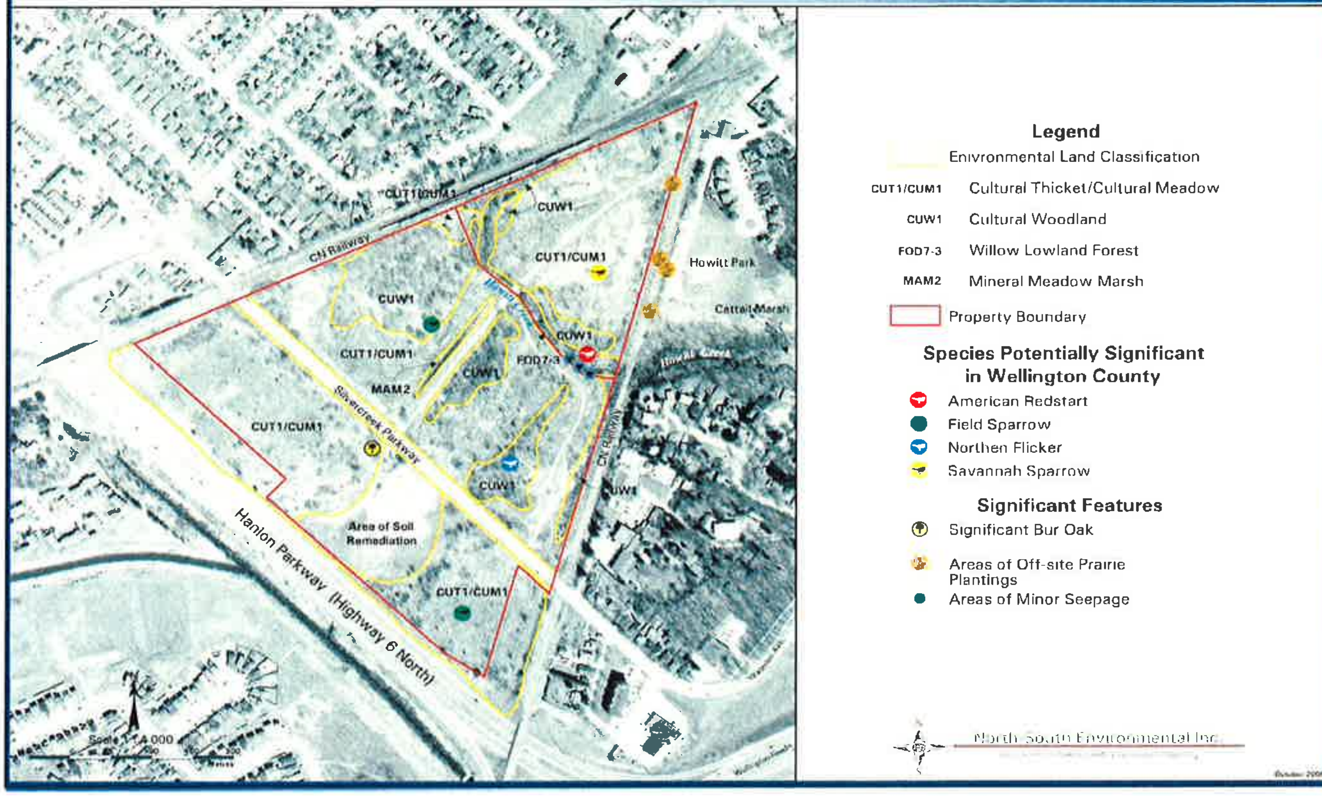
⇨ A bur oak tree is situated on the west of Silvercreek Parkway, noteworthy for its ecological, aesthetic and heritage functions.

⇨ Thirty-two species of wildlife were identified on the site, mostly birds and common mammals. Signs of white-tailed deer were noted along the western portion of the site. One amphibian was noted: leopard frog, along the Howitt Creek lowland forest. One Species at Risk in Canada, monarch butterfly, was seen in cultural thicket/meadow on all parts of the site.

⇨ Howitt Creek, located approx. 350 metres northeast of Silvercreek Parkway, is classified as a coolwater stream, but does not support coldwater fish species.

⇨ There are no natural features on the site subject to the Provincial Policy Statement, including Significant Wetlands, Significant Valleylands, Significant Wildlife Habitat, Significant Woodlands, or Significant Portions of the Habitat of Threatened or Endangered Species.

NATURAL ENVIRONMENT



CULTURAL ENVIRONMENT

Given the previous uses of the land (Red-D-Mix Plant and extraction) and planning studies undertaken as part of the development application, an archaeological assessment was not considered necessary for the purpose of the Silvercreek Parkway EA undertakings.

SOIL CONDITION

Phase 1 and 2 environmental site assessments completed in the area of the former Red-D-Mix Plant identified the presence of free product TPH in the soil and groundwater. The site was also found to contain underground fuel storage tanks. This area has since undergone soil remediation.

SOCIO-ECONOMIC ENVIRONMENT

⇨ Planned land use for the area of development is *Mixed-Use*, consisting of a combination of:

- Warehouse membership Club or Home Improvement Retail Warehouse establishment
- Non-food retail
- Service commercial
- Residential
- Office use.

⇨ North of the CN Mainline, adjacent land use is comprised of primarily single detached residential dwellings. Three properties access onto Silvercreek Parkway, south of Paisley Road.

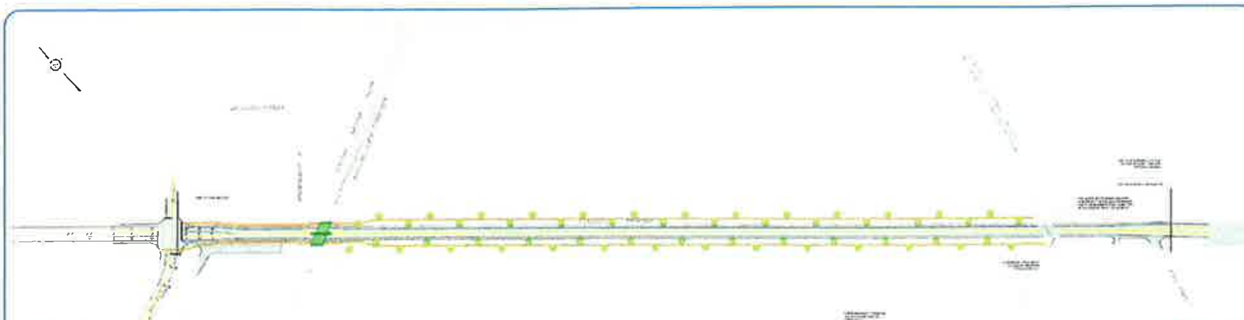
⇨ South of the CN secondary line, at the south limits of the study area, the land use is comprised of single detached residential dwellings, an apartment building, hotel and Bible Chapel/conference centre.

ALTERNATIVE SOLUTIONS

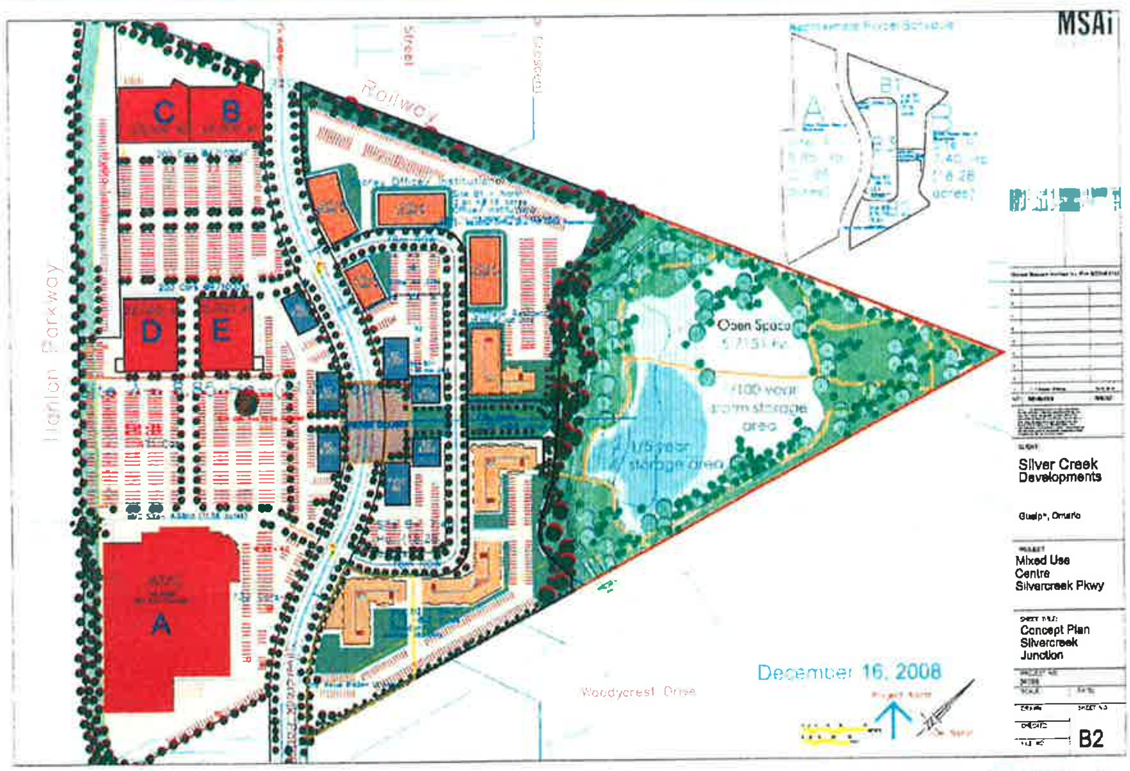
In accordance with the Municipal Class EA process, reasonable alternatives were developed to address the study problem/opportunity. Those solutions (except "Do Nothing") which did not address the Problem Statement were discounted and therefore not considered for evaluation.

Alternative A	*Do nothing, Silvercreek Parkway would remain closed at the CNR Guelph Mainline*
Alternative B	*Reconstruct Silvercreek Parkway on the existing alignment, including a new Subway at the CNR Mainline*
Alternative C-1	*Reconstruct Silvercreek Parkway on a new alignment as per the Silvercreek development concept plan, including Subway at the CNR Mainline*
Alternative C-2	*Reconstruct Silvercreek Parkway on a new alignment as per the Silvercreek development concept plan, refined to meet Transportation Association of Canada (TAC) engineering standards, including Subway at the CNR Mainline*

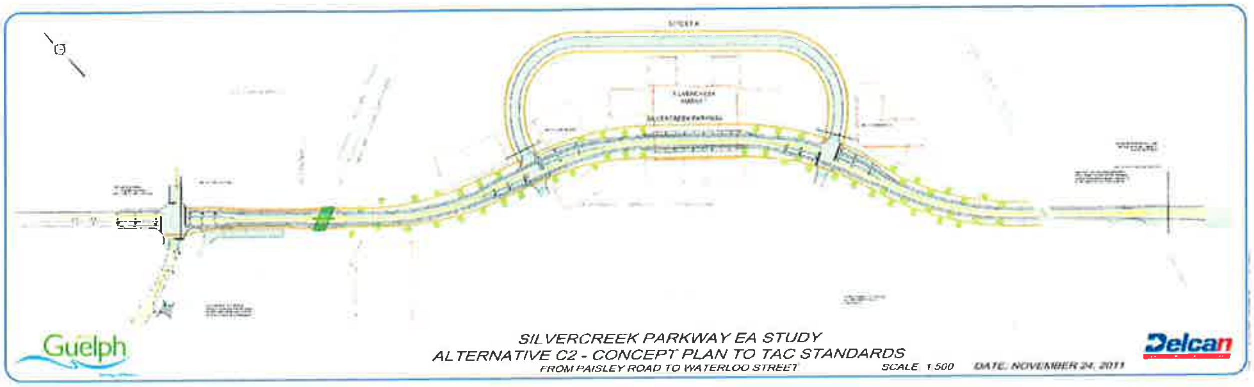
SILVERCREEK PARKWAY EA STUDY
ALTERNATIVE A - DO NOTHING
FROM PAISLEY ROAD TO WATERLOO STREET
SCALE: 1:500 DATE: NOVEMBER24, 2011



SILVERCREEK PARKWAY EA STUDY
ALTERNATIVE B - EXISTING ALIGNMENT
FROM PAISLEY ROAD TO WATERLOO STREET
SCALE 1:500 DATE NOVEMBER 24, 2011



SILVERCREEK PARKWAY EA STUDY
ALTERNATIVE C1 - DEVELOPER'S CONCEPT PLAN
FROM PAISLEY ROAD TOWATERLOO STREET SCALE: 1:500 DATE: NOVEMBER 24, 2011



EVALUATION CRITERIA

The Project Team will consider a number of criteria (representing the broad definition of the environment as described in the EA Act) to comparatively evaluate the alternative solutions.

Transportation/ Technical	Socio-Economic Environment	Natural Environment	Cost
⇨ Roadway Performance ⇨ Roadway Safety ⇨ Pedestrian & Cyclist accommodations ⇨ Network Continuity ⇨ Commercial Vehicles ⇨ Emergency Services ⇨ Planning Objectives ⇨ Utility Relocations	⇨ Direct Property Impacts ⇨ Compatibility with Area Land Use ⇨ Residential Access ⇨ Illumination Impact ⇨ Visual/Aesthetic Impact ⇨ Construction Disruption	⇨ Vegetation Impact ⇨ Wildlife and Habitat Impact ⇨ Special Designation Areas ⇨ Groundwater Impacts ⇨ Surface Water Impacts ⇨ Air Quality ⇨ Natural Hazards	⇨ Capital Cost ⇨ Operation and Maintenance ⇨ Property Costs

UNDERGROUND SERVICES, UTILITIES & DRAINAGE

⇨ As part of the study, the preferred solution will be circulated to utility companies, Rail America (on behalf of CNR) and any other companies with assets that could be affected by the proposed construction.

⇨ All received comments and infrastructure plans will be incorporated into the preliminary design drawings.

⇨ Drainage of the roadway will be accommodated through an existing culvert under the Hanlon Expressway.

⇨ Localized sanitary sewer design and watermain services will also be included in the design drawings.

NEXT STEPS

Following this PIC, the City of Guelph and their consultant, Delcan, will:

- Review comments submitted at today's PIC;
- Meet with directly affected property owners and technical agencies as required;
- Evaluate the alternative solutions and develop a recommended solution in consideration of the comments received;
- Undertake Grade Crossing Safety Assessment per Transport Canada guidelines for the CNR Secondary Line
- Identify and evaluate alternative design concepts to implement the preferred solution;
- Present the alternative and recommended design concepts at a second PIC (to be held in early 2012).

APPENDIX C

Submitted Comments

Delcan

City of Guelph — Making a Difference

PUBLIC INFORMATION CENTER #1

NOVEMBER 24, 2011

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline

Class Environmental Assessment and Preliminary Design

COMMENT FORM (PLEASE PRINT)

Option B - reconnecting silvercreek Parkway and keeping all the green space.

For our household keeping the green space would be best as we back onto this space.

There are not many green spaces in the city anyone or safe places near home to walk the dog and get out into nature.

It's a place that doesn't feel like we live in the city with the green space behind us →

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by December 8, 2011 to:

Mr. Peter Jefford, P. Eng.
Project Manager
Delcan Corporation
675 Queen St South, Suite 201
Kitchener ON N2M 1A1
Telephone: (519) 744-4509, Fax: (519) 744-2822, Email: p.jefford@delcan.com

**Alternatively you may submit your Comment Form to m.vandyk@delcan.com

Contact Name:

Address:

Phone:

E-Mail:

Having the green space was one of the main factors in ~~[illegible]~~ choosing to move to guelph & buy that house 2 years ago.

Delcan

City of Guelph
Making a Difference

PUBLIC INFORMATION CENTER #1

NOVEMBER 24, 2011

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

COMMENT FORM (PLEASE PRINT)

We love the way the land is 'as is' but also recognize we cannot stop progress!

P.12 That said we favour either Alternative C1 or C2 (do not understand TAC engg standards, but would assume more beneficial...?)

Thank you for opportunity to comment!

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by December 8, 2011 to:

Mr. Peter Jefford, P. Eng.
Project Manager
Delcan Corporation
675 Queen St South, Suite 201
Kitchener ON N2M 1A1
Telephone: (519) 744-4509, Fax: (519) 744-2822, Email: p.jefford@delcan.com

**Alternatively you may submit your Comment Form to m.vandyk@delcan.com

Contact Name:
Address:

Phone:
E-Mail:

Public Information Center #1

November 24, 2011

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

Comment Form (Please Print)

I would like to address the issue of the intersection of Eden St. + Silvercreek Pkwys. During the winter, it is common for Eden to be snow covered and due to the down ward grade of Eden @ SPS, vehicles routinely slide through the stop and into SPS. Presently this does not pose an issue as there is no traffic to speak of. However, with the planned development there will be constant traffic on SPS. this will become a hazard for both the residents and commuters.
there is also an issue of a shed on the NW corner that inhibits proper/safe sightlines before entering the grade.

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by December 8, 2011 to:

Mr. Peter Jefford, P. Eng.
Project Manager
Delcan Corporation
675 Queen St South, Suite 201
Kitchener ON N2M 1A1
Telephone: (519) 744-4509, Fax: (519) 744-2822, Email: p.jefford@delcan.com

**Alternatively you may submit your Comment Form to m.vandyk@delcan.com

Contact Name:
Address:

Phone:
E-Mail:

Delcan

Guelph

PUBLIC INFORMATION CENTER #1

NOVEMBER 24, 2011

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

COMMENT FORM (PLEASE PRINT)

I BELIEVE THAT THE C2 OPTION IS BEST GIVEN NO OTHER INFO TO THINK ABOUT. DO NOTHING IS NOT AN OPTION. THIS WILL ALLOW ACCESS SO DEVELOPMENT CAN HAPPEN ON THE FORMER LAFARGE PROPERTY WHICH IS A BIT OF AN EYESORE. PEOPLE WILL STILL BE ABLE TO WALK DOGS IF PARK CONCEPT IS KEPT IN FUTURE DESIGNS BY A DEVELOPER. THANK YOU FOR ALLOWING COMMENTS AND FOR YOUR EXPLANATIONS.

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by December 8, 2011 to:

Mr. Peter Jefford, P. Eng.
Project Manager
Delcan Corporation
675 Queen St South, Suite 201
Kitchener ON N2M 1A1
Telephone: (519) 744-4509, Fax: (519) 744-2822, Email: p.jefford@delcan.com

**Alternatively you may submit your Comment Form to m.vandyk@delcan.com

Contact Name: ______
Address: ______

Phone: ______
E-Mail: ______

Delcan

City of Guelph
Making a Difference

Public Information Center #1

November 24, 2011

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

Comment form (please print)

Separate bikes from pedestrians & from cars/trucks

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by December 8, 2011 to:

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Project Manager
Delcan Corporation
675 Queen St South, Suite 201
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Contact Name:
Address:

Phone:
E-Mail:

Public Information Center #1

November 24, 2011

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

Comment form (please print)

Alternative B poses the best solution for our household ~~[illegible]~~ ~~[illegible]~~ as we back on to the development site.

Please complete the form and deposit in the “Comment Box” provided or mail, fax, email by December 8, 2011 to:

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Delcan

City of Guelph
Making a Difference

PUBLIC INFORMATION CENTER #1

NOVEMBER 24, 2011

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

COMMENT FORM (PLEASE PRINT)

I would like bike and pedestrian underpass grade raised under the rail bridge. This would be a much safer option. Same grade as underpass vehicle traffic would be dangerous in bad weather conditions.

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by December 8, 2011 to:

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Project Manager
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Telephone: (519) 744-4509, Fax: (519) 744-2822, Email: p.jefford@delcan.com

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City of Guelph
Making a Difference

Public Information Center #1

November 24, 2011

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

Comment Form (Please Print)

I prefer that this site not be developed and be kept as a natural area I have always felt this way. I now realize this will not happen. The proposed subway with raised sidewalks and bike lanes in the plan I find acceptable and I prefer Alternative C-2. It was explained that the bike lanes will be extended beyond the development up Silvercreek towards Willow Rd and South to Waterloo Ave and I am pleased that is being done. I also hope any lighting for the new road and development as a whole will be considerate of the neighbourhoods surrounding this new property plan. I guess this has met all of the basic requirements for this to go ahead, sad as I think it is.

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by December 8, 2011 to:

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675 Queen St South, Suite 201
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PUBLIC INFORMATION CENTER #1

NOVEMBER 24, 2011

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline

Class Environmental Assessment and Preliminary Design

COMMENT FORM (PLEASE PRINT)

ALTERNATE "B" IS THE BEST FOR OUR HOUSEHOLD.

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by December 8, 2011 to:

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Project Manager
Delcan Corporation
675 Queen St South, Suite 201
Kitchener ON N2M 1A1
Telephone: (519) 744-4509, Fax: (519) 744-2822, Email: p.jefford@delcan.com

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Delcan

City of Guelph
Making a Difference

PUBLIC INFORMATION CENTER #1

NOVEMBER 24, 2011

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

COMMENT FORM (PLEASE PRINT)

I LIKE PLAN C2 I REALLY WANT
SILVERCREEK REOPENED TO TRAFFIC

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by December 8, 2011 to:

Mr. Peter Jefford, P. Eng.
Project Manager
Delcan Corporation
675 Queen St South, Suite 201
Kitchener ON N2M 1A1
Telephone: (519) 744-4509, Fax: (519) 744-2822, Email: p.jefford@delcan.com

**Alternatively you may submit your Comment Form to m.vandyk@delcan.com

Contact Name:
Address:

Phone:
E-Mail:

The City of Guelph and Delcan thank you for your involvement in this Class EA. All information will be collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act.* With the exception of personal information, all comments will become part of the public record.

RECEIVED
DEC 07 2011

Delcan

Guelph

PUBLIC INFORMATION CENTER #1

NOVEMBER 24, 2011

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

COMMENT FORM (PLEASE PRINT)

1.) Acess in and out of our road at all times (including during construction)

2.) We are requesting acess from left and right turns from our road

3.) No road incline onto Paisley Road

4.) Acess to Paisley & Silvercreek at all times

5.) Traffic Concerns

6.) Truck entrance & exit from Waterloo Ave. only

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by December 8, 2011 to:

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Project Manager
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Telephone: (519) 744-4509, Fax: (519) 744-2822, Email: p.jefford@delcan.com

**Alternatively you may submit your Comment Form to m.vandyk@delcan.com

Contact Name:

Address:

Phone:

E-Mail:

Andrew McGregor

From: Mary Vandyk [m.vandyk@delcan.com]
Sent: Friday, December 09, 2011 11:01 AM
To: 'Andrew McGregor'
Subject: FW: PIC 1 Input - Silvercreek Pkwy EA

Ditto from previous e-mail.

Mary

From:
Sent: December-08-11 4:17 PM
To: p.jefford@delcan.com
Cc: m.vandyk@delcan.com; Rajan.Philips@guelph.ca; Chris Sims
Subject: PIC 1 Input - Silvercreek Pkwy EA

I attended PIC 1 on November 24 2011 held in the main lobby of Guelph City Hall.

Armel Corporation owns a property (currently vacant) which is zoned for commercial use at the south-east corner of the intersection of Paisley Road and Silvercreek Parkway, as well as another property (currently vacant) which is zoned for industrial use on the west side of existing Silvercreek just north of the southerly rail line. Both properties are within the 'study area' as defined on the information boards presented at the Nov 24 meeting, hence our interest in this process.

At PIC 1, information was presented on various graphic panels set up on easels. The presentation graphics and information were also reproduced and in a take away handout booklet that was available at the meeting. The following questions and comments are based primarily on the on the materials presented at PIC 1.

The information handout indicates that "Reconnection of Silvercreek Parkway is required to accommodate the Silvercreek lands, with access to both Paisley Road and Waterloo Avenue/Wellington Road." The handout also provides information regarding the development concept proposed for the Silvercreek lands.

1. As currently shown, the study area is focused around the existing Silvercreek alignment only. Should the study area limits be expanded to pick up the lands where the proposed re-aligned Silvercreek and the proposed new road east of this are shown on the 'Developer's Concept Plan'?

2. Should the study area limits be extended to pick up lands south of the southerly track? It appears that by 2021 southbound traffic (Silvercreek South to Waterloo Ave) will increase by over 4,500% - - this seems significant. Will implications of this increase be assessed, and will there be discussion of how this increase will be accommodated?

3. As currently shown, the study area picks up some of the existing residences between the north track and Paisley, west of Silvercreek. Should the study area be expanded to capture all of the houses to the west of Silvercreek in this area?

4. The information handout states that "Silvercreek Guelph Developments has obtained the necessary approvals to develop ...". Is this fully accurate, or is approval of the EA also required as part of the necessary approvals to develop the Silvercreek Lands?

5. The information handout states that an archaeological assessment "was not considered necessary". Has the Ministry of Culture confirmed this to be the case?

6. The information handout notes that adjacent land use north of the CN Mainline is primarily residential. A vacant commercial property (owned in part by Armel) also exists on the east side of Silvercreek, with existing access from Silvercreek Parkway. We request that EA information be updated to reflect this use north of the CN Mainline.

7. Alternatives presented at PIC 1 appear to be similar in scope and program to design options previously prepared on behalf of the developer of the Silvercreek Lands. Please confirm whether this is the case - - or - - if the designs are substantively different, how so?

8. The information handout notes that the Guelph Official Plan identifies Silvercreek Parkway as a continuous roadway with a grade separation at the CNR Mainline. The Official Plan also identifies the Paisley Road and CNR grade separation as part of the reconfiguration of the Paisley Road-Hanlon Expressway intersection (Paisley overpass of the Hanlon). Given the close proximity of Silvercreek, Paisley, and the Hanlon, what consideration has occurred regarding the coordination of any outcome of this EA, with the outcome of any future EA required to determine the best option for a grade separation of Paisley with the Hanlon?

9. North of the CN Mainline, Alternative C2 appears to include additional traffic works west of Silvercreek – please provide clarification on these works.

10. North of the CN Mainline, Alternative C2 appears to show a widened Silvercreek right-of-way, and possibly a widened Paisley right-of-way – please provide clarification, specifically regarding how any proposed works may affect neighbouring properties.
    a. How will the proposed underpass affect the commercial lands on the east side of Silvercreek, just south of Paisley?
    b. How will the proposed underpass affect the residential lands on the west side of Silvercreek, just south of Paisley?

11. How many lanes of through traffic are proposed at the northerly track, ie how many through lanes will be constructed through the proposed underpass section? As existing Silvercreek is a four lane road north of Paisley, will the proposed connection and southerly section of the proposed new Silvercreek also be four lanes of through traffic?

12. The materials you presented on Nov 24 11, did provide some detail regarding the horizontal alignment of the proposed new Silvercreek, but did not provide any detail regarding the vertical alignment of proposed new Silvercreek between the tracks and Paisley. We are concerned with potential impacts the underpass may have on our property at Silvercreek and Paisley, specifically that the vertical alignment of Silvercreek between the track and Paisley will remove access potential of our property in this location (to existing Silvercreek), and the implications that go along with this.

    Further, no detail was presented regarding how the proposed 'new' intersection of Paisley and Silvercreek would be designed to function in a generally safe and operationally efficient manner, how the intersection will be designed to facilitate any access to our site or other properties located on the east side of Silvercreek between Paisley and the tracks, and how the intersection will be designed to facilitate access to existing properties west of Silvercreek.

    In addition to what was presented at PIC 1, and in light of the foregoing, are there other reasonable alternatives that could/should be explored so as to minimize potential impacts on properties between Paisley and the tracks, such as:

a. Re-opening Silvercreek with an at-grade crossing in conjunction with appropriate protection signals – there are many examples of local at-grade crossings that presently function without issue (ie Edinburgh Rd, Alma St, etc) – very significant cost savings and minimizing of impacts would be achieved with this option.
b. Shift horizontal alignment of the track to the south and/or raise the vertical alignment of the track to improve underpass geometry – both alternatives, either individually or in combination, could have potential to soften the vertical grade of the Silvercreek underpass between Paisley and the northerly track, thereby softening impact on existing adjacent properties located between Paisley and the northerly track.

As part of this EA process, we believe the above two options merit consideration as alternatives in context with evaluation criteria listed in your information handout – Transportation / Technical, Socio-Economic Environment, Natural Environment, and Cost, and respectfully request that an analysis be undertaken of these additional alternatives on a comparative basis with the alternatives you have already listed in your information handout to determine the relative advantages and disadvantages of all. Please respond in writing to our request.

13. Will information regarding this EA process be posted on the City's website? As of today's' date (Dec 8 11), I can find no information regarding PIC 1 on the City's website.

14. When will meetings referenced in your information booklet occur between the study team for this EA and directly affected property owners? Will these meetings occur individually with each affected owner, or will a meeting with all affected property owners be held? Will there be one, or more than one meeting with affected property owners?

We look forward to receiving written responses to questions we have posed herein. We also look forward to our meeting with you as an affected property owner – kindly advise of dates.

With regard to any future scheduled public meetings, please ensure that we are advised in writing so that we can attend.

Please ensure that this correspondence forms part of the record for this process.

Thank you for the opportunity of providing input, and we look forward to continued involvement in this process. My contact information is included below.

Mary Vandyk

From:
Sent: December-08-11 10:15 PM
To: p.jefford@delcan.com
Cc: m.vandyk@delcan.com
Subject: Silvercreek Parkway South & the LaFarge lands

As you are aware these lands have been used for many years as a natural refuge, a place to walk, a place to bike, a place to ski and a place for foxes and other wildlife. Contrary to your description, they have been well used. I would like to see it remain as it is. I am strongly opposed to it becoming another mall. This will have a negative impact on downtown. If it were to intersect with Paisley Road as shown in all your alternatives, it will create a major traffic hazard at Paisley. Paisley is already quite busy at this point, Paisley Road provides access to downtown Guelph, the Hanlon and to Silvercreek north. There are also many children in the area where it is shown to intersect with Silvercreek south. For these reasons I am opposed to connecting Silvercreek south of Paisley with Silvercreek north of Paisley. Leave it as it is; furthermore, the City of Guelph cannot afford to build an underpass under the CN Mainline. Guelph claims it can't afford a library. Guelph is making cuts to its public transit system.
Howitt Creek should be protected. If it were protected it might be able to support coldwater fish species. A buffer with a naturalized area of at least 15 metres should be required and the old stone bridge should be protected.
Some single family homes and a low-rise apartment (3stories or less) would be appropriate for this site, but most of it should be preserved as a natural area.

APPENDIX H

PUBLIC CONSULTATION CENTRE NO. 2 SUMMARY REPORT

Public Information Centre No. 2
Summary Report

Silvercreek Parkway South Improvements
Including Grade Separation at the CN North Mainline
Class Environmental Assessment

Prepared for:
City of Guelph

March 2012

TRANSPORTATION • INFORMATION TECHNOLOGY • WATER

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Appendices

1.0 Background

Public Information Centre (PIC) No. 2 for the Silvercreek Parkway South Improvements Class Environmental Assessment (EA) Study was held on February 15th, 2012 from 6:00 p.m. to 8:00 p.m. at Guelph City Hall Galleria, located at 1 Carden Street, Guelph, Ontario.

The PIC was held as a forum for the public to convey their issues/concerns and suggestions to the project team on the study and the evaluation and selection of the project team's recommended solution(s).

Local area residents, special interest groups and technical agencies were invited to attend via regular mail, hand delivered notice (to local residents), the City of Guelph's website and newspaper publications in the *Guelph Tribune*.

All PIC notification materials are provided in **Appendix A**.

The PIC followed an "Open House" format with information pertaining to the study on display and members of the project team on hand to discuss the study with those in attendance. During the PIC, participants were encouraged to view the boards on display and to address their questions and concerns to members of the project team.

Local area residents that were determined to be directly impacted by the project works were invited to meet the project team and discuss project-related issues and potential impacts prior to the actual start of the PIC.

2.0 Display Materials

Information displays presented at the PIC are provided in **Appendix B.**

In addition to the display materials presented, an information package was distributed which included an 8.5" x 11" booklet version of the materials presented at the PIC.

3.0 Attendance and Comments Received

Those attending the PIC were requested to sign an attendance booklet and were encouraged to provide their written comments to the material presented. Attendance at the PIC included 23 individuals signing the attendance booklet. A summary of the comments submitted at, and following the PIC, is provided in **Table 3.1**. Only those comments received that were within the scope of the EA Study are summarized. The submitted comments are provided in **Appendix C**.

Table 2 - Public Information Centre No. 2 Comment Summary

Key Issue	Comment Summary	Project Team's Consideration of Comments
Support for the Recommended Solution	The majority of the verbal comments received at the PIC were in support of the Project Team's overall recommendations.	Comments noted.
Access Restrictions to Northbound Silvercreek Parkway and Southbound Paisley Road	Study area residents on the southwest portion of the Paisley Road/Silvercreek Parkway intersection were against the Project Team's recommendation for right turn accesses onto Paisley Road and Silvercreek Parkway off of the proposed Paisley / Silvercreek Service Road. Residents stated that the proposed design does not accommodate them as the majority of their trips are northbound on Silvercreek Parkway and southbound on Paisley Road.	Subsequent to the PIC, the access to Paisley Road was revised from a Right-In/Right-Out design to a Right Out only. This change will provide improved access to Paisley Rd in the eastbound (downtown) direction. It will also permit limited access to Silvercreek northbound in off-peak periods, subject to traffic conditions. Access to Paisley Rd can be significantly improved upon completion of the Paisley/Hanlon Overpass in 10± years
Other	Additional comments were received that identified the following issues and concerns:	
	• Vehicle turning movements on access Road (garbage trucks, snow plows etc.).	The local service road will be constructed 6.0m in width. There is insufficient ROW to construct a turn-around at the end of the access road. Hence garbage trucks and winter maintanance equipment will need to drive in/back out. The City may utilize a pickup truck to plow/and/salt the access road.
	• What will happen to the trees, rock and 30 ft privet on City land in front of my property?	The Silvercreek Road allowance (66 feet) will be fully utilized to construct the roadway, retaining walls and local access road.
	• Access restrictions onto Paisley Road will result in decreased property value.	Under the *Ontario Expropriations Act*, an individual may file a claim against the City for injurious affection. In accordance with the Act, a person may be entitled to compensation, where their lands are negatively affected by the execution of municipal works.
	• Construction impacts (noise, dust, access, etc.)	Impacts related to construction will be minimized

Key Issue	Comment Summary	Project Team's Consideration of Comments
		to the extent possible.
	• How much notice will I receive before construction?	Construction is planned to begin in the Fall of 2012. 1-2 weeks prior to construction, local residents will be provided with a handout including the proposed schedule, including emergency contact names and phone numbers in the event of any unforeseen circumstances.
	• Will there be a tax break for the inconvenience?	There will be no tax breaks associated with the construction works.
	• Question about traffic signals on Westwood due to increased traffic.	Traffic signals on Westwood Road are not recommended at this time. This area will be monitored for increased traffic following the construction works.
	• Plan for new transit route on Silvercreek Parkway	The City does intend to provide transit service on Silvercreek Parkway. However route details have not been determined at this time.
	• Protect for future grade separation at Fergus Subdivision.	Train volume on the CN Secondary (Fergus) crossing is extremely low. A grade separation would only be considered in the event of a major change in track usage, such as for example implementation of LRT or other train service to Cambridge. This possibility is considered unlikely at this time. However, major track improvements along the corridor could be considered at that time when proposed usage has been determined.

4.0 Recommendations

Where applicable, the comments received at the PIC are to be incorporated into the preferred solution.

APPENDIX A

Public Information Centre Notification Materials

Woodside Business Centre
675 Queen Street South, Suite 201
Kitchener, Ontario N2M 1A1
Tel: 519.744.4509 ● Fax: 519.744.2822
www.delcan.com

February 2, 2012

OUR REF: TW-1366

«AddressBlock»

«GreetingLine»

Subject: **Notice of Public Information Centre #2**
Class Environmental Assessment - Silvercreek Parkway South Improvements

---

The City of Guelph is currently undertaking a Class Environmental Assessment (EA) Study for the Silvercreek Parkway Road South improvements including grade separation at CN North mainline, in the City of Guelph.

Following a review of the Class EA requirements, the City has decided to proceed with the Environmental Assessment as a Schedule "B" project.

A Notice containing details of the study and upcoming Public Information Centre (PIC) is enclosed.

If you have any questions or require additional information, please contact the undersigned at 519-744-4509. Thank you for your assistance with this project.

Yours very truly,

Peter Jefford

Peter Jefford, P. Eng.
Project Manager, Delcan Corporation

c.c. Rajan Philips – City of Guelph
Andrew McGregor – Delcan Corporation

Encls.

NOTICE

Public Information Centre No. 2
Class Environmental Assessment
Silvercreek Parkway South Improvements

February 2, 2012

The project
The City of Guelph has initiated a Class Environmental Assessment study for undertaking improvements to Silvercreek Parkway, from north of Paisley Road to south of Canadian National Railway (CNR) secondary line including: (1) grade separation at the CNR mainline; (2) the reconnection of Silvercreek Parkway between the two CN rail lines; (3) a new roadway to the east of Silvercreek Parkway as shown in the concept plan (Figure 1); and (4) the upgrading of underground services and utilities within the road allowance, including the drainage of the reconnected roadway and underpass. Figure 2 shows the Study Area.

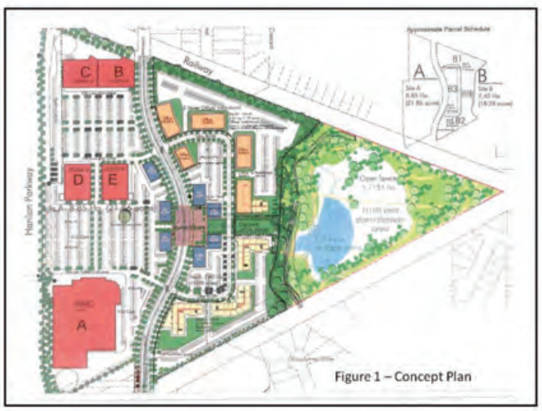


Figure 1 – Concept Plan

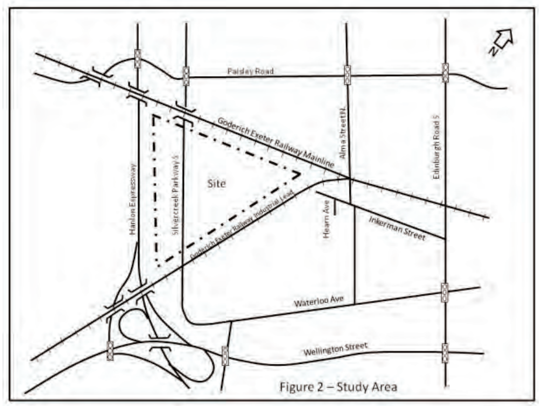


Figure 2 – Study Area

The process
Following a review of the Class Environmental Assessment requirements, the City has decided to proceed with the Environmental Assessment as a Schedule B project in accordance with the Municipal Class Environmental Assessment process (Municipal Engineers Association, October 2000 as amended in 2007) under the Ontario Environmental Assessment Act. The Class Environmental Assessment process includes public and review agency consultation, an evaluation of alternatives, an assessment of potential environmental effects of the proposed improvements and identification of reasonable measures to mitigate any adverse impacts that may result.

How to participate
As part of the consultation process, a Public Information Centre is being planned to provide background information on the study, and the evaluation and selection of the project team's recommended solution(s). Representatives from the City and its consultant will be available to answer questions and discuss the next steps in the study. The Public Information Centre will be held:

Wednesday, February 15
6 - 8 p.m.
City Hall Galleria, 1 Carden Street

You are encouraged to attend the Public Information Centre and provide your comments for consideration. Comments and information regarding this project will be collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act* for the purpose of meeting environmental assessment requirements.

City Hall
1 Carden St
Guelph, ON
Canada
N1H 3A1

T 519-822-1260
TTY 519-826-9771

guelph.ca

With the exception of personal information, all comments will become part of the public record.

Opportunities for public input will continue throughout the Class Environmental Assessment process. Future consultation opportunities will be posted on the City's website at **guelph.ca.**

For more information

Please contact either of the following project team members if you have any questions or comments, wish to obtain more information on the project, or if you would like to be added to the project mailing list:

Mr. Rajan Philips, P. Eng., Manager
Transportation Planning & Development Engineering
Planning & Building, Engineering and Environment
City of Guelph
1 Carden Street
Guelph ON N1H 3A1
T **519-822-1260 x 2369**
E **rajan.philips@guelph.ca**

Mr. Peter Jefford, P.Eng., Project Manager
Delcan Corporation
675 Queen Street South, Suite 201
Kitchener ON N2M 1A1
T **519-744-4509**
E **p.jefford@delcan.com**

(Notice first issued February 2, 2012)

C: Mayor and Councillors

PUBLIC INFORMATION CENTRE #2 - MAILING LIST – DELCAN
Silvercreek Parkway Road Improvements including CNR Grade Separation
City of Guelph Contract No. 11-104

FEDERAL & PROVINCIAL AGENCIES	
Mr. Mike Stone District Planner	Ministry of Natural Resources Guelph District Office 1 Stone Road West Guelph, ON N1G 4Y2
Ms. Barb Slattery Environmental Resource Planner / EA Coordinator	Ministry of the Environment Air, Pesticides and Environmental Planning 119 King Street West 12th Floor Hamilton, ON L8P 4Y7
Mr. Barry Duffey Manager	Ministry of the Environment Air, Pesticides and Environmental Planning 119 King Street West 12th Floor Hamilton, ON L8P 4Y7
Ms. Dolly Goyette Director	Ministry of the Environment Guelph District Office 1 Stone Road West 4th Floor Guelph, ON N1G 4Y2
Mr. Kevin Bentley Manager	Ministry of Transportation Southwestern Region 659 Exeter Road 4th Floor London, ON N6E 1L3
Mr. Ian Smyth Corridor Management Planner	MTO 659 Exeter Road 4th Floor London, ON N6E 1L3
Mr. Robert Bakalarczyk Project Engineer, Planning & Design Section	Ministry of Transportation Southwestern Region 659 Exeter Road 4th Floor London, ON N6E 1L3
Mr. Alan Sawyer Environmental Assessement Facilitator	Ontario Realty Corporation Southwest Region 1 Stone Road West 4th Floor Guelph, ON N1G 4Y2
Environmental Assessment Coordinator	Transport Canada, Ontario Region 4900 Yonge St. 4th Floor Toronto, ON M2N 6A5
CONSERVATION AUTHORITY	
Mr. Fred Natolochny Supervisor Of Resource Planning	Grand River Conservation Authority 400 Clyde Road PO Box 729 Cambridge, ON N1R 5W6

Mr. John Palmer Senior Water Resources Engineer	Grand River Conservation Authority 400 Clyde Road PO Box 729 Cambridge, ON N1R 5W6
Mr. Jamie Ferguson	Grand River Conservation Authority 400 Clyde Road PO Box 729 Cambridge, ON N1R 5W6
SCHOOL BOARDS	
Ms. Heather Imm Senior Planner	Upper Grand District School Board Planning Department 500 Victoria Road North Guelph, ON N1E 6K2
ABORIGINAL AGENCIES	
Grand Chief Randall Philips	Association of Iroquois and Allied Indians 387 Princess Avenue London, ON N6B 2A7
Mr. Don Boswell Senior Claims Analyst	Indian and Northern Affairs Canada 10 Wellington Street Gatineau, Quebec K1A 0H4
Ms. Heather Levecque Manager, Consultation Unit	Ministry of Aboriginal Affairs Consultation Unit 160 Bloor Street East 9th Floor Toronto, ON M7A 2E6
Chief Bryan LaForme	Mississaugas of the New Credit First Nation 2789 Mississauga Road RR#6 Hagersville, ON N0A 1H0
Mr. Leroy Hill Secretary	Six Nations Haudenosaunee Confederacy Council 2634 6th Line RR#2 Ohsweken, ON N0A 1M2
Chief William K. Montour	Six Nations of the Grand River PO Box 5000 1695 Chiefswood Road Oshweken, ON N0A 1M0
Chief Allen McNaughton	Haudenosaunee Confederacy Chiefs Council 2634 6th Line RR#2 Oshweken, ON N0A 1M2

Ms. Debbie Alves President	Credit River Metis Council 1515 Matheson Blvd. E. Suite 103 Mississauga, ON L4W 2P5
Metis Consultation Unit	Metis Nation of Ontario Head Office 500 Old St. Patrick St. Unit D Ottawa, ON K1N 9G4
UTILITIES	
Mr. Brad Boulton	Bell Canada 575 Riverbend Dr. Floor 1 Kitchener, Ontario N2K 3S3
Mr. Ian Bolton	Guelph Hydro 395 Southgate Drive Guelph, ON N1G 4Y1
Mr. Charles S. Esendal Sustainment Manager	Hydro One Networks Lines Information Systems and Programs 483 Bay Street TCT15-A11 North Tower Toronto, ON M5G 2P5
Ms. Jenny Mui Transmission Lines, Systems Investment	Hydro One Networks Lines Information Systems and Programs 483 Bay Street 15 Floor Toronto, ON M5G 2P5
Mr. Les Hart	Hydro One Real Estate Management 185 Clegg Road Markham, ON L6G 1B7
Ms. Cara Clairman Vice President, Sustainable Development	Ontario Power Generation Inc. 700 University Ave. Toronto, ON L5G 1X6
Mr. Brian Murray	Rogers Cable 85 Grand Crest Place PO Box 488 Kitchener, ON N2G 4A8
Mr. Kevin Schimus	Union Gas 603 Kumpf Drive PO Box 340 Waterloo, ON L2J 4A4
Ms. Yvonne Huang Construction Project Manager	Union Gas Limited 603 Kumpf Drive PO Box 340 Waterloo, ON L2J 4A4

Ms. Dana Moffatt	Telus Access Engineering TELUS Central Region 25 York Street 22nd Floor Toronto, Ontario M5J 2V5
Mr. Mohammed Saif	Telus Access Engineering TELUS Central Region 25 York Street 22nd Floor Toronto, Ontario M5J 2V5
	Ontario One Call 335 Laird Rd Unit 8 Guelph, Ontario N1G 4P7
RAILWAY AGENCIES	
Ms. Marissa Crawford Manager, Design & Construction	CN Rail 4 Welding Way PO Box 1000 Concord, Ontario L4K 1B9
Mr. Mike Cyr Director, Rail Services	Go Transit 20 Bay St. Suite 600 Toronto, ON M5J 2W3
Mr. Daryl J. Barnett Director, Railway Corridor Infrastructure	Go Transit 20 Bay St. Suite 600 Toronto, ON M5J 2W3
Mr. Doug MacKenzie General Manager	Rail America 101 Shakespeare Street 2nd Floor Stratford, Ontario N5A 3W5
Ms. Kathy Petroglou Administrator - Real Estate	Rail America 7411 Fullerton Street Suite 110 Jacksonville, Florida 32256
Ms. Donna Killingsworth Real Estate Manager	Rail America 7411 Fullerton Street Suite 110 Jacksonville, Florida 32256

Mr. Larry Romaine AVP Engineering Services	Rail America 7411 Fullerton Street Suite 110 Jacksonville, Florida 32256
Mr. Benoit Filion Project Manager Infrastructure	Via Rail Canada Inc. 3 Place Ville Marie Suite 500 Montreal, Quebec H3B 2C9
Mr. Kenneth Rose Sr. Manager Real Estate Southwestern Ontario & West	Via Rail Canada Inc. 50 Drummond Street Unit C Etobicoke, Ontario M8V 4B5
DEVELOPER CIRCULATION	
Mr. Matthew West Fieldgate Commercial Director of Development	Silvercreek Developments 5400 Yonge Street 5th Floor Toronto, Ontario M2N 5R5
Mr. Neil Robinson President	Neil Robinson Real Estate Consultants ltd. 38 Hogarth Avenue Toronto, Ontario M4K 1K1
Mr. Rob Merwin Leader Ontario West	R.J. Burnside & Associates Limited 170 Steelwell Rd. Suite 200 Brampton, ON L6T 5T3
COMMUNITY CIRCULATION	
Mr. Ron Foley	Howitt Park Neighbourhood Residents Association 67 Watson Road South Guelph, Ontario N1L 1E3
Mr. Hudson Merritt	CB Richards Limited 100 Frederick Street Suite 810 Kitchener, Ontario N2H 6R2

APPENDIX B

Presentation Materials

WELCOME

Class Environmental Assessment Study

Silvercreek Parkway South Improvements
From North of Paisley Road to South of the CNR Secondary Line

Public Information Centre No. 2
February 15th, 2012
6:00 p.m. to 8:00 p.m.

Please sign in so we can keep you updated on this study.
Please provide your comments by February 29th, 2012.

STUDY BACKGROUND

1. The Class EA study was initiated on May 19th, 2011.

2. Interested members of the public and technical agencies were invited to a PIC held on November 24, 2011 to present and obtain comments on the study background and relevant issues, alternative solutions and the planning process being followed.

3. The project team evaluated the alternative solutions against criteria representing the environment as defined in the *EA Act* and in consideration of comments received from technical agencies and the public.

4. Additional design features were incorporated into the recommended solution to address the requirements of the study problem statement.

STUDY AREA

The project limits extend from north of Paisley Road to south of the CNR secondary line in the City of Guelph, Ontario.

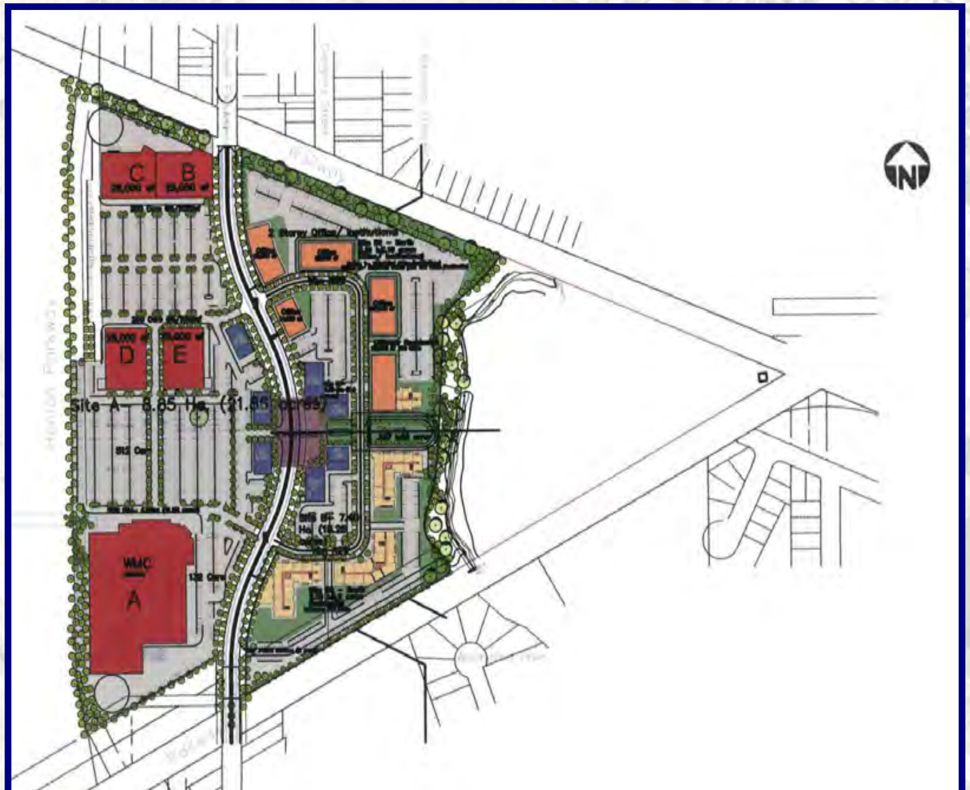
The subject portion of Silvercreek Parkway is situated primarily within the Silvercreek lands, a former quarry site that is presently undeveloped and unused.

HISTORY (SILVERCREEK PARKWAY)

Until 1975, Silvercreek Parkway was a continuous road between Waterloo Avenue and Paisley Road with at-grade crossings at the CNR Mainline and the CNR Secondary Line. In 1975, Silvercreek Parkway was closed at the CNR Mainline in conjunction with the construction of the Hanlon Expressway to the West.

In 2009, the City of Guelph and Silvercreek Developments entered into a Minutes of Settlement for the Development of the Silvercreek Lands based on the following:

- Reconnection of Silvercreek Parkway as a continuous roadway between Waterloo Avenue and Paisley Road.
- Grade Separation at the CNR Mainline.
- A new road to the east of Silvercreek Parkway as shown in the development concept plan.



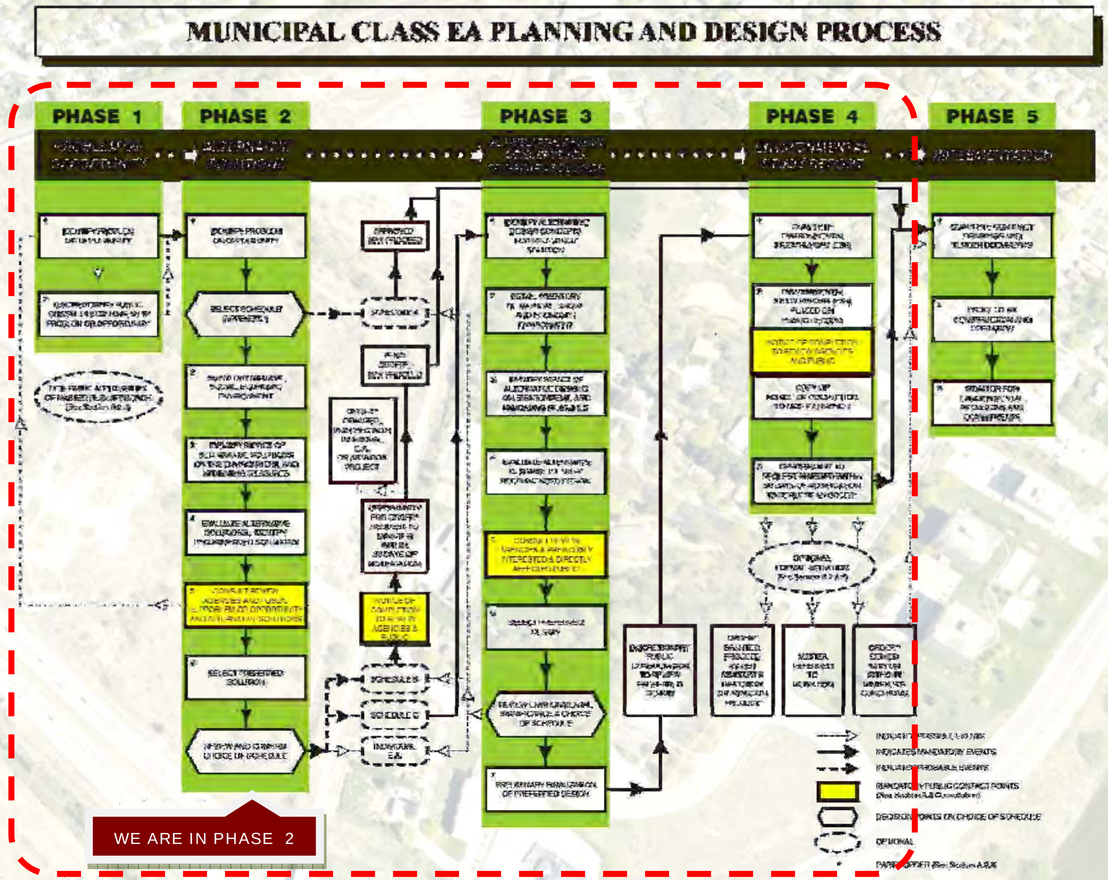
THE CLASS ENVIRONMENTAL ASSESSMENT PROCESS

Formal planning process approved under the *Ontario Environmental Assessment Act.*

Ensures that all reasonable alternatives are considered and evaluated.

Aims to avoid and/or minimize adverse impacts to the surrounding environment.

This project has been reclassified as a Schedule “B” Class EA study.



SCHEDULE “B” PROJECTS REQUIRE COMPLETION OF FIRST 2 PHASES.

NEED & JUSTIFICATION

Silvercreek Parkway / CNR Grade Separation:

- Reconnection of Silvercreek Parkway is required to accommodate the Silvercreek lands, with access to both Paisley Road and Waterloo Avenue/Wellington Road.
- Silvercreek Parkway reconnection requires a grade separation at the CNR Mainline.
- The City of Guelph Official Plan identifies Silvercreek Parkway as a continuous roadway with a grade separation at the CNR Mainline.
- The projected traffic volumes on Silvercreek Parkway and the number of trains per day on the CNR Mainline justify the need for grade separation.
- There will not be a need for grade separation at the CNR Secondary Line.

Silvercreek Parkway Alignment: The proposed curvilinear alignment is based on the development Concept Plan to meet intensification, mixed-use and urban design requirements.

New Development Road: The development Concept Plan includes a new municipal road to the east of Silvercreek Parkway to provide access within the mixed-use development area.

OPERATIONAL (TRANSPORTATION) ENVIRONMENT

Railway Crossing	2011 Existing*			2021 Full Development			2031 Hanlon Expressway Upgraded as Freeway		
	AADT	Train/Day	Cross Product	AADT	Train/Day	Cross Product	AADT	Train/Day	Cross Product
Main Line	0	14	0	9,600	22	211,200	9,800	34	333,200
Secondary Line	0	1	0	12,900	1	12,900	10,900	6	65,400

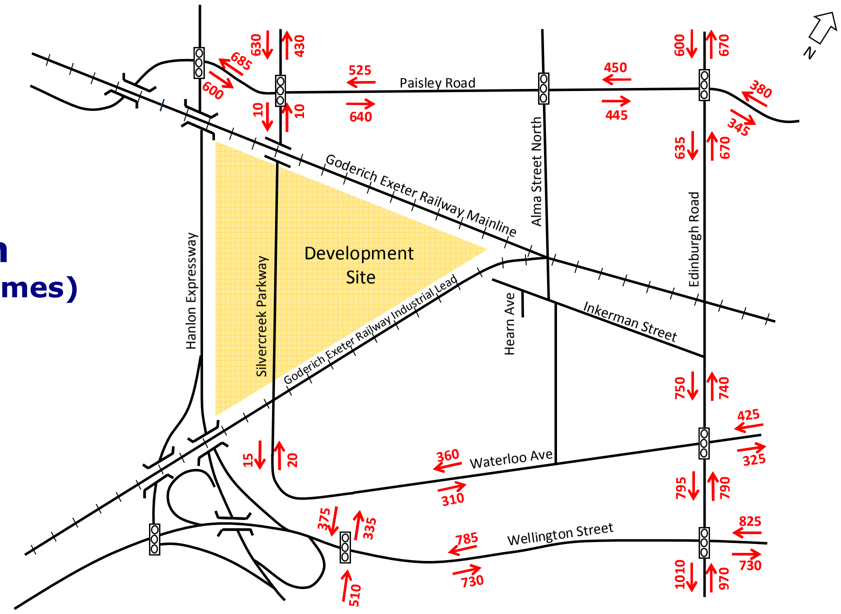
2011 Existing Rail Traffic*

- 6 (3x2) Passenger Trains
- 4 (2x2) Freight Trains
- 4 (2x2) GO Trains (Starting Dec 2011)
- TOTAL = 14 Existing

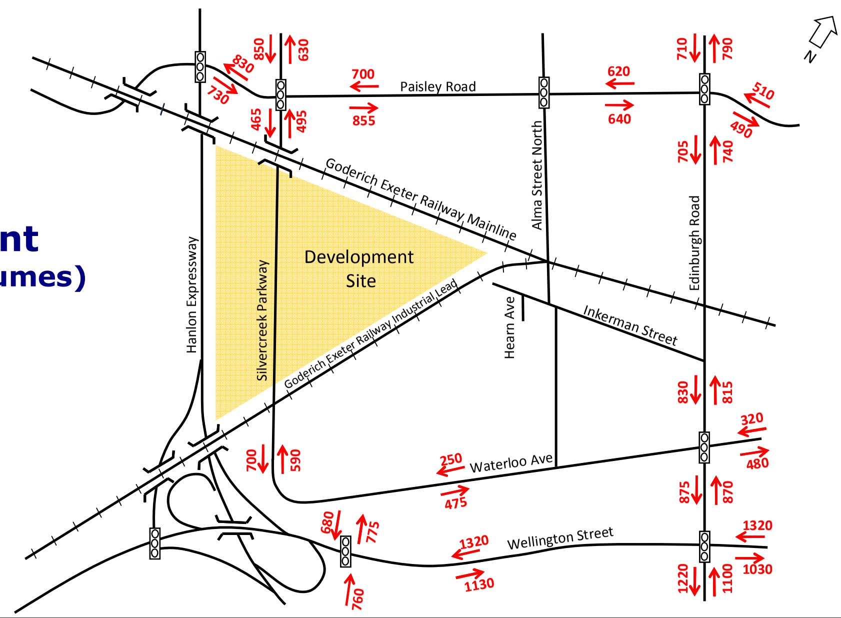
Cross-Product

- The Road / Rail Cross Product is one of many factors used in the determination of crossing safety improvements.
- The City will undertake a Grade Crossing Safety Assessment in accordance with Transport Canada guidelines to determine the extent of crossing improvements required at the Silvercreek crossing of the CNR Secondary Line.

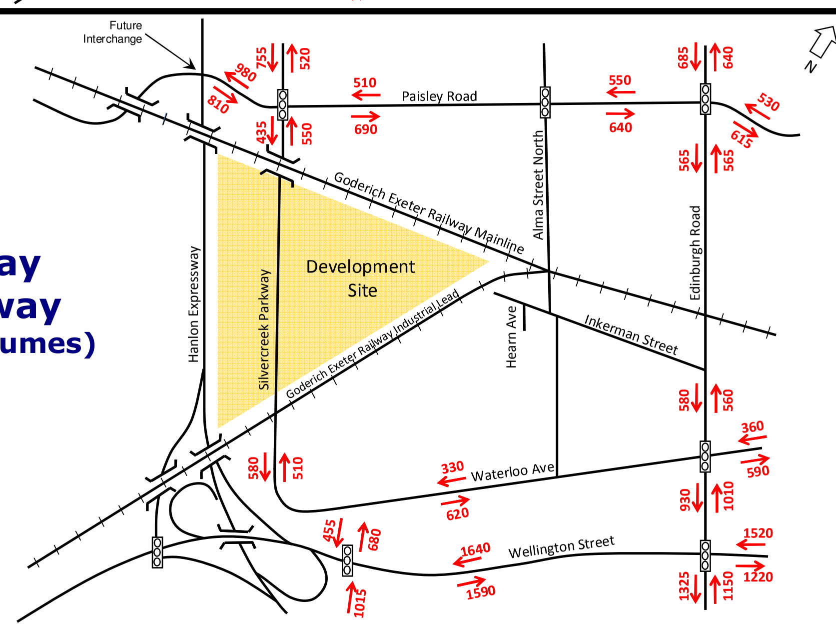
2011
Existing Condition
(PM Peak Hour Traffic Volumes)



2021
At Full Development
(PM Peak Hour Traffic Volumes)



2031
Hanlon Expressway
Upgraded as Freeway
(PM Peak Hour Traffic Volumes)



Class Environmental Assessment
Silvercreek Parkway from North of Paisley Road to South of CNR Secondary Line
City of Guelph

ALTERNATIVE SOLUTIONS

Alternative A	Do nothing, Silvercreek Parkway would remain closed at the CNR mainline
Alternative B	Reconstruct Silvercreek Parkway on existing alignment, including Subway at the CNR mainline
Alternative C-1	Reconstruct Silvercreek Parkway on a new alignment as per Silvercreek Developments Concept Plan, including Subway at the CNR mainline
Alternative C-2	Same as Alternative C-1, but improved to meet Transportation Association of Canada (TAC) engineering standards
Alternative D*	Same as Alternative C-2, but with an at-grade crossing at the CNR Mainline
Alternative E*	Same as Alternative C-2, but the Subway at the CNR mainline would be raised and shifted to the south

**Alternatives D and E were developed for consideration following review of the comments received after the first PIC.*

EVALUATION CRITERIA

The Project Team considered a number of criteria (representing the broad definition of the environment as described in the EA Act) to comparatively evaluate the alternative solutions.

Transportation / Technical	Socio-Economic Environment	Natural Environment	Cost
⇨ Roadway Performance ⇨ Roadway/Rail Safety ⇨ Pedestrian & Cyclist Accommodations ⇨ Network Continuity ⇨ Commercial Vehicles ⇨ Emergency Services ⇨ Planning Objectives ⇨ Utility Relocations	⇨ Direct Property Impacts ⇨ Compatibility with Area Land Use ⇨ Residential Access ⇨ Illumination Impact ⇨ Visual/Aesthetic Impact ⇨ Construction Disruption	⇨ Vegetation Impact ⇨ Wildlife and Habitat Impact ⇨ Special Designation Areas ⇨ Groundwater Impacts ⇨ Surface Water Impacts ⇨ Air Quality ⇨ Natural Hazards	⇨ Capital Cost ⇨ Operation and Maintenance ⇨ Property Costs

EVALUATION OF THE ALTERNATIVE SOLUTIONS

EVALUATION CRITERIA	ALTERNATIVE A *Do nothing, Silvercreek Parkway would remain closed at the CNR Mainline*	ALTERNATIVE B *Reconstruct Silvercreek Parkway on existing alignment / Subway at the CNR Mainline*	ALTERNATIVE C-1 *Silvercreek alignment as per Concept Plan / Subway at the CNR Mainline*	ALTERNATIVE C-2 *Same as Alternative C-1, but improved to meet TAC# engineering standards*	ALTERNATIVE D* *Same Alignment as C-2 / At-Grade Crossing at the CNR Mainline*	ALTERNATIVE E* *Same Alignment as C-2 / Subway at the CNR Mainline Raised & Shifted to the South*
TRAFFIC OPERATIONS & TECHNICAL	Vehicular, cyclist and pedestrian traffic requirements not addressed.	Vehicular, cyclist and pedestrian traffic requirements addressed. Lack of roadway curve would not address traffic calming requirements.	Vehicular traffic requirements not addressed (not in conformance with technical design standards -TAC).	Vehicular, cyclist and pedestrian traffic requirements addressed. Traffic access / egress modifications required at north end.	Would not accomodate projected traffic volumes on Silvercreek Parkway or the number of trains on the CNR Mainline.	Not compatible with CNR structures at Hanlon Parkway and Paisley Road.
SOCIO-ECONOMIC	Would not accommodate proposed development of the Silvercreek lands. Does not support the City's Official Plan.	Straight alignment would limit the amount of developable land west of the Silvercreek Parkway.	Accommodates proposed development of the Silvercreek lands.	Accommodates proposed development of the Silvercreek lands.	Accommodates proposed development of the Silvercreek lands.	Accommodates proposed development of the Silvercreek lands.
NATURAL ENVIRONMENT	No impacts to the area's natural environmental features.	Development of the Silvercreek lands will result in the loss of natural environmental features in the area. The selected roadway alignment would have negligible affects.	Development of the Silvercreek lands will result in the loss of natural environmental features in the area. The selected roadway alignment would have negligible affects.	Development of the Silvercreek lands will result in the loss of natural environmental features in the area. The selected roadway alignment would have negligible affects.	Development of the Silvercreek lands will result in the loss of natural environmental features in the area. The selected roadway alignment would have negligible affects.	Development of the Silvercreek lands will result in the loss of natural environmental features in the area. The selected roadway alignment would have negligible affects.
COST	No construction cost.	Moderate costs associated with construction.	Moderate costs associated with construction.	Moderate costs associated with construction.	High costs to convert at-grade crossing to a future subway at CNR Guelph mainline.	High costs associated with shifting of CNR structures and lines at Hanlon Parkway and Paisley Road.
EVALUATION SUMMARY	**Not Recommended**	**Not Recommended**	**Not Recommended**	**Recommended**	**Not Recommended**	**Not Recommended**

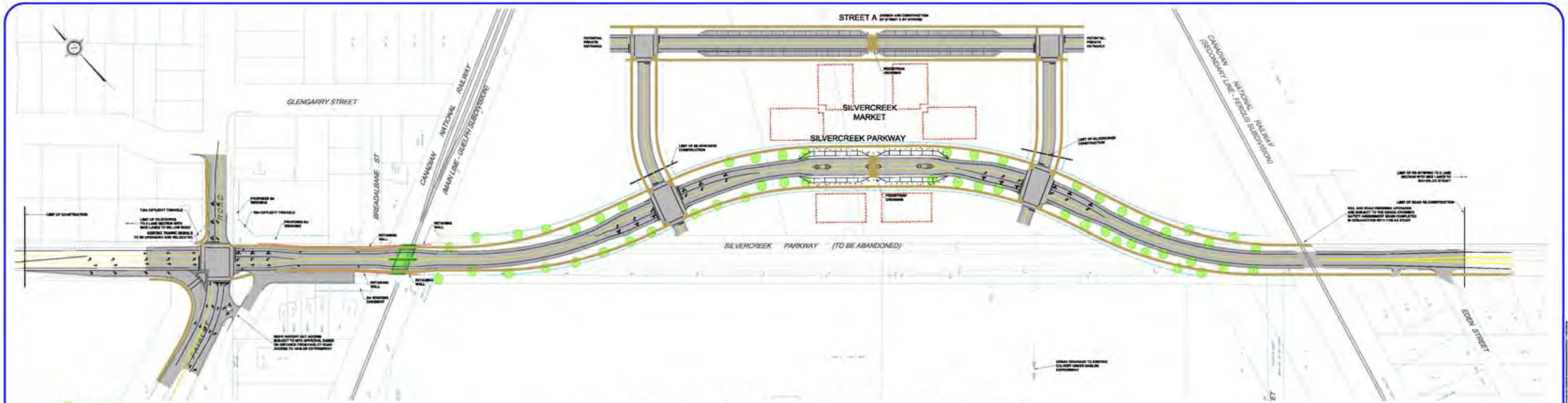
Transportation Association of Canada

* *These alternatives were developed for consideration following review of the comments received after the first public information centre.*

Legend

- Does not Support Criteria
- Moderately Supports Criteria
- Fully Supports Criteria

Class Environmental Assessment
Silvercreek Parkway from North of Paisley Road to South of CNR Secondary Line
City of Guelph



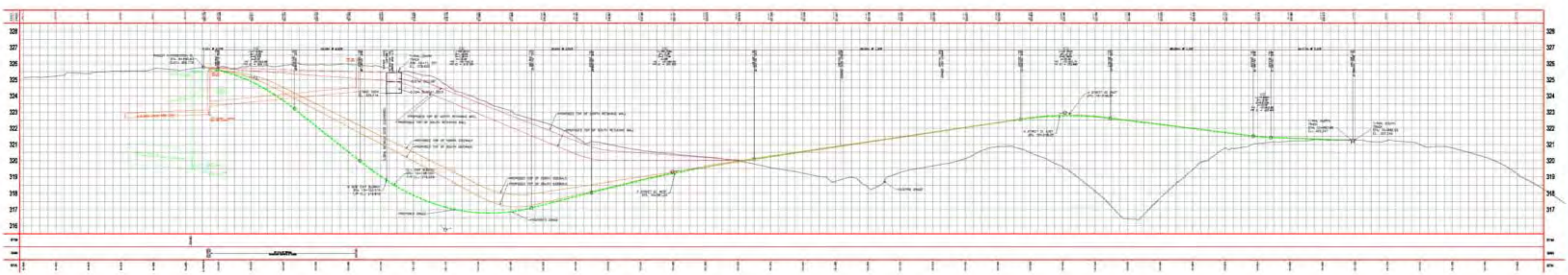
City of Guelph — Making a Difference

SILVERCREEK PARKWAY EA STUDY

RECOMMENDED SOLUTION - CONCEPT PLAN TO TAC STANDARDS

FROM PAISLEY ROAD TO WATERLOO STREET SCALE: 1:500 DATE: FEBRUARY 15, 2012

Delcan



City of Guelph — Making a Difference

SILVERCREEK PARKWAY EA STUDY

RECOMMENDED SOLUTION - CONCEPT PLAN TO TAC STANDARDS - PROFILE VIEW

FROM PAISLEY ROAD TO WATERLOO STREET SCALE: 1:500 DATE: FEBRUARY 15, 2012

Delcan

KEY FEATURES OF THE RECOMMENDED SOLUTION

A subway at the CNR Mainline consisting of a twin span skewed rigid frame structure, featuring a 5.3 metre vertical clearance.

Retaining walls on the east and west sides of Silvercreek Parkway, from south of the CNR Mainline to just south of Paisley Road.

To safely accommodate pedestrians and cyclists under the CNR structure, sidewalk grades will be reduced and the northbound bike lane will be elevated, adjacent to the sidewalk.

The Silvercreek Parkway cross section will feature 2 through lanes, bike lanes and sidewalks throughout.

A 3 metre wide centre island median and on-street parking provided at the Silvercreek Square.

KEY FEATURES OF THE RECOMMENDED SOLUTION

A new roadway constructed to the east of the Silvercreek Parkway in accordance with the Silvercreek Development Concept Plan.

Intersection improvements at the Silvercreek Parkway/Paisley Road intersection.

A service road to provide access (limited to right-in, right-out movements) to existing residential properties west of the Silvercreek Parkway, north of the CNR mainline. Access in and out of Paisley Road is also proposed (limited to right-in, right-out movements) subject to MTO approval.

Safety improvements for the Fergus Subdivision at the CNR secondary line, subject to the recommendations of a Grade Crossing Safety Assessment currently being completed.

Roadway drainage to be accommodated via an existing culvert under the Hanlon Expressway.

RECOMMENDED DESIGN BENEFIT / IMPACT SUMMARY

CRITERIA	BENEFIT SUMMARY	IMPACT SUMMARY	MITIGATION MEASURES
TRAFFIC OPERATIONS & TECHNICAL	Accommodates all modes of traffic (rail, bus, cars, bicycles and pedestrians) and provides a new north-south road connection.	During construction, rail traffic will be diverted to a temporary diversion to be located on the south side of the existing track Change in access movements to properties on the west side of Silvercreek Parkway north of CN Mainline.	Following completion of the CNR Subway, rail traffic will be restored to the existing track alignment Provide service road with right-in, right-out access on Silvercreek Parkway, and a second right-in, right-out access on Paisley Road, subject to MTO approval.
SOCIO-ECONOMIC ENVIRONMENT	Accommodates proposed development of the Silvercreek lands.	Short term access restrictions to properties on the west side, north of CN Mainline during construction. Temporary access to properties north of CN Mainline may be required for construction of retailing walls for the CNR Subway. Dust/debris and noise impacts during construction.	Minimize access restrictions during construction. Property owners will be notified. Any lands disturbed as a result of construction would be restored to their original state. Minimize dust, debris and noise control impacts. Carry out construction in conformity with City By-laws.
NATURAL ENVIRONMENT	Negligible effects on the area's natural environmental features.	Potential surface water impacts during construction.	Minimize impacts using erosion and sediment control (ESC) measures (e.g. heavy duty silt fence, rock flow checks, straw bale flow checks, fibre filtration tubes).

NEXT STEPS

Following this PIC, the City of Guelph and their consultant, Delcan, will:

1. Review all comments submitted at today's PIC and undertake any necessary modifications to the design plans;

2. Prepare and submit a Project File describing the study recommendations and planning process undertaken for 30 Day public review;

3. Proceed to the detailed design and construction phase of the project. Assuming no Part II Order requests are received construction is anticipated to start in Summer 2012.

APPENDIX C

Submitted Comments

Delcan

City of Guelph
Making a Difference

PUBLIC INFORMATION CENTER #2

FEBRUARY 15, 2012

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

COMMENT FORM (PLEASE PRINT)

- We are not pleased with the current plan, at the end of our road
- It is a safety issue
- We have not the proper acess to and from our homes.
- We are being limited to everyday acess to turn left.
- We are very worried about our property value
- We really cannot see any resolution to this.
- We do not want to have to drive everyday out of our way.
- We would require acess in both directions.
- We can only turn right from our street (Paisley Rd. extension) and this is unacceptable.

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by February 29, 2012 to:

Mr. Peter Jefford, P. Eng.
Project Manager
Delcan Corporation
675 Queen St South, Suite 201
Kitchener ON N2M 1A1
Telephone: (519) 744-4509, Fax: (519) 744-2822, Email: p.jefford@delcan.com

**Alternatively you may submit your Comment Form to m.vandyk@delcan.com

Delcan

Guelph
Making a Difference

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Public Information Center #2

February 15, 2012

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

Comment form (please print)

My concerns are vehickles turning around on the service road provided. ie - garbage truck, snow plows, trucks, people lost in general without using my driveway. We all need access to turn left on Paisley and go North on Silvercreek. Right ins and right outs only are NO GOOD! Ive maintained the 10+ ft of property in front of my house for 20yrs. I have 2 trees, a shrub, a huge rock and a 30 ft privet which is on City property right now. Will these items be moved somewhere back on my property?

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by February 29, 2012 to:

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Project Manager
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City of Guelph — Making a Difference

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PUBLIC INFORMATION CENTER #2

FEBRUARY 15, 2012

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

COMMENT FORM (PLEASE PRINT)

Further concerns are noise through the day for those who work night shift while all this developement is going on. Dust & debris in the hot summer days coming into my home. I won't even be able to open my windows in my house. Further concerns are cracking of my walls, window frames, foundation etc... Will my property decrease in value? Will my taxes go up for something I don't want? The outside of my house needs upgrades ie (painting, staining, lawn maintainance. How is it possible during developement.

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by February 29, 2012 to:

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Contact Name:
Address:

Phone:
E-Mail:

Delcan

City of Guelph — Making a Difference

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Public Information Center #2

February 15, 2012

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

Comment form (please print)

A huge concern is access in and out of my house during construction and more so, trailering a boat with such a steep grade accessing to Paisley. When will this start and how much notice will I receive before it starts? Will I get a tax break for all our inconveniences?!

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by February 29, 2012 to:

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Kitchener ON N2M 1A1
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**Alternatively you may submit your Comment Form to m.vandyk@delcan.com

Contact Name:

Address:

Phone:

E-Mail:

Delcan

City of Guelph
Making a Difference

PUBLIC INFORMATION CENTER #2

FEBRUARY 15, 2012

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

COMMENT FORM (PLEASE PRINT)

Will there be traffic lights
put up at Westwood to
accomodate increased traffic
on Silvercreek?
It is already hard to
exit onto Silvercreek.

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by February 29, 2012 to:

Mr. Peter Jefford, P. Eng.
Project Manager
Delcan Corporation
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Kitchener ON N2M 1A1
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PUBLIC INFORMATION CENTER #2

FEBRUARY 15, 2012

Silvercreek Parkway South Improvements, Including Grade Separation at the CNR Mainline
Class Environmental Assessment and Preliminary Design

COMMENT FORM (PLEASE PRINT)

- Option Recommended looks reasonable
- Plan for new transit route on Silvercreek
- Leave Fergus sub as is but PROTECT for future Grade Separation

Please complete the form and deposit in the "Comment Box" provided or mail, fax, email by February 29, 2012 to:

Mr. Peter Jefford, P. Eng.
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675 Queen St South, Suite 201
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**Alternatively you may submit your Comment Form to m.vandyk@delcan.com

Hello,

I am a longtime Guelph resident and homeowner who lives on Paisley Road between Alma and Silvercreek. I have received the notice of and plan to attend the public information session on February 15th 2012 regarding the Class Environmental Assessment, Silvercreek Parkway South Improvements.

As someone who lives with the already heavy traffic on Paisley Road, I've been rear-ended as I waited (with my indicator on) to turn into my driveway, seen my neighbours get into accidents trying to back out of their driveways, watched as a driver lost control of their car and landed on my neighbour's lawn and seen my dog hit by a car in front of our home. I mention these events because I notice the large number of parking spaces in the Silvercreek Parkway South "improvements" concept map which indicates you are expecting a lot of cars to visit this proposed development.

Are the authors of the "concept map" aware that there is a grade school and church (plus another grade school just off of Paisley) also between Alma and Silvercreek on Paisley Road? How on earth is this section of road and the people who live, go to church and send their children to school here going to cope with the additional traffic? Morning and afternoon I can hardly get out of my driveway already. Paisley Road Public School staff must be outside at the entrance to the school due to traffic congestion at the beginning and end of the school day.

I'd like the details to hear more about traffic flow assessment, impact on air quality, and the land. I'd also like to see numbers about the additional transport trucks in the area as well. Who on earth thought up this concept plan - certainly not someone who has bothered to looked beyond the narrow boundaries of the former quarry site. The former quarry is IN THE MIDDLE OF AN ESTABLISHED NEIGHBOURHOOD. I wonder how far such a development plan would get if the former quarry site was green space in the south end, surrounded by new and expensive homes.

I would love to see the developers of this site take into consideration the schools, church and residents of the immediate area. I write this in my living room listening through closed windows at the many cars zooming by and think to myself why would we design and build a development to draw cars from all over the city to the middle of a residential area?

Thank you for your time and attention to my request,

Kind Regards,

APPENDIX I

TECHNICAL AGENCY AND STAKEHOLDER MEETING MINUTES

MINUTES OF MEETING

Subject:	Silvercreek Parkway Road Improvements	**Date:**	June 22, 2011
Purpose:	To review MTO plans for the Paisley Road interchange and consider design impacts to the reconstruction of the Silvercreek Parkway		
Attendees:	**City Of Guelph** • Rajan Phillips, Project Manager • Andrew Janes, Project Engineer Supervisor • Colin Baker, Environmental Engineer • Gwen Zang, Transportation Planning Engineer • Stacey Laughlin **MTO** • Ian Smyth, Corridor Management Planner • Robert Bakalarczyk, Project Engineer **Delcan Corporation** • Nick Palomba, VP Transportation • Peter Jefford, Waterloo Regional Manager	**Location:** **Ref:**	City of Guelph TW1366

Item	DISCUSSION	Action By

Notes:

- MTO is considering issuing an EOI for the planning of the Paisley Road Interchange in the next few months
- MTO anticipates construction of the Paisley Road Interchange to be 10+ years
- The construction of Silvercreek Pkwy will be on the City of Guelph 2012 Capital Program.
- Given the disparity between years of construction, Delcan will consider Silvercreek access to Paisley Road on a “not to preclude” basis for the eventual construction of the Paisley Road interchange.
- Delcan will review any changes to the Paisley Road access and profile with the Ministry.
- Vertical alignment alternatives will consider access to west-side properties (preferably from Silvercreek, or alternatively from Paisley road between Silvercreek and Hanlon – for MTO’s review.

The above notes are intended to summarize the major items of discussion at the meeting. Please advise the undersigned asap in the event that you note any significant errors or omissions.

Peter Jefford

Peter Jefford, P.Eng.
Principal, Transportation Division
Delcan Corporation
675 Queen Street South, Suite 201
Kitchener, Ontario N2M 1A1
Office: 519-744-4509 Cell: 519-573-6358
p.jefford@delcan.com

MINUTES OF MEETING

Subject:	Silvercreek Parkway Road Improvements	**Date:**	Tuesday, July 26, 2011
Attendees:	**RailAmerica** Doug MacKenzie, General Manager **City of Guelph** Andrew Janes, Project Engineer Supervisor **Delcan** Jonathan Werner, Sr. Structural Engineer Gus Garron, Sr. Rail Designer Peter Jefford, Waterloo Region Manager	**Location:** **Ref:**	Rail America Inc. 101 Shakespeare Street Stratford, Ontario N5A 3W5 TW1366

Item	DISCUSSION	ACTION
1	**Project Scope** The CN Rail Overpass structure is proposed for construction in 2012. The project is located on Silvercreek Pkwy, and is being driven by local municipal development known as the “Silvercreek Lands” The project includes (2) Rail Crossings (Rail America Plan RI-49.50-50.50 is attached for reference.): • Proposed CN Rail Overpass at Guelph Subdivision 50.24 • Existing at-grade crossing of the Fergus Spur at Mileage 29.51.	

2	**Protocol**
	
	• The track at the rail crossings is owned by CN Rail. Rail America holds a 21 year lease on the Track, and operates as the Goderich Exeter Railway (GEXR). http://www.railamerica.com/RailServices/GEXR.aspx
	• Xorail. (http://www.xorail.com/contact-xorail) – is the Rail America signaling contractor.
	• Doug Mackenzie is the Rail America General Manager, and holds responsibility for rail operations on the track.
	• Rail America will need to obtain approval of the engineering details for the structure from CN.
	• Doug MacKenzie provided a copy of the following Rail America requirements (attached):
	  ○ Right of Entry and accessing Property
	  ○ Grade Crossings
	  ○ Insurance Requirements
	  ○ Application for Contractor Occupancy on Railway Property
	• Contact information for the Railway Authorities is provided on the above-noted (and attached) Rail America requirements.
	• Doug MacKenzie will make initial contact with the Railways operating within the corridor.
		Rail America

3	**Authorization and Approval Procedure from Rail Authorities** • The point of contact for permits and approvals is Donna Kellingsworth	

Item	DISCUSSION	ACTION
	of Rail America – Jacksonville office. All concepts and design drawings will need to be reviewed by Rail America's consultants to be contacted through Donna. On a later stage Larry Romaine of Rail America may also need to be contacted.	
	• Marissa Crawford of the Concorde, ON office is the CN Rail point of contact. Marissa should be notified of all aspects related to the proposed structure and track corridor work.	Delcan
	• All operational temporary and permanent proposed actions must be discussed with Doug MacKenzie.	
4	**Design Features & Issues – CN Rail Overpass Guelph Subdivision 50.24**	
	• Silvercreek Pkwy will include 2-Lanes @ 3.5m, 2 Bike Lanes @ 1.5m, 2 Boulevards @ 1.0m (includes 500mm curb), and 2 Sidewalks @ 1.5m. (Draft Silvercreek Section attached).	
	• Delcan anticipates a rigid frame structure constructed at an approximate skew of 23° (Skew tbc pending survey).	
	• The Design will need to meet CN Rail Specifications.	
	• The existing Rail Design Speed is classified as 80 Miles/Hr. Design Speed for the Diversion will be 35 Miles/Hr.	
	• Existing daily train rail traffic includes: ○ 6 Passenger trains ○ 4-6 Freight trains ○ 4 GO trains (Service beginning Jan 2012)	
	• CN will likely require 450 mm. of ballast on top of the structure deck.	
	• The Guelph Subdivision is Line Rated at 286, but is likely to grow to 316 (Gross Weight Rail Car)	
	• Rail America was in general agreement with the proposed section, but noted that approval of the structural details will need to be obtained from CN Rail.	Delcan
5	**Vertical Clearance – CN Rail Overpass Guelph Subdivision 50.24**	
	• The existing site geometry presents some challenges in terms of meeting vertical grade requirements.	
	• The Preliminary Design (attached) indicates a vertical clearance for the Rail Underpass of 5.3m. However this results in an 8% grade on Silvercreek Pkwy, which will present winter safety issues in the event of icy road conditions.	
	• CN Policy for Vertical Clearances allows: ○ "For secondary roads or bridge sites with height constraints, a reduction in the vertical clearance may be allowed with the written approval from the Senior Engineer".	
	• Delcan noted that: ○ The Ontario Highway Bridge Design Code (OHBDC) requirement for vertical clearance under a cast-in-place structure was 4.65m. Most existing structures in the province have been constructed to this minimum standard. ○ The Canadian Highway Bridge Design Code (CHBDC) replaced the OHBDC approximately 10 years ago, at which	

Item	DISCUSSION	ACTION
	time the vertical clearance requirement for cast-in-place structures was increased to 4.8m. o Delcan would propose a vertical clearance of 4.9m, which includes a 100mm construction tolerance over the CHBDC requirement.	
	• Doug MacKenzie advised that Delcan will need to submit any proposal for reduced vertical clearance to CN Rail.	Delcan
6	**Design Features & Issues – CN Rail At-Grade Crossing, Fergus Spur at Mileage 29.51.**	
	• Delcan noted that the proposed Silvercreek Developments plan includes commercial, office and residential development.	
	• Delcan also noted that the existing rail signals on Silvercreek Pkwy appear very old, and may require upgrades given the significance of the Silvercreek Developments.	
	• Doug MacKenzie is of the view that, given the scope of development, gates will likely be required. The cost of a set of gates on a 2-lane roadway is circa $275k.	
	• Crossing requirements will be confirmed after a review of traffic volumes generated by the development. Delcan will include projected traffic volumes on Silvercreek Pkwy with the crossing plan.	Delcan
7	**Utilities & Underground Services**	
	• There is fiber optic cable located on both sides of the Guelph Subdivision track (Bell 360 and Rogers).	
	• The fiber optic was installed across City Lands without City permission. Hence the City is of the view that relocation costs will be at the cost of Bell and Rogers. These utility plants and any other municipal service or utility affected by the design of the proposed structure and/or temporary works must considered in the design.	Delcan
	• Delcan may retain the services of a utility locator firm (MultiView) to locate utilities potentially affected by the works	Delcan (tbd)
8	**Railway Costs for Plan Review**	
	• The City of Guelph asked Delcan to develop a list of rail plans & applications to be submitted to the Railways so that costs can be determined before the design review is commenced.	Delcan
	• The City recommended Delcan to contact Donna Kellingsworth of Rail America promptly to assess the cost of the design review by Rail America's consultant.	Delcan
9	**Contact List**	
	• Delcan will prepare and distribute a contact list for the project. *(NOTE: Contact List attached to these Minutes)*	Delcan

Item	DISCUSSION	ACTION

These minutes are believed to reasonably summarize the major items of discussion at the meeting. Please advise asap if you note any significant errors or omissions.

Thank you for your participation.

Peter Jefford

Peter Jefford, P.Eng.
Principal, Transportation Division
Delcan Corporation
Woodside Business Centre
675 Queen Street South
Suite 201
Kitchener, Ontario
N2M 1A1

Office: 519-744-4509
Cell: 519-573-6358
p.jefford@delcan.com
www.delcan.com

Distribution: All Attendees
Rajan Phillips, Mgr Transportation Planning & Development, City of Guelph
Neil Robinson, Silvercreek Developments

MINUTES OF MEETING

Subject: Silvercreek Parkway Road Improvements
City of Guelph Contract #11-104

Date: Monday, October 3, 2011

Attendees:

City of Guelph
Rajan Philips, Project Manager
Andrew Janes, Project Engineer Supervisor

CN Rail
Marissa Crawford, Manager Design & Construction, CN Rail

Rail America
Doug MacKenzie, General Manager, GEXR

Delcan
Brent Archibald, Structural Design
Gus Garron, Track Design
Peter Jefford, Waterloo Region Manager

Location: 4 Welding Way
Concord

Ref: TW1366

Item	DISCUSSION	ACTION

1 **Project Scope**

The CN Rail Overpass structure is proposed for construction in 2012. The project is located on Silvercreek Pkwy, and is being driven by local municipal development known as the “Silvercreek Lands” The project includes (2) Rail Crossings (Rail America Plan RI-49.50-50.50 is attached for reference.):

- Proposed CN Rail Overpass at Guelph Subdivision 50.24
- Existing at-grade crossing of the Fergus Spur at Mileage 29.51.

Notice of Class EA Study Commencement was issued to the Public on Sept 26, 2011. CN and Rail America were circulated with EA Notices.

CNR Mainline – Guelph Subdivision Mileage 50.24

2 **Road Design**

- The design of Silvercreek Pkwy includes a 2-lane cross section with 3.5 m travel lanes, 3.5m lanes, 1.5m bike lanes, 1.0m Blvds and 1.5m S/W (15m total roadway)
- The preliminary design for Silvercreek Pkwy under the CN Rail subway will be located on a grade at or near 8%. In consideration of the road safety issues, 8% is the maximum desirable grade.
- Subject to resolution of the Rail Diversion & Structural issues (as noted below) it may also be necessary to cut the grade on paisley Road. Some limited roadway cut may be achievable, however Paisley Rd was developed some years ago, and any material grade change will negatively impact the existing residences, driveway grades and utilities.
- For these reasons, the structural depth of the CN Rail subway will need to be minimized to the extent possible.

Item	DISCUSSION	ACTION
3	**Structure Design CN Subway:** • The existing CN Rail track design provides for a future 2nd track, to be located on the north side of the existing track. • Delcan considered a rail structure with a steel substructure, however the sidings to the east and CIP concrete rail structure over the Hanlon Expressway to the west would seem to preclude any widening of the track alignment. • Delcan has developed alternative 1-Span and 2-Span CIP concrete structures. The 2-Span structure will require a thinner structural thickness. The overall span will be longer to accommodate the centre Column in the roadway median, which will in turn require an easterly shift of the east abutment. However the initial evaluation of alternatives would seem to favor the 2-Span CIP concrete structure. • In consideration of the constraints in vertical grades at this site, CN Rail was asked to consider reduced vertical structural clearance from the CN standard of 5.3m. CN advised that reduced vertical clearances could be considered, but approval would require the submission of need & justification, and would be subject to the construction of an overhead crash barrier. • CN advised that abutments should need to be constructed perpendicular to the track. Delcan noted that at this location, given the 23 degree skew angle, construction of perpendicular abutments would require a significant lengthening of the structure. Delcan also noted that the adjacent CN Subway at the Hanlon is a CIP concrete structure, and featured skewed abutments. • CN advised that construction of skewed approach slabs perpendicular the track could be considered, but again need & justification would need to be provided. • CN asked if precast voided box girders had been considered. Delcan advised that box girders were not considered to be a viable option at this site given the span and vertical clearance issues. However Delcan will further review this option in our structural report.	
4	**Track Diversion:** • Delcan proposed a 35mph Track Design Speed for the Diversion. GEXR advised that GO Transit may not accept reducing speed even on a temporary basis, and if increasing the speed is not feasible, may ask for compensation. The City noted that there is a 10mph speed limit imposed by the CTA at the Alma Street crossing located immediately east of the Silvercreek Crossing. GEXR noted that GO Transit will be initiating operations (test trains) in Dec 2011, and full operations in Jan 2012. GEXR also noted that passenger train acceleration could exceed 35mph at Silvercreek. Delcan will notify GEXR the maximum speed the diversion can reach without affecting the existing Hanlon bridge; GEXR will then discuss the issue with GO Transit. • CN & GEXR noted that the Rail Diversion on the North Side of the existing track will be tight to the ROW which backs onto 4 private residences (2 residences are especially tight to the ROW), which could potentially generate noise and vibration complaints from the residents. It was agreed that a diversion to the south seems preferable, since even if a north diversion can be designed within City ROW, the option will likely be	

Item	DISCUSSION	ACTION

unacceptable to the community due mostly to noise and vibration effects.

- Delcan will re-assess the relocation strategy and layout of the two switches just east of the Silvercreek crossing, aiming to minimize operational inconvenience to the operators.

5 **Construction Staging**

- If the Track Diversion was located on the South Side of the existing track, it may be possible to construct the CN Rail Subway in a single construction stage, thereby shortening the duration the Rail Diversion will be in effect. It is estimated that a 1-Stage Construction could be completed in a single construction season, however 2-Stage Construction is likely to extend into a second construction season.
- Delcan agreed to evaluate the Track Diversion alternatives against the Structural Design and Construction Staging alternatives and recommend a design strategy that best responds to all issues.

6 **CNR Spur - Fergus Subdivision Mileage 29.51**

- The existing Silvercreek/Fergus subdivision crossing is a public crossing open to traffic. However as the Silvercreek Lands are undeveloped, and as the north crossing of Silvercreek at the CN Mainline (Guelph Subdivision) is closed, there is very little existing traffic on Silvercreek Pkwy. However upon development of the Silvercreek Lands, there will be vehicular traffic at the CNR Fergus Crossing.
- GEXR advised that the Fergus Subdivision runs 8 trains a week. However the existing signals at the crossing are very old/obsolete, and given the major increase in roadway traffic following the redevelopment of the Silvercreek Lands and the construction of a Subway at the Guelph Subdivision, there will likely need to be a major upgrade of the crossing protection, perhaps including new signals.
- The threshold for the installation of crossing gates is 50,000 (AADT x # trains/day). While the Silvercreek Crossing would seem to be below this threshold, CN & GEXR noted that there are other considerations, including visibility leading to the crossing. Delcan noted sight lines may be compromised as the road is skewed to the track at the crossing locations. *(Note: After the mtg the rail/road skew angle was confirmed at 28.4 degrees).* CN noted that other issues will need to be considered and evaluated in a Crossing Safety Audit through which the need for gates will be determined.

7 **Utilities**

- CN, GEXR & the City advised that utilities will include:
  - CN/GEXR Communication Cables
  - Bell 360 Networks and Rogers
  - City 10” Watermain
  - Union Gas, Hydro and potentially others tbd.
- Delcan will issue base plans to the Utility Companies with a request to locate their plant.
- The City requested CN to coordinate the relocation of utilities during construction.

Item	DISCUSSION	ACTION

8	**Permits**
	• The City will issue PO's to both CN ($10,000) and Rail America. Delcan will confirm the amount with Rail America.
	• Rail America Contacts are:
	  ○ Larry Romaine, Director of Engineering
	  ○ Donna Killingsworth
	• Permit Applications & Design Submissions should go direct to Rail America, who will internally coordinate the approvals with CN.
	• CN & Rail America will require a legal agreement responding to cost sharing & maintenance issues before construction can commence.	

These minutes are believed to reasonably summarize the major items of discussion at the meeting. Please advise asap if you note any significant errors or omissions.

Thank you for your participation.

Peter Jefford

Peter Jefford, P.Eng.
Principal, Transportation Division
Delcan Corporation
Woodside Business Centre
675 Queen Street South
Suite 201
Kitchener, Ontario
N2M 1A1

Office: 519-744-4509
Cell: 519-573-6358
p.jefford@delcan.com
www.delcan.com

Distribution: Project Team
Neil Robinson, Silvercreek Developments
Marissa Crawford, CN Rail
Doug MacKenzie, GEXR

MINUTES OF MEETING

Subject: Silvercreek Parkway Road Improvements

Date: Monday, January 19, 2012

Attendees:
City of Guelph
Rajan Philips, Project Manager
Andrew Janes, Project Engineer Supervisor
Gwen Zhang, Transportation Planning Engineer
David deGroot, Urban Designer
Rory Templeton, Urban Planner
Delcan
Frank Zadorozniak, Design Manager
Peter Jefford, Waterloo Region Manager
Developer
Matthew West, Fieldgate Developments
Owen Scott, The Landplan Collaborative Ltd.
Micheal Spaziani, MSAi

Location: 1 Carden Street
Guelph City Hall

Ref: TW1366

Item	DISCUSSION	ACTION

1 **Section for Silvercreek Square**

The Developer, in consultation with the City of Guelph Planning Department, reviewed the section of Silvercreek Parkway at Silvercreek Square and at a meeting in mid-December requested a center lane median be introduced to make the road inside Silvercreek Square more esthetically pleasing and pedestrian friendly. The median was to be 1.5m in width and consist of an island at the start and end of Silvercreek Square and potentially a pedestrian refuge in the middle. This section was presented to Delcan at the Jan 9th project meeting. It was discussed and D. deGroot noted he was meeting with the Developer in the near future to finalize their requests. Delcan requested to be at that meeting.

Landplan (Developer's Consultant) introduced a revised version of their concept for the center lane medians and traffic calming measures at today's meeting. They are indicating the median to be 3m wide and consist of three islands with no vegetation but potentially lights and hard landscape. The center island shall act as a pedestrian refuge for the crossing of Silvercreek Parkway.

This section is considerably different from the one that Delcan submitted to the City of Guelph on Oct 3rd, 2011 to which there were no comments received from the City. Delcan assumed that the sections were acceptable and finalized and therefore commenced detailed design based on these sections.

After much discussion the following was agreed upon by all parties for this section:

- Width of median to be 3m.
- No planting inside of islands per the direction of the Operations department, City of Guelph.
- Electrical conduit to be supplied to each island for future use.
- Curb to be semi-mountable curb and gutter with drop curb through Silvercreek Parkway (OPSD 600.060) to match proposed curb through remainder of the project.
- Bike lanes to transition prior to on-street parking from street side of curb & gutter to behind the curb & gutter.

Item	DISCUSSION	ACTION
	• No bus bays will be required. • Construction shall be to complete to base course asphalt with temporary asphalt (2.0m) for bike lanes through the Silvercreek Section. • All other sections of Silvercreek Parkway shall be constructed to final cross-sections. • Bollards to be placed 1.0m beyond the limit of the on-street parking. • Bollards to have concrete encased bases and not be the bolt-on type. • Surface treatment of bike lanes, on-street parking and sidewalk areas to be determined at a later date.	
	The Developer is to supply the City of Guelph and Delcan with a final section within a couple of days of this meeting so that there will be no delays in proceeding with the EA Study PCC #2 scheduled for Feb 15, 2012.	Developer
2	**Street A** The Developer has requested that Street A be included in the EA Study as a conceptual design.	
	Delcan shall modify the design to be a right-angled intersection including stop bars with a note that the detail design be completed by others.	Delcan
	Delcan shall be responsible to construct stubs to Street A 5m past the end of curb returns.	Delcan
3	**Paisley Road** Delcan is to modify the island with respect to the channelization of the south bound right turn lane to the following: • Decrease inside radius to reduce travel speed for the right turn. • Increase lane width (app. 7m) to accommodate large vehicle traffic. • Flair curb lines away from traffic lanes to provide more travel area.	Delcan
	Delcan shall lengthen combined straight thru/right turn lane of west bound Paisley Road to the middle of the intersection of Paisley Road and Heath Road.	Delcan
4	**Other Business** City of Guelph to contact Guelph PUC to commence design for hydro servicing of Silvercreek Development.	City
	City of Guelph to arrange for Utility Coordination Meeting with Delcan to attend to satisfy all concerns regarding utilities and their future designs.	City

These minutes are believed to reasonably summarize the major items of discussion at the meeting. Please advise asap if you note any significant errors or omissions.

We thank you for your participation.

Frank Zadorozniak

Frank Zadorozniak, CET
Design Manager, Transportation Division
Delcan Corporation

MINUTES OF MEETING

Subject:	Silvercreek Parkway Road Improvements	**Date:**	February 9, 2012
Attendees:	**<u>City of Guelph</u>** Rajan Philips, Project Manager Andrew Janes, Project Engineer Supervisor Gwen Zhang, Transportation Planning Engineer Joanne Starr, Supervisor Traffic Investigations Rory Templeton, Urban Planner **<u>Developer</u>** Neil Robinson, Neil Robinson Consultants Rob Merwin, RJ Burnside **<u>Delcan</u>** Andrew McGregor, Environmental Planner Frank Zadorozniak, Design Manager Peter Jefford, Waterloo Region Manager	**Location:** **Ref:**	1 Carden Street Guelph City Hall TW1366

Item	DISCUSSION	ACTION

1 **Intersection Design – Silvercreek/Paisley Rd**

- Delcan presented the current intersection design for SilvercreekPkwy /Paisley Rd.
- The intersection design had been previously agreed upon, subject to further consideration of the Southbound to Westbound Right Turn Lane Channelization.
- Delcan designed the channelization to accommodate a Heavy Single Unit (HSU, TAC 1999) Delivery truck within the channelization. The channelization will also accommodate a tractor trailer (WB-20), which would be tight to both curbs, but would cross into the median lane on Paisley Rd WB.
- The volume of WB-20 vehicles is not anticipated to be high, however there will be a few from the grocery and furniture stores north of the intersection, and given that the proposed upgrades to the Hanlon are anticipated to include only a flyover at Willow Street, Delcan is of the view that the Right Turn Channelization should accommodate a WB-20. However, Delcan noted that this is a City decision to make.
- The City remains concerned that the lane as designed will encourage free flow traffic around the channelization, which is not desirable in terms of pedestrian safety. The City advised that they would like to undertake further review of the traffic and safety issues, and will advise.
- Delcan further advised that the island for the right turn channelization would be beneficial for the placement of the traffic standard and as a pedestrian refuge.
- The City requested that the curb on the inside of the channelization be semi-mountable.

2 **Class EA Status**

- The PIC #1 Summary Report was reviewed and no concerns were noted.
- The Report will eventually become part of the Environmental File for the Project.
- As the report will eventually become a public document and part of the environmental record for the project. Hence the summary report might

Item	DISCUSSION	ACTION

be posted on the City website for the project. However it was agreed that this was not necessary at this time.

3 **City Response to Public Comment**

- Armed raised many concerns to the project, to which the City responded in an email dated Feb 3, 2012.
- Most other comments were of a general nature, many favorable to the project.

4 **Review of Display Materials for PIC #2**

- All Attendees provided many helpful comments regarding the content of the draft displays to be presented at PIC #2.
- Delcan will make revisions as follows:
  - Slide 2 – remove note re Pre-PIC meeting with directly affected residents
  - Slide 3 – remove note re OMB Hearing & placement of holding symbol under the Planning Act.
  - Slide 5 – Project has been reclassified (not downgraded) as a Schedule B Class EA Study.
  - Slide 9 – Descriptions of Alternatives will be rewritten to generally reflect "same as above, except…" to improve clarity. Also, reference to Alternative F to be deleted.
  - Slide 11 – Minor edits to the Evaluation Table. The City proposed that a new supplementary table should be developed to display the Evaluation Criteria for the preferred solution, with columns for the Benefits, Impacts and Mitigation. Delcan to resubmit this slide to the City for review prior to PIC #2.
  - Slides 12 & 13 – Key Features of Recommended Solution will be reorganized to improve the "flow" of the displays, to include: 1) Bridge, 2) Silvercreek Pkwy, 3) Pedestrians & Cyclists, 4) Market Square, 5) Street A and 6) other miscellaneous issues. Also LTL's to be revised to Auxiliary Lanes, and a Service Road "is proposed" will be changed to "will" provide access. Also reference to easements for construction will be deleted.
  - Slide 15 – next step to "meet with Property owners" will be deleted. While this may occur related to specific construction issues, the EA file will be closed after the 30 day review period, and the City does not want to imply that the public consultation process will continue.

These minutes are believed to reasonably summarize the major items of discussion at the meeting. Please advise asap if you note any significant errors or omissions.

We thank you for your participation.

Peter Jefford

Peter Jefford,
Waterloo Regional Manager
Delcan Corporation

MINUTES OF MEETING

Subject:	Silvercreek Parkway Road Improvements Coordination Meeting	**Date:**	Tuesday, February 21, 2012
Attendees:	**City of Guelph** Rajan Philips, Project Manager Andrew Janes, Project Engineer Supervisor Colin Baker, Environmental Engineer Don Kudo, Manager of Design and Construction **RJ Burnside** Rob Merwin **AECOM** Rick Clement **Silvercreek Developments** Neil Robinson **Delcan** Peter Jefford Frank Zadorozniak	**Location:** **Ref:**	1 Carden Street Guelph City Hall TW1366

Item	DISCUSSION	ACTION
1	**Stormwater Management**	
	- To be designed by AECOM.	AECOM
	- Follows original concept from 2007.	
	- Outlet from SWM Facility is to culvert under the Hanlon Expressways.	
	- AECOM to circulate a limit of construction plan with respect to the construction of the SWM facility.	AECOM
	- Tender and construction of the SWM area will be a separate contract.	
	- Burnside asked about soils information and suitability of material for reuse. It was understood that geotechnical was forthcoming. AECOM was going to provide a digital copy of the pond design to Burnside for review.	AECOM
2	**Sanitary Sewer Design**	
	- RJ Burnside to complete design of sanitary sewer.	RJ Burnside
	- Outlet for sewer to be on Waterloo street.	
	- Design shall incorporate the reconstruction of the existing sewer on Silvercreek to Waterloo Street and upgrade to accommodate the development.	
	- Burnside to forward final design to Delcan (Mar 2) for inclusion in Silvercreek Design and Contract drawings.	RJ Burnside
	- Previous outlet crossing the Hanlon Expressway to be abandoned subject to confirmation of available capacity in Waterloo Street sewer from the City.	
	- MOE Forms to be completed by RJ Burnside and submitted by the City of Guelph.	RJ Burnside
3	**Storm Sewer Design**	
	- Burnside to complete Storm sewer design complete with design sheets to City of Guelph's standards.	RJ Burnside
	- Silvercreek Storm Sewer to Outlet @ Hanlon to be designed to pass 10 year	

Item	DISCUSSION	ACTION
	Storm.	
	- Road drainage and development drainage to be incorporated in one pipe.	
	- Storm sewer to outlet under the Hanlon Expressway with a large diameter circular pipe traversing an elliptical culvert.	
	- Culvert to be grouted and sealed at both ends upon completion of the installment of storm sewer and watermain. Design detail to be provided by AECOM.	AECOM
	- Design to be sent to Delcan (Mar 2) to be incorporated in the design and construction documents.	
	- MOE Forms to be completed in draft by Delcan and submitted by the City of Guelph.	Delcan
4	**Watermain**	
	- AECOM designing feeder trunk main under south rail crossing and out letting under the Hanlon Expressing through the existing culvert.	AECOM
	- Delcan to design the local watermain.	Delcan
	- Local main to be 300mm dia., including 300mm crosses & valves and two pipe lengths at both Street A intersections.	
	- Reducers will be located beyond the valves as part of future works as required.	
	- Local mains will be stub-ended beyond the reducers.	
	- MOE Forms to be completed in draft by Delcan and submitted by the City of Guelph.	Delcan
5	**Electrical**	
	- Guelph Hydro to design Silvercreek Illumination.	Guelph Hydro
	- Fieldgate to retain Hammerschlag to design Silvercreek Square Illumination.	Fieldgate
	- City of Guelph to design Temporary & Permanent Signals at Paisley/Silvercreek.	City of Guelph
6	**Utility Ducts - Fergus At-Grade Crossing**	
	- Crossing Ducts are anticipated for: o Feeder main (450mm) o Local Main (300mm) o Sanitary Sewer o Guelph Hydro o Union Gas o Bell o Rogers o Others?	
	- It is anticipated that a duct bank will be developed as part of the Silvercreek project, with provision for utilities as required on a cost-recoverable basis.	
	- It is also anticipated that the Fergus A-Grade Crossing will be open cut, which will require coordination with Rail America.	
	- In order to provide sufficient lead time for Delcan to apply to Rail America for the crossing permits, all utility crossing requirements must be submitted to Delcan no later than May 2, 2012.	
7	**Schedule**	
	- City Guelph PUC Mtg Wed March 7 @ 9:30AM	March 7, 2011
	- Submission of EA Documents	April 2012
	- All information for underground work at the Fergus at-grade crossing to	May 2, 2012

Item	DISCUSSION	ACTION
	Delcan	
-	MOE Review of EA Documents	June 2012
-	Bump up request for EA	June 2012
-	EA Final approvals	July 2012
-	Rail America approval of works for grade separation	July 2012
-	Rail America approval of works for at grade crossing	July 2012
-	Tender Documents for Silvercreek Project	July 2012
-	Construction of Rail diversion	August 2012
-	Construction of CNR Subway	Sept. 2012
-	Construction of Silvercreek Parkway	October 2012

These minutes are believed to reasonably summarize the major items of discussion at the meeting. Please advise asap if you note any significant errors or omissions.

We thank you for your participation.

Peter Jefford

Peter Jefford,
Waterloo Regional Manager
Transportation Division
Delcan Corporation

MINUTES OF MEETING

Subject:	To Review Armel Concerns Related to the Redevelopment of Silvercreek Parkway	**Date:**	Thursday, March 15, 2012
Attendees:	**City of Guelph** Rajan Phillips Andrew Janes **Armel** Joe Wolfong Chris Corosky Chris Sims **Delcan** Peter Jefford	**Location:** **Ref:**	1 Carden Street Guelph, Ontario TW1366

Item	DISCUSSION	ACTION
1)	Armel raised concerns related to the proposed design of the Silvercreek Pkwy, as presented at/in the following meetings/documents: • PIC #1 held on Nov 24, 2011 • Chris Corosky email dated Dec 8, 2011 • PIC #2 held on Feb 15, 2012 • City of Guelph email response to Armel dated Jan 9, 2012.	
2)	Armels primary concern is that given the proposed grade separation at the CNR Subway, Silvercreek pkwy will be located in a cut behind retaining walls, which will prevent access to the Armel property from Silvercreek. Access will be available from Paisley Road, however given the limited frontage only a single access will be possible which will constrain truck access/egress to the site. Armel had submitted a development application for a gas station, but given the access limitations resulting from the proposed reconstruction of Silvercreek Pkwy, Armel's proposed development is no longer practical.	
3)	The Armel property is zoned as commercial land in the City's Official Plan. The Armel Corporation has paid municipal taxes on the lands for many years, and given the work on Silvercreek now sees limited development opportunity on this property.	
4)	The City noted that the at-grade crossing of Silvercreek was closed as the result of a CTC Board Order issued in 1972 at the time the Hanlon Expressway was constructed. The construction of a Silvercreek grade separation has been included in the City's OP for 40± years. Given the geometric constraints at the site, there is no opportunity to permit access from Silvercreek to the Armel property.	
5)	Armel advised that the City should have considered additional options as part of the Municipal Class EA, including: a) Divert the CN Track to the south, which would permit greater separation between Paisley Rd & the CN Track, which would facilitate access from Silvercreek to the Armel property. b) Construct the CN Crossing at-grade rather than through a CN Subway grade separation.	

Item	DISCUSSION	ACTION

6) The City advised that the track is owned by CN Rail, but is under lease to Rail America, and is operated by Goderich Exeter Rail (GEXR) which is a subsidiary of Rail America, and carry freight. GO Transit & Via also operate passenger service on the track. As a result railway approvals are required at several levels.

In response to the 2 design issues raised by Armel, the City advised:

a) During meetings with Rail America (GEXR) and CN Rail (July 26, 2011 and Oct 3, 2011), the City & Delcan were advised that the Rail Design Speed on this section of track is 80 miles/hr. The railways agreed to a design speed of 35 miles/hour on the temporary rail diversion so as to fit the diversion within the limits of the Hanlon Structure to the west and the existing switches & sidings to the east. Given the above design criteria, shifting the track alignment on a permanent basis was not possible.

b) The City advised that an at-grade crossing was not realistic alternative given that:

- Silvercreek traffic, post development is forecast to grow to 9,600 AADT in 2021.
- Train traffic is 14 trains/day (2011), forecast to grow to 22 trains/day in 2021, and 34 trains/day in 2031.
- At PIC #2, Alternatives D & E were introduced to the Public presenting Armel's proposals. The City did not receive any verbal or written comment supporting either of the options proposed by Armel.
- The Canadian Transportation Commission issued Board Order No. R15437 dated Dec 4, 1972, which stated (in part) that "*When the said subway hereby authorized (ie..Hanlon) has been opened for use by the public, the Canadian National Railways shall close within the limits of their right of way the crossing of Silvercreek Road, at mileage 50.24 Guelph Subdivision and remove the protection here from*.
- The City sees no benefit to the City of Guelph in filing an application to overturn the CTC Board Order. *(In any event the CTC Order instructed CN to close the Silvercreek at-grade crossing, not the City, and so presumably CN Rail would need to apply to reopen the at-grade crossing.)*
- East and West of Silvercreek, there are grade separations on this section of track at Watson Rd, Victoria, Eramosa, Wyndham, Norfolk, the Hanlon, Paisley Rd, Imperial Road and Elmira Road. The Region of Waterloo is also planning a grade separation at King Street.
- Given the track design speed on this section of track, re-opening the CN crossing at-grade would introduce serious traffic safety issues.

8) Armel suggested that the City should apply to the CTC to request that the Board Order instructing the closing Silvercreek Pkwy be rescinded. Given the above issues the City does not believe reopening the at-grade crossing would be in the City's best interest and would not support such an application. Hence the City has no interest is submitting such an application to the CTC.

7) Given all of the above issues, Armel suggested that their property may no longer be commercially viable, and that they may be interested in the sale of the lands to the City. The City suggested that Armel may wish to approach the City real estate manager for further information regarding the possible sale of the property. — **Action:** Armel

These minutes are believed to reasonably summarize the major items of discussion at the meeting. Please advise asap if you note any significant errors or omissions.

We thank you for your participation.

Peter Jefford

Peter Jefford
Waterloo Regional Manager
Transportation Division
Delcan Corporation

APPENDIX J

COMMENTS RECEIVED FROM TECHNICAL AGENCIES & SPECIAL INTEREST GROUPS

From: Peter Jefford [p.jefford@delcan.com]
Sent: Thursday, October 06, 2011 10:27 AM
To: 'Andrew McGregor'
Subject: FW: Notice of Study Commencement & Request for Information –Silvercreek Parkway South Improvements, Including Grade Separation at the CN North Mainline – Class Environmental Assessment, City of Guelph, File Ref: TW-1366

Hi Andrew

After you have reviewed this, I would like to discuss it with you.

Thx,
Peter

From: Don Boswell [mailto:Don.Boswell@aadnc-aandc.gc.ca]
Sent: Thursday, October 06, 2011 10:00 AM
To: p.jefford@delcan.com
Cc: Ralph Vachon
Subject: Notice of Study Commencement & Request for Information –Silvercreek Parkway South Improvements, Including Grade Separation at the CN North Mainline – Class Environmental Assessment, City of Guelph, File Ref: TW-1366

I am writing in response to your letter of September 27, 2011 inquiring about claims in the above noted area.

In determining your duty to consult, you may wish to contact the First Nations in the vicinity of your area of interest to advise them of your intentions. To do this you may:

1. find the Reserves in your area of interest by consulting a map of the region such as the Province of Ontario Ministry of Aboriginal Affairs online map at http://www.ainc-inac.gc.ca/ai/scr/on/rp/mcarte/mcarte-eng.asp ; then
2. search for the First Nations located on those Reserves by using the *INAC Search by Reserve* site at http://pse5-esd5.ainc-inac.gc.ca/fnp/Main/Search/SearchRV.aspx?lang=eng.

To determine the First Nations in your area of interest who have submitted claims please consult the *Reporting Centre on Specific Claims* at http://pse4-esd4.ainc-inac.gc.ca/SCBRI/Main/ReportingCentre/External/ExternalReporting.aspx?lang=eng.

It should be noted that the reports available on the INAC website are updated regularly and therefore, you may want to check this site often for updates. In accordance with legislative requirements, confidential information has not been disclosed.

Please rest assured that it is the policy of the Government of Canada as expressed in *The Specific Claims Policy and Process Guide* that:

> “in any settlement of specific native claims the government will take third party interests into account. As a general rule, the government will not accept any settlement which will lead to third parties being dispossessed.”

We can only speak directly to claims filed under the Specific Claims Policy in the Province of Ontario. We cannot make any comments regarding potential or future claims, or claims filed under other departmental policies. This includes claims under Canada’s Comprehensive Claims Policy or legal action by a First Nation against the Crown. You may wish to contact the Assessment and Historical Research Directorate at (819) 994-6453, the Consultation and Accommodation Unit at (613) 944-9313 and Litigation Management and Resolution Branch at (819) 934-2185 directly for more information.

You may also wish to visit http://www.ainc-inac.gc.ca/ai/mr/is/acp/acp-eng.asp on the INAC website for information regarding the Federal Action Plan on Aboriginal Consultation and Accommodation.

To the best of our knowledge, the information we have provided you is current and up-to-date. However, this information may not be exhaustive with regard to your needs and you may wish to consider seeking information from other government and private sources (including Aboriginal groups). In addition, please note that Canada does not act as a representative for any Aboriginal group for the purpose of any claim or the purpose of consultation.

I hope this information will be of assistance to you. I trust that this satisfactorily addresses your concerns.

Sincerely,

Don Boswell
Senior Claims Analyst
Ontario Research Team
Specific Claims Branch

Ministry of Transportation
West Region

659 Exeter Road
London, Ontario N6E 1L3
Telephone: (519) 873-4500
Facsimile: (519) 873-4600

Ministère des Transports
Région de l'Ouest

659, chemin Exeter
London (Ontario) N6E 1L3
Téléphone : (519) 873- 4500
Télécopieur : (519) 873-4600

Ontario

February 13, 2012

Peter Jefford, P.Eng.
Project Manager
Delcan Corporation
Woodside Business Centre
675 Queen Street South, Suite 201
Kitchener, Ontario
N2M 1A1

Dear Mr. Jefford:

RE: Notice of Public Information Centre #2
Class Environmental Assessment – Silvercreek Parkway South Improvements

---

In 2008, the Ministry reviewed and provided comments on a traffic impact study that was completed by BA Consulting Group on behalf of Silvercreek Developments. The traffic impact study was for a proposed development on the former Lafarge lands that are located on the east side of the Hanlon Expressway between the Wellington Street interchange and Paisley Road. This development had significant impacts to the intersections both north and south of the proposed development as summarized in the following table.

Intersection	Critical Move & Volume	Required Storage	Level of Service	Volume to Capacity
Hwy 6 at Paisley	WBL-325	Single Left Lane – 105 m Dual Left lanes – 52.5 m	F F	0.93 1.81
Paisley at Silvercreek	EBL-340	105 m	C	0.83
Hwy 6 at Wellington East ramps	SBL-185 SBR Channelized -610	60 m	E F	0.82 0.54
Silvercreek at Waterloo	NBL-395 EBR Channelized -415	112.5 m	C A	0.34 0.53

The distance along Paisley Road between Highway 6 (Hanlon Expressway) and Silvercreek Parkway is approximately 175 metres. Based on the information that was provided in the traffic impact study and summarized in the above table, the required left turn storage plus the parallel and taper for the westbound left at the Highway 6 (Hanlon Expressway) and the eastbound left at Silvercreek Parkway may exceed the available space and therefore may not be able to be constructed. This concern also applies to the intersection of the Highway 6 (Hanlon Expressway) ramp terminal and Wellington Street. The distance between Wellington Road and Waterloo Road on the north leg of the ramp terminal is approximately 105 metres. As indicated in the table, the southbound left turn lane storage, parallel and taper required at Waterloo Road may exceed the available space and may not be able to be constructed. In addition, there also appears to be level of service and capacity concerns at some intersections as indicated in the table.

Based on the information above and considering that the improvements to Silvercreek Parkway South will ultimately provide access to the new development, the Ministry is hereby requesting that the study area of the Class EA be expanded to include Silvercreek Parkway from north of Paisley to the Wellington Street interchange, including the intersection of Silvercreek and Waterloo Ave., and that the traffic impact study prepared by BA Consulting be updated so that the impacts to our intersections can be re-evaluated and mitigated.

If you require any further information, please do not hesitate to contact me at (519) 873-4602.

Sincerely,

Robert Bakalarczyk, P.Eng.
Senior Project Engineer
Planning and Design
West Region

c.c. Rajan Philips – City of Guelph
Ian Smyth – Ministry of Transportation

Delcan

CITY OF Guelph Making a Difference

COMMENT SUMMARY FORM

TO: Peter Jefford, P. Eng., Delcan Corporation

EMAIL: p.jefford@delcan.com

FAX: (519) 744-2822

RE: Notice of Study Commencement & Request for Information
Silvercreek Parkway South Improvements, Including Grade Separation at the CN North Mainline - Class Environmental Assessment

CONTACT NAME: Rob Merwin

TITLE: Engineer

BUSINESS/AGENCY: R.J. Burnside

PHONE: (905) 793-9239

FAX: ( ) -

E-MAIL: rob.merwin@rjburnside.com

Please indicate the appropriate response(s):

☐ I/my group/agency have **NO** concerns about this project and would like to be removed from your contact list.

☐ I/my group/agency have **NO** concerns about this project but would like to remain on your contact list.

☒ I/my group/agency have the following comments on, or concerns with, this project:

I represent the developer of the lands.

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COMMENT SUMMARY FORM

TO: **Peter Jefford, P. Eng., Delcan Corporation**

EMAIL: **p.jefford@delcan.com**

FAX: **(519) 744-2822**

RE: **Notice of Study Commencement & Request for Information Silvercreek Parkway South Improvements, Including Grade Separation at the CN North Mainline - Class Environmental Assessment**

CONTACT NAME: LARRY ROMAINE

TITLE: AVP- ENGINEERING SERVICES

BUSINESS/AGENCY: GEXR\RAILAMERICA

PHONE: (904) 538-6054

FAX: (904) 538-6457

E-MAIL: LARRY.ROMAINE@RAILAMERICA.COM

Please indicate the appropriate response(s):

- ☐ I/my group/agency have **NO** concerns about this project and would like to be removed from your contact list.
- ☐ I/my group/agency have **NO** concerns about this project but would like to remain on your contact list.
- ☒ I/my group/agency have the following comments on, or concerns with, this project:

THE GEXR WILL BE DIRECTY AFFECTED BY THE PROJECT WORK. ALL APPLICABLE PLANS MUST BE SUBMITTED TO GEXR FOR REVIEW AND APPROVAL. PLEASE SUBMIT INFORMATION TO THE FOLLOWING: GEXR\RAILAMERICA
ENGINEERING SERVICES
7411 FULLERTON STREET, SUITE 300
JACKSONVILLE, FL 32256
C/O - LARRY ROMAINE

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COMMENT SUMMARY FORM

TO: **Peter Jefford, P. Eng., Delcan Corporation**

EMAIL: **p.jefford@delcan.com**

FAX: **(519) 744-2822**

RE: **Notice of Study Commencement & Request for Information Silvercreek Parkway South Improvements, Including Grade Separation at the CN North Mainline - Class Environmental Assessment**

CONTACT NAME: JAMIE FERGUSON

TITLE: RESOURCE PLANNER

BUSINESS/AGENCY: GRAND RIVER CONSERVATION AUTHORITY

PHONE: (519) 621-2763 x 2238

FAX: (519) 621-4945

E-MAIL: jferguson@grandriver.ca

Please indicate the appropriate response(s):

☐ I/my group/agency have **NO** concerns about this project and would like to be removed from your contact list.

☐ I/my group/agency have **NO** concerns about this project but would like to remain on your contact list.

☑ I/my group/agency have the following comments on, or concerns with, this project:

Information currently available at this office indicates that the subject lands contain Howitt Creek, a tributary of the Northwest Drainage channel, floodplains and slopes.

FAXED Oct 11 2011

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COMMENT SUMMARY FORM

TO: **Peter Jefford, P. Eng., Delcan Corporation**

EMAIL: **p.jefford@delcan.com**

FAX: **(519) 744-2822**

RE: **Notice of Study Commencement & Request for Information**
Silvercreek Parkway South Improvements, Including Grade Separation at the CN North Mainline - Class Environmental Assessment

CONTACT NAME: Brian Murray

TITLE: System Planner

BUSINESS/AGENCY: Rogers Communications Inc.

PHONE: (519) 895 - 3278

FAX: (519) 893 - 6463

E-MAIL: briana.murray@rci.rogers.com

Please indicate the appropriate response(s):

☐ I/my group/agency have **NO** concerns about this project and would like to be removed from your contact list.

☐ I/my group/agency have **NO** concerns about this project but would like to remain on your contact list.

☑ I/my group/agency have the following comments on, or concerns with, this project:

- long haul fibre optics on CN tracks
- servicing development
- relocation of existing plant.

Mary Vandyk

From:	Peter Jefford <p.jefford@delcan.com>
Sent:	October-03-11 4:14 PM
To:	'Brent Archibald'; 'Gus Garron'
Cc:	'Frank Zadorozniak'; 'Andrew McGregor'
Subject:	City of Guelph, Silvercreek/CNR Subway, Road & Structure Design Options

Hello Brent & Gus

During our discussions this AM at our meeting with CN Rail, GEXR and the City, it is apparent that many design options remain on the table. We cannot prepare preliminary designs for all options, and so I would suggest that we develop the "most probable" scenario, and with a measure of luck, changes required to meet all requirements by all parties will be minimized. I would therefore suggest that we consider the following design parameters as our most probable scenario:

Road Design (through the subway):
- X-Sections per previous agreement with City, including 3.5m lanes, 1.5m bike lanes, 1.0m Blvds and 1.5m S/W (15m total roadway)
- 8% Max Grade on Silvercreek
- Reverse crown on Paisley Rd (ie. Fix grade on N Curb, details tbc subject to review of the alignment)

Structure Design CN Subway:
- 2-span structure w/ centre column
- 5.0m Vertical clearance
- Abutments perpendicular to Silvercreek
- Crash Barrier on structure

Track Diversion:
- 35mph Design Speed

At our meeting we discussed several options for the track diversion. Given that the future track is to be located on the N Side of the existing track, my conclusion of the discussions is that locating the Rail Diversion on the South Side of the existing track will permit the subway construction to be undertaken in 1-Stage, thereby shortening the duration of time that the Rail Diversion is in effect.

Could you pls review and advise, as we would like to proceed incorporating these features into our road design work. I also note that it is likely that any of CN, GEXR and/or the City are likely to request changes as part of the design review/submission process, and so we should advance the design work only as far as required to support our design submissions.

Pls review & advise.
Thank you.

Peter Jefford, P. Eng.
Principal, Transportation Division
Delcan Corporation
Suite 201, Woodside Business Centre
675 Queen Street South
Kitchener, Ontario

N2M 1A1

Office: 519-744-4509
Cell: 519-573-6358
Fax: 519-744-2822

Ministry of Aboriginal Affairs

160 Bloor St. East, 9th Floor
Toronto, ON M7A 2E6
Tel: (416) 326-4740
Fax: (416) 325-1066
www.aboriginalaffairs.gov.on.ca

Ministère des Affaires Autochtones

160, rue Bloor Est, 9e étage
Toronto ON M7A 2E6
Tél. : (416) 326-4740
Téléc. : (416) 325-1066
www.aboriginalaffairs.gov.on.ca

Ontario

RECEIVED
DEC 0 6 2011

Reference: 508

RECEIVED
DEC 0 6 2011

NOV 2 3 2011

Mr. Peter Jefford, P. Eng.
Project Manager, Delcan Corporation
Woodside Business Centre
675 Queen Street South, Suite 201
Kitchener, Ontario N2M 1A1

Re: Notice of Study Commencement & Request for Information Silvercreek Parkway South Improvements, Including Grade Separation at the CN North Mainline – Class Environmental Assessment

Dear Mr. Jefford:

Thank you for your inquiry dated September 27, 2011 regarding the above-noted project.

As a member of the government review team, the Ministry of Aboriginal Affairs (MAA) identifies First Nation and Métis communities who may have the following interests in the area of your project:

- reserves;
- land claims or claims in litigation against Ontario;
- existing or asserted Aboriginal or treaty rights, such as harvesting rights; or
- an interest in your project's potential environmental impacts.

MAA is not the approval or regulatory authority for your project, and receives very limited information about projects in the early stages of their development. In circumstances where a Crown-approved project may negatively impact a claimed Aboriginal or treaty right, the Crown may have a duty to consult the Aboriginal community advancing the claim. The Crown often delegates procedural aspects of its duty to consult to proponents. Please note that the information in this letter should not be relied on as advice about whether the Crown owes a duty to consult in respect of your project, or what consultation may be appropriate. Should you have any questions about your consultation obligations, please contact the appropriate ministry.

You should be aware that many First Nations and Métis communities either have or assert rights to hunt and fish in their traditional territories. For First Nations, these territories typically include lands and waters outside of their reserves.

In some instances, project work may impact aboriginal archaeological resources. If any Aboriginal archaeological resources could be impacted by your project, you should contact your regulating or approving Ministry to inquire about whether any additional Aboriginal communities should be contacted. Aboriginal communities with an interest in archaeological resources may include communities who are not presently located in the vicinity of the proposed project.

For federal information on litigation contact:

Mr. Marc-André Millaire
Litigation Team Leader for Ontario
Litigation Management and Resolutions Branch
Indian and Northern Affairs Canada
10 Wellington St.
Gatineau, QC K1A 0H4
Tel: (819) 994-1947
Fax: (819) 953-1139

Additional details about your project or changes to it that suggest impacts beyond what you have provided to date may necessitate further consideration of which Aboriginal communities may be affected by or interested in your undertaking. If you think that further consideration may be required, please bring your inquiry to whatever government body oversees the regulatory process for your project.

The information upon which the above comments are based is subject to change. First Nation or Métis communities can make claims at any time, and other developments can occur that could result in additional communities being affected by or interested in your undertaking.

Yours truly,

Heather Levecque

Heather Levecque
Manager, Consultation Unit
Aboriginal Relations and Ministry Partnerships Division

With respect to your project, and based on the brief materials you have provided, we can

With respect to your project, and based on the brief materials you have provided, we can advise that the project appears to be located in an area where First Nations may have existing or asserted rights or claims in MAA's land claims process or litigation, that could be impacted by your project. Contact information is below:

Six Nations of the Grand River Territory P.O. Box 5000 Ohsweken, Ontario N0A 1M0	Chief William K. Montour (519) 445-2201 (Fax) 445-4208 wkm@sixnations.ca arleenmaracle@sixnations.ca
Haudenosaunee Confederacy Chiefs Council 2634 6th Line Road RR 2 Ohsweken, Ontario N0A 1M0	Chief Allen MacNaughton (519) 755-2769
Mississaugas of the New Credit First Nation 2789 Mississauga Rd., R.R. #6 HAGERSVILLE, Ontario NOA 1HO	Chief Bryan LaForme (905) 768-1133 (Fax) 768-1225 bryanlaforme@newcreditfirstnation.com

For your information, MAA notes that the following Métis community may be interested in your project given the proximity of their community to the area of the proposed project or because of your project's potential environmental impacts:

Credit River Métis Council 1515 Matheson Blvd. E. #103 Mississauga, ON, L4W 2P5	Debbie Alves, President (905) 629-9644 e-mail: debbie.alves@sympatico.ca website: www.creditrivermetiscouncil.com

Please copy any correspondence to Credit River Métis Council to the Métis Nation of Ontario. Contact information is below:

Métis Nation of Ontario Head Office 500 Old St. Patrick Street, Unit D Ottawa, Ontario, K1N 9G4	Métis Consultation Unit Fax: (613) 725-4225

The Government of Canada sometimes receives claims that Ontario does not receive, or with which Ontario does not become involved. For information about possible claims in the area, MAA recommends you contact the following federal contacts:

Ms. Janet Townson Claims Analyst, Ontario Team Specific Claims Branch Indian and Northern Affairs Canada 1310-10 Wellington St. Gatineau, QC K1A 0H4 Tel: (819) 953-4667 Fax: (819) 997-9873	Mr. Sean Darcy Manager Assessment and Historical Research Indian and Northern Affairs Canada 10 Wellington St. Gatineau, QC K1A 0H4 Tel: (819) 997-8155 Fax: (819) 997-1366

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COMMENT SUMMARY FORM

RECEIVED
OCT 17 2011

TO: **Peter Jefford, P. Eng., Delcan Corporation**

EMAIL: **p.jefford@delcan.com**

FAX: **(519) 744-2822**

RE: **Notice of Study Commencement & Request for Information Silvercreek Parkway South Improvements, Including Grade Separation at the CN North Mainline - Class Environmental Assessment**

CONTACT NAME: RON FOLEY

TITLE: PRESIDENT

BUSINESS/AGENCY: HPNRA

PHONE: (519) 837-6583

FAX: (519) 837-2497

E-MAIL: ronfoley@hpng.ca, ronf@scenework.com

Please indicate the appropriate response(s):

☐ I/my group/agency have **NO** concerns about this project and would like to be removed from your contact list.

☐ I/my group/agency have **NO** concerns about this project but would like to remain on your contact list.

☒ I/my group/agency have the following comments on, or concerns with, this project:

REQUIRE FURTHER INFORMATION

From: Peter Jefford [p.jefford@delcan.com]
Sent: Monday, October 24, 2011 8:58 AM
To: 'Andrew McGregor'
Cc: 'Mary Vandyk'
Subject: FW: TW-1366 Silvercreek Parkway South Improvements

From: Huang, Yvonne [mailto:YHuang@uniongas.com]
Sent: Friday, October 21, 2011 4:47 PM
To: p.jefford@delcan.com
Cc: Schimus, Kevin
Subject: TW-1366 Silvercreek Parkway South Improvements

Good afternoon Peter,

Thank you for the notice on Silvercreek Parkway South Improvements in Guelph.

Can you please send us any digital drawings you may have of this project? Even if they may just be conceptual plans at this point in time. Also do you know when this project may start if it goes through?

Thank you for your assistance.

Yvonne Huang
Construction Project Manager
Union Gas Limited | A Spectra Energy Company
603 Kumpf Dr. | Waterloo, ON N2J 4A4
Tel: 519-885-7407
Cell: 519-841-1952
Pager: 519-244-0143

From: Peter Jefford [p.jefford@delcan.com]
Sent: Wednesday, February 08, 2012 2:41 PM
To: 'Brent Archibald'
Cc: 'Frank Zadorozniak'; 'Andrew McGregor'
Subject: FW: Silvercreek Improvements, including CNR Subway, City of Guelph

Attachments: image001.png

Hi Brent

XO Rail approval of the general arrangement for the Silvercreek Subway per below.

- Could you give me an eta for the final bridge design? When it is ready, we will need to submit it to Rail America for final approvals.
- Could you also give me an approximate time line for final quantities and construction specifications?

Thx
Peter

From: Peter Jefford [mailto:p.jefford@delcan.com]
Sent: Wednesday, February 08, 2012 9:36 AM
To: 'jomoore@xorail.com'
Cc: 'Douglas.MacKenzie@railamerica.com'; 'Larry.Romaine@railamerica.com'; 'ra-pm@xorail.com'; 'stefan.linder@cn.ca'; 'Rajan.Philips@guelph.ca'; 'Andrew.Janes@guelph.ca'
Subject: Silvercreek Improvements, including CNR Subway, City of Guelph

Hello Joey

Thank you for your response. In reviewing the Silvercreek road design, Delcan has determined that we can achieve an 8% grade on Silvercreek with the twin span rigid frame, as the twin span design resulted in a reduced deck section. Reducing the vertical clearance from 5.3m to 5.0m would enable us to reduce our grade from 8% to 7.7%, which over 100m would be of minimal benefit.

For these reasons, the City of Guelph has decided to proceed based upon Structural Option #6,for a ***2-span skewed rigid frame with approach slabs.*** However we would prefer to provide ***5.3m vertical clearance with no crash beam***. We trust this structural design option will be acceptable to Rail America/GEXR, CN Rail and XO Rail. However please advise asap if the rail authorities have any concerns.

With this approval, Delcan is now proceeding on the detail structural design of the Rail Subway based upon the above criteria.

Peter Jefford, P. Eng.
Principal, Transportation Division
Delcan Corporation
Suite 201, Queen South Business Centre
675 Queen Street South
Kitchener, Ontario
N2M 1A1

Office: 519-744-4509
Cell: 519-573-6358
Fax: 519-744-2822

From: jomoore@xorail.com [mailto:jomoore@xorail.com]
Sent: Tuesday, February 07, 2012 1:50 PM
To: p.jefford@delcan.com
Cc: Douglas.MacKenzie@railamerica.com; Larry.Romaine@railamerica.com; ra-pm@xorail.com; stefan.linder@cn.ca
Subject: RE: Silvercreek Improvements, including CNR Subway, City of Guelph

Peter,

Sorry for the delay, I was awaiting confirmation of the conceptual bridge layout. I did receive this statement from CN about the proposed bridge design:

"The preferred option #6 , 2-span skewed rigid frame with approach slabs, and a 5.0 m vertical clearance (with crash beam) is acceptable to CN."

This should help you move forward with the design. I will be out of town on business Wednesday and Thursday but have put in a request for any objections to this recommendation with the GEXR. If any comments or changes recommended I will forward to you immediately.

Please feel free to contact me anytime if you have any questions or need further information.

JOEY MOORE, E.I.T.
PROJECT MANAGER

5011 GATE PARKWAY
BLDG. 100 – SUITE 400
JACKSONVILLE, FL 32256-0562
OFFICE :(904)443-0083
MOBILE: (904) 874-2394
FAX: (904) 443-0089
EMAIL: jomoore@xorail.com

From: Peter Jefford [mailto:p.jefford@delcan.com]
Sent: Wednesday, February 01, 2012 4:42 PM
To: Moore, Joey
Subject: Silvercreek Improvements, including CNR Subway, City of Guelph

Joey Moore
XO Rail

On Dec 19, Delcan resubmitted all of the Design Submissions and Applications to XO Rail that had originally been submitted to Rail America attached to a series of (6) emails between Oct 21, 2011 and Dec 9, 2011. Our Structural, Road & Drainage Design Engineers are now working on the detail design for the Silvercreek Improvements, including the CNR Track Diversion, Subway Structure, Retaining walls, roadways and ancillary works.

The City has issued a PO to Rail America for the Design Review, and has presented the design plans to the Public at Public Information Centre #1 on Nov 24, 2011, and will be presenting the final design to the Public at Public Information Centre #2 on Feb 15, 2011.   Construction is scheduled to start in May 2012.

However we have yet to receive any comment from either Rail America or XO Rail regarding the acceptability of any of our design submissions, and as we move forward it will be increasingly difficult to make any changes without incurring significant costs for redesign and significant delays in design completion & the construction to follow. We would therefore request that XO Rail advise asap as to the status of our designs.

Thank you for your assistance regarding these issues.

Peter Jefford, P. Eng.
Principal, Transportation Division
Delcan Corporation
Suite 201, Queen South Business Centre
675 Queen Street South
Kitchener, Ontario
N2M 1A1

Office: 519-744-4509
Cell: 519-573-6358
Fax: 519-744-2822