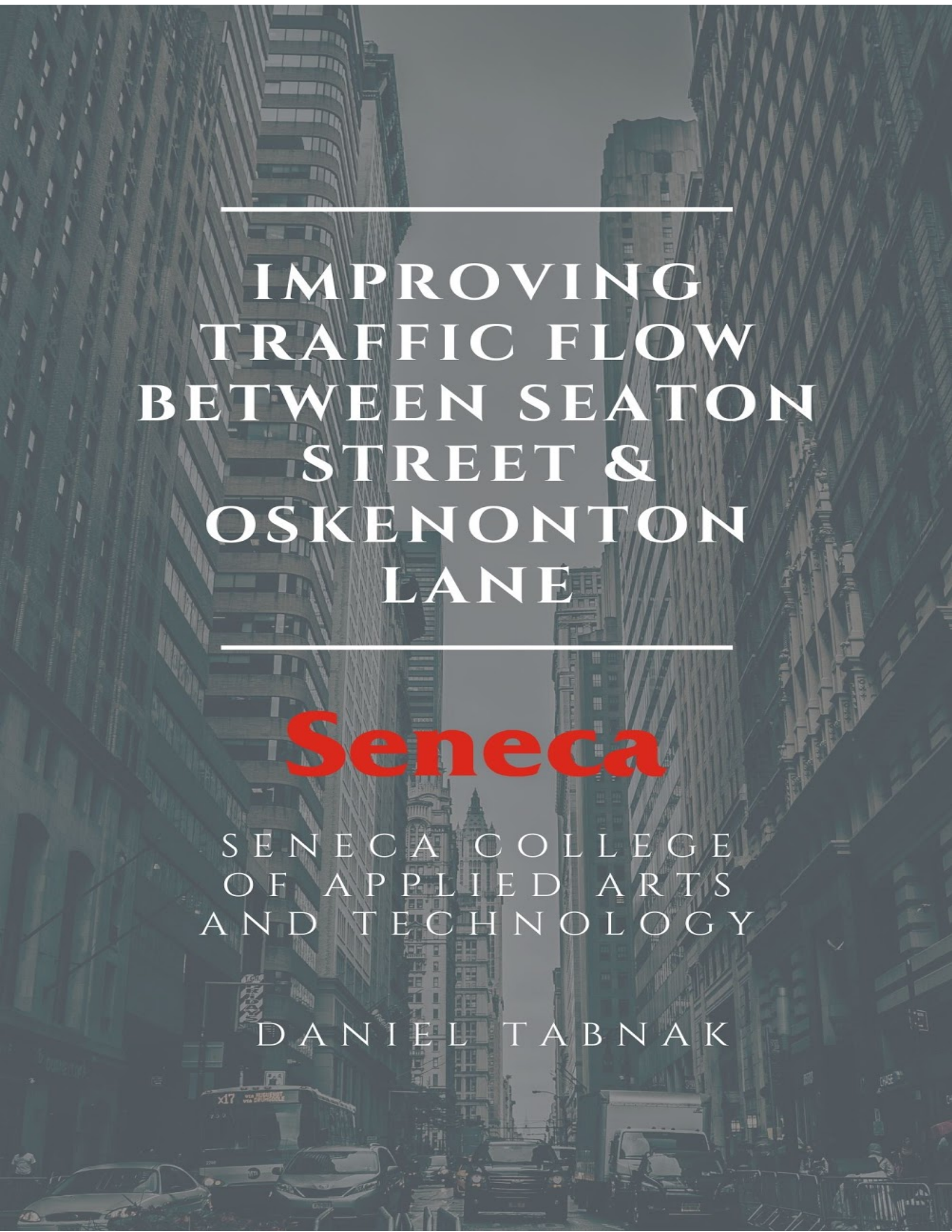

IMPROVING TRAFFIC FLOW BETWEEN SEATON STREET & OSKENONTON LANE

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Improving Traffic Flow

Between Seaton Street & Oskenonton Lane

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Abstract

The intersection of Gerrard Street East and Seaton Street does not allow for east-bound-right (EBR) turns, leaving many drivers confused when trying to drive through Seaton Street. This often leads to congestion at the intersection while drivers try to navigate onto Seaton street.

By harvesting data of the existing conditions at the unsignalized, Seaton Street & Gerrard Street East intersection -through Synchro 10- usable metrics were obtained to help exhibit the inefficiency at that site and determine the optimal site design, which recommended allowing the use of legal EBR turns onto Seaton street from the intersection and modifying the current traffic signs. This analysis showed that this site design implementation would greatly increase the level of service from an F to an A and drastically reduce the control delay from 96.0 to 16.0 -corresponding to reduced congestion at the subject location.

Declaration of Sole Authorship

I, Daniel Tabnak Acknowledge that this technical report submitted is my own and is expressed in my own words. Any uses made within it of the works of any other author, in any form (ideas, equations, figures, texts, tables, programs), are properly acknowledged at the point of use. A list of the references used is included

(OACETT - Technology Report Guidelines, January 2017)

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1.0 Introduction

Gerrard Street and Seaton street is an unsignalized intersection. Seaton Street is one-way and the intersection does not allow for east-bound right hand turns (EBR) into Seaton Street. When driving east-bound, drivers must first make a right-hand turn into the hidden and sometimes obstructed Oskenonton Lane, leaving many drivers confused when trying to drive through Seaton Street, and often leads to them to either making the illegal right-hand turn or drive around the block in the opposite way, come back and make a left-hand turn.

This has led to accidents, acts of road rage and discomforting road conditions that impedes the travel and enjoyment of mobility within the community. As designated by the City of Toronto, Gerrard Street East is classified as a Minor Arterial Road, Seaton Street is a Local Road and Oskenonton Lane is a Laneway

1.1 Background

Figure 1 Sign at the subject intersection indicating a one - way street, above a sign indicating bicycles only may mislead drivers when trying to navigate through the community.

The subject site has seen major development since approximately 1856. 30% of the buildings had been constructed in a relatively quick period between 1880 - 1890, and by 1900 more than half (63%) of the area had been developed (Cabbagetown Southwest Heritage Conservation District Study). Since many properties have a significant historical and architectural importance, they have been listed to the City of Toronto's Heritage Registrar and designated to Part 4 of the Ontario Heritage Act

-meaning that any alterations or demolitions must seek additional permits (Ontario Heritage Act, 1990).

As population and density intensifies, it has led complexities in ways which were not foreseen, with infrastructure built to the road extents, lack of consideration for right-of-way expansion (to increase the number of driving lanes), unintelligible traffic signs and poor quality planning for the intended direction of flow. All these factors have contributed to congestion and discomforting road conditions.

Figure 2 Approaching Oskenonton Lane, Eastbound Through (EBT) on Gerrard Street East.

Figure 3 Shows the legally accepted method of getting onto Seaton Street (EBR - Eastbound Right Turn on Oskenonton Lane) being obstructed by an exiting vehicle.

1.2 Purpose

The purpose is to explore alternative, more efficient implementations for road design, intended traffic flow and traffic sign usage at the subject site in order to carry out an improved and more harmonious flow of traffic. This report is also intended to address issues regarding mobility with the growing number of residents, workers, students and visitors and also to promote positive growth within the downtown core, which is also the same intention of the Downtown Mobility Strategy (TOCore 2018). The desired results of this report is to and improve the flow of recurring congestion due to the existing road design.

This report can benefit future municipal planners and engineers to advocate for the best use and implementation of the road design at the subject site.

1.3 Scope

This proposal will observe an approximately 80 metre stretch of road along Gerrard Street East -between Sherbourne Street and Ontario Street in the area locally known as Cabbagetown South. The total approximate area and perimeter of the junction is 3400 square metres and 700 metres long, and can be found using the Google Earth Dimensions tool.

Figure 4 The subject intersection and laneway -Oskenonton Lane and Seaton Street & Gerrard Street East intersection.

A manual traffic count had been conducted for the morning peak hours (rush hours, 7:00 AM - 9:00 AM) of both Seaton Street & Gerrard Street East intersection and Oskenonton Lane & Gerrard Street East intersection. This is the main data that will be harvested and help guide the results. Additional data provided from the City of Toronto and other pertinent technical guidelines/criteria will also be considered for best practices.

This report will not include road grading or geotechnical aspects of engineering, AutoCAD designs or any finances pertaining to the overall project.

2.0 Operational Performance Metrics

A manual traffic count had been conducted on February 4, 2020 during the morning peak hours of 7:00 AM - 9:00 AM (Daniel Tabnak, 2020) and was the data used to obtain the volume to capacity ratio (v/c or degree of saturation), Control Delay and level of service (LOS). This is necessary to prove a need for change or alternative road design implementation at the subject site. Additionally, the same analysis process was done at the intersection of Oskenonton lane & Gerrard Street East for best practices.

The v/c ratio may also be referred to as the degree of saturation and is a measure of whether an intersection can adequately accommodate increased vehicular flow (Chapter 7 - Operational Analysis Methods). A v/c ratio less than 1.00 generally indicates an acceptable level of service whereas a v/c ratio greater than 1.00 indicates the least efficient level of service (Chapter 7 - Operational Analysis Methods).

The Level of Service is a grade letter for the performance for lane and/or intersection. Maximum efficiency is achieved through an “A” grade, and the degree of efficiency decreases with each respective letter grade until “E” which means it meets the minimal amount of efficiency acceptable. A grade of “F” means it fails to meet any efficiency standard set by the Transportation Association of Canada (Transportation Association of Canada, 2017).

Control Delay is the amount of delay that results from the type of control at the intersection -in other words- the difference in travel time that would have occurred without any type of control at the intersection (Transportation Association of Canada, 2017).

By harvesting the traffic count data at the existing at the unsignalized, Seaton Street & Gerrard Street East intersection -through Synchro 10- those usable metrics were obtained to help exhibit the inefficiency at that site.

Table 1 Existing Conditions - Peak Hours Performance Metrics For each Lane of Seaton Street & Gerrard Street East Intersection

Traffic Flow Data (Road Path)	EBL, EBT, EBR Gerrard Street East	WBL, WBT, WBR Gerrard Street East	NBL, NBT, NBR Seaton Street	SBL, SBT, SBR Seaton Street
v/c Ratio	1.33	0.24	N/A	N/A
Level of Service (LOS)	F	A	N/A	N/A
Control Delay(s)	183	0.3	N/A	N/A

Gerrard Street East's metrics surpass acceptable efficiency standards set by the ministry of transportation. The v/c ratio at 1.33, is recommended to be reduced to below 1.00. The LOS of "F" and control delay of 183 are expected to be the main reason for congestion and inefficiency at the subject site.

Table 2 Existing Conditions - Peak Hours Intersection Performance Metrics - Seaton Street & Gerrard Street East

Control type	Unsignalized
Max v/c Ratio	1.33
Intersection LOS	F
Intersection Delay(s)	96

The LOS of "F" and control delay of 183 on Table 1 are the main contributors to the "F" grade and large intersection delay of 96. Further analysis will need to be conducted before a determination of best use can be proposed.

Table 3 Existing Conditions - Peak Hours Performance Metrics

Traffic Flow Data (Road Path)	EBL, EBT, EBR Gerrard Street East	WBL, WBT, WBR Gerrard Street East	NBL, NBT, NBR Oskenonton Lane
v/c Ratio	0.71	0.55	0.02
Level of Service (LOS)	B	B	A
Control Delay(s)	17.8	13.9	9.7

For best practices, the same analysis process had been conducted at Gerrard Street East and Oskenonton Lane, which determined that each lane had acceptable standards, with v/c ratios less than 1.00, minimal delays and passing LOS.

Table 4 Existing Conditions - Peak Hours Intersection Performance Metrics - Oskenonton Lane & Gerrard Street East

Control type	Unsignalized (Stop Sign)
Max v/c Ratio	0.71
Intersection LOS	B
Intersection Delay(s)	16.0

The intersection of Oskenonton Lane & Gerrard Street East meets all standards recommended by the Transportation Association of Canada, however these metrics may improve or remain negligble with alteration to the main intersection of Gerrard street east and Seaton Street.

2.1 Analysis of Operational Performance Metrics

During the peak hours of the traffic count, it had been noted that almost as many vehicles had made an illegal eastbound right turn (EBR = 19) onto Seaton Street compared to the number of vehicles that had made the legally intended flow -westbound left turn (WBL = 20). This number of eastbound right turns onto Seaton Street from Gerrard Street East also exceeded the number of eastbound right turns (EBR = 8) and westbound left turns (WBL = 8) onto Oskenonton Lane from Gerrard Street East that would be assumed to go in the same direction (Daniel Tabnak, 2020).

It is also noted that consideration had been taken to implement the data of the illegal eastbound right turn from Gerrard Street East onto Seaton Street into Synchro 10, however due to the nature of the intersection and site, a comprehensive simulation and entire full scale model is not feasible at the time.

As hypothesized, the inefficiency at the main intersection is largely caused by the confusion when approaching and intending to turn onto seaton street. This can be seen where the level of service (LOS) is an F and the v/c ratio is 1.33 in both Table 1 and 2. Generally, any case with a v/c ratio greater than 1.00 indicates inefficiency and contributes to the increase of the control delay (Transportation Association of Canada, 2017).

3.0 Consideration EBR Turn From Gerrard Street East Onto Seaton Street

A favourable solution may be allowing a legal EBR turn at the main intersection and prioritizing free - flow traffic without the use of a signalized traffic light. Along with this change, a modification of the current traffic signs at the subject site is suggested for best practices.

3.1 Traffic Sign Proposal At Main Intersection

ALL MOVEMENTS PERMITTED Sign

Rb-46	60 cm x 60 cm
Font	N/A
Colour	Legend & Border – White Reflective Background – Black

Figure 5 Proposed sign change at the subject intersection in eastbound flow, indicating all direction of turns are permitted (Ontario Traffic Manual Book 5 - Regulatory Signs, 2001).

Table 5 EBR Turn Allowed - Peak Hours Performance Metrics

Traffic Flow Data (Road Path)	EBL, EBT, EBR Gerrard Street East	WBL, WBT, WBR Gerrard Street East	NBL, NBT, NBR Seaton Street	SBL, SBT, SBR Seaton Street
v/c Ratio	0.03	0.02	N/A	N/A
Level of Service (LOS)	A	A	N/A	N/A
Control Delay(s)	0.8	0.6	N/A	N/A

The metrics EBL,EBT, EBR Gerrard Street East have improved significantly by altering the use of the intersection to allow for EBR turns onto Seaton Street, especially regarding the LOS which was previously a failing grade of "F" -in now an "A".

Table 6 EBR Turn Allowed - Peak Hours Intersection Performance Metrics - Seaton Street & Gerrard Street East

Control type	Unsignalized
Max v/c Ratio	0.03
Intersection LOS	A
Intersection Delay(s)	0.7

The proposed alteration has also improved the Gerrard Street East & Seaton Street intersection. This change has allowed for an acceptable LOS of "A" and a greatly reduced v/c ratio of 0.03 (recommended is below 1.00).

Table 7 EBR Turn Allowed - Peak Hours Performance Metrics

Traffic Flow Data (Road Path)	EBL, EBT, EBR Gerrard Street East	WBL, WBT, WBR Gerrard Street East	NBL, NBT, NBR Oskenonton Lane
v/c Ratio	0.28	0.01	0.04
Level of Service (LOS)	A	A	B
Control Delay(s)	0.0	0.3	13.8

Table 8 EBR Turn Allowed - Peak Hours Intersection Performance Metrics - Oskenonton Lane & Gerrard Street East

Control type	Unsignalized (Stop Sign)
Max v/c Ratio	0.28
Intersection LOS	A
Intersection Delay(s)	0.4

3.2 Analysis of Proposed Legal EBR Turn

By prioritizing the flow of traffic and allowing a legal EBR turn at the main intersection, the EBL, EBT, EBR performance metrics for Gerrard Street East improved by a significant margin, going from a LOS of F (Table 1) to a LOS of A (Table 5) meaning an increase in efficiency at the intersection, which is shown in the proposed Intersection LOS (Table 6).

With the two major factors of prioritizing traffic flow along Gerrard Street East and opening up access to vehicular flow southbound on Seaton Street with the EBR turn, this implementation allows for optimal efficiency at the Oskenonton Lane & Gerrard Street East intersection with an intersection LOS of A (Table 8).

Table 9 Proposed Roundabout - Peak Hours Intersection Performance Metrics - Seaton Street & Gerrard Street East

Control type	Roundabout
Max v/c Ratio	0.34
Intersection LOS (ICU)	A
# of Lanes	1

*ICU (Intersection Capacity Utilization) - total sum of ratios of an approach volume divided by approach capacity (I.e. the number of cars passing through divided by the amount of cars that can be held in that area), for each leg of intersection

Figure 6 - Proposed Roundabout Synchro 10 Model

3.3 Proposed Roundabout Consideration

Roundabouts are generally more efficient in influencing drivers to moderate vehicle speeds in a natural way compared to abruptly stopping and starting (Transportation Association of Canada, 2017).

Although though the results achieved with a roundabout model in Synchro 10 were sufficient to consider an efficient change (Table 9), due to the nature of the built environment and the projected growth in the area it is best to choose an implementation that would cause least amount of change at the subject site, thus refraining to furthermore negatively impact the site.

4.0 Conclusion / Recommendations

All manually collected traffic data at Gerrard Street East, Seaton Street and Oskenonton Lane had been interpreted into performance metrics via Synchro 10.

The Synchro intersection model produced improved results for the implementation of an accessible EBR turn onto Seaton Street, increasing the level of service from an F to an A and also decreasing the amount of Control Delay from 96.0 to 16.0 (Table 1.1 and Table 1.3).

It is recommended to keep the same site design and allow for use of the EBR turn at the Gerrard Street East & Seaton Street intersection as the main path of flow onto seaton street, as this does not affect the surrounding site design and only requires modification of sign usage at the intersection

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Glossary

EBR - Eastbound Right

EBL - Eastbound Left

EBT - Eastbound Through

WBR - Westbound Right

WBL - Westbound Left

WBT - Westbound Through

NBR - Northbound Right

NBL - Northbound Left

NBT - Northbound Through

SBR - Southbound Right

SBL - Southbound Left

SBT - Southbound Through

v/c Ratio - Volume to Capacity Ratio

LOS - Level of Service

Synchro 10 - Traffic simulation software / tool

ICU (Intersection Capacity Utilization) - total sum of ratios of an approach volume divided by approach capacity (I.e. the number of cars passing through divided by the amount of cars that can be held in that area), for each leg of intersection.