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ROAD SAFETY AUDIT FOR A REGIONAL CORRIDOR

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A project

Presented to Ryerson University

In partial fulfillment of the

Requirement for the degree of

Master of Engineering

In the Program of

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ROAD SAFETY AUDIT FOR A REGIONAL CORRIDOR

Dhara Sudani

Master of Engineering, 2006

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ABSTRACT

Road Safety Audit is a safety tool that offers promise to help reduce roadway crashes and fatalities. The Transportation Association of Canada (Reference 2) defines a road safety audit as “a formal and independent safety performance review of a road transportation project by an experienced team of safety specialists, addressing the safety of all road users.” The purpose of this project was to select a “high risk” corridor in the Region of Waterloo, Ontario and to conduct a Road Safety Audit of the corridor. The audit involved an in-depth study of the accidents that have occurred in the corridor during the last five years. Analysis of the collision data was supported by site visits during which the roadway and intersections were examined in detail to gain an understanding of why collisions occurred and why particular types of collision occurred. Numerous recommendations were developed from the audit process. The recommendations included improving pavement condition, installing new traffic signs, relocating existing traffic signs, reducing the number of driveways at certain locations, improving lighting, installing additional traffic control devices such as red light cameras, and conducting an in-depth study to consider possible geometric improvements. All of the measures suggested are designed to contribute to accident reduction in the corridor. In addition, the report recommends that road safety audit should be widely used in Canada to evaluate and improve the safety of our highway system and to minimize the risk of accidents.

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TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT	v
ACKNOWLEDGMENTS	vi
TABLE OF CONTENTS	vii
LIST OF FIGURES	x
LIST OF TABLES	xiv
1.0 INTRODUCTION	1
1.1 General Discussion	1
1.2 Purpose of Project	2
1.3 About the Region	3
1.4 Report Structure	4
2.0 LITERATURE REVIEW	5
2.1 Introduction	5
2.2 Discussion of Literature Reviewed	10
3.0 ABOUT THE CORRIDOR	12
3.1 Introduction	12
3.2 Corridor selection	12
3.3 Collision Rate	14
3.4 Critical Collision Rate	16
3.5 Site Physical Characteristics	17
3.6 Traffic Volume Counts	19
3.7 Traffic Operational Characteristics	19

4.0	COLLISION REPORT	21
4.1	Victoria street at Fisher-Hallman Rd	22
4.2	Victoria street between Fisher-Hallman & Hazelglen Dr	28
4.3	Victoria street at Hazelglen Dr	34
4.4	Victoria street between Hazelglen Dr and Westmount Rd	40
4.5	Victoria street at Westmount Rd	46
4.6	Victoria street between Westmount Rd and Lawrence Ave	52
4.7	Victoria street at Lawrence Ave	58
4.8	Victoria street between Lawrence Ave and Belmont Ave	63
4.9	Victoria street at Lawrence Ave	69
4.10	Conclusions	75
5.0	LEVEL OF SERVICE ANALYSIS	77
5.1	Introduction	77
5.2	Comparison of ICU, HCS 2000 and Synchro/simtraffic Software	77
5.3	Application of ICU Spreadsheet	79
5.4	Application of HCS2000 Software	79
5.5	Application of Synchro/Simtraffic Software	80
5.6	Summary of Results	82
6.0	FINDINGS OF AUDIT	84
6.1	Introduction of Safety Audit	84
6.2	Site Visit	85
6.3	General Findings of Corridor	85
6.4	Specific Findings at Intersections of Corridor	88
6.5	Conclusions	98

7.0	CONCLUSIONS	99
7.1	Road Safety Audits	99
7.2	The Victoria street corridor Road Safety Audit	99
7.3	Conclusions	100
	REFERENCES	101
APPENDIX A	TRAFFIC VOLUME DATA	
APPENDIX B	SIGNAL PHASING AND TIMING PLAN	
APPENDIX C	COLLISION DATA	
APPENDIX D	SITE OBSERAVATION REPORT	
APPENDIX E	ICU SPREADSHEET	
APPENDIX F	HCS2000 DETAILED REPORT	
APPENDIX G	SYNCHRO DETAILED REPORT	

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1.1.1	Photo of Intersection in Grand Rapids Before safety Audit	2
1.1.2	Photo of Intersection in Grand Rapids After safety Audit	2
1.3.1	Region of Waterloo	3
3.2.1	Map showing Location of Corridor	13
3.3.1	Collision Rate of Corridor	15
3.4.1	Critical Collision Rate of Corridor	16
3.5.1	Lane Configuration of Major intersections along Corridor	17
3.5.2	Map showing Bus stop Location	18
3.6.1	Traffic Volume Count	19
3.7.1	Traffic Signal Phasing & Timing Plan	20
4.1	Victoria/Fisher-hallman (Number of Collision)	22
4.1.1	Motor Vehicle Collision History	22
4.1.2	Road Surface Condition	23
4.1.3	Environment Condition	23
4.1.4	Time of Occurrence	24
4.1.5	Light	25
4.1.6	Impact Type	25
4.1.7	Type of Collision	26
4.2	Between Fisher-hallman & Hazelglen (Number of Collision)	28
4.2.1	Motor Vehicle Collision History	28
4.2.2	Road Surface Condition	29
4.2.3	Environment Condition	29
4.2.4	Time of Occurrence	30
4.2.5	Light	31
4.2.6	Impact Type	31
4.2.7	Type of Collision	32

4.3	Victoria/ Hazelglen (Number of Collision)	34
4.3.1	Motor Vehicle Collision History	34
4.3.2	Road Surface Condition	35
4.3.3	Environment Condition	35
4.3.4	Time of Occurrence	36
4.3.5	Light	37
4.3.6	Impact Type	37
4.3.7	Type of Collision	38
4.4	Between Hazelglen & Westmount (Number of Collision)	40
4.4.1	Motor Vehicle Collision History	40
4.4.2	Road Surface Condition	41
4.4.3	Environment Condition	41
4.4.4	Time of Occurrence	42
4.4.5	Light	43
4.4.6	Impact Type	43
4.4.7	Type of Collision	44
4.5	Victoria/ Westmount (Number of Collision)	46
4.5.1	Motor Vehicle Collision History	46
4.5.2	Road Surface Condition	47
4.5.3	Environment Condition	47
4.5.4	Time of Occurrence	48
4.5.5	Light	49
4.5.6	Impact Type	49
4.5.7	Type of Collision	50
4.6	Between Westmount & Lawrence (Number of Collision)	52
4.6.1	Motor Vehicle Collision History	52
4.6.2	Road Surface Condition	53
4.6.3	Environment Condition	53
4.6.4	Time of Occurrence	54
4.6.5	Light	55
4.6.6	Impact Type	55

4.6.7	Type of Collision	56
4.7	Victoria/Lawrence (Number of Collision)	58
4.7.1	Motor Vehicle Collision History	58
4.7.2	Road Surface Condition	59
4.7.3	Environment Condition	59
4.7.4	Time of Occurrence	60
4.7.5	Light	61
4.7.6	Impact Type	61
4.7.7	Type of Collision	62
4.8	Between Lawrence & Belmont (Number of Collision)	63
4.8.1	Motor Vehicle Collision History	63
4.8.2	Road Surface Condition	64
4.8.3	Environment Condition	64
4.8.4	Time of Occurrence	65
4.8.5	Light	66
4.8.6	Impact Type	66
4.8.7	Type of Collision	67
4.9	Victoria/Belmont (Number of Collision)	69
4.9.1	Motor Vehicle Collision History	69
4.9.2	Road Surface Condition	70
4.9.3	Environment Condition	70
4.9.4	Time of Occurrence	71
4.9.5	Light	72
4.9.6	Impact Type	72
4.9.7	Type of Collision	73
5.5.1	Level of service results obtained from Synchro Network	80
5.5.2	Simtraffic Network showing vehicles simulating along Victoria corridor	80
6.3.1	Downhill gradient from Fisher-hallman Road to hazelglen Dr	86
6.3.2	Driveways on Victoria street Corridor	86

6.3.3	Cracks and potholes on Pavement	87
6.3.4	Sunlight glare at east-west aligned traffic signals	87
6.4.1.1	Aerial view of the Victoria/Fisher-Hallman Intersection	88
6.4.1.2	Sign for Red light Cameras	89
6.4.2.1	Aerial view of Victoria / Hazelglen Intersection	90
6.4.3.1	Aerial view of the Victoria/ Westmount Intersection	91
6.4.3.2	Uphill Gradient of Vertical Curve on Victoria street	92
6.4.3.3	Driveways near Westmount Intersection	93
6.4.3.4	Vehicle making left turn from the Entrance of Mooregate building onto Victoria street	94
6.4.4.1	Aerial view of the Victoria/ Lawrence Intersection	95
6.4.4.2	Poor pedestrian visibility at Victoria /Lawrence Intersection	96
6.4.5.1	Aerial view of the Victoria/Belmont Intersection	97
6.4.5.2	Traffic Queuing on south bound of Belmont Avenue at Victoria/ Belmont Intersection	98

LIST OF TABLES

<u>Table No</u>		<u>Page</u>
3.2.1	Intersections Along Corridor	13
3.3.1	Collision Rate of Corridor for year 2004	15
4.1.8	Victoria/Fisher-Hallman Collision Summary	27
4.2.8	BTWN Fisher-hallman & Hazelglen Collision Summary	33
4.3.8	Victoria/ Hazelglen Collision Summary	39
4.4.8	BTWN Hazelglen & Westmount Collision Summary	45
4.5.8	Victoria/ Westmount Collision Summary	51
4.6.8	BTWN Westmount & Lawrence	57
4.7.8	Victoria/Lawrence Collision Summary	62
4.8.8	BTWN Lawrence & Belmont Collision Summary	68
4.9.8	Victoria/Belmont Collision Summary	74
4.10.1	Collision Summary of All Locations	75
5.2.1	Comparison of ICU, HCM and simulation	78
5.3.1	Results of the ICU spread sheet	79
5.4.1	Results obtained from HCS2000 software	79
5.5.1	Results obtained from Synchro/Simtraffic software	81
5.6.1	Results obtained from ICU, HCS 2000 & Synchro/simtraffic	82

Chapter 1

INTRODUCTION

This Project describes a Road Safety Audit conducted on a road corridor in the Region of Waterloo, Ontario. The Audit was based on five years of collision data.

1.1 General Discussion

For many years, traffic growth and led to a large number of road accidents, associated with economic losses and human suffering. Road traffic safety is an important social issue. Traffic accidents are the combined result of various influences at a certain location and time, the result of a complex interplay between the driver, his vehicle and the road infrastructure. Comprehensive Road Safety Audit Reviews are designed to investigate this complexity.

Factors, such as human error, traffic characteristics, road geometry, traffic signs, traffic signals, pavement condition, and roadside objects, all contribute to the occurrence of traffic accidents. In most cases, human error is considered to be the main cause of traffic accidents. If human error is the over-riding factor that leads to crashes, then there should be no need to improve physical environment of highways (*Reference No 6*), but it may not be appropriate simply to blame the drivers involved. The effect of highway characteristics and deficiencies should also be considered in many cases. Highway characteristics interact in a complex way and may lead to an environment prone to the occurrence of traffic accidents. While it is true that the effects of highway characteristics are often not easy to identify or quantify, we can say that that it may be possible to prevent collisions attributed to driver error by improving the road environment. Where collisions cannot be prevented, it may be possible to make the collisions less severe. Traffic engineers with an understanding of human behavior can improve roads to prevent common driver errors that lead to collisions (*Reference No 1*).

Improving the physical and operational characteristics of existing roads is a proven and effective method to improve road safety. For example, **Figure 1.1.1** is a photo of an intersection in Grand Rapids, Michigan, before a road safety audit was conducted. The two traffic signal heads are hung on a diagonal span of wire and only one head is over the travel lanes. There are two lanes approaching the intersection separated by a dashed white pavement marking.

Figure 1.1.2 is the same intersection after a road safety audit was conducted. The traffic signals are now hung on a box span of wire and they can now be hung directly over the travel lanes. Now there are three traffic signal heads, two for the through lane and one for the left turn lane. Pavement markings now show a separate left-turn lane at the intersection. (Reference 19)

Figure 1.1.1

Before

Figure 1.1.2

After

Source: Road Safety Audit Website

1.2 Purpose of Project

The purpose of this project is:

To conduct a Road Safety Audit and suggest possible measures that would contribute to accident reduction on the corridor.

1.3 About the Region

Figure 1.3.1 Region of Waterloo

Source: Region of Waterloo website

“Waterloo Region is a vital, prosperous area, located in Southern Ontario in the center of the triangle formed by three Great Lakes: Ontario, Erie and Huron. Three urban municipalities – Cambridge and Waterloo, and four rural townships – North Dumfries, Wellesley, Wilmot and Woolwich – make up Waterloo Region. With a combined population of over 450,000, Waterloo Region is one of the fastest growing areas in Ontario. The unique balance of the urban and rural, our proximity to major North American markets and transportation networks, diverse ethnic makeup, and excellent education, health, cultural and recreational facilities contribute to the allure this area has for families and businesses.” (Reference No 21)

The Region of Waterloo has about 385,000 registered vehicles for a population of 488,490. There are more than 420 signalized intersections on a 1646 km road network that experiences 6,000 to 7,000 collisions annually.

1.4 Report Structure

This report is organized into eight chapter: Introduction, Literature Review, About the Corridor, Collision Report, and Applications of software, Findings of Audit, Conclusions and References.

Chapter 1 provides an introduction to the project, describes the purpose of project, outlines the main details of the region and sets out the report structure.

Chapter 2 summarizes the literature review conducted for the study.

Chapter 3 discusses the corridor selection procedure, the selected corridor's location, the collision rate, and the critical collision rate of all the intersections and road sections along the selected corridor. Chapter 3 also presents the data provided by the Department of Transportation – Region of Waterloo and the data collected on the field visit.

Chapter 4 presents the corridor's collision history from 2000 to 2004 inclusive.

Chapter 5 describes the Level of service analysis using of HCS 2000 (Highway capacity software), synchro/simtraffic & the ICU (Intersection Capacity Utilization) spreadsheet. The section presents all the results obtained.

Chapter 6 presents the findings and recommendations of the Audit.

Chapter 7 addresses the conclusions and completes the Report with some practical considerations and indications for Future Research.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

The objective of the literature review was to increase the background understanding of the road safety and road safety audits. This literature review presents the findings of the literature review.

Craig Lyon, Anwar Haq, Bhagwant Persaud, Steven T. Kodama. Development of safety performance functions for signalized Intersections in a large urban area and application to evaluation of left turn priority treatment. Transportation Research Board 2005

In this paper, the authors describe the development of Safety Performance Functions (SPFs) for signalized intersections in a large urban area and the application of the SPFs to the evaluation of left turn priority lanes. SPFs relate the collision experience of a road location to its traffic, operational and geometric characteristics. They are indispensable in modern day safety analysis. The paper presents the development of SPFs for signalized intersections in the City of Toronto.

Two types of left turn priority treatment applications were evaluated: flashing advanced green (FAG) and left turn green arrow (LTGA). The results showed that the treatment was effective in reducing collisions; particularly those involving left turn side impacts.

Filip Van den Bossche, Geert Wets and Tom Brijs. A Regression Model with ARMA Errors to Investigate the Frequency and Severity of Road Traffic Accidents. Transportation Research Board 2004

In this paper, the authors describe a “regression model with ARMA (Auto-Regressive Moving Average) errors to investigate the frequency and severity of road traffic

accidents.” The authors developed models to explain and forecast the frequency and severity of accidents in Belgium.

Using a regression model with ARMA errors, the impact of variables on aggregate traffic safety was quantified. The impact of unknown factors was captured by the error term. The results showed a significant effect attributable to weather conditions and to laws and regulations on traffic safety, but the impact of economic conditions seemed to be statistically negligible.

The model can easily be used to forecast traffic safety, as can be seen from the reasonably good fit obtained on a 95% confidence level.

Richard J. Hanowski, Alejandra L. Medina, Walter W. Wierwille, Suzanne E. Lee:
Incident Clustering: A Diagnostic Approach to Assess the Usability of Intersections and Other Road Sites, Transportation Research Board 2004

In the paper entitled “Incident Clustering: A Diagnostic Approach to Assess the Usability of Intersections and Other Road Sites”, the authors developed an analysis designed to help identify infrastructure-related and non-infrastructure-related problems at intersections and other roadway sites. The authors explain that an incident cluster is a group of critical incidents with similar characteristics that occur at the same location. From these incident clusters, the researchers were able to gain insight into potential infrastructure-related and non-infrastructure-related causal factors associated with the critical incidents. The authors were able to use the findings to suggest solutions.

The researchers concluded that their procedure serves as an efficient and robust tool for evaluating problem roadway sites.

King K. Mak, Dean L. Sicking, Karl Zimmerman. **Road Safety Analysis Program (RSAP) – A Cost –Effectiveness Analysis Procedure**, Transportation Research Board 1998

The authors present brief descriptions of the Roadside Safety Analysis Program (RSAP), which is a new cost-effectiveness analysis program developed under NCHRP (National Cooperative Highway research Program) for the evaluation of roadside safety improvements. The RSAP program is an improvement over existing cost-effectiveness analysis procedures, such as those in the 1977 AASHTO (American Association of State Highway and Transportation Officials) Barrier Guide and the ROADSIDE program. The RSAP program improves many of the algorithms in existing procedures and provides a user-friendly interface. The program has undergone extensive testing and validation, including evaluation by an independent reviewer.

Rune Elvik, Finn Harald Amundsen, Frode Hofset. Road Safety Effects of Bypasses, Transportation Research Board 2001

In this paper, the authors describe the road safety effects of bypasses. The researchers investigated the effects on injury accidents of 20 bypass road projects in Norway. The effects were evaluated by means of an observational before-and-after study, controlling for regression-to-the-mean and general area wide trends in the number of accidents. On average, a statistically significant reduction of 19% in the number of injury accidents was found.

Kimberly A. Eccles, Joseph E. Hummer: Safety Effects of Fluorescent Yellow Warning Signs At Hazardous Sites in Daylight, Transportation Research Board 2000

The authors describe the safety effects of fluorescent yellow warning signs at hazardous sites in daylight. The purpose of the research paper was to evaluate the effectiveness of fluorescent yellow warning signs in improving highway safety at hazardous locations. A before and after study used surrogate measures (encroachments, conflicts and events, signal violations, stop sign observance, stopping behavior, and speed) to evaluate the safety effectiveness of replacing existing yellow warning signs with fluorescent yellow warning signs at seven hazardous locations.

The researchers found that the use of fluorescent yellow sheeting in place of standard yellow sheeting provides an inexpensive method to increase the conspicuity of the traffic sign. The results indicated that fluorescent yellow warning signs likely increased safety at four of the seven sites by providing a more conspicuous warning to motorists. There was little change at the other three sites. However, since surrogate measures were used, the actual collision savings are unknown.

The researchers recommend the use of fluorescent yellow warning signs as an inexpensive countermeasure at sites like those tested in the study. They recommend more research to find the collision savings and long-term effects.

Tarek Sayed, Walid Abdelwahab, and John Nepomuceno: Safety Evaluation of Alternative Signal Head Design, Transportation Research Board 2001

The authors present the safety evaluation results of an alternative signal head design. The design of the alternative signal head consists of a 300-millimeter red light, a 300 millimeter amber light, and a 300-millimeter green light, all with 150-watt lamps and a yellow backboard with an additional 50-millimeter reflective border.

The research was based on an Empirical Bayes before and after safety analysis. The results of the study indicated that the new signal head was effective in reducing the total number of accidents and severe accidents. The alternative signal head design was effective in increasing safety at signalized intersections and consideration should be given to adopting its use.

The authors concluded that increasing traffic signal visibility through the improvement of signal head design is an effective measure of reducing both the frequency and severity of traffic accidents at signalized intersections. They recommended that a larger study be undertaken to review the safety benefits of the 300 millimeter RYG signal head. The larger study would examine a larger number of treatment sites as sites become available.

The authors also recommended that the treatment sites should include a variety of intersection types.

Fei Yuan, John N. Ivan, Xiao Qin, Norman W. Garrick, Christian F. Davis. Safety Benefits of Intersection Approach Realignment On Rural Two-lane Highways. Transportation Research Board 2001

The authors describe the safety benefits of intersection approach realignment on rural two-lane highways. The paper presents a before/after type study using the Empirical Bayes method to estimate crash reduction factors for modern conditions on two-lane rural highways. The authors also use an analysis of variance model to identify the extra benefits of the comprehensive treatments.

The study found that the improvements appeared to reduce the total number of crashes, but that the effect on different type of crashes was different. The study also found that, combining realignment with adding a left-turn lane or traffic signal did not appear to offer significant additional benefits in crash reduction.

Charles V. Zegeer, J. Richard Stewart, and Herman Huang. Safety Effects of Marked vs Unmarked Crosswalks at Uncontrolled Locations: Analysis of Pedestrian Crashes in 30 Cities. Transportation Research Board 2000

In the paper entitled “Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations and Analysis of Pedestrian Crashes in 30 Cities”, the authors point out the need to identify pedestrian needs when crossing streets and the need to select appropriate solutions that will improve pedestrian safety and access. Deciding where to mark crosswalks is only one consideration in meeting the authors’ objective.

The study involved an analysis of five years of pedestrian crashes at 1,000 marked crosswalks and 1,000 matched unmarked comparison sites. All the sites studied had no traffic signal or stop sign on the approaches. Detailed data were collected on traffic

volume, pedestrian exposure, number of lanes, median type, speed limit, and other site variables. Poisson and negative binomial regressive models were used.

The study results revealed that on two-lane roads, the presence of a marked crosswalk alone at an uncontrolled location was associated with no difference in pedestrian crash rate, compared to an unmarked crosswalk. Further, on multi-lane roads with traffic volumes above about 12,000 vehicles per day, having a marked crosswalk was associated with a higher pedestrian crash rate (after controlling for other site factors) compared to an unmarked crosswalk. Raised medians provided significantly lower pedestrian crash rates on multi-lane roads, compared to roads with no raised median. Older pedestrians had higher crashes compared to their crossing exposure.

The authors recommended the introduction of substantial improvements designed to provide for safer pedestrian crossings. Examples include adding traffic signals (with pedestrian signals) when warranted, providing raised medians, and speed reduction measures.

2.2 Discussion of the literature reviewed

The primary objective of road safety is to reduce the incidence, severity and cost to the community of road crashes. These goals can be achieved through improved research and education, continued media campaigns focusing on attitudes and behaviors, attention to design and safety features of roads and vehicles, stringent enforcement of road laws, and coordination of the efforts of all related agencies (Reference 2). The papers included in the literature review describe the safety benefits by applying various treatments, for example, Marked vs. Unmarked Crosswalks, Realignment, alternative signal head design, yellow signs at hazardous sites.

The Road Safety Audit is a proactive low-cost approach to improving road safety. The Road Safety Audit helps the engineering team to develop a number of safety solutions for planned and existing projects and can save thousands of dollars by correcting a design problem. The road safety audit process looks at the roadway from a purely technical

safety viewpoint without outside influences. It is a valuable process that gives an unbiased view of safety issues from a team of safety experts. The road safety audit process can be regarded as a key part of the process of working towards safer vehicles, safer roads and safer road users. (Reference 17)

Chapter 3

ABOUT THE CORRIDOR

3.1 Introduction

This chapter discusses the corridor selection process. The chapter then discusses the selected corridor's collision rate, critical collision rate, physical characteristics, traffic volume counts and traffic operational characteristics.

3.2 Corridor selection

Network screening provides a systematic and unbiased method of identifying and selecting which sites need to be the subject of a Road Safety Audit. The network screening process consists of evaluating the safety performance of the network according to several measures and tools. (*Reference No 2*)

In this study the corridor with the intersection having the highest number of collisions was selected for Road Safety Audit. Collision frequency rankings are a useful starting point for the network screening process.

“The 2004 Collision Report” by the Region of Waterloo ranks 100 locations in the region by the number of collisions in 2004. The intersection with the highest number of collisions was “Victoria Street at Fisher-hallman Road”. The intersection described as “Victoria Street at Westmont Road” also had a high number of collisions and was ranked in the top ten locations. On the basis of this information, Victoria Street was selected as the study corridor.

Figure 3.2.1 shows the location of the Victoria corridor.

Figure 3.2.1 Location of Victoria Street Corridor

Table 3.2.1 describes the Victoria Street corridor’s ten signalized intersections from West to East. In this study, only signalized intersections are considered.

Table 3.2.1

Intersections Along Victoria St Corridor From West to East	Signalized / Non Signalized	3 Legged / 4 Legged
Fisher-Hallman Rd	Signalized	4 Legged
Fenwick Cr/Monte Carlo	Non signalized	4 Legged
Hazelglen Dr	Signalized	3 Legged
Vicmount Dr	Non signalized	3 Legged
Westmount Rd	Signalized	4 Legged
Weichel Street	Non signalized	3 Legged

Paulander Dr	Non signalized	3 Legged
Alice Ave	Non signalized	3 Legged
Lawrence Ave	Signalized	4 Legged
Belmont Ave	Signalized	4 Legged

3.3 Collision Rate

The collision rates for intersections and road section along the Victoria corridor were calculated from the collision data and traffic volume data using the following equations.

For Intersections:

$$CR = N \times 10^6 / AADT \times t \times 365$$

For Road Sections:

$$CR = N \times 10^6 / L \times AADT \times t \times 365$$

Where,

N = number of collisions during time t,

AADT= Average Annual Daily Traffic (entering)

t = observation period (years)

L= segment length (km)

Table 3.3.1 and Figure 3.3.1 show the collision rate for the Victoria Corridor for 2004. The Fisher Hallman intersection and the road section between (BTWN) Westmount and Lawrence have the highest collision rates.

Table No. 3.3.1 Collision Rate

Intersection / Road Section	N	AADT	L (Km)	CR
Fisher-Hallman Rd	30	43,401	-	1.89
BTWN Fisher-hallman & Hazeglen	3	19,297	0.466	0.92
Hazeglen Dr	4	23,521	-	0.5
BTWN Hazeglen & Westmount Rd	3	20,784	0.266	1.49
Westmount Rd	20	38,114	-	1.44
BTWN Westmount & Lawrence Ave	13	17,218	0.603	3.42
Lawrence Ave	3	20,000	-	1.15
BTWN Lawrence Ave & Belmont Ave	3	18,685	0.250	1.75
Belmont Ave	14	33,499	-	0.41

Figure No. 3.3.1

3.4 Critical Collision Rate

Figure 3.4.1 shows the critical collision rate analysis for the intersections and road sections. Collision rates along the Victoria Corridor are plotted and compared with a critical curve. Locations with a collision rate at or above the curve are “critical” and can be considered “high risk”.

The following equation (*Reference No 2*) is used to calculate the critical collision rate for intersections and road sections along the Victoria corridor.

$$R_c = R_a + K\sqrt{(R_a/M) + 1/2M}$$

Where:

R_c = intersection critical collision rate,

R_a = average collision rate for the intersection type being analyzed (total number of collisions divided by the total entering volume in millions for the entire analysis period),

M = vehicle volume entering the study intersection (in millions, total for the entire analysis period),

K = constant: 1.28 for 90 percent confidence, 1.65 for 95 percent confidence, and 2.33 for 99 percent confidence

Figure 3.4.1 Critical Analysis

3.5 Site Physical Characteristics

This section presents the geometric features of the Victoria corridor and the surrounding area. The physical data collected include:

- **Surrounding land use:** Residential / Commercial
- **Road classification:** Arterial. The Victoria corridor is part of Route # 55.
- **Posted speed limit:** 50 km/hr.
- **Cross-sectional elements including lane configuration and widths:** Figure 3.5.1 presents the lane configuration for the Victoria corridor. The width of the through lane is 3.65 / 3.75 / 3.35 m. The width of left turn lanes is 3.25m throughout the corridor.

Figure 3.5.1 Victoria Corridor Lane Configuration

- **Sidewalks, crosswalks, bike paths, and boulevards:** 1.8m / 1.5m concrete sidewalk, 2.5 / 3 m crosswalk, No bike paths on Victoria Corridor, 2m boulevard on both sides of the road

3.6 Traffic Volume Counts

Traffic volume counts for five of the ten intersections along the Victoria corridor are shown in Figure 3.6.1.

Figure 3.6.1 Traffic Volume Counts

See Appendix A for the following traffic volumes:

- Vehicular traffic volumes;
- Pedestrian traffic volumes; and
- Vehicle classification, particularly the proportion of heavy trucks.

3.7 Traffic Operational Characteristics

Traffic operational characteristics relate to the traffic control devices at the study location. Traffic operational characteristics data collected for Road Safety Reviews include:

- Parking regulations: There is no parking on both sides of the Victoria Corridor.
- Traffic signal phasing and timing plan: Figure 3.7.1 presents the maximum green time and cycle length for all major intersections along the Victoria corridor.

Figure 3.7.1 Traffic Signal Phasing and Timing Plan

Source: Road Safety Vision Website, Reference No 17

See Appendix B for detailed information on signal phasing and timing along the Victoria corridor.

Chapter 4

COLLISION REPORT

The information presented in this Chapter is based on vehicle collisions occurring on Regional Road No. 55 (Victoria Street Corridor) under the jurisdiction of the Regional Municipality of Waterloo or occurring at signalized intersections under the jurisdiction of area municipalities. The collisions were either investigated by the Regional Police or reported to the Collision Reporting Center. This Chapter is a summary of the factors associated with traffic collisions that occurred from 2000 to 2004.

Traffic collisions involve complex intersections between human behavior, vehicle characteristics, and environmental conditions. The factor or factors responsible for causing a collision are not always the most obvious, nor are they always readily apparent. Caution should be exercised in drawing conclusions from the statistics presented in this report. Conclusions should be drawn only with appropriate qualifications and supportive information.

This Chapter presents graphs for five major intersection and four road sections along the Victoria Corridor. The following graphs are presented for each major intersection and road section:

- Motor vehicle collision history;
- Road surface condition VS. Number of collisions;
- Condition of environment VS. Number of collisions;
- Time of day VS. Number of collisions;
- Lighting conditions VS. Number of collisions;
- Impact type VS. Number of collisions; and
- Type of collision VS. Number of collisions.

4.1 VICTORIA STREET AT FISHER-HALLMAN

4.1.1 Motor Vehicle Collision History

Figure 4.1.1 shows the historical trend (five years) for motor vehicle collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004 inclusive.

Figure 4.1.1 Motor Vehicle Collision History for Regional Road 55 at Fisher-Hallman from 2000 to 2004

4.1.2 Road Surface Condition

Figure 4.1.2 shows the road surface conditions VS. the number of collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004 inclusive. The highest number of collision occurred during Dry Road surface conditions.

Figure 4.1.2 Road Surface Conditions VS. Number of collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004

4.1.3 Condition of Environment

Figure 4.1.3 shows the condition of the environment VS. the number of collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004 inclusive. The highest number of collisions occurred under clear conditions.

Figure 4.1.3 Condition of Environment VS. Number of Collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004

4.1.4 Time of Occurrence

Figure 4.1.4 shows the time of day VS. the number of collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004 inclusive. The highest number of collisions occurred BETWEEN the hours of 17:00 and 18:00.

Figure 4.1.4 Time of Day VS. Number of Collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004

4.1.5 Lighting Conditions

Figure 4.1.5 shows lighting conditions VS. the number of collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004 inclusive. The highest number of collisions occurred in daylight conditions.

Figure 4.1.5 Lighting Conditions VS. Number of Collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004

4.1.6 Impact Type

Figure 4.1.6 shows impact type VS. the number of collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004 inclusive. Rear end collisions accounted for the highest number of collisions.

Figure 4.1.6 Impact Type VS. Number of Collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004

4.1.7 Type of Collision

Figure 4.1.7 shows the type of collision VS. the number of collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004 inclusive. Non-reportable collisions accounted for the highest number of collisions.

Figure 4. 1.7 Type of Collision VS. Number of Collisions on Regional Road 55 at Fisher-Hallman from 2000 to 2004

4.1.8 Summary of Findings for Regional Road 55 at Fisher-Hallman from 2000 to 2004

Table 4.1.8 summarizes the charts for Regional Road 55 at Fisher-Hallman. It shows the collision factor and the sub-factor with the highest number of collisions from 2000 to 2004.

Table 4.1.8 Summary of Findings for Regional Road 55 at Fisher-Hallman from 2000 to 2004

Factor	Sub-factor
Road surface condition	Dry
Condition of environment	Clear
Time of occurrence	17:00 to 18:00
Lighting conditions	Daylight
Impact type	Rear end
Type of collision	Non-reportable

4.2 VICTORIA STREET BETWEEN FISHER-HALLMAN AND HAZELGLEN

4.2.1 Motor Vehicle Collision History

Figure 4.2.1 shows the historical trend (five years) for motor vehicle collisions on Regional Road 55 between Fisher-Hallman and Hazelglen from 2000 to 2004 inclusive.

Figure 4.2.1 Motor Vehicle Collision History for Regional Road 55 between Fisher-Hallman and Hazelglen from 2000 to 2004

4.2.2 Road Surface Condition

Figure 4.2.2 shows the road surface conditions VS. the number of collisions on Regional Road 55 between Fisher-Hallman and Hazelglen from 2000 to 2004 inclusive. The highest number of collisions occurred under dry weather condition.

Figure 4.2.2 Road Surface Conditions VS. Number of Collisions on Regional Road 55 BETWEEN Fisher-Hallman and Hazelglen from 2000 to 2004

4.2.3 Condition of Environment

Figure 4.2.3 shows the condition of the environment VS. the number of collisions on Regional Road 55 between Fisher-Hallman and Hazelglen from 2000 to 2004 inclusive. The highest number of collisions occurred under clear conditions.

Figure 4.2.3 Condition of Environment VS. Number of Collisions on Regional Road 55 BETWEEN Fisher-Hallman and Hazelglen from 2000 to 2004

4.2.4 Time of Occurrence

Figure 4.2.4 shows the time of day VS. the number of collisions on Regional Road 55 between Fisher-Hallman and Hazelglen from 2000 to 2004 inclusive. The highest number of collisions occurred between the hours of 16:00 and 17:00.

Figure 4.2.4 Time of Day VS. Number of Collisions on Regional Road 55 BETWEEN Fisher-Hallman and Hazelglen from 2000 to 2004

4.2.5 Lighting Conditions

Figure 4.2.5 shows lighting conditions VS. the number of collisions on Regional Road 55 between Fisher-Hallman and Hazelglen from 2000 to 2004 inclusive. The highest number of collisions occurred in daylight conditions, suggesting that at this intersection, lighting was not the major cause of collisions.

Figure 4.2.5 Lighting Conditions VS. Number of Collisions on Regional Road 55 BETWEEN Fisher-Hallman and Hazelglen from 2000 to 2004

4.2.6 Impact Type

Figure 4.2.6 shows impact type VS. the number of collisions on Regional Road 55 between Fisher-Hallman and Hazelglen from 2000 to 2004 inclusive. Rear end collisions accounted for the highest number of collisions.

Figure 4.2.6 Impact Type VS. Number of Collisions on Regional Road 55 BETWEEN Fisher-Hallman and Hazelglen from 2000 to 2004

4.2.7 Type of Collision

Figure 4.2.7 shows the type of collision VS. the number of collisions on Regional Road 55 between Fisher-Hallman and Hazelglen from 2000 to 2004 inclusive. Non-reportable collisions accounted for the highest number of collisions.

Figure 4.2.7 Type of Collision VS. Number of Collisions on Regional Road 55 between Fisher-Hallman and Hazelglen from 2000 to 2004

4.2.8 Summary of Findings for Regional Road 55 BETWEEN Fisher-Hallman and Hazelglen Dr from 2000 to 2004

Table 4.2.8 shows the summary of all above charts. . The Table shows the collision factor and the sub-factor with the highest number of collisions from 2000 to 2004.

Table 4.2.8 Summary of Findings for Regional Road 55 between Fisher-Hallman and Hazelglen from 2000 to 2004

Factor	Sub-factor
Road surface condition	Dry
Condition of environment	Clear
Time of occurrence	16:00 to 17:00
Lighting conditions	Daylight conditions
Impact type	Rear end
Type of collision	Non-reportable

4.3 VICTORIA STREET AT HAZELGLEN DRIVE

4.3.1 Motor Vehicle Collision History

Figure 4.3.1 shows the historical trend (five years) for motor vehicle collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004 inclusive. The highest number of collisions occurred in year 2004.

Figure 4.3.1 Motor Vehicle Collision History for Regional Road 55 at Hazelglen Drive from 2000 to 2004

4.3.2 Road Surface Condition

Figure 4.3.2 shows the road surface conditions VS. the number of collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004 inclusive. The highest number of collisions occurred under dry weather condition.

Figure 4.3.2 Road Surface Conditions VS. Number of Collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004

4.3.3 Condition of Environment

Figure 4.3.3 shows the condition of the environment VS. the number of collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004 inclusive. The highest number of collisions occurred under clear conditions.

Figure 4.3.3 Condition of Environment VS. Number of Collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004

4.3.4 Time of Occurrence

Figure 4.3.4 shows the time of day VS. the number of collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004 inclusive. The highest number of collisions occurred between the hours of 14:00 and 15:00.

Figure 4.3.4 Time of Day VS. Number of Collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004

4.3.5 Lighting Conditions

Figure 4.3.5 shows lighting conditions VS. the number of collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004 inclusive. The highest number of collisions occurred during daylight conditions.

Figure 4.3.5 Lighting Conditions VS. Number of Collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004

4.3.6 Impact Type

Figure 4.3.6 shows impact type VS. the number of collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004 inclusive. Rear end collisions accounted for the highest number of collisions.

Figure 4.3.6 Impact Type VS. Number of Collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004

4.3.7 Type of Collision

Figure 4.3.7 shows the type of collision VS. the number of collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004 inclusive. Non-reportable and property damage only collisions accounted for the highest number of collisions.

Figure 4.3.7 Type of Collision VS. Number of Collisions on Regional Road 55 at Hazelglen Drive from 2000 to 2004

4.3.8 Summary of Findings for Regional Road 55 at Hazelglen Drive from 2000 to 2004

Table 4.3.8 summarizes the charts for Regional Road 55 at Hazelglen Drive. The Table shows the collision factor and the sub-factor with the highest number of collisions from 2000 to 2004.

Table 4.3.8 Summary of Findings for Regional Road 55 at Hazelglen Drive from 2000 to 2004

Factor	Sub-factor
Road surface condition	Dry
Condition of environment	Clear
Time of occurrence	14:00 to 15:00
Lighting conditions	Daylight
Impact type	Rear end
Type of collision	Non-reportable, Property damage only

4.4 VICTORIA STREET BETWEEN HAZELGLEN AND WESTMOUNT ROAD

4.4.1 Motor Vehicle Collision History

Figure 4.4.1 shows the historical trend (five years) for motor vehicle collisions on Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004 inclusive.

Figure 4.4.1 Motor Vehicle Collision History for Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004

4.4.2 Road Surface Condition

Figure 4.4.2 shows the road surface conditions VS. the number of collisions on Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004 inclusive. The highest number of collisions occurred under dry road surface condition.

Figure 4.4.2 Road Surface Conditions VS. Number of Collisions on Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004

4.4.3 Condition of Environment

Figure 4.4.3 shows the condition of the environment VS. the number of collisions on Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004 inclusive. The highest number of collisions occurred under clear environment conditions.

Figure 4.4.3 Condition of Environment VS. Number of Collisions on Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004

4.4.4 Time of Occurrence

Figure 4.4.4 shows the time of day VS. the number of collisions on Regional Road between Hazelglen Drive and Westmount Road from 2000 to 2004 inclusive. The highest number of collisions occurred between the hours of 17:00 and 18:00.

Figure 4.4.4 Time of Day VS. Number of Collisions on Regional Road between Hazelglen Drive and Westmount Road from 2000 to 2004

4.4.5 Lighting Conditions

Figure 4.4.5 shows lighting conditions VS. the number of collisions on Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004 inclusive. The highest number of collisions occurred during daylight conditions.

Figure 4.4.5 Lighting conditions VS. Number of Collisions on Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004

4.4.6 Impact Type

Figure 4.4.6 shows impact type VS. the number of collisions on Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004 inclusive. Turning movement collisions accounted for the highest number of collisions.

Figure 4.4.6 Impact Type VS. Number of Collisions on Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004

4.4.7 Type of Collision

Figure 4.4.7 shows the type of collision VS. the number of collisions on Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004 inclusive. Non-reportable collisions accounted for the highest number of collisions.

Figure 4.4.7 Type of Collisions VS. Number of Collisions on Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004

4.4.8 Summary of Findings for Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004

Table 4.4.8 summarizes the charts for Regional Road 55 between Hazelglen Drive and Westmount Road. The Table shows the collision factor and the sub-factor with the highest number of collisions from 2000 to 2004.

Table 4.4.8 Summary of Findings for Regional Road 55 between Hazelglen Drive and Westmount Road from 2000 to 2004

Factor	Sub-factor
Road surface condition	Dry
Condition of environment	Clear
Time of occurrence	17:00 to 18:00
Lighting conditions	Daylight
Impact type	Turning movement
Type of collision	Non-reportable

4.5 VICTORIA STREET AT WESTMOUNT ROAD

4.5.1 Motor Vehicle Collision History

Figure 4.5.1 shows the historical trend (five years) for motor vehicle collisions on Regional Road 55 at Westmount Road from 2000 to 2004 inclusive.

Figure 4.5.1 Motor Vehicle Collision History for Regional Road 55 at Westmount Road

4.5.2 Road Surface Condition

Figure 4.5.2 shows the road surface conditions VS. the number of collisions on Regional Road 55 at Westmount Road from 2000 to 2004 inclusive. The highest number of collisions occurred under dry road surface conditions.

Figure 4.5.2 Road Surface Conditions VS. Number of Collisions on Regional Road 55 at Westmount Road from 2000 to 2004

4.5.3 Condition of Environment

Figure 4.5.3 shows the condition of the environment VS. the number of collisions on Regional Road 55 at Westmount Road from 2000 to 2004 inclusive. The highest number of collisions occurred under clear environment condition.

Figure 4.5.3 Condition of Environment VS. Number of Collisions on Regional Road 55 at Westmount Road from 2000 to 2004

4.5.4 Time of Occurrence

Figure 4.5.4 shows the time of day VS. the number of collisions on Regional Road 55 at Westmount Road from 2000 to 2004 inclusive. The highest number of collisions occurred between the hours of 16:00 and 17:00.

Figure 4.5.4 Time of Day VS. Number of Collisions on Regional Road 55 at Westmount Road from 2000 to 2004

4.5.5 Lighting conditions

Figure 4.5.5 shows lighting conditions VS. the number of collisions on Regional Road 55 at Westmount Road from 2000 to 2004 inclusive. The highest number of collisions occurred during daylight conditions.

Figure 4.5.5 Lighting Conditions VS. Number of Collisions on Regional Road 55 at Westmount Road from 2000 to 2004

4.5.6 Impact Type

Figure 4.5.6 shows impact type VS. the number of collisions on Regional Road 55 at Westmount Road from 2000 to 2004 inclusive. Rear end collisions accounted for the highest number of collisions.

Figure 4.5.6 Impact Type VS. Number of Collisions on Regional Road 55 at Westmount Road from 2000 to 2004

4.5.7 Type of Collision

Figure 4.5.7 shows the type of collision VS. the number of collisions on Regional Road 55 at Westmount Road from 2000 to 2004 inclusive. Non-reportable collisions accounted for the highest number of collisions.

Figure 4.5.7 Type of Collision VS. Number of Collisions on Regional Road 55 at Westmount Road from 2000 to 2004

4.5.8 Summary of Findings for Regional Road 55 at Westmount Road from 2000 to 2004

Table 4.5.8 summarizes the charts for Regional Road 55 at Westmount Road. The Table shows the collision factor and the sub-factor with the highest number of collisions from 2000 to 2004.

Table 4.5.8 Summary of Findings for Regional Road 55 at Westmount Road from 2000 to 2004

Factor	Sub-factor
Road surface condition	Dry
Condition of environment	Clear
Time of occurrence	16:00 to 17:00
Lighting conditions	Daylight
Impact type	Rear End
Type of collision	Non- Reportable

4.6 VICTORIA STREET BETWEEN WESTMOUNT AND LAWRENCE AVENUE

4.6.1 Motor Vehicle Collision History

Figure 4.6.1 shows the historical trend (five years) for motor vehicle collisions on Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004 inclusive.

Figure 4.6.1 Motor Vehicle Collision History for Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004

4.6.2 Road Surface Condition

Figure 4.6.2 shows the road surface conditions VS. the number of collisions on Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred under dry road surface conditions.

Figure 4.6.2 Road Surface Conditions VS. Number of Collisions on Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004

4.6.3 Condition of Environment

Figure 4.6.3 shows the condition of the environment VS. the number of collisions on Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004 inclusive.

Figure 4.6.3 Condition of Environment VS. Number of Collisions on Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004

4.6.4 Time of Occurrence

Figure 4.6.4 shows the time of day VS. the number of collisions on Regional Road between Westmount Road and Lawrence Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred between the hours of 16:00 and 17:00.

Figure 4.6.4 Time of Day VS. Number of Collisions on Regional Road between Westmount Road and Lawrence Avenue from 2000 to 2004

4.6.5 Lighting Conditions

Figure 4.6.5 shows lighting conditions VS. the number of collisions on Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred in daylight conditions, suggesting that at this intersection, lighting was not the major cause of collisions.

Figure 4.6.5 Lighting conditions VS. Number of Collisions on Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004

4.6.6 Impact Type

Figure 4.6.6 shows the impact type VS. the number of collisions on Regional Road between Westmount Road and Lawrence Avenue from 2000 to 2004 inclusive. Rear end collisions accounted for the highest number of collisions.

Figure 4.6.6 Impact Type VS. Number of Collisions on Regional Road between Westmount Road and Lawrence Avenue from 2000 to 2004

4.6.7 Type of Collision

Figure 4.6.7 shows the type of collision VS. the number of collisions on Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004 inclusive. Property damage only collisions accounted for the highest number of collisions.

Figure 4.6.7 Type of Collision VS. Number of Collisions on Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004

4.6.8 Summary of Findings for Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004

Table 4.6.8 summarizes the charts for Regional Road 55 between Westmount Road and Lawrence Avenue. The Table shows the collision factor and the sub-factor with the highest number of collisions from 2000 to 2004.

Table 4.6.8 Summary of Findings for Regional Road 55 between Westmount Road and Lawrence Avenue from 2000 to 2004

Factor	Sub-factor
Road surface condition	Dry
Condition of environment	Clear
Time of occurrence	16:00 to 17:00
Lighting conditions	Daylight
Impact type	Rear end
Type of collision	Property damage only

4.7 VICTORIA STREET AT LAWRENCE AVENUE

4.7.1 Motor Vehicle Collision History

Figure 4.7.1 shows the historical trend (five years) for motor vehicle collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004 inclusive.

Figure 4.7.1 Motor Vehicle Collision History for Regional Road 55 at Lawrence Avenue

4.7.2 Road Surface Condition

Figure 4.7.2 shows the road surface conditions VS. number of collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred under dry road surface conditions.

Figure 4.7.2 Road Surface Condition VS. Number of Collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004

4.7.3 Condition of Environment

Figure 4.7.3 shows the condition of the environment VS. the number of collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004 inclusive. The highest number of collisions during clear conditions.

Figure 4.7.3 Condition of Environment VS. Number of Collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004

4.7.4 Time of Occurrence

Figure 4.7.4 shows the time of day VS. the number of collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred between the hours of 16:00 and 17:00.

Figure 4.7.4 Time of Day VS. Number of Collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004

4.7.5 Lighting conditions

Figure 4.7.5 shows lighting conditions VS. the number of collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred in daylight conditions, suggesting that at this intersection, lighting was not the major cause of collisions.

Figure 4.7.5 Lighting conditions VS. Number of Collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004

4.7.6 Impact Type

Figure 4.7.6 shows impact type VS. number of collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004 inclusive. Rear end collisions accounted for the highest number of collisions.

Figure 4.7.6 Impact Type VS. Number of Collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004 inclusive

4.7.7 Type of Collision

Figure 4.7.7 shows the type of collision VS. the number of collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004 inclusive. Non-reportable and non-fatal injury collisions accounted for the highest number of collisions.

Figure 4.7.7 Type of Collision VS. Number of Collisions on Regional Road 55 at Lawrence Avenue from 2000 to 2004

4.7.8 Summary of Findings for Regional Road 55 at Lawrence Avenue from 2000 to 2004

Table 4.7.8 shows the summary of all above charts. It shows the Year and all the conditions in which highest number of Collisions occurred.

Table 4.7.8 Summary of Findings for Regional Road 55 at Lawrence Avenue from 2000 to 2004

Factor	Sub-factor
Road surface condition	Dry
Condition of environment	Clear
Time of occurrence	16:00 to 17:00
Lighting conditions	Daylight
Impact type	Rear end
Type of collision	Non-reportable, Non-fatal injury

4.8 VICTORIA STREET BETWEEN LAWRENCE AVENUE AND BELMONT AVENUE

4.8.1 Motor Vehicle Collision History

Figure 4.8.1 shows the historical trend (five years) for motor vehicle collisions on Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004 inclusive.

Figure 4.8.1 Motor Vehicle Collision History for Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004

4.8.2 Road Surface Condition

Figure 4.8.2 shows the road surface conditions VS. the number of collisions on Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred under dry road surface conditions.

Figure 4.8.2 Road Surface Condition on Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004

4.8.3 Condition of Environment

Figure 4.8.3 shows the condition of the environment VS. the number of collisions on Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred during clear conditions.

Figure 4.8.3 Condition of Environment VS. Number of Collisions on Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004

4.8.4 Time of Occurrence

Figure 4.8.4 shows the time of day VS. the number of collisions on Regional Road BETWEEN Lawrence Avenue and Belmont Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred between the hours of 11:00 and 12:00.

Figure 4.8.4 Time of Day VS. Number of Collisions on Regional Road between Lawrence Avenue and Belmont Avenue from 2000 to 2004

4.8.5 Lighting Conditions

Figure 4.8.5 shows lighting conditions VS. the number of collisions on Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred in daylight conditions, suggesting that at this intersection, lighting was not the major cause of collisions.

Figure 4.8.5 Lighting Conditions VS. Number of Collisions on Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004

4.8.6 Impact Type

Figure 4.8.6 shows impact type VS. the number of collisions on Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004-inclusive. Rear end collisions accounted for the highest number of collisions.

Figure 4.8.6 Impact Type VS. Number of Collisions on Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004

4.8.7 Type of Collision

Figure 4.8.7 shows the type of collision VS. the number of collisions on Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004 inclusive. Non-reportable collisions accounted for the highest number of collisions.

Figure 4.8.7 Type of Collision VS. Number of Collisions on Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004

4.8.8 Summary of Findings for Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004

Table 4.8.8 summarizes the charts for Regional Road 55 between Lawrence Avenue and Belmont Avenue. It shows the collision factor and the sub-factor with the highest number of collisions from 2000 to 2004.

Table 4.8.8 Summary of Findings for Regional Road 55 between Lawrence Avenue and Belmont Avenue from 2000 to 2004

Factor	Sub-factor
Road surface condition	Dry
Condition of environment	Clear
Time of occurrence	11:00 to 12:00
Lighting conditions	Daylight
Impact type	Rear end
Type of collision	Non-reportable,

4.9 VICTORIA ST AT BELMONT AVENUE

4.9.1 Motor Vehicle Collision History

Figure 4.9.1 shows the historical trend (five years) for motor vehicle collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004 inclusive.

Figure 4.9.1 Motor Vehicle Collision History for Regional Road 55 at Belmont Avenue from 2000 to 2004

4.9.2 Road Surface Condition

Figure 4.9.2 shows the road surface conditions VS. the number of collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred under dry road surface conditions.

Figure 4.9.2 Road Surface Conditions on Regional Road 55 at Belmont Avenue from 2000 to 2004

4.9.3 Condition of Environment

Figure 4.9.3 shows the condition of the environment VS. the number of collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred under clear environment conditions.

Figure 4.9.3 Condition of Environment VS. Number of Collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004

4.9.4 Time of Occurrence

Figure 4.9.4 shows the time of day VS. the number of collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred between the hours of 14:00 and 15:00.

Figure 4.9.4 Time of Day VS. Number of Collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004

4.9.5 Lighting Conditions

Figure 4.9.5 shows lighting conditions VS. the number of collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004 inclusive. The highest number of collisions occurred in daylight conditions, suggesting that at this intersection, lighting was not the major cause of collisions.

Figure 4.9.5 Lighting Conditions VS. Number of Collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004

4.9.6 Impact Type

Figure 4.9.6 shows impact type VS. the number of collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004 inclusive. Rear end collisions followed by turning movement collisions accounted for the highest number of collisions.

Figure 4.9.6 Impact Type VS. Number of Collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004

4.9.7 Type of Collision

Figure 4.9.7 shows the type of collision VS. the number of collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004 inclusive. Property damage only collisions accounted for the highest number of collisions.

Figure 4.9.7 Type of Collision VS. Number of Collisions on Regional Road 55 at Belmont Avenue from 2000 to 2004

4.9.8 Summary of Findings for Regional Road 55 at Belmont Avenue from 2000 to 2004

Table 4.9.8 summarizes the charts for Regional Road 55 at Belmont Avenue. The Table shows the collision factor and the sub-factor with the highest number of collisions from 2000 to 2004.

Table 4.9.8

Factor	Sub-factor
Road surface condition	Dry
Condition of environment	Clear
Time of occurrence	14:00 to 15:00
Lighting conditions	Daylight
Impact type	Rear end
Type of collision	Property damage only,

4.10 CONCLUSIONS

Table 4.10.1 shows the conditions for which the highest number of collisions occurred at different locations along the Victoria Street (Regional Road 55) study corridor. The Table also shows the year in which the highest number of collisions occurred.

Table 4.10.1 Comparison of collisions at nine locations along the Victoria Street study corridor

	I	II	III	IV	V	VI	VII	VIII	IX
Year	2004	2001	2004	2003	2004	2004	2002	2003	2001
Road Surface Condition	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Condition of Environment	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Time of Occurrence	17,18	16,17	14,15	17, 18	16,17	16,17	16,17	11,12	14,15
Lighting conditions	DL	DL	DL	DL	DL	DL	DL	DL	DL
Impact Type	Rear End	Rear End	Rear End	Turning Movement	Rear End	Rear End	Rear End	Rear End	Rear End
Type of Collision	NR	NR	NR, PDO	NR	NR	PDO	NR, Non Fatal Injury	NR	PDO

I-Fisher-Hallman Rd, II- Between Fisher-Hallman and Hazelglen Drive., III- Hazelglen Drive., IV- Between Hazelglen and Westmount Road., V- Westmount Road., VI- Between Westmount and Lawrence Avenue., VII-Lawrence Avenue., VIII- Between Lawrence Avenue and Belmont Avenue ., IX- Belmont Avenue .

Table 4.10.1 shows that the most common characteristics of the collisions recorded along the Victoria Street corridor were:

- Dry road surface (road surface conditions);
- Clear weather (condition of environment);

- Between the hours of 14.00 and 18.00 (time of occurrence); and
- Occurring during daylight (lighting conditions).
- Rear end collisions were the most common type of collision (impact type) at all locations except location number IV (Between Hazelglen and Westmount Road).
- Non-reportable type of collision

Chapter 5

LEVEL OF SERVICE ANALYSIS

5.1 Introduction

This chapter discusses the software options available for the level of service (LOS) analyses conducted for intersections along the Victoria Street corridor. Options include Intersection Capacity Utilization (ICU), Highway Capacity Software (HCS 2000) and Synchro/Simtraffic Software.

Level of service analysis under existing traffic and geometric conditions was performed to determine the present quality of service provided by the major intersections along the Victoria Street corridor. The analysis was conducted using the ICU Spread Sheet, Highway Capacity Software (HCS 2000), Synchro/Simtraffic software and year 2004 traffic counts obtained from the Transportation Department of Region of Waterloo (Appendix A).

The level of service is an indicator of the quality of traffic flow with “A” being the best and “F” the worst.

5.2 Comparison of Intersection Capacity Utilization (ICU), Highway Capacity Software (HCS 2000) and Synchro/Simtraffic Software

The ICU method is a simple but powerful tool for measuring an intersection’s capacity. The ICU can be calculated using a single page worksheet that is both easy to generate and easy to review. (Reference No 16)

Highway Capacity Software (HCS 2000) is currently the most popular software for analyzing capacity. It is based on estimating delays at the intersection.

The Synchro/Simtraffic (simulation) suite is a complete solution for optimizing and modeling urban traffic networks. The suite is comprised of Synchro, signal timing and analysis program, and SimTraffic, an easy-to-use, microscopic simulation and animation package. (Reference No 20)

Table 5.2.1 compares the Intersection Capacity Utilization (ICU), Highway Capacity Software (HCS 2000) and Synchro/Simtraffic Software options.

Table 5.2.1 Comparison of Intersection Capacity Utilization (ICU), Highway Capacity Software (HCS 2000) and Synchro/Simtraffic (Simulation) Software

	ICU	HCM and Delay Based	Simulation
Measure of Effectiveness	Volume to Capacity	Delay	Delay, Stops, Queues
Best Applications	Planning, Impact Studies, Roadway Design	Operations, Signal Timing	Unusual Situations, Closely Spaced Intersections
Secondary Applications		Planning, Impact Studies, Roadway Design	Operations, Signal Timing, Planning, Impact Studies, Roadway Design
Pages of Input	0.3	2	4
Pages of Output	0.7	5	12
Expected Accuracy	10%	30%	30%
Dependent on signal timing	No	Yes	Yes

Source: ICU 2003 Addition, Reference No 16

5.3 Application of Intersection Capacity Utilization

The Intersection Capacity Utilization (ICU) method was applied to all the major signalized intersections along the Victoria Street corridor. Table 5.3.1 presents the results of the ICU method. See Appendix E for the ICU spreadsheets.

Table 5.3.1 Results of the Intersection Capacity Utilization Method Applied to Major Intersections along Victoria Street Corridor

Intersections along Victoria Street corridor	Intersection Capacity Utilization (ICU)	Intersection LOS
Fisher-Hallman Road	48.9%	A
Hazelglen Road	35.5%	A
Westmount Road	60.3%	B
Lawrence Avenue	48.0%	A
Belmont Avenue	66.2%	C

5.4 Application of Highway Capacity Software (HCS 2000)

Highway Capacity Software (HCS 2000) was also applied to all the major signalized intersections along the Victoria Street corridor. Table 5.4.1 presents the results obtained from the HCS 2000 software. See Appendix F for the detailed HCS 2000 Report.

Table 5.4.1 Results obtained from Highway Capacity Software (HCS 2000) Applied to Major Intersections along Victoria Street Corridor

Intersections along Victoria Street corridor	Intersection Delay	Intersection LOS
Fisher-Hallman Road	29.7 sec/veh	C
Hazelglen Road	19.1 sec/veh	B
Westmount Road	31.9 sec/veh	C
Lawrence Avenue	14.7 sec/veh	B
Belmont Avenue	26.3 sec/veh	B

5.5 Application of Synchro/Simtraffic software

Synchro/Simtraffic software provided a third analysis for all the major signalized intersections along the Victoria Street corridor. Figure 5.5.1 presents the Synchro results and shows the LOS of all major intersections along the corridor.

Figure 5.5.1 Level of Service Results obtained from Synchro for Major Intersections along Victoria Street Corridor

Figure 5.5.2 shows the Simtraffic Network with vehicle simulation along the Victoria Street corridor.

Figure 5.5.2 Simtraffic Network showing Vehicle Simulation along Victoria Street Corridor

Table 5.5.1 presents the results obtained from the Synchro/Simtraffic software. See Appendix G for the detailed Synchro/ Simtraffic Results

Table 5.5.1 Results obtained from Synchro/ Simtraffic Software Applied to Major Intersections along the Victoria Corridor

Intersections along Victoria Street corridor	Intersection Delay	Intersection LOS
Fisher-Hallman Road	21.8 sec/veh	C
Hazelglen Road	13.8 sec/veh	B
Westmount Road	29.7 sec/veh	C
Lawrence Avenue	9.9 sec/veh	A
Belmont Avenue	20.8 sec/veh	C

5.6 Summary of Results

Table 5.6.1 presents the results obtained from Intersection Capacity Utilization (ICU), Highway Capacity Software (HCS 2000) and Synchro/Simtraffic software

Table 5.6.1 Results obtained from Intersection Capacity Utilization (ICU), Highway Capacity Software (HCS 2000) and Synchro/Simtraffic Software

Intersections along Victoria Street Corridor	ICU		HCS 2000		Synchro/simtraffic	
	Intersection Capacity Utilization	Level of Service	Intersection Delay Sec/veh	Level of Service	Intersection Delay Sec/veh	Level of Service
Fisher- Hallman Road	48.9%	A	29.7 sec/veh	C	21.8 sec/veh	C
Hazelglen Road	35.5%	A	19.1 sec/veh	B	13.8 sec/veh	B
Westmount Road	60.3%	B	31.9 sec/veh	C	29.7 sec/veh	C
Lawrence Avenue	48.0%	A	14.7 sec/veh	B	9.9 sec/veh	A
Belmont Avenue	66.2%	C	26.3 sec/veh	B	20.8 sec/veh	C

Table 5.6.1 shows that, for the first three intersections listed, the ICU method gave a higher LOS than did the HCS 2000 and Synchro/Simtraffic methods. In the case of the last two intersections, the ICU and Synchro/Simtraffic methods gave similar LOS.

Also Table 5.2.1 presents that the expected accuracy of the ICU method is 10 %, compared with 30% for the HCS 2000 and Synchro/Simtraffic methods, this study used the HCS 2000 and Synchro/Simtraffic results.

Table 5.6.1 shows that Hazelglen Road/Victoria Street and Lawrence Avenue/Victoria Street are operating at a satisfactory level of service (LOS A or B). At Belmont Avenue/Victoria Street, HCS 2000 gives a LOS of B and Synchro/Simtraffic gives a LOS of C.

The LOS of the Fisher-Hallman/Victoria and Westmount/Victoria intersections, however, is only “C”. These two intersections have experienced significant increases in traffic volume and can be expected to operate at an unacceptable level of service in the future with decreases in the safety and efficiency of the two intersections.

An in-depth study of these two intersections is recommended. The study should consider possible geometric improvements and the possibility of revising the signal timing.

Chapter 6

FINDINGS OF SAFETY AUDIT

6.1 Introduction of Safety Audit

A safety audit was conducted on Victoria Street from the intersection at Fisher-Hallman Road to the intersection at Belmont Road, a distance of approximately one mile.

The audit was conducted using the “Road Safety Audit Guide” developed by the Transportation Association of Canada (TAC). It is a practical guide for conducting Road safety audit. The recommended practices outlined in this guide are based on current experience in Canada and internationally, and the latest road safety engineering research applicable to the Canadian environment.

A Road safety audit is an in-depth engineering study of an existing road using road safety principles with the purpose of identifying cost-effective countermeasures that would improve road safety and operations of all road users. The Road safety audit process includes following steps:

- Network screening to select a “High risk” Corridor of Region of waterloo,
- Data Collection
- In-depth study of the accidents that have occurred on the corridor during the last five years,
- Level of service analysis using various Software
- Identification of road safety problems and provide recommendations to address these problems using results from above mention analysis and site visit.

This chapter discusses the final step of Road safety audit process. It discusses about site visit, General findings of safety audit and specific finding at intersection.

6.2 Site Visit

- The first site visit took place on Feb 15, 2006 from approximately 13 PM to 16 PM. The purpose of the site visit was to have a general look and collect the physical data about the site.
- The second visit took place on March 06, 2006 from approximately 10AM to 13PM and from approximately 17 PM to 20 PM. Site visit was conducted using “ Site visit observation report” provided by Road Safety Audit Guide (TAC) to identify the safety problems. See Appendix D for the site visit observation Report of Victoria street corridor.

The weather during both visits was partly cloudy.

The safety audit site is located in a mixed residential and commercial area that has experienced considerable residential/commercial growth and will continue to experience more growth in the future. The corridor appears to be an unimproved route experiencing an increase in traffic volume. The increase in traffic volume is likely to lead to a concern for safety.

6.3 General Findings of the Safety Audit

The safety audit documentation and site visits found that the following safety issues affected much of the area audited:

- Inadequate pavement markings throughout the corridor. Vehicle paths, stop lines and crosswalk need to be repainted.
- From Fisher-Hallman to Hazelglen Drive, there is a downhill gradient with limited visibility on the side road approach, too many driveways, and slippery areas when the road is wet, increasing the risk of crashes. Additional signs (slippery when wet) should be provided to warn traffic. There is no advance warning of an upcoming signal over the top of the steep hill. This can result in inappropriate braking and steering maneuvers that may result in collisions. Figure 6.3.1 shows the downhill gradient from Fisher-Hallman to Hazelglen Drive.

Figure 6.3.1 Downhill Gradient from Fisher-Hallman Road to Hazelglen Drive

- There are too many driveways along the corridor. See Figure 6.3.2.

Figure 6.3.2 Driveways on Victoria Street Corridor

- Pavement quality throughout the corridor should be upgraded to create better drainage and to resist skidding. Figure 6.3.3 shows cracks and potholes in the pavement.

Figure 6.3.3 Cracks and Potholes in Pavement

Longitudinal cracks

Map Cracks and Potholes

- Morning and evening sunlight glare interferes with the visibility of east-west aligned traffic signals. Figure 6.3.4 illustrates the problem at Victoria/Westmount and at Victoria /Lawrence intersections.

Figure 6.3.4 Sunlight Glare at east-west aligned traffic signals

Victoria / Lawrence

Victoria / Westmount

6.4 Safety Audit Findings for Specific Intersections

The safety audit findings for individual intersections are discussed in the following sections.

6.4.1 Victoria Street and Fisher Hallman Road

The collision history from 2000 to 2004 inclusive (figure 4.1.1) showed that the Victoria Street and Fisher Hallman Road had the highest number of crashes in the year 2004. The higher number of collisions occurred during the evening peak hour. The LOS is C. Figure 6.4.1.1 is an aerial view of the Victoria/Fisher-Hallman intersection.

Figure 6.4.1.1 Aerial View of the Victoria/Fisher-Hallman Intersection

Source: City of Kitchener Website, Reference No 22

The following safety issues were noted in the audit:

- For vehicles traveling south on Fisher-Hallman Road, the intersection is not visible ahead of time due to a horizontal curve and there is no sign warning of the

intersection. The curve/intersection warning sign should be relocated further upstream.

- The speed zones on Fisher-Hallman Road should be reviewed. A speed reduction may reduce the number of crashes.
- The intersection has experienced a significant increase in traffic volume due to the development of adjacent properties for high-use commercial purposes. Increases in traffic volume can decrease the safety and efficiency of an intersection.
- This intersection had the highest number of collisions in 2004. A number of recommendations can be suggested to reduce the number of collisions: review the intersection; re-time the signals; improve signal visibility; improve sign visibility; increase decision sight distances; and provide additional traffic control devices such as red light cameras. If red light cameras are installed, a warning sign should be provided. Figure 6.4.1.3 shows the sign for red-light cameras.

Figure 6.4.1.2 Sign for Red-Light Cameras

Source: Federal Highway Administration Website, Reference No 18

Red-light cameras are recommended to stop red-light-running, reduce crashes, save lives, prevent injuries, lower health care costs and respond to community concerns about drivers who break traffic laws. (Reference No 18)

6.4.2 Victoria Street and Hazelglen Drive

The Victoria Street and Hazelglen Drive intersection is a 3-legged intersection. The collision history from year 2000 to 2004 inclusive (Figure 4.3.1) shows that this location had the highest number of collision in the year 2003 and 2004. The LOS is B. This LOS is fairly satisfactory, but as the collisions included non-fatal injury and property damage collisions, the intersection required a safety review. Figure 6.4.2.1 is an aerial view of the Victoria Street and Hazelglen Drive intersection

Figure 6.4.2.1 Aerial View of the Victoria Street and Hazelglen Drive Intersection

Source: City of Kitchener Website, Reference No 22

The following safety issues were noted in the audit:

- There is a risk of pedestrian accidents because vehicles turning left from Hazelglen and pedestrians crossing Victoria Street have a green signal at the same time. A pedestrian-only phasing in the traffic signal cycle should be considered. Crash data consistently show that collisions with pedestrians occur far more often with turning vehicles than with straight-through traffic. Left-turning vehicles are more often involved in pedestrian accidents than right-turning vehicles, partly because drivers are not able to see pedestrians to the left as well.
- Traffic queuing occurs due to the bus stop location on Hazelglen Road before Mooregate Crescent. The bus stop should be relocated further back after the intersection of Hazelglen Road and Mooregate Crescent.

6.4.3 Victoria Street and Westmount Road

The collision history of Victoria street and westmount road from year 2000 to 2004 inclusive (Figure 4.3.1) shows that at this location the number of crashes increased each year. Most crashes were sideswipe, rear end or angle. The intersection's LOS is C. Figure 6.4.3.1 is an aerial view of the Victoria/Westmount intersection

Figure 6.4.3.1 Aerial View of the Victoria/Westmount Intersection

Source: City of Kitchener Website, Reference No 22

- For vehicles traveling west on Victoria Street, the Victoria/Westmount intersection is not visible ahead of time due to the uphill vertical curve. The downhill gradient of this vertical curve has a sign warning drivers to avoid sharp braking. The sign should be replaced with a curve/intersection warning sign which should be relocated further upstream. Figure 6.4.3.2 shows the uphill gradient and the intersection's lack of visibility

Figure 6.4.3.2 Uphill Gradient of Vertical Curve on Victoria Street

- The distance between the Victoria/Hazelglen Road intersection and the Victoria/Westmount Road Intersection is very short. Two intersections within such close proximity can lead to an increase in traffic conflicts.
- Westbound on Victoria street between Hazelglen and Westmount Intersection, there is a parking entrance for 50-Mooregate Crescent Building and an entry/exit to a gas station. Eastbound on Victoria Street, there is an entry/exit to a shopping plaza and Vicmount Drive. The close proximity of the two intersections to these driveways may create traffic conflicts and an increase in crashes. Figure 6.4.3.3 shows two of the driveways.
- Traffic queuing occurs due to the bus stop location on Hazelglen Road before Mooregate Crescent. The bus stop should be relocated further back after the intersection of Hazelglen Road and Mooregate Crescent.

Figure 6.4.3.3 Driveways near Westmount Intersection

Mooregate Crescent Building Entrance

Entry/Exit of Gas Station

Entry/Exit of Shopping Plaza

Vicmount Drive

- The numerous trees around the intersection impede drivers' sight distance. The proximity between the intersections and the presence of the driveways leads to angle and sideswipe collisions. Additional signage and improved lighting are recommended. A No left turn for the vehicles using the exit from Mooregate Crescent could help to reduce collisions. A sign should be provided at the Entry/Exit of Mooregate Crescent Building. Alternatively, a median would prevent drivers from making a left turn. Figure 6.4.3.4 shows a vehicle making a left turn from the Moorgate Entrance onto Victoria Street.

Figure 6.4.3.4 Vehicle Making Left Turn from the Entrance of Mooregate Building onto Victoria Street

6.4.4 Victoria Street and Lawrence Avenue

The collision history of Victoria Street and Lawrence Avenue from year 2000 to 2004 inclusive (Figure 4.5.1) shows that at this location number of collisions decreased over the last two years. The intersection's LOS is B. Figure 6.4.4.1 is an aerial view of the Victoria/Lawrence Avenue intersection

Figure 6.4.4.1 Aerial View of the Victoria/Lawrence Avenue Intersection

Source: City of Kitchener Website, Reference No 22

- The numerous trees around the intersection impede drivers' sight distance. The trees should be removed and any new planting should be small or located so that sight distance is not impaired.
- Poor lighting at this intersection reduces pedestrian visibility to drivers during the hours of darkness. Lighting should be improved. Figure 6.4.4.2 shows the poor pedestrian visibility.

Figure 6.4.4.2 Poor Pedestrian Visibility at the Victoria Street and Lawrence Avenue Intersection

Source: City of Kitchener, Historic Reference No. 22

- The numerous trees around the intersection impede drivers' sight distance. The trees should be removed and any new planting should be small or located so that sight distance is not impaired.
- Poor lighting at this intersection reduces pedestrian visibility to drivers during the hours of darkness. Lighting should be improved. Figure 6.4.4.3 shows the poor pedestrian visibility.

6.4.5 Victoria Street and Belmont Avenue

Turning movement and rear end collisions are the most common types of collision at the Victoria Street and Belmont Avenue intersection. The intersection's LOS is C. Figure 6.4.5.1 is an aerial view of the Victoria/ Belmont Avenue intersection

Figure 6.4.5.1 Aerial View of the Victoria/ Belmont Avenue Intersection

Source: City of Kitchener Website, Reference No 22

- Southbound traffic on Belmont Avenue operates at low levels of service during peak hours due to numerous movements in and out of the various driveways, entrances, and streets with access onto Belmont Avenue. Figure 6.4.5.2 shows traffic queuing on southbound of Belmont Avenue at this intersection.

Figure 6.4.5.2 Traffic Queuing on Southbound of Belmont Avenue at the Victoria/ Belmont Avenue Intersection

- Signal heads should be increased in size. The crosswalks and stop lines should be re-stripped.

6.5 Conclusions

After reviewing the relevant data, documentation and site visit the study identifies all the issues and deficiencies on Victoria street corridor. Because the whole point of conducting an RSA is to improve safety, an important step is to actually implement the changes. This implementation also should be documented and made a part of safety audit.

In my judgment, consideration of the recommendations should improve the overall safety of the Victoria Street corridor.

Chapter 7

CONCLUSIONS

7.1 Road Safety Audits

A road safety audit is a safety tool that helps to reduce roadway crashes and fatalities. The audit helps to identify safety problems and to suggest appropriate potential solutions.

7.2 The Victoria Street Corridor Road Safety Audit

In this study, a corridor in Region of Waterloo, Ontario was selected for a road safety audit. The Victoria Street corridor was selected because it was a location known to have a high collision risk. The approach adopted was based on the “Road Safety Audit Guide” developed by the Transportation Association of Canada (TAC).

The safety audit of the Victoria Street corridor investigated the corridor’s collision history (for example, frequency and type of collision) and used site visits to make field observations and to collect data from the field. The data were analyzed using the Intersection Capacity Utilization (ICU) method, Highway Capacity Software (HCS 2000), and Synchro /Simtraffic software to establish the level of service (LOS) of the major intersections.

Numerous recommendations were developed from audit process. The recommendations included: improve pavement condition; remove or cut back vegetation; install new traffic signs; relocate existing traffic signs; revise and re-time signal timing, reduce the number of driveways at certain locations; revise speed zones; relocate bus stop locations; repaint crosswalks and stop lines; improve lighting; improve traffic signal visibility; improve sign visibility; increase sight distances; provide additional traffic control devices such as red light cameras; and conduct an in-depth study of selected intersections to consider possible geometric improvements.

7.3 Conclusions

The Victoria Street audit showed that a safety audit could be used to identify specific safety problems and treatments. To reduce the number of collisions in the short term, we can apply treatments, which may be readily implemented and relatively low-cost. Such treatments include changes to traffic signs, pavement markings, signal operations, and traffic control visibility. Longer term and higher cost treatments include road widening, adding travel lanes, and installing new signals.

A safety audit may become advisable because the original geometric and operational characteristics of corridor or intersection may become incompatible with the demands made by increasing traffic volumes and by changes in land use, road user behavior, population demographics, vehicle characteristics, traffic operations technology and road safety knowledge, all of which change over time. It becomes necessary to upgrade the operational and physical characteristics of a corridor or intersection to ensure that the roadway remains compatible with current traffic conditions and safety knowledge, and to reduce the potential for collisions.

The example of the Victoria Street safety audit showed that the audit approach is an excellent tool for evaluating and improving the safety of our highway system and minimizing the risk of accidents. Additional benefits include reducing long-term costs, enhancing awareness of road safety needs, and promoting awareness of safe design practices.

REFERENCES

1. NCHRP (National Cooperative Highway Research Program) SYNTHESIS 336, Road Safety Audits, Transportation Research Board of the National Academies.
2. Transportation Association of Canada, The Canadian Road Safety Audit Guide, TAC, 2004.
3. Transport Canada and the Canadian Council of Motor Transport Administrators (CCMTA), Road Safety Vision 2010, Transport Canada, 2002.
4. Transportation Association of Canada, Geometric Design Guide for Canadian Roads, TAC, 1999
5. Transportation Research Board, Highway Capacity Manual, National Research Council, 2000.
6. Pei Liu, Hsien-Guo Young. A Neural Network Approach on Studying the Effect of Urban Signalized Intersection Characteristics on Occurrence of Traffic Accident date?
7. Craig Lyon, Anwar Haq, Bhagwant Persaud, Steven T. Kodama. Development of safety performance functions for signalized Intersections in a large urban area and application to evaluation of left turn priority treatment. Transportation Research Board, 2005.
8. Filip Van den Bossche, Geert Wets and Tom Brijs. A Regression Model with ARMA Errors to Investigate the Frequency and Severity of Road Traffic Accidents. Transportation Research Board, 2004.
9. Richard J. Hanowski, Alejandra L. Medina, Walter W. Wierwille, Suzanne E. Lee. Incident Clustering: A Diagnostic Approach to Assess the Usability of Intersections and Other Road Sites, Transportation Research Board, 2004
10. King K. Mak, Dean L. Sicking, Karl Zimmerman. Road Safety Analysis Program (RSAP) – A Cost –Effectiveness Analysis Procedure, Transportation Research Board, 1998
11. Rune Elvik, Finn Harald Amundsen, Frode Hofset. Road Safety Effects of Bypasses, Transportation Research Board, 2001.

12. Kimberly A. Eccles, Joseph E. Hummer: Safety Effects of Fluorescent Yellow Warning Signs at Hazardous Sites in Daylight, Transportation Research Board, 2000
13. Tarek Sayed, Walid Abdelwahab, and John Nepomuceno: Safety Evaluation of Alternative Signal Head Design, Transportation Research Board, 2001
14. Fei Yuan, John N. Ivan, Xiao Qin, Norman W. Garrick, Christian F. Davis. Safety Benefits of Intersection Approach Realignment on Rural Two-lane Highways, Transportation Research Board, 2001
15. Charles V. Zegeer, J. Richard Stewart, and Herman Huang. Safety Effects of Marked vs Unmarked Crosswalks at Uncontrolled Locations: Analysis of Pedestrian Crashes in 30 Cities. Transportation Research Board, 2000
16. David Husch & John Albeck. Intersection Capacity Utilization Evaluation Procedures for Intersections and Interchanges 2003 edition. David Husch & John Albeck.
17. Road Safety Vision website, Visited on Oct 2005:
<http://www.tc.gc.ca/roadsafety/vision/menu.htm>
18. US Department of Transportation, Federal Highway Administration Website, Visited on Feb 2005. <http://safety.fhwa.dot.gov/index.htm>
19. Road Safety Audit website, Visited on Nov 2005:
<http://www.roadwaysafetyaudits.org/>
20. Trafficware website, Visited on Dec 2005
<http://www.trafficware.com>
21. Region of Waterloo website, Visited on Dec 2005:
<http://www.region.waterloo.on.ca>
22. City of Kitchener map website, Visited on Dec 2005
<http://www.city.kitchener.on.ca/maps/maps.htm>

APPENDIX A

TRAFFIC VOLUME DATA

REGIONAL MUNICIPALITY OF WATERLOO

TURNING MOVEMENT COUNT

Average Annual Daily Traffic

Total Factor = Monthly Factor 1.08 x Daily Factor 0.95 x 24 Hour Factor 2.03 = 2.082780

Municipality: Kitchener
Intersection: Victoria St. @ Hazelglen Dr.
Control: Signalized
Major Road: Victoria St.

Weather conditions:
 Sunny

Person(s) who counted:
 Jean

GeolD: 8625
Count Date: Wednesday, 10-Mar-04

North Leg Total: 6,961	% Trks	6%	0%	2%	
North Entering: 3,247	Heavys	44	0	2	46
North Peds: 117	Trucks	33	0	31	65
Peds Cross: X	Cars	1,293	0	1,843	3,137
	Total	1,370	0	1,877	

Heavys	73
Trucks	83
Cars	3,557
Total	3714

East Leg Total: 20,784
East Entering: 10,281
East Peds: 117
Peds Cross: X

Heavys	Trucks	Cars	Total
121	137	9,046	9,304

Hazelglen Dr.

Total	Cars	Trucks	Heavys	% Trks
2,347	2,272	46	29	3%
7,933	7,752	104	77	2%
0	0	0	0	0%
	10,024	150	106	

Victoria St.

% Trks	Heavys	Trucks	Cars	Total
6%	44	37	1,285	1,366
3%	115	110	8,402	8,627
0%	0	0	0	0
	158	148	9,687

Victoria St.

Cars	Trucks	Heavys	Total
10,245	142	117	10,503

XX

Peds Cross: X
West Peds: 65
West Entering: 9,993
West leg Total: 19,297

Heavys	0
Trucks	0
Cars	0
Total	0

Total	0	0	0
Cars	0	0	0
Trucks	0	0	0
Heavys	0	0	0
% Trks	0%	0%	0%

Peds Cross: X
South Peds: 0
South Entering: 0
South leg Total: 0

Comments

To determine the AADT (Average Annual Daily Traffic), add all four leg totals and divide by two.
 This will give you the approximate number of vehicles entering and exiting the intersection in a 24-hour period

Example:

$$\frac{(\text{West leg total} + \text{South leg total} + \text{East leg total} + \text{North leg total})}{2}$$

$$AADT = 23,521$$

Region of Waterloo Turning Movement Count

Annual Average Daily Traffic Diagram

Total Factor = Monthly Factor(1.05) x Daily Factor(0.96) x 24 Hour Factor(1.91) = 1.925280

Municipality: Kitchener
Site #: 8511000000
Intersection: Westmount Rd. & Victoria St.
TFR File #: 12
Count date: 20-Feb-2002

Weather conditions:
 Rain
Person(s) who counted:
 LS

**** Signalized Intersection ****

Major Road: Westmount Rd. runs N/S

North Leg Total: 19235
 North Entering: 9457
 North Peds: 121
 Peds Cross: X

	Heavys	Trucks	Cars	Totals
North	12	37	64	112
East	13	71	13	98
South	1550	6459	1238	9247
Totals	1575	6567	1315

Heavys 39
 Trucks 110
 Cars 9630
 Totals 9778

East Leg Total: 15352
 East Entering: 7000
 East Peds: 69
 Peds Cross: X

Heavys	Trucks	Cars	Totals
100	102	9147	9349

Westmount Rd.

Cars	Trucks	Heavys	Totals
687	12	2	701
4807	71	77	4956
1303	33	8	1344
6798	116	87

Victoria St.

Heavys	Trucks	Cars	Totals
13	19	2564	2597
44	96	6126	6267
19	4	1221	1244
77	119	9911

Victoria St.

Peds Cross: X
 West Peds: 162
 West Entering: 10108
 West Leg Total: 19457

Cars	Trucks	Heavys	Totals
8983	108	64	9155

Cars	Trucks	Heavys	Totals
2790	17	12	2819
6378	79	23	6480
749	13	8	770
9917	110	42	

Cars	Trucks	Heavys	Totals
8113	123	116	8352

Peds Cross: X
 South Peds: 33
 South Entering: 10069
 South Leg Total: 19224

Comments

REGIONAL MUNICIPALITY OF WATERLOO

TURNING MOVEMENT COUNT

Average Annual Daily Traffic

Total Factor = Monthly Factor 1.08 x Daily Factor 0.95 x 24 Hour Factor 2.03 = 2.082780

Municipality: Kitchener
Intersection: Victoria St. @ Lawrence Ave.
Control: Signalized
Major Road: Victoria St.

Weather conditions:
 Overcast
Person(s) who counted:
 Amanda

GeoID: 8522
Count Date: Tuesday, 22-Feb-05

North Leg Total:	1,214	% Trks	1%	1%	6%	
North Entering:	596	Heavys	0	0	0	0
North Peds:	46	Trucks	2	2	2	6
Peds Cross:	⌂	Cars	269	287	33	589
		Total	271	290	35

Heavys	2
Trucks	8
Cars	608
Total	619

East Leg Total:	17,962
East Entering:	9,206
East Peds:	10
Peds Cross:	⌂

Heavys	Trucks	Cars	Total
154	102	8,483	8,739

Lawrence Ave.

Total	Cars	Trucks	Heavys	% Trks
67	62	2	2	6%
7,698	7,461	87	150	3%
1,441	1,412	12	17	2%
	8,935	102	169	

Victoria St.

% Trks	Heavys	Trucks	Cars	Total
3%	0	4	160	165
3%	144	81	7,061	7,286
3%	6	27	996	1,029
	150	112	8,217

Victoria St.

Cars	Trucks	Heavys	Total
8,498	98	160	8,756

Lawrence Ave.

Total	771	387	1,435
Cars	754	385	1,404
Trucks	12	2	15
Heavys	4	0	17
% Trks	2%	1%	2%

Peds Cross:	⌂
West Peds:	121
West Entering:	8,479
West leg Total:	17,218

Heavys	23
Trucks	42
Cars	2,695
Total	2,760

Peds Cross:	⌂
South Peds:	75
South Entering:	2,593
South leg Total:	5,353

Comments

To determine the AADT (Average Annual Daily Traffic), add all four leg totals and divide by two.
 This will give you the approximate number of vehicles entering and exiting the intersection in a 24-hour period

Example:

$$\frac{(\text{West leg total} + \text{South leg total} + \text{East leg total} + \text{North leg total})}{2}$$

AADT = 20,874

REGIONAL MUNICIPALITY OF WATERLOO

TURNING MOVEMENT COUNT

Average Annual Daily Traffic

Total Factor = Monthly Factor 1.08 x Daily Factor 0.95 x 24 Hour Factor 2.03 = 2.082780

Municipality: Kitchener
Intersection: Victoria St. @ Belmont Ave.
Control: Signalized
Major Road: Victoria St.

Weather conditions:
 Cloudy
Person(s) who counted:
 Zibi

GeoID: 8520
Count Date: Wednesday, 25-Feb-04

North Leg Total:	16,094	% Trks	2%	3%	5%	
North Entering:	8,429	Heavys	15	69	44	127
North Peds:	94	Trucks	19	85	29	133
Peds Cross:	⌂	Cars	1,675	5,059	1,435	8,169
		Total	1,708	5,213	1,508

Heavys	112
Trucks	146
Cars	7,406
Total	7665

East Leg Total:	19,584
East Entering:	9,758
East Peds:	100
Peds Cross:	⌂

Heavys	90
Trucks	160
Cars	9,241
Total	9,491

Belmont Ave.

Total	1,491	Cars	1,429	Trucks	29	Heavys	33	% Trks	4%
	7,348		7,142		131		75		3%
	919		906		8		4		1%
			9,477		169		112		

Victoria St.

Victoria St.

% Trks	3%	Heavys	23	Trucks	19	Cars	1,264	Total	1,306
	3%		52		173		7,277		7,502
	2%		2		4		379		385
			77		196		8,921		

Belmont Ave.

Cars	9,516
Trucks	212
Heavys	98
Total	9,827

Peds Cross:	⌂
West Peds:	190
West Entering:	9,193
West leg Total:	18,685

Heavys	75
Trucks	98
Cars	6,344
Total	6,517

Total	435	4,867	816	
Cars	425	4,713	804	5,942
Trucks	10	98	10	119
Heavys	0	56	2	58
% Trks	2%	3%	2%	

Peds Cross:	⌂
South Peds:	69
South Entering:	6,119
South leg Total:	12,636

Comments

To determine the AADT (Average Annual Daily Traffic), add all four leg totals and divide by two.
 This will give you the approximate number of vehicles entering and exiting the intersection in a 24-hour period

Example:

$$\frac{(\text{West leg total} + \text{South leg total} + \text{East leg total} + \text{North leg total})}{2}$$

$$\text{AADT} = 33,499$$

APPENDIX B

SIGNAL PHASING &

TIMING PLAN

Region of Waterloo Input Requirements for Intersection Capacity Analysis

Program - we require using a program which uses the 2000 Highway Capacity Manual

Lost Time - we use 4 seconds

PHF - we use .9 for existing volumes, 1.0 for future volumes

Clearances - For through movements, amber of 4 seconds, all red of 2 seconds (total 6 seconds)
- For Left Turn Arrows, amber of 3 seconds, all red of 1 second (total 4 seconds)
- For Fully Pprotected Left Turn arrows, amber 4 seconds, all red 2 seconds (total 6 seconds)

Pedestrian movements - walking speed of 1.06 metres/second

Left turn movements - we generally consider dual left turn lanes when the volume of left turns reaches 500

Cycle lengths - we only use cycle lengths which end in 0 (zero) and along a corridor, a common cycle length must be used for progression
- generally speaking, we don't use cycle lengths over 90 seconds for single lane approach intersections and CBD intersections
- the highest corridor cycle length in use is 120 seconds, anything higher than this is for very short durations and under special operating conditions

Queue Lengths - we use the 90th percentile

Saturation Flow Values

Dual left turn lanes - 1775

Left turn lane - 1775

Through lane - 1900

Right turn lane - 1750

Combination Through and Through/Right (2 lane approach) – 1775

Combination Through, Through and Through/Right (3 lane approach) - 1820

Through/Left lane - 1650

Through/Right lane - 1650

Left/Through/Right lane - 1550 (single lane approach)

Jan/05

FISCHER-HALLMAN & VICTORIA - INT #100**T08-50/143K**

Fixed time operation

Actuated flashing Northbound-Southbound left turn arrows on Fischer-Hallman

Actuated flashing Eastbound-Westbound left turn arrows on Victoria St

Signal timing in effect: (07:00 - 10:00; Monday to Friday)**FISCHER-HALLMAN ROAD**

N-S Grn Arrow - Min	- 5.0 sec	
- Ext	- 3.0 sec	
- Max	- 18.0 sec (SB)	
- Max	- 8.0 sec (NB)	
N-S Amber Arrow	- 3.0 sec	
All Red	- 1.0 sec	
Green	- 42.0 sec	Walk - 22.0 sec
Amber	- 4.0 sec	FDW - 20.0 sec
All Red	- 2.0 sec	

VICTORIA STREET

E-W Grn Arrow - Min	- 5.0 sec	
- Ext	- 3.0 sec	
- Max	- 7.0 sec	
E-W Amber Arrow	- 3.0 sec	
All Red	- 1.0 sec	
Green	- 33.0 sec	Walk - 11.0 sec
Amber	- 4.0 sec	FDW - 22.0 sec
All Red	- 2.0 sec	
TOTAL	120.0 seconds	

Cont'd...P2

Signal timing in effect: (10:00 - 15:00; 19:00 - 22:00, Monday to Friday)
(11:00 - 18:00 Sunday)

FISCHER-HALLMAN ROAD

N-S Grn Arrow - Min	- 5.0 sec	
- Ext	- 3.0 sec	
- Max	- 10.0 sec	
N-S Amber Arrow	- 3.0 sec	
All Red	- 1.0 sec	
Green	- 40.0 sec	Walk - 20.0 sec
Amber	- 4.0 sec	FDW - 20.0 sec
All Red	- 2.0 sec	

VICTORIA STREET

E-W Grn Arrow - Min	- 5.0 sec	
- Ext	- 3.0 sec	
- Max	- 8.0 sec	
E-W Amber Arrow	- 3.0 sec	
All Red	- 1.0 sec	
Green	- 32.0 sec	Walk - 10.0 sec
Amber	- 4.0 sec	FDW - 22.0 sec
All Red	- 2.0 sec	
TOTAL	110.0 seconds	

Cont'd...P3

Signal timing in effect: (15:00 - 19:00; Monday to Friday)
(08:30 - 22:00 Saturday)

FISCHER-HALLMAN ROAD

N-S Grn Arrow - Min	- 5.0 sec	
- Ext	- 3.0 sec	
- Max	- 12.0 sec (SB)	
- Max	- 7.0 sec (NB)	
N-S Amber Arrow	- 3.0 sec	
All Red	- 1.0 sec	
Green	- 45.0 sec	Walk - 25.0 sec
Amber	- 4.0 sec	FDW - 20.0 sec
All Red	- 2.0 sec	

VICTORIA STREET

E-W Grn Arrow - Min	- 5.0 sec	
- Ext	- 3.0 sec	
- Max	- 7.0 sec (EB)	
- Max	- 10.0 sec (WB)	
E-W Amber Arrow	- 3.0 sec	
All Red	- 1.0 sec	
Green	- 33.0 sec	Walk - 11.0 sec
Amber	- 4.0 sec	FDW - 22.0 sec
All Red	- 2.0 sec	
TOTAL	120.0 seconds	

Signal timing in effect: (All Other Times)

FISCHER-HALLMAN ROAD

Green	- 35.0 sec	Walk - 15.0 sec
Amber	- 4.0 sec	FDW - 20.0 sec
All Red	- 2.0 sec	

VICTORIA STREET

Green	- 33.0 sec	Walk - 11.0 sec
Amber	- 4.0 sec	FDW - 22.0 sec
All Red	- 2.0 sec	
TOTAL	80.0 seconds	

VICTORIA STREET & HAZEL GLEN DRIVE - #104**T08-50/193K**

Sidestreet vehicle phase callable and extendable.

Sidestreet pedestrian phase callable.

Audible signals to cross east and west legs of Victoria

Non-actuated eastbound flashing advance green on Victoria

Signal timing in effect: (07:00 - 10:00; 14:00 - 20:00 Monday to Friday)
(08:30 - 22:00 Saturday)**VICTORIA STREET**

EB Adv Grn - 11.0 sec

EB Clearance - 2.0 sec

Green - 58.0 sec

Amber - 4.0 sec

All Red - 2.0 sec

Walk - 48.0 sec

FDW - 10.0 sec

HAZELGLEN DRIVE**Vehicle Call****Pedestrian Call**

Green - Min - 8.0 sec

-Ext - 3.0 sec

-Max - 27.0 sec

Amber - 4.0 sec

All Red - 2.0 sec

TOTAL 110.0 seconds

Green/Walk - 7.0 sec

Green/FDW - 11.0 sec

Green/SDW - 9.0 sec

Amber - 4.0 sec

All Red - 2.0 sec

Signal timing in effect: (10:00 - 14:00, Monday to Friday)
(11:00 - 18:00 Sunday)**VICTORIA STREET**

EB Adv Grn - 10.0 sec

EB Clearance - 2.0 sec

Green - 49.0 sec

Amber - 4.0 sec

All Red - 2.0 sec

Walk - 39.0 sec

FDW - 10.0 sec

HAZELGLEN DRIVE**Vehicle Call****Pedestrian Call**

Green - Min - 8.0 sec

-Ext - 3.0 sec

-Max - 27.0 sec

Amber - 4.0 sec

All Red - 2.0 sec

TOTAL 100.0 seconds

Green/Walk - 7.0 sec

Green/FDW - 11.0 sec

Green/SDW - 9.0 sec

Amber - 4.0 sec

All Red - 2.0 sec

#75 - WESTMOUNT ROAD @ VICTORIA STREET

T08-50/116K

Fixed time operation.

Actuated NB/SB Flashing Left turn arrows on Westmount Rd

Actuated EB/WB Flashing Left turn arrows on Victoria St

Signal timing in effect: (07:00 - 10:00; 14:00 - 20:00 Monday to Friday)
(08:30 - 22:00 Saturday)

Westmount Road

NB/SB Grn Arrow	-Min - 5.0 sec	
	-Ext - 3.0 sec	
	-Max - 12.0 sec	
Amber Arrow	- 4.0 sec	
Green	- 35.0 sec	Walk - 18.0 sec
Amber	- 4.0 sec	FDW - 17.0 sec
All Red	- 2.0 sec	

Victoria Street

EB/WB Grn Arrow	-Min - 5.0 sec	
	-Ext - 3.0 sec	
	-Max - 11.0 sec	
Amber	- 4.0 sec	
Green	- 32.0 sec	Walk - 9.0 sec
Amber	- 4.0 sec	FDW - 23.0 sec
All Red	- 2.0 sec	
Total	110.0 seconds	

Signal timing in effect: (10:00 - 14:00; 20:00 - 22:00 Monday to Friday)
(11:00 - 18:00 Sunday)

Westmount Road

NB/SB Grn Arrow	-Min - 5.0 sec	
	-Ext - 3.0 sec	
	-Max - 12.0 sec	
Amber Arrow	- 4.0 sec	
Green	- 26.0 sec	Walk - 9.0 sec
Amber	- 4.0 sec	FDW - 17.0 sec
All Red	- 2.0 sec	

Victoria Street

EB/WB Grn Arrow	-Min - 5.0 sec	
	-Ext - 3.0 sec	
	-Max - 10.0 sec	
Amber	- 4.0 sec	
Green	- 32.0 sec	Walk - 9.0 sec
Amber	- 4.0 sec	FDW - 23.0 sec
All Red	- 2.0 sec	
Total	100.0 seconds	

Signal timing in effect: (All Other Times)

Westmount Road

Green	- 32.0 sec	Walk - 15.0 sec
Amber	- 4.0 sec	FDW - 17.0 sec
All Red	- 2.0 sec	

Victoria Street

Green	- 36.0 sec	Walk - 13.0 sec
Amber	- 4.0 sec	FDW - 23.0 sec
All Red	- 2.0 sec	
Total	80.0 seconds	

Feb/06

VICTORIA STREET & LAWRENCE AVE. - #107**T08-50/186K**

Sidestreet vehicle phase callable and extendable.
Sidestreet pedestrian phase callable.

Signal timing in effect: (07:30-09:00; 11:30-13:30, 15:00-19:00, Monday to Friday)
(08:30 - 18:00 Saturday; 11:00 - 18:00 Sunday)

VICTORIA STREET

Green	- 58.0 sec	Walk	- 47.0 sec
Amber	- 4.0 sec	FDW	- 11.0 sec
All Red	- 2.0 sec		

LAWRENCE AVENUE**Vehicle Call****Pedestrian Call**

Green - Min	- 7.0 sec	Green/Walk	- 7.0 sec
-Ext	- 3.0 sec	Green/FDW	- 11.0 sec
-Max	- 30.0 sec	Green/SDW	- 12.0 sec
Amber	- 4.0 sec	Amber	- 4.0 sec
All Red	- 2.0 sec	All Red	- 2.0 sec
TOTAL	100.0 seconds		

Signal timing in effect: (All Other Times)

VICTORIA STREET

Green	- 36.0 sec	Walk	- 25.0 sec
Amber	- 4.0 sec	FDW	- 11.0 sec
All Red	- 2.0 sec		

LAWRENCE AVENUE**Vehicle Call****Pedestrian Call**

Green - Min	- 7.0 sec	Green/Walk	- 7.0 sec
-Ext	- 3.0 sec	Green/FDW	- 11.0 sec
-Max	- 22.0 sec	Green/SDW	- 4.0 sec
Amber	- 4.0 sec	Amber	- 4.0 sec
All Red	- 2.0 sec	All Red	- 2.0 sec
TOTAL	70.0 seconds		

Feb/06

VICTORIA ST & BELMONT AVENUE - #70

1. Fixed time mode of control
2. Left turn phase on Belmont is not actuated
3. Belmont runs north-south

Signal timing in effect: (07:30 - 09:00, 11:30 - 13:30, Monday to Friday)
(08:30 - 18:00 Saturday; 11:00 - 18:00 Sunday)

VICTORIA STREET

Green	- 51.0 seconds	Walk	- 40.0 seconds
Amber	- 4.0 seconds	FDW	- 11.0 seconds
All Red	- 2.0 seconds		

BELMONT AVENUE

Southbound Advance Green	- 7.0 seconds		
Southbound Clearance	- 2.0 seconds		
Green	- 28.0 seconds	Walk	- 20.0 seconds
Amber	- 4.0 seconds	FDW	- 8.0 seconds
All Red	- <u>2.0 seconds</u>		
TOTAL	100.0 seconds		

Signal timing in effect: (09:00 - 11:30, 13:30 - 15:00, 19:00 - 21:00, Mon to Friday)
(18:00 - 21:00, Saturday)

VICTORIA STREET

Green	- 29.0 seconds	Walk	- 18.0 seconds
Amber	- 4.0 seconds	FDW	- 11.0 seconds
All Red	- 2.0 seconds		

BELMONT AVENUE

Southbound Advance Green	- 7.0 seconds		
Southbound Clearance	- 2.0 seconds		
Green	- 20.0 seconds	Walk	- 12.0 seconds
Amber	- 4.0 seconds	FDW	- 8.0 seconds
All Red	- <u>2.0 seconds</u>		
TOTAL	70.0 seconds		

Signal timing in effect: (15:00 - 19:00, Monday to Friday)

VICTORIA STREET

Green	- 52.0 seconds	Walk - 41.0 seconds
Amber	- 4.0 seconds	FDW - 11.0 seconds
All Red	- 2.0 seconds	

BELMONT AVENUE

Southbound Advance Green	- 8.0 seconds	
Southbound Clearance	- 2.0 seconds	
Green	- 26.0 seconds	Walk - 18.0 seconds
Amber	- 4.0 seconds	FDW - 8.0 seconds
All Red	- <u>2.0 seconds</u>	
TOTAL	100.0 seconds	

Signal timing in effect: (All Other Times)

VICTORIA STREET

Green	- 33.0 seconds	Walk - 22.0 seconds
Amber	- 4.0 seconds	FDW - 11.0 seconds
All Red	- 2.0 seconds	

BELMONT AVENUE

Green	- 25.0 seconds	Walk - 17.0 seconds
Amber	- 4.0 seconds	FDW - 8.0 seconds
All Red	- <u>2.0 seconds</u>	
TOTAL	70.0 seconds	

APPENDIX C

COLLISION DATA

Collision Summary

Victoria Street (Regional Road #55)

from Fischer-Hallman Road to King Street

KITCHENER

From January 1, 2000 to December 31, 2004

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
WESTMOUNT RD AT VICTORIA ST								
Total for Location = 72 collisions								
12/06/04	4	3	8	1	2	4	1	1
11/30/04	1	1	16	1	3	4	1	1
10/30/04	2	7	6	7	2	4	1	1
10/17/04	2	2	16	1	3	2	1	1
8/16/04	1	1	14	1	7	4	4	1
8/12/04	1	1	8	1	3	3	1	1
7/16/04	1	1	12	1	2	3	1	34
7/10/04	1	1	18	1	2	3	1	1
6/21/04	2	2	21	7	3	2	1	1
6/01/04	2	1	17	1	3	4	1	1
5/31/04	2	2	11	1	3	4	1	1
4/10/04	1	1	10	1	3	3	1	4
3/23/04	2	3	17	1	3	4	1	4
2/21/04	6	5	17	5	5	2	5	1
2/21/04	6	3	19	7	3	4	1	1
2/19/04	2	1	16	1	3	3	1	4
1/15/04	6	1	11	1	3	2	1	1
1/13/04	3	1	7	3	5	4	1	
1/13/04	2	1	10	1	2	4	1	5
1/10/04	1	1	11	1	2	3	1	5
12/16/03	2	1	17	7	5	2	1	1
12/07/03	1	1	10	1	4	4	1	1
11/14/03	1	1	22	7	5	3	1	1
10/01/03	2	2	23	7	8	2	1	

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
9/26/03	1	✓	19	5	8	2	1	
9/17/03	1	1	16	1	5	4	1	4
9/17/03	1	1	10	1	8	2	1	
9/14/03	2	2	3	7	7	3	5	
8/28/03	1	1	23	7	5	3	1	1
8/02/03	1	1	20	1	3	4	1	4
7/01/03	1	1	17	1	3	3	1	1
6/13/03	1	1	20	1	3	2	1	1
5/25/03	1	2	0	7	5	2	1	4
5/21/03	1	1	8	1	3	4	1	5
2/10/03	2	1	15	1	3	4	4	
2/09/03	1	1	20	7	5	2	1	1
1/23/03	5	3	12	1	3	3	1	1
1/22/03	2	1	13	1	3	4	1	1
12/17/02	1	1	10	1	1	2	1	1
12/04/02	1	1	12	1	4	4	4	1
11/11/02	1	1	16	1	3	4	1	1
10/10/02	1	1	9	1	5	3	1	1
8/07/02	1	(1)	20	5	3	2	4	1
7/19/02	1	(1)	8	1	3	2	5	1
7/11/02	1	(1)	16	1	5	4	1	1
6/07/02	1	1	16	1	5	3	1	4
5/23/02	1	1	10	1	3	4	5	1
5/11/02	1	1	17	1	3	3	1	1
3/28/02	1	1	16	1	3	3	1	1
2/26/02	6	3	20	7	7	3	1	
2/01/02	2	3	9	1	4	4	1	1
1/22/02	2	1	18	7	4	3	1	4
11/26/01	1	1	13	1	4	2	1	1
10/20/01	1	1	12	1	4	4	5	1
10/08/01	1	1	15	1	2	3	1	1
10/01/01	1	1	8	1	1	3	36	1
8/12/01	1	1	18	1	2	2	1	1
6/20/01	1	1	18	1	3	4	1	1
4/16/01	2	2	16	1	5	2	4	1
2/14/01	2	3	18	5	3	4	1	1

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
1/26/01	3	3	21	7	3	3	1	5
1/19/01	1	1	18	7	4	3	1	1
1/05/01	6	1	11	1	3	4	1	1
10/18/00	1	1	13	1	2	3	1	1
5/19/00	1	1	16	1	5	4	1	1
5/13/00	2	2	9	1	4	3	1	5
4/28/00	1	1	16	1	2	2	1	1
3/16/00	1	1	9	1	2	3	1	5
2/06/00	1	1	19	7	4	4	1	
2/04/00	1	1	14	1	3	4	6	1
1/09/00	1	1	2	7	7	3	5	
1/07/00	1	1	15	1	6	2	1	

VICTORIA ST

AT

FISCHER-HALLMAN RD

Total for Location = 116 collisions

12/20/04	5	3	22	7	7	3	1	
12/06/04	2	1	17	7	3	4	1	1
11/06/04	1	1	9	1	5	3	1	1
11/06/04	1	1	8	1	4	4	1	1
10/31/04	1	1	23	7	7	3	4	
10/24/04	2	2	18	7	5	4	1	5
10/20/04	1	1	15	1	5	2	1	1
10/14/04	2	2	18	7	3	3	1	1
9/30/04	1	1	19	7	3	4	1	1
9/16/04	1	1	14	1	3	3	4	1
9/01/04	1	1	11	1	5	3	1	1
7/16/04	1	1	18	1	5	2	2	1
7/07/04	1	1	18	1	3	2	1	1
7/02/04	1	1	13	1	3	4	1	1
6/23/04	2	2	21	5	3	4	1	1
6/19/04	2	2	3	7	3	2	1	1
5/25/04	2	2	16	1	5	2	4	4
5/07/04	1	1	8	1	3	4	4	1
5/01/04	1	1	17	1	3	2	4	1
4/18/04	1	1	12	1	3	4	4	1
4/18/04	1	1	19	7	3	2	1	1
4/09/04	1	1	17	1	5	2	1	1

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
3/14/04	6	1	22	7	4	4	1	1
3/12/04	2	1	21	7	3	3	1	1
3/09/04	1	1	17	1	3	2	8	1
3/06/04	1	1	13	1	3	4	4	4
1/25/04	1	1	9	1	3	4	4	1
1/14/04	3	3	11	1	5	2	4	1
1/13/04	6	5	10	1	3	3	5	5
1/12/04	6	4	23	7	3	3	1	1
12/13/03	1	1	11	1	4	4	4	1
11/26/03	1	1	11	1	3	4	4	
11/26/03	1	1	11	1	3	2	1	4
11/12/03	2	2	22	7	5	3	1	1
10/17/03	1	1	17	1	3	4	1	1
9/28/03	2	2	2	7	3	3	1	1
9/15/03	2	2	15	1	3	4	98	1
9/05/03	1	1	15	1	3	2	1	5
8/17/03	1	1	13	1	3	4	1	1
7/03/03	1	1	11	1	3	4	1	
6/23/03	1	1	18	1	3	4	1	4
6/12/03	2	2	18	1	3	3	1	1
3/19/03	2	2	23	7	5	3	1	1
3/13/03	2	1	16	1	3	2	1	1
3/04/03	2	3	16	1	3	4	5	1
2/22/03	4	3	18	7	3	3	1	4
1/23/03	3	1	16	1	3	3	4	1
1/22/03	1	1	16	1	3	4	4	1
1/03/03	2	3	17	5	3	4	1	1
12/15/02	2	1	9	1	2	3	1	
12/12/02	2	1	7	1	3	4	4	1
12/07/02	2	1	18	5	5	2	31	14
12/01/02	4	1	9	1	3	4	4	
12/01/02	6	3	8	1	2	4	5	4
11/27/02	1	1	18	7	5	4	1	1
11/19/02	2	1	15	1	3	4	1	1
10/04/02	1	1	0	7	7	4	1	
9/27/02	2	2	15	1	3	4	1	1

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
9/27/02\	2	2	14	1	3	2	4	1
9/14/02	2	2	0	7	3	2	1	4
9/14/02	1	2	20	7	3	4	1	1
9/05/02	1	1	18	1	3	4	1	6
8/23/02	1	1	17	1	2	2	1	1
7/25/02	1	1	20	1	3	4	1	1
7/12/02	1	1	8	1	3	3	1	1
6/20/02	1	1	17	1	3	4	1	1
6/07/02	1	1	16	1	3	4	5	4
5/11/02	2	2	20	7	3	3	1	1
4/25/02	1	1	12	1	5	2	1	17
2/27/02	3	3	9	1	4	3	8	9
2/11/02	1	1	18	5	3	4	1	1
2/11/02	1	1	17	1	5	2	4	1
2/10/02	1	1	19	7	7	3	1	
1/05/02	2	3	22	7	3	3	1	1
12/22/01	2	2	20	7	3	2	1	1
12/17/01	2	1	22	7	7	3	1	1
12/17/01	2	2	7	1	3	4	1	1
12/17/01	2	2	7	3	3	4	1	
12/13/01	2	2	9	1	2	3	4	1
11/27/01	2	1	21	7	4	4	1	1
11/26/01	2	2	6	7	3	4	4	1
11/18/01	1	1	13	1	3	3	1	1
10/16/01	2	2	8	1	3	4	1	1
10/15/01	1	1	14	1	3	3	1	1
10/14/01	2	2	14	1	3	2	1	1
10/12/01	2	2	17	1	5	4	1	1
9/20/01	2	1	13	1	3	4	4	6
9/09/01	1	1	12	1	5	3	1	1
9/07/01	1	1	8	1	5	3	1	4
9/06/01	1	1	15	1	3	4	5	4
6/20/01	2	99	8	1	3	3	1	4
6/10/01	2	2	2	7	2	3	4	1
5/17/01	1	1	19	1	3	4	1	5
4/28/01	1	1	17	1	3	4	1	1

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
4/18/01	1	1	18	1	4	4	1	
4/06/01	1	1	14	1	3	4	1	4
3/05/01	4	3	19	7	3	2	1	1
1/24/01	2	3	18	7	3	3	1	1
12/27/00	2	3	17	5	5	4	1	1
12/08/00	4	3	19	5	4	4	4	1
12/05/00	5	5	13	1	5	4	4	1
11/09/00	2	2	18	7	3	4	5	1
11/04/00	2	2	12	1	3	4	5	1
11/03/00	1	1	6	3	4	4	5	1
10/05/00	2	2	15	1	5	4	1	1
9/27/00	1	1	9	1	3	4	1	1
8/29/00	1	1	21	7	3	4	1	1
6/16/00	2	2	20	5	3	4	1	1
5/28/00	1	1	16	1	3	4	1	1
5/24/00	2	2	14	1	7	3	1	
5/15/00	1	1	17	1	3	4	1	1
4/07/00	2	2	19	5	7	3	1	
3/20/00	1	1	11	1	3	4	6	1
3/17/00	1	1	16	1	3	2	1	1
3/08/00	1	1	17	1	3	2	2	1
1/05/00	1	1	13	1	3	2	1	1

VICTORIA ST S

BTWN

Fenwick Crt/Monte Carlo & FISCHER-HALLMA

Total for Location = 3 collisions

12/02/04	2	1	17	5	4	4	1	4
9/01/04	1	1	16	1	3	4	1	1
4/13/03	1	1	11	1	3	2	1	1

VICTORIA ST

AT

Fenwick Crt/Monte Carlo St

Total for Location = 6 collisions

9/27/04	1	1	17	1	5	2	36	1
4/22/03	99	1	8	1	5	4	4	1
12/14/01	4	3	16	1	3	4	1	1
10/12/01	2	2	23	7	3	3	1	1
8/31/01	2	2	14	1	3	3	1	1
1/05/01	2	1	15	1	5	4	1	1

Date	Road	Environment	Time	Light	Impact	Classification of	Type of Vehicle	
	Surface	Condition			Type		Accident	Vehicle 1
VICTORIA ST S BTWN Fenwick Crt/Monte Carlo & Hazelglen								
Total for Location = 1 collision								
1/17/03	1	1	18	7	3	2	1	1
VICTORIA ST AT Hazelglen Dr								
Total for Location = 29 collisions								
10/15/04	2	2	15	1	5	2	1	4
5/08/04	2	2	15	1	3	2	1	1
2/21/04	6	1	17	5	3	4	4	1
1/27/04	3	4	12	1	3	3	1	9
12/21/03	1	1	11	1	5	4	1	1
9/15/03	2	2	14	1	3	3	1	1
8/28/03	1	1	18	1	3	3	1	1
6/01/03	1	1	15	1	3	2	1	1
3/22/03	2	1	17	1	4	3	1	1
2/17/03	3	1	13	1	4	3	14	1
2/07/03	1	1	8	1	3	4	5	1
1/04/03	2	1	14	1	5	4	1	1
10/03/02	1	1	18	5	3	2	9	1
1/10/02	2	1	17	1	5	3	1	1
9/19/01	1	1	13	1	3	3	1	1
8/24/01	1	1	14	1	5	2	5	36
8/04/01	1	1	18	1	3	3	1	1
7/26/01	1	1	20	5	8	2	1	
7/21/01	2	2	17	1	3	3	5	4
5/14/01	1	1	9	1	3	4	5	1
11/21/00	1	6	18	5	3	4	1	1
11/09/00	2	2	21	7	5	4	1	1
10/05/00	2	2	15	1	3	4	1	1
5/28/00	1	1	15	1	4	4	1	1
5/24/00	2	2	8	1	3	2	4	1
4/23/00	1	1	15	1	3	4	1	1
4/08/00	2	2	3	7	4	2	1	1
1/23/00	4	1	10	1	3	3	1	1
1/20/00	4	3	6	1	3	4	1	5
VICTORIA ST S BTWN Hazelglen & Vicmount								
Total for Location = 2 collisions								

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
11/25/03	1	1	10	1	7	3	0	
5/27/02	1	1	6	1	1	4	1	1
VICTORIA ST AT Vicmount Dr								
<i>Total for Location = 3 collisions</i>								
10/31/02	2	1	11	1	5	3	1	1
1/15/01	1	2	16	1	5	4	1	
1/07/00	1	1	21	7	2	3	4	1
VICTORIA ST S BTWN Vicmount & WESTMOUNT								
<i>Total for Location = 26 collisions</i>								
11/04/04	2	2	12	1	3	4	1	1
8/17/04	1	1	7	1	5	2	1	1
6/05/04	1	1	21	7	2	2	1	36
12/12/03	3	3	15	1	5	3	4	5
10/02/03	1	1	14	1	5	2	5	36
6/03/03	1	1	17	1	8	2	1	
5/15/03	1	1	18	1	5	4	1	1
5/02/03	1	1	16	1	5	3	1	5
4/23/03	1	1	15	1	3	2	1	1
1/17/03	1	1	17	1	5	3	5	1
12/19/02	2	2	20	7	2	3	1	6
12/19/02	2	1	15	1	5	4	1	1
4/15/02	1	1	10	1	3	3	5	1
3/23/02	1	1	18	1	3	4	1	4
12/17/01	2	2	18	7	5	4	5	4
10/11/01	2	2	17	1	3	4	4	
9/22/01	1	1	4	7	7	3	1	
5/03/01	1	1	18	1	2	4	1	1
4/12/01	1	1	14	1	4	4	4	1
2/09/01	2	4	18	7	3	2	5	5
12/05/00	3	3	8	1	3	2	1	1
12/05/00	3	3	13	1	6	2	1	1
9/04/00	1	1	16	1	3	4	1	5
6/23/00	1	1	14	1	4	4	4	4
5/19/00	2	2	8	1	4	4	1	1
5/02/00	1	1	19	1	2	3	1	1

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
VICTORIA ST S BTWN Weichel & WESTMOUNT								
<i>Total for Location = 13 collisions</i>								
11/29/04	1	1	13	1	5	2	1	1
10/30/04	2	2	11	1	4	3	4	1
3/22/04	1	1	15	1	5	4	1	
12/24/03	1	99	14	1	2	3	1	1
11/03/03	2	2	13	1	3	4	4	1
11/22/02	1	1	17	7	5	2	1	1
8/20/02	1	1	17	1	2	3	1	5
11/23/01	1	1	11	1	2	4	4	1
11/13/01	1	1	16	1	2	4	6	4
10/26/01	2	2	17	5	2	4	1	1
10/23/01	1	1	17	1	2	2	1	4
9/12/00	1	1	18	1	1	3	4	1
6/09/00	2	2	11	1	2	2	5	1
VICTORIA ST AT Weichel St								
<i>Total for Location = 7 collisions</i>								
12/18/03	1	1	17	7	3	4	5	1
7/15/03	2	2	18	1	4	3	1	4
2/10/03	6	3	17	5	1	3	1	
2/24/02	1	1	0	7	3	3	5	1
11/27/01	2	2	17	7	3	4	4	1
8/13/01	1	1	13	1	3	2	4	4
1/03/01	2	3	12	1	4	3	1	6
VICTORIA ST S BTWN Paulander & Weichel								
<i>Total for Location = 4 collisions</i>								
7/18/04	2	1	13	1	6	4	1	
1/17/04	3	3	21	7	7	3	1	
1/17/02	2	3	18	7	2	4	1	1
11/02/01	2	1	16	1	3	4	1	1
VICTORIA ST AT Paulander Dr								
<i>Total for Location = 8 collisions</i>								
9/02/04	1	1	19	1	3	3	1	1
5/24/04	1	1	16	1	5	4	1	1
4/17/04	2	2	11	1	5	3	1	1
1/22/02	1	1	15	1	4	4	1	1

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
1/18/02	4	3	8	1	2	2	1	1
10/01/01	1	1	20	1	3	2	1	1
9/25/01	2	2	12	1	7	2	1	
2/20/00	1	1	17	1	2	4	1	1
VICTORIA ST S BTWN Alice & Paulander								
<i>Total for Location = 6 collisions</i>								
2/21/04	6	3	18	7	7	4	1	1
2/15/04	1	1	14	1	3	4	4	4
1/26/04	3	3	20	5	4	3	1	1
3/26/02	4	3	13	1	5	3	1	1
1/31/02	5	4	12	1	3	3	5	5
1/25/02	1	1	10	1	4	3	1	1
VICTORIA ST AT Alice Ave								
<i>Total for Location = 3 collisions</i>								
4/04/03	3	3	15	1	7	3	1	
12/17/01	2	2	16	1	2	3	1	1
4/06/01	1	1	16	1	7	3	1	
VICTORIA ST S BTWN Alice & Lawrence								
<i>Total for Location = 6 collisions</i>								
10/15/04	2	2	19	7	3	1	1	1
9/27/04	1	1	11	1	5	2	5	1
2/01/02	3	4	16	1	3	4	4	1
2/01/02	3	3	18	5	7	3	4	
9/11/00	1	1	22	7	7	3	1	
8/04/00	1	1	15	1	2	3	1	1
VICTORIA ST AT Lawrence Ave								
<i>Total for Location = 35 collisions</i>								
10/15/04	2	1	21	7	3	2	1	1
8/09/04	1	1	21	7	7	2	4	
6/29/04	1	1	17	1	5	2	1	36
12/30/03	1	1	16	5	8	2	1	
12/12/03	5	3	11	1	5	4	1	1
6/25/03	1	1	10	1	4	3	11	1
4/27/03	8	1	17	1	3	4	1	1
1/26/03	2	1	16	1	2	3	4	1
12/14/02	2	1	10	1	5	3	1	1

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
12/10/02	1	1	16	1	2	3	4	4
11/30/02	1	1	13	1	3	4	4	9
10/19/02	2	2	18	7	3	4	1	1
10/18/02	2	1	8	1	3	2	1	1
10/10/02	1	1	17	1	3	4	1	1
10/07/02	2	2	9	1	3	4	1	1
7/20/02	2	2	14	1	3	4	1	1
7/09/02	1	1	16	1	3	2	1	1
5/27/02	1	1	9	1	4	4	1	1
3/14/02	1	1	4	7	3	3	1	1
2/26/02	3	3	16	1	3	4	1	5
2/11/02	1	1	16	1	3	2	1	1
2/04/02	2	1	11	1	4	3	1	98
2/02/02	1	1	21	7	5	3	5	4
12/21/01	2	1	11	1	2	4	1	1
11/27/01	2	7	21	7	3	3	1	1
10/19/01	1	1	19	7	2	2	1	1
10/16/01	2	2	12	1	2	2	1	1
10/11/01	2	2	15	1	3	2	1	1
4/14/01	1	1	21	7	3	4	1	1
11/23/00	2	1	20	7	5	2	5	36
8/24/00	1	1	7	1	5	3	5	1
6/29/00	1	1	13	1	5	2	4	1
3/23/00	1	1	14	1	3	4	1	1
3/03/00	1	1	2	7	3	4	1	1
1/03/00	1	1	14	1	3	2	1	1

VICTORIA ST S

BTWN

Belmont & Lawrence

Total for Location = 11 collisions

11/02/04	2	2	14	1	4	3	1	1
4/27/04	1	1	16	1	3	4	1	1
3/05/04	1	1	13	1	99	4	1	1
8/17/03	1	1	12	1	5	2	2	1
7/19/03	1	1	12	1	2	4	1	1
3/10/03	1	1	14	1	5	4	6	6
1/07/03	2	1	11	1	3	4	1	4
5/04/02	1	1	12	1	2	4	1	1

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
10/23/01	1	1	19	7	3	3	1	1
10/22/01	1	1	15	1	2	4	1	13
5/26/00	1	1	11	1	3	4	1	5
VICTORIA ST AT Belmont Ave <i>Total for Location = 66 collisions</i>								
12/16/04	3	3	21	7	3	4	4	1
12/02/04	1	1	11	1	5	3	1	4
11/30/04	2	2	19	7	5	2	36	1
11/12/04	1	1	7	1	3	3	9	1
11/11/04	1	1	10	1	99	3	1	34
9/22/04	1	1	17	1	3	4	4	1
9/16/04	1	1	12	1	3	4	1	1
7/23/04	1	1	21	5	2	3	1	1
7/14/04	1	1	19	1	2	2	1	1
6/04/04	2	1	14	1	5	2	1	1
4/02/04	1	1	15	1	99	4	1	1
2/20/04	2	1	15	1	5	4	4	1
1/14/04	6	1	9	1	3	4	4	5
1/13/04	4	1	8	1	4	4	6	7
12/02/03	4	1	7	1	5	4	1	4
9/26/03	1	1	14	1	5	3	1	1
8/18/03	1	1	18	1	2	3	4	1
8/06/03	2	2	4	7	3	3	1	1
8/03/03	1	1	10	1	5	4	5	1
7/11/03	2	2	12	1	3	2	1	1
7/11/03	1	1	15	1	5	4	1	5
6/14/03	1	1	15	1	3	3	1	4
6/13/03	2	2	8	1	3	4	1	1
5/17/03	1	1	20	1	5	2	1	1
4/25/03	1	1	8	1	2	4	1	1
1/16/03	2	1	13	1	2	4	1	5
1/16/03	4	1	8	1	5	3	1	1
12/25/02	4	1	20	7	3	2	1	1
12/03/02	2	3	19	7	5	3	9	1
11/25/02	2	1	10	1	1	3	4	1
11/22/02	1	1	19	7	3	4	1	5

Date	Road Surface Condition	Environment Condition	Time	Light	Impact Type	Classification of Accident	Type of Vehicle	
							Vehicle 1	Vehicle 2
10/28/02	1	1	18	7	3	4	1	5
9/27/02	2	2	12	1	7	3	1	
7/18/02	2	1	17	1	3	4	4	4
7/16/02	1	1	11	1	5	2	1	1
3/14/02	1	1	10	1	5	2	1	1
1/29/02	1	1	13	1	5	3	1	1
11/13/01	1	1	8	1	3	3	1	1
10/09/01	1	1	7	1	2	3	1	1
9/19/01	2	2	19	7	4	3	1	1
9/17/01	1	1	9	1	3	4	1	1
9/06/01	1	1	15	1	5	2	1	5
9/04/01	1	1	15	1	3	2	1	1
8/22/01	1	1	15	1	3	3	1	1
7/07/01	2	2	12	1	3	4	1	
6/27/01	1	1	14	1	7	3	0	
6/05/01	1	1	16	1	5	3	13	1
5/27/01	2	2	12	1	5	4	1	1
3/27/01	1	1	18	1	2	2	1	1
3/15/01	1	1	14	1	5	3	4	1
2/20/01	2	1	14	1	3	4	5	1
2/20/01	1	1	13	1	3	2	13	1
2/09/01	2	2	18	7	8	2	1	
12/19/00	3	3	7	1	4	3	1	14
11/05/00	2	1	2	7	3	2	1	1
9/28/00	1	1	15	1	5	3	1	4
8/14/00	1	1	17	1	3	4	0	
8/02/00	1	1	16	1	2	3	1	1
7/31/00	1	1	16	1	4	3	13	1
7/05/00	1	1	17	1	3	4	1	1
6/08/00	1	1	13	1	2	3	1	1
6/02/00	1	1	16	1	2	3	1	16
5/24/00	1	1	7	1	2	4	9	1
4/03/00	2	2	8	1	4	4	14	98
3/01/00	2	2	14	1	4	4	13	5
2/23/00	2	1	6	1	5	2	1	1

Road Surface Condition: 1-dry, 2-wet, 3-loose snow, 4-slush, 5-packed snow, 6-ice, 7-mud, 8-loose sand, 9-spilled liquid, 99-other

Environment Condition: 1-clear, 2-rain, 3-snow, 4-freezing rain, 5-drilling snow, 6-strong wind, 7-fog, mist, smoke, 99-other

Light: 1-daylight, 3-Dawn, 5-Dusk, 99-other

Impact Type: 1-approaching, 2-angle, 3-rear end, 4-sideswipe, 5-turning movement, 6-SMV*/animal/pedestrian, 7-SMV*/fixed object, 99-other

Classification of Accident: 1-fatal injury, 2-non-fatal injury, 3-property damage only, 4-non-reportable, 99-other

Type of Vehicle: 1-automobile, 2-motorcycle, 3-moped, 4-Passenger van, 5-pick up truck, 6-delivery van, 7-tow truck, 8-truck(open), 9-truck(closed), 10-truck(tank), 11-truck(dump), 12-truck(car carrier), 13-truck(tractor), 14-transit bus, 15-intercity bus, 16-bus(other), 17-school bus, 18-school van, 19-other school vehicle, 20-motor home, 21-off-road vehicle(2wheels), 22-off-road vehicle(3wheels), 23-off-road vehicle(4wheels), 24-off-road(other), 25-motorized snow vehicle, 26-farm tractor, 27-other farm vehicle, 28-construction equipment, 29-railway train, 30-street car, 31-snow plow, 32-ambulance, 33-fire vehicle, 34-police vehicle, 35-other emergency vehicle, 36-bicycle, 37-buggy(horse), 00-unknown, 98-truck(other), 99-other

*SMV = Single Motor Vehicle

APPENDIX D

SITE VISIT OBSERVATION

REPORT

APPENDIX D

SITE VISIT SAMPLE OBSERVATION REPORT

FIELD OBSERVATION REPORT <u>Intersection</u>	
Location <u>Victoria St / Fisher-hallman</u>	Date <u>March 06, 2006</u>
Observer <u>Dhara Sudani</u>	Time <u>10 AM - 11 AM</u>
Part I - Physical Checklist	
	Comments
1 Are there sight distance obstructions to:	
a. Traffic control devices?	
✓ b. Intersections and driveways?	<u>On south bound - due to H curve.</u>
c. Turning or oncoming vehicles?	
2 Does parking affect:	
a. Sight distance?	
b. Through or turning vehicle paths?	
3 Is horizontal alignment inadequate?	
4 Is vertical alignment inadequate?	
5 Is pavement width or the number of lanes inadequate?	
6 Are intersection or driveway radii too short?	
7 Are there problems with driveways or bus stops such as:	
a. Inadequate design?	
✓ b. Location near major intersection?	<u>Bus stop is near to intersection.</u>
c. Too many driveways?	
8 Is channelization inadequate for:	
a. Reducing conflict points?	
b. Separating traffic flows or defining movements?	
9 Should pedestrian crosswalks be:	
a. Added?	
b. Relocated or repainted?	
10 Are there problems with traffic signs such as:	
a. Inadequate or improper message?	
b. Too many signs?	
c. Placement or size?	
11 Are there problems with traffic signals such as:	
a. Timing?	
b. Number of signal heads?	
c. Placement or size? Poles?	
✓ 12 Are there problems with pavement markings such as:	
a. Vehicle paths not clearly marked?	<u>Need to repaint.</u>
b. Location of the markings?	
✓ 13 Do posted speed limits appear to be too high or too low for conditions?	<u>High - On Fisherhallman Rd.</u>
14 Does the pavement condition (potholes, irregular surface, etc.) appear to contribute to safety problems?	
15 Is roadway lighting inadequate?	
16 Are there tire skid marks on the pavement?	
17 Is there evidence of vehicle collisions such as scar marks on trees, utility poles, embankments, or other objects?	
18 Is there an abundance of vehicle collision debris such as small pieces of crushed glass, plastic, etc., along the shoulder or in the median area?	

SITE VISIT SAMPLE OBSERVATION REPORT

continued

Part II - Operational Checklist	
1	Do obstructions block the driver's view of opposing or conflicting vehicles? _____
2	Do drivers have trouble finding the correct path through the location? _____
3	Is there any indication of driver confusion about routes, street names, or other guidance information? _____
4	Do steep grades create large speed differences? _____
5	Are pavement surfaces conditions creating erratic driver movements? _____
6	Does the presence of existing driveways contribute to erratic driver movements? _____
7	Is excessive vehicle delay, queuing creating unsafe risk-taking by motorists? _____
8	Are there large speed differences between vehicles: a. Traveling through the location? _____ b. Turning at driveways or intersections? _____
9	Do drivers respond incorrectly to: a. Signals? _____ b. Signs or other traffic control devices? _____ c. Turning lanes? _____
10	Are problems being caused by the volume of: a. Through traffic? _____ b. Turning traffic? _____
11	Do pedestrian movements create conflicts? _____
12	Do bicycle movements create conflicts? _____
13	Is there considerable weaving or lane changing by drivers at the location? _____
14	Are there violations of parking at the location? _____
15	Are there violations of other traffic control devices or regulations such as: ☒ a. Running red light? _____ b. Failing to stop or yield the right-of-way? _____ c. Speed limits? _____ d. Right-turn-on-red? _____ e. Other? _____
16	Are there traffic flow problems or traffic conflict patterns associated with turning vehicles? _____
17	Are there any other unusual traffic flow problems or traffic conflict patterns? _____
18	Does inadequate lighting cause drivers to slow down or create erratic manoeuvres? _____
comments This intersection is a high volume traffic intersection. Need to provide additional traffic control devices such as red light cameras.	

APPENDIX D

SITE VISIT SAMPLE OBSERVATION REPORT

FIELD OBSERVATION REPORT <u>Intersection</u>	
Location <u>Victoria St / Hazelglen Dr</u>	Date <u>March 06, 2006</u>
Observer <u>Dhara Sudani</u>	Time <u>11 AM</u>
Part I - Physical Checklist	
	Comments
1 Are there sight distance obstructions to:	
a. Traffic control devices?	
b. Intersections and driveways?	
c. Turning or oncoming vehicles?	
2 Does parking affect:	
a. Sight distance?	
b. Through or turning vehicle paths?	
3 Is horizontal alignment inadequate?	
4 Is vertical alignment inadequate?	
5 Is pavement width or the number of lanes inadequate?	
6 Are intersection or driveway radii too short?	
7 Are there problems with driveways or bus stops such as:	
a. Inadequate design?	
☒ b. Location near major intersection?	<u>Bus stop location creating</u>
c. Too many driveways?	<u>queuing on Victoria St.</u>
8 Is channelization inadequate for:	<u>Hazelglen</u>
a. Reducing conflict points?	
b. Separating traffic flows or defining movements?	
9 Should pedestrian crosswalks be:	
a. Added?	
b. Relocated or repainted?	
10 Are there problems with traffic signs such as:	
a. Inadequate or improper message?	
b. Too many signs?	
c. Placement or size?	
11 Are there problems with traffic signals such as:	
☒ a. Timing?	<u>Need to consider</u>
b. Number of signal heads?	<u>pedestrian only phasing</u>
c. Placement or size? Poles?	<u>traffic signal cycle.</u>
12 Are there problems with pavement markings such as:	
a. Vehicle paths not clearly marked?	
b. Location of the markings?	
13 Do posted speed limits appear to be too high or too low for conditions?	
☒ 14 Does the pavement condition (potholes, irregular surface, etc.) appear to contribute to safety problems?	<u>Potholes & cracks on the</u>
15 Is roadway lighting inadequate?	<u>Pavement</u>
16 Are there tire skid marks on the pavement?	
17 Is there evidence of vehicle collisions such as scar marks on trees, utility poles, embankments, or other objects?	
18 Is there an abundance of vehicle collision debris such as small pieces of crushed glass, plastic, etc., along the shoulder or in the median area?	

SITE VISIT SAMPLE OBSERVATION REPORT

continued

Part II - Operational Checklist	
1	Do obstructions block the driver's view of opposing or conflicting vehicles?
2	Do drivers have trouble finding the correct path through the location?
3	Is there any indication of driver confusion about routes, street names, or other guidance information?
4	Do steep grades create large speed differences?
5	Are pavement surfaces conditions creating erratic driver movements?
6	Does the presence of existing driveways contribute to erratic driver movements?
7	Is excessive vehicle delay, queuing creating unsafe risk-taking by motorists?
8	Are there large speed differences between vehicles:
	a. Traveling through the location?
	b. Turning at driveways or intersections?
9	Do drivers respond incorrectly to:
	a. Signals?
	b. Signs or other traffic control devices?
	c. Turning lanes?
10	Are problems being caused by the volume of:
	a. Through traffic?
	b. Turning traffic?
✓ 11	Do pedestrian movements create conflicts?
12	Do bicycle movements create conflicts?
13	Is there considerable weaving or lane changing by drivers at the location?
14	Are there violations of parking at the location?
15	Are there violations of other traffic control devices or regulations such as:
	a. Running red light?
	b. Failing to stop or yield the right-of-way?
	c. Speed limits?
	d. Right-turn-on-red?
	e. Other?
16	Are there traffic flow problems or traffic conflict patterns associated with turning vehicles?
17	Are there any other unusual traffic flow problems or traffic conflict patterns?
18	Does inadequate lighting cause drivers to slow down or create erratic manoeuvres?
<p>comments</p> <p>This intersection has traffic queuing due to bus stop location. Need to relocate bus stop.</p>	

Pedestrian conflicts with
left turn vehicles from Hazelton.

APPENDIX D

SITE VISIT SAMPLE OBSERVATION REPORT

FIELD OBSERVATION REPORT		Intersection
Location	<u>Victoria st. / Westmount Rd</u>	
Observer	<u>Dhoro Sudan</u>	
Date	<u>March 06, 2006</u>	
Time	<u>11:30 AM</u>	
Part I - Physical Checklist		
		Comments
1 Are there sight distance obstructions to:		
a. Traffic control devices?		
✓ b. Intersections and driveways?		<u>Vertical gradient obstructions</u>
c. Turning or oncoming vehicles?		<u>Westmount Intersection area</u>
2 Does parking affect:		
a. Sight distance?		
b. Through or turning vehicle paths?		
3 Is horizontal alignment inadequate?		
4 Is vertical alignment inadequate?		
5 Is pavement width or the number of lanes inadequate?		
6 Are intersection or driveway radii too short?		
7 Are there problems with driveways or bus stops such as:		
a. Inadequate design?		
b. Location near major intersection?		
✓ c. Too many driveways?		<u>Too many Driveways between</u>
8 Is channelization inadequate for:		<u>Westmount & Hazelton Creek</u>
a. Reducing conflict points?		<u>problems</u>
b. Separating traffic flows or defining movements?		
9 Should pedestrian crosswalks be:		
a. Added?		
b. Relocated or repainted?		
10 Are there problems with traffic signs such as:		
a. Inadequate or improper message?		
b. Too many signs?		
c. Placement or size?		
11 Are there problems with traffic signals such as:		
a. Timing?		
b. Number of signal heads?		
c. Placement or size? Poles?		
12 Are there problems with pavement markings such as:		
a. Vehicle paths not clearly marked?		<u>Need to repaint</u>
b. Location of the markings?		
13 Do posted speed limits appear to be too high or too low for conditions?		
14 Does the pavement condition (potholes, irregular surface, etc.) appear to contribute to safety problems?		
15 Is roadway lighting inadequate?		
16 Are there tire skid marks on the pavement?		
17 Is there evidence of vehicle collisions such as scar marks on trees, utility poles, embankments, or other objects?		
18 Is there an abundance of vehicle collision debris such as small pieces of crushed glass, plastic, etc., along the shoulder or in the median area?		

SITE VISIT SAMPLE OBSERVATION REPORT

continued

Part II - Operational Checklist	
1	Do obstructions block the driver's view of opposing or conflicting vehicles?
2	Do drivers have trouble finding the correct path through the location?
3	Is there any indication of driver confusion about routes, street names, or other guidance information?
4	Do steep grades create large speed differences?
5	Are pavement surfaces conditions creating erratic driver movements?
6	Does the presence of existing driveways contribute to erratic driver movements?
7	Is excessive vehicle delay, queuing creating unsafe risk-taking by motorists?
8	Are there large speed differences between vehicles:
	a. Traveling through the location?
	b. Turning at driveways or intersections?
9	Do drivers respond incorrectly to:
	a. Signals?
	b. Signs or other traffic control devices?
	c. Turning lanes?
10	Are problems being caused by the volume of:
	a. Through traffic?
	b. Turning traffic?
11	Do pedestrian movements create conflicts?
12	Do bicycle movements create conflicts?
13	Is there considerable weaving or lane changing by drivers at the location?
14	Are there violations of parking at the location?
15	Are there violations of other traffic control devices or regulations such as:
	a. Running red light?
	b. Failing to stop or yield the right-of-way?
	c. Speed limits?
	d. Right-turn-on-red?
	e. Other?
16	Are there traffic flow problems or traffic conflict patterns associated with turning vehicles?
17	Are there any other unusual traffic flow problems or traffic conflict patterns? <u>Vehicles taking Left turn from Mountain entrance create conflicts.</u>
18	Does inadequate lighting cause drivers to slow down or create erratic manoeuvres?
<p>comments</p> <p><u>Too many Driveways is the major problem of this intersection. Need to provide some additional signs to avoid traffic conflicts.</u></p>	

APPENDIX D

SITE VISIT SAMPLE OBSERVATION REPORT

FIELD OBSERVATION REPORT		Intersection
Location	Victoria St. / Lawrence Ave	
Observer	Othara Sudan	
Date	March 06, 2006	
Time	12:30 PM; 7 PM	
Part I - Physical Checklist		
		Comments
1	Are there sight distance obstructions to:	
	a. Traffic control devices?	
	b. Intersections and driveways?	Trees along intersection
	c. Turning or oncoming vehicles?	inhibits sight distance.
2	Does parking affect:	
	a. Sight distance?	
	b. Through or turning vehicle paths?	
3	Is horizontal alignment inadequate?	
4	Is vertical alignment inadequate?	
5	Is pavement width or the number of lanes inadequate?	
6	Are intersection or driveway radii too short?	
7	Are there problems with driveways or bus stops such as:	
	a. Inadequate design?	
	b. Location near major intersection?	
	c. Too many driveways?	
8	Is channelization inadequate for:	
	a. Reducing conflict points?	
	b. Separating traffic flows or defining movements?	
9	Should pedestrian crosswalks be:	
	a. Added?	
	b. Relocated or repainted?	
10	Are there problems with traffic signs such as:	
	a. Inadequate or improper message?	
	b. Too many signs?	
	c. Placement or size?	
11	Are there problems with traffic signals such as:	
	a. Timing?	
	b. Number of signal heads?	
	c. Placement or size? Poles?	
12	Are there problems with pavement markings such as:	
	a. Vehicle paths not clearly marked?	
	b. Location of the markings?	
13	Do posted speed limits appear to be too high or too low for conditions?	
14	Does the pavement condition (potholes, irregular surface, etc.) appear to contribute to safety problems?	
✓ 15	Is roadway lighting inadequate?	Lighting is not sufficient
16	Are there tire skid marks on the pavement?	
17	Is there evidence of vehicle collisions such as scar marks on trees, utility poles, embankments, or other objects?	
18	Is there an abundance of vehicle collision debris such as small pieces of crushed glass, plastic, etc., along the shoulder or in the median area?	

SITE VISIT SAMPLE OBSERVATION REPORT

continued

Part II - Operational Checklist	
1	Do obstructions block the driver's view of opposing or conflicting vehicles? _____
2	Do drivers have trouble finding the correct path through the location? _____
3	Is there any indication of driver confusion about routes, street names, or other guidance information? _____
4	Do steep grades create large speed differences? _____
5	Are pavement surfaces conditions creating erratic driver movements? _____
6	Does the presence of existing driveways contribute to erratic driver movements? _____
7	Is excessive vehicle delay, queuing creating unsafe risk-taking by motorists? _____
8	Are there large speed differences between vehicles: a. Traveling through the location? _____ b. Turning at driveways or intersections? _____
9	Do drivers respond incorrectly to: a. Signals? _____ b. Signs or other traffic control devices? _____ c. Turning lanes? _____
10	Are problems being caused by the volume of: a. Through traffic? _____ b. Turning traffic? _____
11	Do pedestrian movements create conflicts? _____
12	Do bicycle movements create conflicts? _____
13	Is there considerable weaving or lane changing by drivers at the location? _____
14	Are there violations of parking at the location? _____
15	Are there violations of other traffic control devices or regulations such as: a. Running red light? _____ b. Failing to stop or yield the right-of-way? _____ c. Speed limits? _____ d. Right-turn-on-red? _____ e. Other? _____
16	Are there traffic flow problems or traffic conflict patterns associated with turning vehicles? _____
17	Are there any other unusual traffic flow problems or traffic conflict patterns? _____
18	Does inadequate lighting cause drivers to slow down or create erratic manoeuvres? _____
comments This intersection need to provide additional lighting.	

APPENDIX D

SITE VISIT SAMPLE OBSERVATION REPORT

FIELD OBSERVATION REPORT		Intersection	
Location	<u>Victoria St. / Belmont Ave</u>	Date	<u>March 06, 2006</u>
Observer	<u>Phara Sudani</u>	Time	<u>1:15 PM</u>
Part I - Physical Checklist			
		Comments	
1	Are there sight distance obstructions to:		
	a. Traffic control devices?		
	b. Intersections and driveways?		
	c. Turning or oncoming vehicles?		
2	Does parking affect:		
	a. Sight distance?		
	b. Through or turning vehicle paths?		
3	Is horizontal alignment inadequate?		
4	Is vertical alignment inadequate?		
5	Is pavement width or the number of lanes inadequate?		
6	Are intersection or driveway radii too short?		
7	Are there problems with driveways or bus stops such as:		
	a. Inadequate design?		
	b. Location near major intersection?		
	c. Too many driveways?		
8	Is channelization inadequate for:		
	a. Reducing conflict points?		
	b. Separating traffic flows or defining movements?		
9	Should pedestrian crosswalks be:		
	a. Added?		
	b. Relocated or repainted?		
10	Are there problems with traffic signs such as:		
	a. Inadequate or improper message?		
	b. Too many signs?		
	c. Placement or size?		
11	Are there problems with traffic signals such as:		
	a. Timing?		
	b. Number of signal heads?		
	c. Placement or size? Poles?		
12	Are there problems with pavement markings such as:		
	a. Vehicle paths not clearly marked?		
	b. Location of the markings?		
13	Do posted speed limits appear to be too high or too low for conditions?		
14	Does the pavement condition (potholes, irregular surface, etc.) appear to contribute to safety problems?		
15	Is roadway lighting inadequate?		
16	Are there tire skid marks on the pavement?		
17	Is there evidence of vehicle collisions such as scar marks on trees, utility poles, embankments, or other objects?		
18	Is there an abundance of vehicle collision debris such as small pieces of crushed glass, plastic, etc., along the shoulder or in the median area?		

Need to increase size
of signal heads.

Need to Repair
Crosswalks & Stopline.

SITE VISIT SAMPLE OBSERVATION REPORT

continued

Part II - Operational Checklist	
1	Do obstructions block the driver's view of opposing or conflicting vehicles?
2	Do drivers have trouble finding the correct path through the location?
3	Is there any indication of driver confusion about routes, street names, or other guidance information?
4	Do steep grades create large speed differences?
5	Are pavement surfaces conditions creating erratic driver movements?
6	Does the presence of existing driveways contribute to erratic driver movements?
7	Is excessive vehicle delay, queuing creating unsafe risk-taking by motorists?
8	Are there large speed differences between vehicles:
	a. Traveling through the location?
	b. Turning at driveways or intersections?
9	Do drivers respond incorrectly to:
	a. Signals?
	b. Signs or other traffic control devices?
	c. Turning lanes?
10	Are problems being caused by the volume of:
	a. Through traffic?
	b. Turning traffic?
11	Do pedestrian movements create conflicts?
12	Do bicycle movements create conflicts?
13	Is there considerable weaving or lane changing by drivers at the location?
14	Are there violations of parking at the location?
15	Are there violations of other traffic control devices or regulations such as:
	a. Running red light?
	b. Failing to stop or yield the right-of-way?
	c. Speed limits?
	d. Right-turn-on-red?
	e. Other?
16	Are there traffic flow problems or traffic conflict patterns associated with turning vehicles?
17	Are there any other unusual traffic flow problems or traffic conflict patterns?
18	Does inadequate lighting cause drivers to slow down or create erratic manoeuvres?
comments The southbound of this intersection operates at low level of service during peak hours (morning & evening).	

APPENDIX D

SITE VISIT SAMPLE OBSERVATION REPORT

FIELD OBSERVATION REPORT (CORRIDOR)	
Location <u>Victoria corridor - Road section</u>	Date <u>March 06, 2006</u>
Observer <u>Dhara Sudani</u>	Time <u>10 AM - 2 PM</u>
Part I - Physical Checklist	Comments
1 Are there sight distance obstructions to:	
a. Traffic control devices?	
✓ b. Intersections and driveways?	
c. Turning or oncoming vehicles?	
2 Does parking affect:	
a. Sight distance?	
b. Through or turning vehicle paths?	
3 Is horizontal alignment inadequate?	
✓ 4 Is vertical alignment inadequate?	<u>BTWN Hazelton & Ashcroft</u>
5 Is pavement width or the number of lanes inadequate?	
6 Are intersection or driveway radii too short?	
7 Are there problems with driveways or bus stops such as:	
a. Inadequate design?	
b. Location near major intersection?	
✓ c. Too many driveways?	<u>Creates traffic conflicts.</u>
8 Is channelization inadequate for:	
a. Reducing conflict points?	
b. Separating traffic flows or defining movements?	
9 Should pedestrian crosswalks be:	
a. Added?	
b. Relocated or repainted?	
10 Are there problems with traffic signs such as:	
a. Inadequate or improper message?	
b. Too many signs?	
c. Placement or size?	
11 Are there problems with traffic signals such as:	
a. Timing?	
b. Number of signal heads?	
c. Placement or size? Poles?	
12 Are there problems with pavement markings such as:	
✓ a. Vehicle paths not clearly marked?	<u>Need to repaint markings.</u>
b. Location of the markings?	
13 Do posted speed limits appear to be too high or too low for conditions?	
✓ 14 Does the pavement condition (potholes, irregular surface, etc.) appear to contribute to safety problems?	<u>LOTS of potholes & cracks.</u>
✓ 15 Is roadway lighting inadequate?	<u>Need to improve New Lawrence Intersection</u>
16 Are there tire skid marks on the pavement?	
17 Is there evidence of vehicle collisions such as scar marks on trees, utility poles, embankments, or other objects?	
18 Is there an abundance of vehicle collision debris such as small pieces of crushed glass, plastic, etc., along the shoulder or in the median area?	

SITE VISIT SAMPLE OBSERVATION REPORT

continued

Part II - Operational Checklist	
1	Do obstructions block the driver's view of opposing or conflicting vehicles?
2	Do drivers have trouble finding the correct path through the location?
3	Is there any indication of driver confusion about routes, street names, or other guidance information?
4	Do steep grades create large speed differences? <u>Neel Westmount Road.</u>
5	Are pavement surfaces conditions creating erratic driver movements?
6	Does the presence of existing driveways contribute to erratic driver movements?
7	Is excessive vehicle delay, queuing creating unsafe risk-taking by motorists?
8	Are there large speed differences between vehicles: a. Traveling through the location? b. Turning at driveways or intersections?
9	Do drivers respond incorrectly to: a. Signals? b. Signs or other traffic control devices? c. Turning lanes?
10	Are problems being caused by the volume of: a. Through traffic? b. Turning traffic?
11	Do pedestrian movements create conflicts?
12	Do bicycle movements create conflicts?
13	Is there considerable weaving or lane changing by drivers at the location?
14	Are there violations of parking at the location?
15	Are there violations of other traffic control devices or regulations such as: a. Running red light? b. Failing to stop or yield the right-of-way? c. Speed limits? d. Right-turn-on-red? e. Other?
16	Are there traffic flow problems or traffic conflict patterns associated with turning vehicles?
17	Are there any other unusual traffic flow problems or traffic conflict patterns?
18	Does inadequate lighting cause drivers to slow down or create erratic manoeuvres?
<p>comments</p> <p><u>The Corridor needs to improve pavement condition,</u> <u>Repaint markings, provide additional lightings</u> <u>& provide additional signs & traffic control devices.</u></p>	

APPENDIX E

ICU SPREADSHEET

Intersection Capacity Utilization Worksheet

Intersection Location: Fisher Hallman/ Victoria Street

Analyzed by: Dhara Sudani

Date and Time of Data: year 2006

City: Kitchener

Alternative:

Project: Road Safety Audit of Victoria st

1 Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR				
2 Lanes	1	2	0	1	1	1	1	2	1	1	2	1				
3 Shared LT Lane (y/n)	☐ Yes			☐ Yes			☐ Yes			☐ Yes						
4 Volume	90	110	60	130	110	110	60	450	150	150	450	90				
5 Pedestrians			5			5			5			5				
6 Ped Button (y/n)	☒ Yes			☒ Yes			☒ Yes			☒ Yes						
7 Pedestrian Timing Required		16			16			16			16					
8 Free Right (y/n)			☒ Yes			☒ Yes			☒ Yes			☒ Yes				
9 Ideal Flow	1775	1900	1750	1775	1900	1750	1775	1900	1750	1775	1900	1750				
10 Lost Time	4	4	4	4	4	4	4	4	4	4	4	4				
11 Minimum Green	4	4	4	4	4	4	4	4	4	4	4	4				
12 Reference Cycle Length	120															
13 Volume Combined	90.0	170.0	0.0	130.0	110.0	110.0	60.0	450.0	150.0	150.0	450.0	90.0				
14 Volume Separate Left	90.0	170.0		130.0	110.0		60.0	450.0		150.0	450.0					
15 Lane Utilization Factor	1.000	0.952	1.000	1.000	1.000	1.000	1.000	0.952	1.000	1.000	0.952	1.000				
16 Turning Factor Adjust	0.950	0.947	0.850	0.950	1.000	0.850	0.950	1.000	0.850	0.950	1.000	0.850				
17 Saturated Flow Combined	1686.3	3426.1	0.0	1686.3	1900.0	1487.5	1686.3	3617.6	1487.5	1686.3	3617.6	1487.5				
18 Saturated Flow Separate	1686.3	3426.1		1686.3	1900.0		1686.3	3617.6		1686.3	3617.6					
19 Pedestrian Interference Time		0.2	0.6		0.0	0.6		0.0	0.6		0.0	0.6				
20 Pedestrian Frequency		15.4%			15.4%			15.4%			15.4%					
21 Protected Option Allowed		TRUE			TRUE			TRUE			TRUE					
22 Reference Time	6.4	6.2	0.0	9.3	6.9	8.9	4.3	14.9	12.1	10.7	14.9	7.3				
23 Adjusted Reference Time	10.4	11.7	8.0	13.3	12.3	12.9	8.3	19.1	16.1	14.7	19.1	11.3				
24 Proportion Lefts	1	0.00		1	0.00		1	0.00		1	0.00					
25 Volume Left Lane	90	85		130	110		60	225		150	225					
26 Proportion Lefts Left	1	0.00		1	0.00		1	0.00		1	0.00					
27 Left turn Equivalents	15.0	15.0		15.0	15.0		15.0	15.0		0.9	15.0					
28 Left turn Factor	0.07	1.00		0.07	1.00		0.07	1.00		1.07	1.00					
29 Permitted Sat Flow	112.4	1713.0		112.4	1900.0		112.4	1808.8		1798.7	1808.8					
30 Reference Time A	96.1	6.2		138.8	6.9		64.0	14.9		10.7	14.9					
31 Adjusted Saturation B		3426.1			1900.0			3617.6			3617.6					
32 Reference Time B		6.2			NA			NA			NA					
33 Reference Time Lefts	14.4			NA			NA			NA						
34 Reference Time		14.4			138.8			64.0			14.9					
35 Adjusted Reference Time		18.6			142.8			68.0			19.1					
36 Split Timing																
37 Ref Time Combined		6.2			6.9			14.9			14.9					
38 Ref Time By Movement	6.4	6.2		9.3	6.9		4.3	14.9		10.7	14.9					
39 Reference Time		6.4			9.3			14.9			14.9					
40 Adjusted Reference Time	11.9	11.9		14.3	14.3		19.1	19.1		19.1	19.1					
41 Summary	East West				North South											
42 Protected Option	24.9				33.8											
43 Permitted Option	142.8				68.0											
44 Split Option	26.2				38.2											
45 Minimum	24.9				33.8											
46 Combined	58.7															
47 Right Turns	EBR	WBR	NBR	SBR												
48 Adjusted Reference Time	8.0	12.9	16.1	11.3												
49 Cross Through Direction	NBT	SBT	WBT	EBT												
50 Cross Through Adj Ref Time	19.1	19.1	12.3	11.7												
51 Oncoming Left Direction	WBL	EBL	SBL	NBL												
52 Oncoming Left Adj Ref Time	13.3	10.4	14.7	8.3												
53 Combined	8.0	12.9	16.1	11.3												
54 Intersection Capacity Utilization	48.9%															
55 Level Of Service	A															

Intersection Capacity Utilization Worksheet

Intersection Location: Hazelglen Dr / Victoria Street

Analyzed by: Dhara Sudani

Date and Time of Data: year 2006

City: Kitchener

Alternative:

Project: Road Safety Audit of Victoria St

1 Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR								
2 Lanes	1	1	0	0	1	0	0	0	0	0	1	0								
3 Shared LT Lane (y/n)	☐ Yes			☐ Yes			☐ Yes			☐ Yes										
4 Volume	60	400	0	0	350	100	0	0	0	90	0	60								
5 Pedestrians			5			5			5			5								
6 Red Button (y/n)		☒ Yes			☒ Yes			☒ Yes			☒ Yes									
7 Pedestrian Timing Required		16			16			16			16									
8 Free Right (y/n)			☒ Yes			☒ Yes			☒ Yes			☒ Yes								
9 Ideal Flow	1775	1900	0	0	1900	0	0	0	0	0	1900	0								
10 Lost Time	4	4	4	4	4	4	4	4	4	4	4	4								
11 Minimum Green	4	4	4	4	4	4	4	4	4	4	4	4								
12 Reference Cycle Length	110																			
13 Volume Combined	60.0	400.0	0.0	0.0	450.0	0.0	0.0	0.0	0.0	90.0	60.0	0.0								
14 Volume Separate Left	60.0	400.0		0.0	450.0		0.0	0.0		90.0	60.0									
15 Lane Utilization Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000								
16 Turning Factor Adjust	0.950	1.000	0.850	0.950	0.967	0.850	0.950	1.000	0.850	0.950	0.850	0.850								
17 Saturated Flow Combined	1686.3	1900.0	0.0	0.0	1836.7	0.0	0.0	0.0	0.0	0.0	1615.0	0.0								
18 Saturated Flow Separate	1686.3	1900.0		0.0	1836.7		0.0	0.0		0.0	1615.0									
19 Pedestrian Interference Time		0.0	0.6		0.1	0.6		0.0	0.6		0.6	0.6								
20 Pedestrian Frequency		14.2%			14.2%			14.2%			14.2%									
21 Protected Option Allowed		TRUE			TRUE			TRUE			TRUE									
22 Reference Time	3.9	23.2	0.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	4.7	0.0								
23 Adjusted Reference Time	8.0	27.2	0.0	0.0	31.1	8.0	0.0	0.0	0.0	0.0	0.0	8.0								
24 Permitted Option																				
25 Proportion Lefts	1	0.00		1	0.00		1	0.00		1	0.00									
26 Volume Left Lane	60	400		0	450		0	0		0	60									
27 Proportion Lefts Left	1	0.00		1	0.00		1	0.00		1	0.00									
28 Left turn Equivalents	13.8	13.8		0.9	13.8		13.8	0.8		0.9	13.8									
29 Left turn Factor	0.07	1.00		1.07	1.00		0.07	1.00		1.07	1.00									
30 Permitted Sat Flow	122.6	1900.0		0.0	1836.7		0.0	0.0		0.0	1615.0									
31 Reference Time A	53.8	23.2		0.0	27.1		0.0	0.0		0.0	4.7									
32 Adjusted Saturation B		1900.0			1836.7			0.0			1615.0									
33 Reference Time B		NA			NA			0.0			4.7									
34 Reference Time Lefts	NA			NA			0.0			0.0										
35 Reference Time		53.8			27.1			0.0			4.7									
36 Adjusted Reference Time		57.8			31.1			9.7			10.3									
37 Split Timing																				
38 Ref Time Combined		23.2			27.1			0.0			4.7									
39 Ref Time By Movement	3.9	23.2		0.0	27.1		0.0	0.0		0.0	4.7									
40 Reference Time		23.2			27.1			0.0			4.7									
41 Adjusted Reference Time	27.2	27.2		31.1	31.1		0.0	0.0		0.0	10.3									
42 Summary	East West		North South																	
43 Protected Option	39.1		0.0																	
44 Permitted Option	57.8		10.3																	
45 Split Option	58.2		10.3																	
46 Minimum	39.1		0.0																	
47 Combined	39.1																			
48 Right Turns	EBR	WBR	NBR	SBR																
49 Adjusted Reference Time	0.0	8.0	0.0	8.0																
50 Cross Through Direction	NBT	SBT	WBT	EBT																
51 Cross Through Adj Ref Time	0.0	0.0	31.1	27.2																
52 Oncoming Left Direction	WBL	EBL	SBL	NBL																
53 Oncoming Left Adj Ref Time	0.0	8.0	0.0	0.0																
54 Combined	0.0	8.0	0.0	8.0																
55 Intersection Capacity Utilization	35.5%																			
56 Level Of Service	A																			

Intersection Capacity Utilization Worksheet

Intersection Location: Westmount Rd / Victoria Street

Analyzed by: Dhara Sudani

Date and Time of Data: year 2006

City: Kitchener

Alternative: _____

Project: Road Safety Audit of Victoria St

1 Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR														
2 Lanes	1	2	0	1	1	0	1	2	0	1	2	1														
3 Shared LT Lane (y/n)	☐ Yes			☐ Yes			☐ Yes			☐ Yes																
4 Volume	120	300	60	100	250	60	150	350	50	100	350	100														
5 Pedestrians			5			5			5			5														
6 Ped Button (y/n)		☒ Yes			☒ Yes			☒ Yes			☒ Yes															
7 Pedestrian Timing Required		16			16			16			16															
8 Free Right (y/n)			☒ Yes			☒ Yes			☒ Yes			☒ Yes														
9 Ideal Flow	1775	1900	1750	1775	1900	1750	1775	1900	1750	1775	1900	1750														
10 Lost Time	4	4	4	4	4	4	4	4	4	4	4	4														
11 Minimum Green	4	4	4	4	4	4	4	4	4	4	4	4														
12 Reference Cycle Length	110																									
13 Volume Combined	120.0	360.0	0.0	100.0	310.0	0.0	150.0	400.0	0.0	100.0	350.0	100.0														
14 Volume Separate Left	120.0	360.0		100.0	310.0		150.0	400.0		100.0	350.0															
15 Lane Utilization Factor	1.000	0.952	1.000	1.000	1.000	1.000	1.000	0.952	1.000	1.000	0.952	1.000														
16 Turning Factor Adjust	0.950	0.975	0.850	0.950	0.971	0.850	0.950	0.981	0.850	0.950	1.000	0.850														
17 Saturated Flow Combined	1686.3	3527.2	0.0	1686.3	1844.8	0.0	1686.3	3549.8	0.0	1686.3	3617.6	1487.5														
18 Saturated Flow Separate	1686.3	3527.2		1686.3	1844.8		1686.3	3549.8		1686.3	3617.6															
19 Pedestrian Interference Time		0.1	0.6		0.1	0.6		0.1	0.6		0.1	0.6														
20 Pedestrian Frequency		14.2%			14.2%			14.2%			14.2%															
21 Protected Option Allowed		TRUE			TRUE			TRUE			TRUE															
22 Reference Time	7.8	11.3	0.0	6.5	18.6	0.0	9.8	12.5	0.0	6.5	10.6	7.4														
23 Adjusted Reference Time	11.8	16.0	8.0	10.5	22.6	8.0	13.8	17.0	8.0	10.5	15.4	11.4														
24 Permitted Option																										
25 Proportion Lefts	1	0.00		1	0.00		1	0.00		1	0.00															
26 Volume Left Lane	120	180		100	310		150	200		100	175															
27 Proportion Lefts Left	1	0.00		1	0.00		1	0.00		1	0.00															
28 Left turn Equivalents	13.8	13.8		13.8	13.8		13.8	13.8		0.9	13.8															
29 Left turn Factor	0.07	1.00		0.07	1.00		0.07	1.00		1.07	1.00															
30 Permitted Sat Flow	122.6	1763.6		122.6	1844.8		122.6	1774.9		1808.9	1808.8															
31 Reference Time A	107.6	11.3		89.7	18.6		134.5	12.5		6.5	10.6															
32 Adjusted Saturation B		3527.2			1844.8			3549.8			3617.6															
33 Reference Time B		NA			NA			NA			NA															
34 Reference Time Lefts	NA			NA			NA			NA																
35 Reference Time		107.6			89.7			134.5			10.6															
36 Adjusted Reference Time		111.6			93.7			138.5			15.4															
37 Split Timing																										
38 Ref Time Combined		11.3			18.6			12.5			10.6															
39 Ref Time By Movement	7.8	11.3		6.5	18.6		9.8	12.5		6.5	10.6															
40 Reference Time		11.3			18.6			12.5			10.6															
41 Adjusted Reference Time	16.0	16.0		22.6	22.6		17.0	17.0		15.4	15.4															
42 Summary	East West		North-South																							
43 Protected Option	34.4		29.2																							
44 Permitted Option	111.6		138.5																							
45 Split Option	38.6		32.4																							
46 Minimum	34.4		29.2																							
47 Combined	63.6																									
48 Right Turns	EBR	WBR	NBR	SBR																						
49 Adjusted Reference Time	8.0	8.0	8.0	11.4																						
50 Cross Through Direction	NBT	SBT	WBT	EBT																						
51 Cross Through Adj Ref Time	17.0	15.4	22.6	16.0																						
52 Oncoming Left Direction	WBL	EBL	SBL	NBL																						
53 Oncoming Left Adj Ref Time	10.5	11.8	10.5	13.8																						
54 Combined	8.0	8.0	8.0	11.4																						
55 Intersection Capacity Utilization	57.8%																									
56 Level Of Service	B																									

Intersection Capacity Utilization Worksheet

Intersection Location: Lawrence Ave / Victoria Street

Analyzed by: Dhara Sudani

Date and Time of Data: year 2006

City: Kitchener

Alternative:

Project: Road Safety Audit of Victoria St

1 Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
2 Lanes	1	1	0	1	1	0	1	1	0	1	1	0
3 Shared L/T Lane (y/n)	☐ Yes			☐ Yes			☐ Yes			☐ Yes		
4 Volume	10	310	50	65	350	40	40	20	60	5	15	15
5 Pedestrians			5			5			5			5
6 Ped Button (y/n)		☒ Yes			☒ Yes			☒ Yes			☒ Yes	
7 Pedestrian Timing Required		16			16			16			16	
8 Free Right (y/n)			☒ Yes			☒ Yes			☒ Yes			☒ Yes
9 Ideal Flow	1775	1900	1750	1775	1900	1750	1775	1900	1750	1775	1900	1750
10 Lost Time	4	4	4	4	4	4	4	4	4	4	4	4
11 Minimum Green	4	4	4	4	4	4	4	4	4	4	4	4
12 Reference Cycle Length	100											
13 Volume Combined	10.0	360.0	0.0	65.0	390.0	0.0	40.0	80.0	0.0	5.0	30.0	0.0
14 Volume Separate Left	10.0	360.0		65.0	390.0		40.0	80.0		5.0	30.0	
15 Lane Utilization Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
16 Turning Factor Adjust	0.950	0.979	0.850	0.950	0.985	0.850	0.950	0.888	0.850	0.950	0.925	0.850
17 Saturated Flow Combined	1686.3	1860.4	0.0	1686.3	1870.8	0.0	1686.3	1686.3	0.0	1686.3	1757.5	0.0
18 Saturated Flow Separate	1686.3	1860.4		1686.3	1870.8		1686.3	1686.3		1686.3	1757.5	
19 Pedestrian Interference Time		0.1	0.5		0.1	0.5		0.4	0.5		0.3	0.5
20 Pedestrian Frequency		13.0%			13.0%			13.0%			13.0%	
21 Protected Option Allowed		TRUE			TRUE			TRUE			TRUE	
22 Reference Time	0.6	19.4	0.0	3.9	20.9	0.0	2.4	5.1	0.0	0.3	2.0	0.0
23 Adjusted Reference Time	8.0	23.4	8.0	8.0	24.9	8.0	8.0	10.6	8.0	8.0	9.6	8.0
24 Permitted Option												
25 Proportion Lefts	1	0.00		1	0.00		1	0.00		1	0.00	
26 Volume Left Lane	10	360		65	390		40	80		5	30	
27 Proportion Lefts Left	1	0.00		1	0.00		1	0.00		1	0.00	
28 Left turn Equivalents	12.5	12.5		12.5	12.5		12.5	12.5		0.9	12.5	
29 Left turn Factor	0.08	1.00		0.08	1.00		0.08	1.00		1.08	1.00	
30 Permitted Sat Flow	134.9	1860.4		134.9	1870.8		134.9	1686.3		1821.2	1757.5	
31 Reference Time A	7.4	19.4		48.2	20.9		29.7	5.1		0.3	2.0	
32 Adjusted Saturation B		1860.4			1870.8			1686.3			1757.5	
33 Reference Time B		NA			NA			5.1			2.0	
34 Reference Time Lefts	NA			NA			10.4			8.3		
35 Reference Time		19.4			48.2			10.4			2.0	
36 Adjusted Reference Time		23.4			52.2			15.1			9.6	
37 Split Timing												
38 Ref Time Combined		19.4			20.9			5.1			2.0	
39 Ref Time By Movement	0.6	19.4		3.9	20.9		2.4	5.1		0.3	2.0	
40 Reference Time		19.4			20.9			5.1			2.0	
41 Adjusted Reference Time	23.4	23.4		24.9	24.9		10.6	10.6		9.6	9.6	
42 Summary	East West		North-South									
43 Protected Option	32.9		18.6									
44 Permitted Option	52.2		15.1									
45 Split Option	48.3		20.1									
46 Minimum	32.9		15.1									
47 Combined	48.0											
48 Right Turns	EBR	WBR	NBR	SBR								
49 Adjusted Reference Time	8.0	8.0	8.0	8.0								
50 Cross Through Direction	NBT	SBT	WBT	EBT								
51 Cross Through Adj Ref Time	10.6	9.6	24.9	23.4								
52 Oncoming Left Direction	WBL	EBL	SBL	NBL								
53 Oncoming Left Adj Ref Time	8.0	8.0	8.0	8.0								
54 Combined	8.0	8.0	8.0	8.0								
55 Intersection Capacity Utilization	48.0%											
56 Level Of Service	A											

Intersection Capacity Utilization Worksheet

Intersection Location: Belmont Ave / Victoria Street

Analyzed by: Dhara Sudani

Date and Time of Data: year 2006

City: Kitchener

Alternative:

Project: Road Safety Audit of Victoria St

1. Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR						
2 Lanes	1	1	0	1	1	0	1	1	1	1	1	0						
3 Shared L/T Lane (y/n)	☐ Yes			☐ Yes			☐ Yes			☐ Yes								
4 Volume	60	350	50	50	350	70	50	250	50	70	250	100						
5 Pedestrians			5			5			5			5						
6 Ped Button (y/n)		☒ Yes			☒ Yes			☒ Yes			☒ Yes							
7 Pedestrian Timing Required		16			16			16			16							
8 Free Right (y/n)			☒ Yes			☒ Yes			☒ Yes			☒ Yes						
9 Ideal Flow	1775	1900	1750	1775	1900	1750	1775	1900	1750	1775	1900	1750						
10 Lost Time	4	4	4	4	4	4	4	4	4	4	4	4						
11 Minimum Green	4	4	4	4	4	4	4	4	4	4	4	4						
12 Reference Cycle Length	100																	
13 Volume Combined	60.0	400.0	0.0	50.0	420.0	0.0	50.0	250.0	50.0	70.0	350.0	0.0						
14 Volume Separate Left	60.0	400.0		50.0	420.0		50.0	250.0		70.0	350.0							
15 Lane Utilization Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000						
16 Turning Factor Adjust	0.950	0.981	0.850	0.950	0.975	0.850	0.950	1.000	0.850	0.950	0.957	0.850						
17 Saturated Flow Combined	1686.3	1864.4	0.0	1686.3	1852.5	0.0	1686.3	1900.0	1487.5	1686.3	1818.6	0.0						
18 Saturated Flow Separate	1686.3	1864.4		1686.3	1852.5		1686.3	1900.0		1686.3	1818.6							
19 Pedestrian Interference Time		0.1	0.5		0.1	0.5		0.0	0.5		0.2	0.5						
20 Pedestrian Frequency		13.0%			13.0%			13.0%			13.0%							
21 Protected Option Allowed		TRUE			TRUE			TRUE			TRUE							
22 Reference Time	3.6	21.5	0.0	3.0	22.8	0.0	3.0	13.2	3.4	4.2	19.4	0.0						
23 Adjusted Reference Time	8.0	25.5	8.0	8.0	26.8	8.0	8.0	17.5	8.0	8.2	23.4	8.0						
24 Permitted Option																		
25 Proportion Lefts	1	0.00		1	0.00		1	0.00		1	0.00							
26 Volume Left Lane	60	400		50	420		50	250		70	350							
27 Proportion Lefts Left	1	0.00		1	0.00		1	0.00		1	0.00							
28 Left turn Equivalents	12.5	12.5		12.5	12.5		12.5	12.5		0.9	12.5							
29 Left turn Factor	0.08	1.00		0.08	1.00		0.08	1.00		1.08	1.00							
30 Permitted Sat Flow	134.9	1864.4		134.9	1852.5		134.9	1900.0		1821.2	1818.6							
31 Reference Time A	44.5	21.5		37.1	22.8		37.1	13.2		4.2	19.4							
32 Adjusted Saturation B		1864.4			1852.5			1900.0			1818.6							
33 Reference Time B		NA			NA			NA			NA							
34 Reference Time Lefts	NA			NA			NA			NA								
35 Reference Time		44.5			37.1			37.1			19.4							
36 Adjusted Reference Time		48.5			41.1			41.1			23.4							
37 Split Timing																		
38 Ref Time Combined		21.5			22.8			13.2			19.4							
39 Ref Time By Movement	3.6	21.5		3.0	22.8		3.0	13.2		4.2	19.4							
40 Reference Time		21.5			22.8			13.2			19.4							
41 Adjusted Reference Time	25.5	25.5		26.8	26.8		17.5	17.5		23.4	23.4							
42 Summary	East West		North South															
43 Protected Option	34.8		31.4															
44 Permitted Option	48.5		41.1															
45 Split Option	52.3		40.9															
46 Minimum	34.8		31.4															
47 Combined	66.2																	
48 Right Turns	EBR	WBR	NBR	SBR														
49 Adjusted Reference Time	8.0	8.0	8.0	8.0														
50 Cross Through Direction	NBT	SBT	WBT	EBT														
51 Cross Through Adj Ref Time	17.5	23.4	26.8	25.5														
52 Oncoming Left Direction	WBL	EBL	SBL	NBL														
53 Oncoming Left Adj Ref Time	8.0	8.0	8.2	8.0														
54 Combined	8.0	8.0	8.0	8.0														
55 Intersection Capacity Utilization	66.2%																	
56 Level Of Service	C																	

APPENDIX F

HCS 2000 DETAILED REPORT

HCS2000™ DETAILED REPORT

General Information						Site Information					
Analyst	Dhara					Intersection	Fisherhallman Rd/Victoria St				
Agency or Co.	Ryerson University					Area Type	All other areas				
Date Performed	3/25/2006					Jurisdiction					
Time Period						Analysis Year	2006				
						Project ID	Road Safety Audit of Victoria Corridor				

Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_i	1	2	0	1	1	1	1	2	1	1	2	1
Lane group	L	TR		L	T	R	L	T	R	L	T	R
Volume, V (vph)	90	110	60	130	110	110	60	450	150	150	450	90
% Heavy vehicles, %HV	1	2	1	2	2	2	3	2	1	1	2	1
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or actuated (A)	P	P	P	P	P	P	P	P	P	P	P	P
Start-up lost time, I_i	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of effective green, e	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type, AT	3	3		3	3	3	3	3	3	3	3	3
Unit extension, UE	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Filtering/metering, I	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Initial unmet demand, Q_b	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ped / Bike / RTOR volumes	5	0	0	5	0	0	5	0	0	5	0	0
Lane width	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0	0		0	0	0	0	0	2	0	0	2
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	EW Perm	03	04	Excl. Left	NS Perm	07	08
Timing	G = 7.0	G = 33.0	G =	G =	G = 18.0	G = 42.0	G =	G =
	Y = 4	Y = 6	Y =	Y =	Y = 4	Y = 6	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 120.0		

Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	100	189		144	122	122	67	500	167	167	500	100
Lane group capacity, c	422	862		379	512	399	464	1239	509	473	1239	509
	0.24	0.22		0.38	0.24	0.31	0.14	0.40	0.33	0.35	0.40	0.20

v/c ratio, X												
Total green ratio, g/C	0.37	0.28		0.37	0.28	0.28	0.53	0.35	0.35	0.53	0.35	0.35
Uniform delay, d_1	25.8	33.6		28.1	33.7	34.4	14.4	29.5	28.6	15.5	29.5	27.2
Progression factor, PF	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Delay calibration, k	0.50	0.50		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Incremental delay, d_2	1.3	0.6		2.9	1.1	2.0	0.7	1.0	1.7	2.1	1.0	0.9
Initial queue delay, d_3												
Control delay	27.1	34.1		31.0	34.8	36.4	15.1	30.5	30.4	17.5	30.5	28.1
Lane group LOS	C	C		C	C	D	B	C	C	B	C	C
Approach delay	31.7			33.9			29.1			27.4		
Approach LOS	C			C			C			C		
Intersection delay	29.7						Intersection LOS			C		

HCS2000™ DETAILED REPORT

General Information						Site Information					
Analyst	Dhara					Intersection	Fisherhallman Rd/Victoria St				
Agency or Co.	Ryerson University					Area Type	All other areas				
Date Performed	3/25/2006					Jurisdiction					
Time Period						Analysis Year	2006				
						Project ID	Road Safety Audit of Victoria Corridor				

Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_i	1	2	0	1	1	1	1	2	1	1	2	1
Lane group	L	TR		L	T	R	L	T	R	L	T	R
Volume, V (vph)	90	110	60	130	110	110	60	450	150	150	450	90
% Heavy vehicles, %HV	1	2	1	2	2	2	3	2	1	1	2	1
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or actuated (A)	P	P	P	P	P	P	P	P	P	P	P	P
Start-up lost time, I_i	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of effective green, e	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type, AT	3	3		3	3	3	3	3	3	3	3	3
Unit extension, UE	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Filtering/metering, I	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Initial unmet demand, Q_b	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ped / Bike / RTOR volumes	5	0	0	5	0	0	5	0	0	5	0	0
Lane width	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0	0		0	0	0	0	0	2	0	0	2
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	EW Perm	03	04	Excl. Left	NS Perm	07	08
Timing	G = 7.0	G = 33.0	G =	G =	G = 18.0	G = 42.0	G =	G =
	Y = 4	Y = 6	Y =	Y =	Y = 4	Y = 6	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 120.0		

Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	100	189		144	122	122	67	500	167	167	500	100
Lane group capacity, c	422	862		379	512	399	464	1239	509	473	1239	509
	0.24	0.22		0.38	0.24	0.31	0.14	0.40	0.33	0.35	0.40	0.20

v/c ratio, X												
Total green ratio, g/C	0.37	0.28		0.37	0.28	0.28	0.53	0.35	0.35	0.53	0.35	0.35
Uniform delay, d_1	25.8	33.6		28.1	33.7	34.4	14.4	29.5	28.6	15.5	29.5	27.2
Progression factor, PF	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Delay calibration, k	0.50	0.50		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Incremental delay, d_2	1.3	0.6		2.9	1.1	2.0	0.7	1.0	1.7	2.1	1.0	0.9
Initial queue delay, d_3												
Control delay	27.1	34.1		31.0	34.8	36.4	15.1	30.5	30.4	17.5	30.5	28.1
Lane group LOS	C	C		C	C	D	B	C	C	B	C	C
Approach delay	31.7			33.9			29.1			27.4		
Approach LOS	C			C			C			C		
Intersection delay	29.7						Intersection LOS			C		

HCS2000™ DETAILED REPORT

General Information						Site Information					
Analyst <i>Dhara</i>						Intersection <i>Hazelglen Dr/Victoria St</i>					
Agency or Co. <i>Ryerson University</i>						Area Type <i>All other areas</i>					
Date Performed <i>3/25/2006</i>						Jurisdiction					
Time Period						Analysis Year <i>2006</i>					
						Project ID <i>Road Safety Audit of Victoria Corridor</i>					

Volume and Timing Input

			EB			WB			NB			SB			
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
Number of lanes, N_1			1	1	0	0	2	0	0	0	0	0	0	0	
Lane group			L	T			TR					LR			
Volume, V (vph)			60	400			350	100				90		60	
% Heavy vehicles, %HV			6	3			2	3				2		6	
Peak-hour factor, PHF			0.90	0.90			0.90	0.90				0.90		0.90	
Pretimed (P) or actuated (A)			P	P			P	P				P		P	
Start-up lost time, I_1			2.0	2.0			2.0					2.0			
Extension of effective green, e			2.0	2.0			2.0					2.0			
Arrival type, AT			3	3			3					3			
Unit extension, UE			3.0	3.0			3.0					3.0			
Filtering/metering, I			1.000	1.000			1.000					1.000			
Initial unmet demand, Q_b			0.0	0.0			0.0					0.0			
Ped / Bike / RTOR volumes						5	0	0	0			5	0	0	
Lane width			12.0	12.0			12.0					12.0			
Parking / Grade / Parking			N	0	N	N	0	N	N		N	N	0	N	
Parking maneuvers, N_m															
Buses stopping, N_B			0	0			2					2			
Min. time for pedestrians, G_p						3.2			3.2			3.2			
Phasing	EB Only	EW Perm	03		04		SB Only		06		07		08		
Timing	G = 11.0	G = 58.0	G =		G =		G = 27.0		G =		G =		G =		
	Y = 2	Y = 6	Y =		Y =		Y = 6		Y =		Y =		Y =		
Duration of Analysis, T = 0.25										Cycle Length, C = 110.0					

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	67	444			500						167	
Lane group capacity, c	548	908			1791						409	
v/c ratio, X	0.12	0.49			0.28						0.41	
Total green ratio, g/C	0.65	0.53			0.53						0.25	
Uniform delay, d_i	7.6	16.6			14.4						34.8	

Progression factor, PF	1.000	1.000			1.000					1.000	
Delay calibration, k	0.50	0.50			0.50					0.50	
Incremental delay, d_2	0.5	1.9			0.4					3.0	
Initial queue delay, d_3											
Control delay	8.1	18.4			14.8					37.8	
Lane group LOS	A	B			B					D	
Approach delay	17.1				14.8				37.8		
Approach LOS	B				B				D		
Intersection delay	19.1						Intersection LOS		B		

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HCS2000™ DETAILED REPORT

General Information						Site Information					
Analyst <i>Dhara</i>						Intersection <i>Westmount Rd/Victoria St</i>					
Agency or Co. <i>Ryerson University</i>						Area Type <i>All other areas</i>					
Date Performed <i>3/25/2006</i>						Jurisdiction					
Time Period						Analysis Year <i>2006</i>					
						Project ID <i>Road Safety Audit of Victoria Corridor</i>					

Volume and Timing Input

		EB			WB			NB			SB				
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Number of lanes, N_i		1	1	0	1	2	0	1	2	0	1	2	1		
Lane group		L	TR		L	TR		L	TR		L	T	R		
Volume, V (vph)		120	300	60	100	250	60	150	350	50	100	350	100		
% Heavy vehicles, %HV		1	2	1	2	2	2	3	2	1	1	2	1		
Peak-hour factor, PHF		0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90		
Pretimed (P) or actuated (A)		P	P	P	P	P	P	P	P	P	P	P	P		
Start-up lost time, I_i		2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0		
Extension of effective green, e		2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0		
Arrival type, AT		3	3		3	3		3	3		3	3	3		
Unit extension, UE		3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0		
Filtering/metering, I		1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000		
Initial unmet demand, Q_b		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0		
Ped / Bike / RTOR volumes		5	0	0	5	0	0	5	0	0	5	0	0		
Lane width		12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0		
Parking / Grade / Parking		N	0	N	N	0	N	N	0	N	N	0	N		
Parking maneuvers, N_m															
Buses stopping, N_B		0	0		0	2		0	0		0	0	2		
Min. time for pedestrians, G_p		3.2			3.2			3.2			3.2				
Phasing	Excl. Left	EW Perm		03		04		Excl. Left		NS Perm		07		08	
Timing	G = 11.0		G = 32.0		G =		G =		G = 12.0		G = 35.0		G =		
	Y = 4		Y = 6		Y =		Y =		Y = 4		Y = 6		Y =		
Duration of Analysis, T = 0.25									Cycle Length, C = 110.0						

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	133	400		111	345		167	445		111	389	111
Lane group capacity, c	420	494		279	995		418	1106		401	1126	463
v/c ratio, X	0.32	0.81		0.40	0.35		0.40	0.40		0.28	0.35	0.24

Total green ratio, g/C	0.43	0.29		0.43	0.29		0.46	0.32		0.46	0.32	0.32
Uniform delay, d_1	20.0	36.2		21.9	30.8		18.1	29.3		17.6	28.7	27.7
Progression factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
Delay calibration, k	0.50	0.50		0.50	0.50		0.50	0.50		0.50	0.50	0.50
Incremental delay, d_2	2.0	13.4		4.2	1.0		2.8	1.1		1.7	0.8	1.2
Initial queue delay, d_3												
Control delay	22.0	49.6		26.1	31.7		21.0	30.4		19.3	29.6	28.9
Lane group LOS	C	D		C	C		C	C		B	C	C
Approach delay	42.7			30.3			27.8			27.6		
Approach LOS	D			C			C			C		
Intersection delay	31.9						Intersection LOS			C		

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HCS2000™ DETAILED REPORT

General Information						Site Information					
Analyst <i>Dhara</i>						Intersection <i>Lawrence Ave/Victoria St</i>					
Agency or Co. <i>Ryerson University</i>						Area Type <i>All other areas</i>					
Date Performed <i>3/25/2006</i>						Jurisdiction					
Time Period						Analysis Year <i>2006</i>					
						Project ID <i>Road Safety Audit of Victoria Corridor</i>					

Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_i	1	1	0	1	1	0	1	1	0	1	1	0
Lane group	L	TR		L	TR		L	TR		L	TR	
Volume, V (vph)	10	310	50	65	350	40	40	20	60	5	15	15
% Heavy vehicles, %HV	1	2	1	2	2	2	3	2	1	1	2	1
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or actuated (A)	P	P	P	P	P	P	P	P	P	P	P	P
Start-up lost time, l_i	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of effective green, e	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival type, AT	3	3		3	3		3	3		3	3	
Unit extension, UE	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Filtering/metering, I	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Initial unmet demand, Q_b	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR volumes	5	0	0	5	0	0	5	0	0	5	0	0
Lane width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0	0		0	2		0	0		0	2	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 58.0	G =	G =	G =	G = 30.0	G =	G =	G =
	Y = 6	Y =	Y =	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 0.25				Cycle Length, C = 100.0				

Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	11	400		72	433		44	89		6	34	
Lane group capacity, c	486	989		476	1055		377	498		367	513	
v/c ratio, X	0.02	0.40		0.15	0.41		0.12	0.18		0.02	0.07	

Total green ratio, g/C	0.58	0.58		0.58	0.58		0.30	0.30		0.30	0.30	
Uniform delay, d_1	8.9	11.5		9.7	11.6		25.4	25.9		24.6	25.0	
Progression factor, PF	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Delay calibration, k	0.50	0.50		0.50	0.50		0.50	0.50		0.50	0.50	
Incremental delay, d_2	0.1	1.2		0.7	1.2		0.6	0.8		0.1	0.2	
Initial queue delay, d_3												
Control delay	9.0	12.8		10.3	12.8		26.0	26.7		24.7	25.2	
Lane group LOS	A	B		B	B		C	C		C	C	
Approach delay	12.7			12.4			26.5			25.2		
Approach LOS	B			B			C			C		
Intersection delay	14.7						Intersection LOS			B		

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HCS2000™ DETAILED REPORT

General Information						Site Information					
Analyst <i>Dhara</i>						Intersection <i>Belmont Ave/Victoria St</i>					
Agency or Co. <i>Ryerson University</i>						Area Type <i>All other areas</i>					
Date Performed <i>3/25/2006</i>						Jurisdiction					
Time Period						Analysis Year <i>2006</i>					
						Project ID <i>Road Safety Audit of Victoria Corridor</i>					

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_i	1	1	0	1	1	1	1	1	1	1	1	0
Lane group	L	TR		L	T	R	L	T	R	L	TR	
Volume, V (vph)	60	350	50	50	350	70	50	250	50	70	250	100
% Heavy vehicles, %HV	3	3	2	4	3	2	2	3	2	5	3	2
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or actuated (A)	P	P	P	P	P	P	P	P	P	P	P	P
Start-up lost time, I_i	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Extension of effective green, e	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Arrival type, AT	3	3		3	3	3	3	3	3	3	3	
Unit extension, UE	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Filtering/metering, I	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Initial unmet demand, Q_b	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Ped / Bike / RTOR volumes	5	0	0	5	0	0	5	0	0	5	0	0
Lane width	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0	2		0	2	0	0	0	2	0	2	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	NS Perm	07	08
Timing	G = 51.0	G =	G =	G =	G = 7.0	G = 28.0	G =	G =
	Y = 6	Y =	Y =	Y =	Y = 2	Y = 6	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	67	445		56	389	78	56	278	56	78	389	
Lane group capacity, c	426	856		352	933	742	209	517	402	279	491	
	0.16	0.52		0.16	0.42	0.11	0.27	0.54	0.14	0.28	0.79	

v/c ratio, X												
Total green ratio, g/C	0.51	0.51		0.51	0.51	0.51	0.37	0.28	0.28	0.37	0.28	
Uniform delay, d_1	13.1	16.3		13.1	15.2	12.7	22.6	30.5	27.0	21.8	33.3	
Progression factor, PF	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Delay calibration, k	0.50	0.50		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Incremental delay, d_2	0.8	2.3		1.0	1.4	0.3	3.1	4.0	0.7	2.5	12.3	
Initial queue delay, d_3												
Control delay	13.8	18.6		14.0	16.6	13.0	25.8	34.5	27.7	24.3	45.7	
Lane group LOS	B	B		B	B	B	C	C	C	C	D	
Approach delay	18.0			15.8			32.3			42.1		
Approach LOS	B			B			C			D		
Intersection delay	26.3						Intersection LOS			C		

APPENDIX G

SYNCHRO DETAILED REPORT

Lanes and Geometrics

3: Victoria Street & Fisher-man Rd

30/03/2006

LANE WINDOW
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes and Sharing (#RL)	↶ ↷	↶ ↷		↶ ↷	↶ ↷	↶ ↷	↶ ↷	↶ ↷	↶ ↷	↶ ↷	↶ ↷	↶ ↷
Ideal Satd. Flow (vphpl)	1775	1775	1000	1775	1900	1750	1775	1900	1750	1775	1900	1750
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)	—	0	—	—	0	—	—	0	—	—	0	—
Area Type		Other	—	—	Other	—	—	Other	—	—	Other	—
Storage Length (ft)	0	—	0	0	—	0	0	—	0	0	—	0
Storage Lanes (#)	—	—	—	—	—	—	—	—	—	—	—	—
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
Leading Detector (ft)	50	50	—	50	50	50	50	50	50	50	50	50
Trailing Detector (ft)	0	0	—	0	0	0	0	0	0	0	0	0
Turning Speed (mph)	15	—	9	15	—	9	15	—	9	15	—	9
Lane Utilization Factor	1.00	0.95	—	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Right Turn Factor	1.000	0.947	—	1.000	1.000	0.850	1.000	1.000	0.850	1.000	1.000	0.850
Left Turn Factor (prot)	0.950	1.000	—	0.950	1.000	1.000	0.950	1.000	1.000	0.950	1.000	1.000
Saturated Flow Rate (prot)	1670	3116	—	1653	1863	1458	1637	3539	1461	1670	3539	1461
Left Turn Factor (perm)	0.636	1.000	—	0.615	1.000	1.000	0.373	1.000	1.000	0.373	1.000	1.000
Right Ped Bike Factor	1.000	0.992	—	1.000	1.000	0.977	1.000	1.000	0.977	1.000	1.000	0.962
Left Ped Factor	0.991	1.000	—	0.992	1.000	1.000	0.993	1.000	1.000	0.996	1.000	1.000
Saturated Flow Rate (perm)	1108	3116	—	1061	1863	1425	638	3539	1427	653	3539	1405
Right Turn on Red	—	—	Yes	—	—	Yes	—	—	Yes	—	—	Yes
Saturated Flow Rate (RTOR)	0	67	—	0	0	122	0	0	167	0	0	100
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.01

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations
Volume (vph)	90	110	130	110	110	60	450	150	150	450	90
Turn Type	pm+pt		pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	1	2	1	2		5	6		5	6	
Permitted Phases	2		2		2	6		6	6		6
Detector Phases	1	2	1	2	2	5	6	6	5	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	22.0	8.0	22.0	22.0	8.0	22.0	22.0	8.0	22.0	22.0
Total Split (s)	11.0	39.0	11.0	39.0	39.0	22.0	48.0	48.0	22.0	48.0	48.0
Total Split (%)	9%	33%	9%	33%	33%	18%	40%	40%	18%	40%	40%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	42.0	35.0	42.0	35.0	35.0	62.0	44.0	44.0	62.0	44.0	44.0
Actuated g/C Ratio	0.35	0.29	0.35	0.29	0.29	0.52	0.37	0.37	0.52	0.37	0.37
v/c Ratio	0.24	0.20	0.35	0.22	0.24	0.14	0.39	0.27	0.34	0.39	0.17
Uniform Delay, d1	24.3	20.2	25.1	32.2	0.0	12.7	28.0	0.0	13.6	28.0	0.0
Delay	24.9	20.5	26.2	32.7	5.7	12.9	28.3	3.9	13.8	28.3	5.0
LOS	C	C	C	C	A	B	C	A	B	C	A
Approach Delay		22.0		21.8			21.3			22.1	
Approach LOS		C		C			C			C	

Intersection Summary

Cycle Length: 120

Offset: 11 (9%), Referenced to phase 2:EBWB, Start of Green

Natural Cycle: 60

Control Type: Pretimed

Maximum v/c Ratio: 0.39

Intersection Signal Delay: 21.8

Intersection Capacity Utilization 58.9%

Intersection LOS: C

ICU Level of Service A

Splits and Phases: 3: Victoria Street & Fisherhall-man Rd

ø1	ø2	ø5	ø6
11.0s	39.0s	22.0s	48.0s

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	90	110	60	130	110	110	60	450	150	150	450	90
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	2%	1%	2%	2%	2%	3%	2%	1%	1%	2%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	2	0	0	2
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	100	122	67	144	122	122	67	500	167	167	500	100
Lane Group Flow (vph)	100	189	0	144	122	122	67	500	167	167	500	100
Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	1	2	1	2		5	6		5	6	
Permitted Phases	2		2		2	6		6	6		6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	22.0	8.0	22.0	22.0	8.0	22.0	22.0	8.0	22.0	22.0
Total Split (s)	11.0	39.0	11.0	39.0	39.0	22.0	48.0	48.0	22.0	48.0	48.0
Total Split (%)	9%	33%	9%	33%	33%	18%	40%	40%	18%	40%	40%
Maximum Green (s)	7.0	33.0	7.0	33.0	33.0	18.0	42.0	42.0	18.0	42.0	42.0
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Walk Time (s)		5.0		5.0	5.0		5.0	5.0		5.0	5.0
Flash Dont Walk (s)		11.0		11.0	11.0		11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0
90th %ile Green (s)	7.0	33.0	7.0	33.0	33.0	18.0	42.0	42.0	18.0	42.0	42.0
90th %ile Term Code	MaxR	Coord	MaxR	Coord	Coord	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR
70th %ile Green (s)	7.0	33.0	7.0	33.0	33.0	18.0	42.0	42.0	18.0	42.0	42.0
70th %ile Term Code	MaxR	Coord	MaxR	Coord	Coord	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR
50th %ile Green (s)	7.0	33.0	7.0	33.0	33.0	18.0	42.0	42.0	18.0	42.0	42.0
50th %ile Term Code	MaxR	Coord	MaxR	Coord	Coord	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR
30th %ile Green (s)	7.0	33.0	7.0	33.0	33.0	18.0	42.0	42.0	18.0	42.0	42.0
30th %ile Term Code	MaxR	Coord	MaxR	Coord	Coord	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR
10th %ile Green (s)	7.0	33.0	7.0	33.0	33.0	18.0	42.0	42.0	18.0	42.0	42.0
10th %ile Term Code	MaxR	Coord	MaxR	Coord	Coord	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR

Intersection Summary

Cycle Length: 120

Offset: 11 (9%), Referenced to phase 2: EBWB, Start of Green

Control Type: Pretimed

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1775	1775	1900	1000	1900	1000
Lane Width (ft)	12	12	12	12	12	12
Grade (%)		0%	0%		0%	
Storage Length (ft)	0			0	0	0
Storage Lanes	1			0	1	0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50		50	
Trailing Detector (ft)	0	0	0		0	
Turning Speed (mph)	15			9	15	9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00		0.99		0.99	
Frt			0.970		0.946	
Flt Protected	0.950				0.971	
Satd. Flow (prot)	1653	1723	1788	0	1670	0
Flt Permitted	0.358				0.971	
Satd. Flow (perm)	620	1723	1788	0	1659	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			21		30	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30	30		30	
Link Distance (ft)		1554	887		1296	
Travel Time (s)		35.3	20.2		29.5	

Intersection Summary

Area Type: Other

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	60	400	350	100	90	60
Confl. Peds. (#/hr)	5			5	5	5
Confl. Bikes (#/hr)						
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	3%	2%	3%	2%	6%
Bus Blockages (#/hr)	0	0	0	2	0	2
Parking (#/hr)						
Mid-Block Traffic (%)		0%	0%		0%	
Adj. Flow (vph)	67	444	389	111	100	67
Lane Group Flow (vph)	67	444	500	0	167	0
Intersection Summary

Lane Group	EBL	EBT	WBT	SBL
Lane Configurations				
Volume (vph)	60	400	350	90
Turn Type	pm+pt			
Protected Phases	1	2	2	7
Permitted Phases	2			
Detector Phases	1	2	2	7
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	22.0	22.0	22.0
Total Split (s)	13.0	64.0	64.0	33.0
Total Split (%)	12%	58%	58%	30%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0
Lead/Lag	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	
Recall Mode	Max	Max	Max	Max
Act Effct Green (s)	69.0	60.0	60.0	29.0
Actuated g/C Ratio	0.63	0.55	0.55	0.26
v/c Ratio	0.14	0.47	0.51	0.36
Uniform Delay, d1	6.6	15.3	14.9	26.7
Delay	6.7	15.7	8.6	27.3
LOS	A	B	A	C
Approach Delay		14.5	8.6	27.3
Approach LOS		B	A	C

Intersection Summary

Cycle Length: 110

Offset: 20 (18%), Referenced to phase 2: EBWB, Start of Green

Natural Cycle: 55

Control Type: Pretimed

Maximum v/c Ratio: 0.51

Intersection Signal Delay: 13.8 Intersection LOS: B

Intersection Capacity Utilization 54.6% ICU Level of Service A

Splits and Phases: 6: Victoria Street & Hazelglen Dr

Lane Group	EBL	EBT	WBT	SBL
Protected Phases	1	2	2	7
Permitted Phases	2			
Minimum Initial (s)	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	22.0	22.0	22.0
Total Split (s)	13.0	64.0	64.0	33.0
Total Split (%)	12%	58%	58%	30%
Maximum Green (s)	11.0	58.0	58.0	27.0
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	0.0	2.0	2.0	2.0
Lead/Lag	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max
Walk Time (s)		5.0	5.0	5.0
Flash Dont Walk (s)		11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0
90th %ile Green (s)	11.0	58.0	58.0	27.0
90th %ile Term Code	MaxR	Coord	Coord	MaxR
70th %ile Green (s)	11.0	58.0	58.0	27.0
70th %ile Term Code	MaxR	Coord	Coord	MaxR
50th %ile Green (s)	11.0	58.0	58.0	27.0
50th %ile Term Code	MaxR	Coord	Coord	MaxR
30th %ile Green (s)	11.0	58.0	58.0	27.0
30th %ile Term Code	MaxR	Coord	Coord	MaxR
10th %ile Green (s)	11.0	58.0	58.0	27.0
10th %ile Term Code	MaxR	Coord	Coord	MaxR

Intersection Summary	
Cycle Length:	110
Offset:	20 (18%), Referenced to phase 2: EBWB, Start of Green
Control Type:	Pretimed

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	→	→	←	→	→	←	→	→	←	→	→
Ideal Flow (vphpl)	1775	1775	1000	1775	1900	1900	1775	1900	1000	1775	1900	1750
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	1		0	1		0	1		0	1		1
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
Leading Detector (ft)	50	50		50	50		50	50		50	50	50
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95	1.00	0.95	1.00
Ped Bike Factor	0.99	1.00			1.00		0.99	1.00		1.00		0.96
Frt		0.975			0.971			0.981				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1670	1680	0	1653	3422	0	1637	3467	0	1670	3539	1461
Flt Permitted	0.472			0.252			0.446			0.402		
Satd. Flow (perm)	825	1680	0	439	3422	0	762	3467	0	703	3539	1407
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			28			16				111
Headway Factor	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		887			2010			1152			1296	
Travel Time (s)		20.2			45.7			26.2			29.5	

Intersection Summary

Area Type: Other

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SEB
Volume (vph)	120	300	60	100	250	60	120	350	50	100	350	100
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	2%	1%	2%	2%	2%	3%	2%	1%	1%	2%	1%
Bus Blockages (#/hr)	0	2	0	0	0	0	0	0	0	0	0	2
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	133	333	67	111	278	67	133	389	56	111	389	111
Lane Group Flow (vph)	133	400	0	111	345	0	133	445	0	111	389	111
Intersection Summary												

Timings

8: Victoria Street & Westmount Rd

30/03/20 06

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SEB
Lane Configurations									
Volume (vph)	120	300	100	250	120	350	100	350	100
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt		Perm
Protected Phases	1	2	1	2	5	6	5	6	
Permitted Phases	2		2		6		6		6
Detector Phases	1	2	1	2	5	6	5	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	22.0	8.0	22.0	8.0	22.0	8.0	22.0	22.0
Total Split (s)	15.0	38.0	15.0	38.0	16.0	41.0	16.0	41.0	41.0
Total Split (%)	14%	35%	14%	35%	15%	37%	15%	37%	37%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	2.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	45.0	34.0	45.0	34.0	49.0	37.0	49.0	37.0	37.0
Actuated g/C Ratio	0.41	0.31	0.41	0.31	0.45	0.34	0.45	0.34	0.34
v/c Ratio	0.32	0.76	0.37	0.32	0.31	0.38	0.26	0.33	0.20
Uniform Delay, d1	18.4	33.4	18.2	26.6	16.2	26.6	15.9	27.2	0.0
Delay	32.1	54.7	18.5	26.9	16.4	26.9	16.2	27.4	5.0
LOS	C	D	B	C	B	C	B	C	A
Approach Delay		49.1		24.8		24.5		21.3	
Approach LOS		D		C		C		C	

Intersection Summary

Cycle Length: 110	
Offset: 0 (0%), Referenced to phase 2:EBWB Start of Green	
Natural Cycle: 60	
Control Type: Pretimed	
Maximum v/c Ratio: 0.76	
Intersection Signal Delay: 29.7	Intersection LOS: C
Intersection Capacity Utilization 64.4%	ICU Level of Service B

Splits and Phases: 8: Victoria Street & Westmount Rd

ø1	ø2	ø5	ø6
15s	38s	15s	15s

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Protected Phases	1	2	1	2	5	6	5	6	
Permitted Phases	2		2		6		6		6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	22.0	8.0	22.0	8.0	22.0	8.0	22.0	22.0
Total Split (s)	15.0	38.0	15.0	38.0	16.0	41.0	16.0	41.0	41.0
Total Split (%)	14%	35%	14%	35%	15%	37%	15%	37%	37%
Maximum Green (s)	11.0	32.0	11.0	32.0	12.0	35.0	12.0	35.0	35.0
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	2.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max
Walk Time (s)		5.0		5.0		5.0		5.0	5.0
Flash Dont Walk (s)		11.0		11.0		11.0		11.0	11.0
Pedestrian Calls (#/hr)		0		0		0		0	0
90th %ile Green (s)	11.0	32.0	11.0	32.0	12.0	35.0	12.0	35.0	35.0
90th %ile Term Code	MaxR	Coord	MaxR	Coord	MaxR	MaxR	MaxR	MaxR	MaxR
70th %ile Green (s)	11.0	32.0	11.0	32.0	12.0	35.0	12.0	35.0	35.0
70th %ile Term Code	MaxR	Coord	MaxR	Coord	MaxR	MaxR	MaxR	MaxR	MaxR
50th %ile Green (s)	11.0	32.0	11.0	32.0	12.0	35.0	12.0	35.0	35.0
50th %ile Term Code	MaxR	Coord	MaxR	Coord	MaxR	MaxR	MaxR	MaxR	MaxR
30th %ile Green (s)	11.0	32.0	11.0	32.0	12.0	35.0	12.0	35.0	35.0
30th %ile Term Code	MaxR	Coord	MaxR	Coord	MaxR	MaxR	MaxR	MaxR	MaxR
10th %ile Green (s)	11.0	32.0	11.0	32.0	12.0	35.0	12.0	35.0	35.0
10th %ile Term Code	MaxR	Coord	MaxR	Coord	MaxR	MaxR	MaxR	MaxR	MaxR

Intersection Summary

Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2: EBWB Start of Green

Control Type: Pretimed

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1775	1775	1900	1775	1775	1000	1775	1775	1000	1775	1775	1000
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	1		0	1		0	1		0	1		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
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. 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
Ped Bike Factor	0.99	1.00		0.99	1.00		0.99	0.98		0.99	0.99	
Frt		0.979			0.985			0.887			0.925	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1670	1698	0	1653	1708	0	1637	1530	0	1670	1600	0
Flt Permitted	0.437			0.461			0.735			0.699		
Satd. Flow (perm)	763	1698	0	797	1708	0	1255	1530	0	1218	1600	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15			10			67			17	
Headway 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
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		2010			834			1120			1312	
Travel Time (s)		45.7			19.0			25.5			29.8	

Intersection Summary

Area Type: Other

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SEB
Volume (vph)	10	310	50	65	350	40	40	20	60	5	15	15
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	2%	1%	2%	2%	2%	3%	2%	1%	1%	2%	1%
Bus Blockages (#/hr)	0	0	0	0	0	2	0	0	0	0	0	2
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	11	344	56	72	389	44	44	22	67	6	17	17
Lane Group Flow (vph)	11	400	0	72	433	0	44	89	0	6	34	0
Intersection Summary												

Timings

11: Victoria Street & Lawrence Ave

30/03/2006

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	10	310	65	350	40	20	5	15
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		1		1		5		5
Permitted Phases	1		1		5		5	
Detector Phases	1	1	1	1	5	5	5	5
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	64.0	64.0	64.0	64.0	36.0	36.0	36.0	36.0
Total Split (%)	64%	64%	64%	64%	36%	36%	36%	36%
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
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	60.0	60.0	60.0	60.0	32.0	32.0	32.0	32.0
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.32	0.32	0.32	0.32
v/c Ratio	0.02	0.39	0.15	0.42	0.11	0.17	0.02	0.06
Uniform Delay, d1	8.1	10.0	8.8	10.4	23.9	5.8	23.2	11.7
Delay	8.3	10.3	7.6	8.1	24.5	9.2	23.4	15.0
LOS	A	B	A	A	C	A	C	B
Approach Delay		10.2		8.0		14.3		16.3
Approach LOS		B		A		B		B

Intersection Summary

Cycle Length: 100

Offset: 0 (0%), Referenced to phase 6, Start of Green

Natural Cycle: 45

Control Type: Pretimed

Maximum v/c Ratio: 0.42

Intersection Signal Delay: 9.9

Intersection Capacity Utilization 51.5%

Intersection LOS: A

ICU Level of Service A

Splits and Phases: 11: Victoria Street & Lawrence Ave

ø1		ø5	
64.0		36.0

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Protected Phases	1		1		5		5	
Permitted Phases	1		1		5		5	
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	64.0	64.0	64.0	64.0	36.0	36.0	36.0	36.0
Total Split (%)	64%	64%	64%	64%	36%	36%	36%	36%
Maximum Green (s)	58.0	58.0	58.0	58.0	30.0	30.0	30.0	30.0
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
Lead/Lag								
Lead-Lag Optimize?								
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max
Walk Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0
90th %ile Green (s)	58.0	58.0	58.0	58.0	30.0	30.0	30.0	30.0
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Coord	Coord	Coord	Coord
70th %ile Green (s)	58.0	58.0	58.0	58.0	30.0	30.0	30.0	30.0
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Coord	Coord	Coord	Coord
50th %ile Green (s)	58.0	58.0	58.0	58.0	30.0	30.0	30.0	30.0
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Coord	Coord	Coord	Coord
30th %ile Green (s)	58.0	58.0	58.0	58.0	30.0	30.0	30.0	30.0
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Coord	Coord	Coord	Coord
10th %ile Green (s)	58.0	58.0	58.0	58.0	30.0	30.0	30.0	30.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Coord	Coord	Coord	Coord

Intersection Summary

Cycle Length: 100

Offset: 0 (0%), Referenced to phase 6, Start of Green

Control Type: Pretimed

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations
Ideal Flow (vphpl)	1775	1775	1000	1775	1000	1750	1775	1900	1750	1775	1775	1000
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	1		0	1		1	1		1	1		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
Leading Detector (ft)	50	50		50	50	50	50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. 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
Ped Bike Factor	1.00	1.00		1.00		0.98	1.00		0.96	0.99	0.99	
Frt		0.981				0.850			0.850		0.957	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1637	1674	0	1621	963	1458	1653	1845	1447	1606	1631	0
Flt Permitted	0.442			0.396			0.261			0.416		
Satd. Flow (perm)	760	1674	0	674	963	1422	453	1845	1396	698	1631	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		11				78			56		21	
Headway Factor	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.00	1.01	1.00	1.01	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		834			1856			1056			1296	
Travel Time (s)		19.0			42.2			24.0			29.5	

Intersection Summary

Area Type: Other

Lane Group	EBL	FBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume (vph)	60	350	50	50	350	70	50	250	50	70	250	100
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Confl. Bikes (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%	3%	2%	4%	3%	2%	2%	3%	2%	5%	3%	2%
Bus Blockages (#/hr)	0	2	0	0	2	0	0	0	2	0	2	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	67	389	56	56	389	78	56	278	56	78	278	111
Lane Group Flow (vph)	67	445	0	56	389	78	56	278	56	78	389	0

Intersection Summary

Timings

14: Victoria Street & Belmont Ave

30/03/2006

	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↰	↱	↰	↱	↰	↱	↰	↱
Volume (vph)	60	350	50	350	70	50	250	50	70	250
Turn Type	Perm		Perm		Perm	pm+pt		Perm	pm+pt	
Protected Phases		1		1		5	6		5	6
Permitted Phases	1		1		1	6		6	6	
Detector Phases	1	1	1	1	1	5	6	6	5	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0	10.0	10.0	10.0	8.0	22.0	22.0	8.0	22.0
Total Split (s)	57.0	57.0	57.0	57.0	57.0	9.0	34.0	34.0	9.0	34.0
Total Split (%)	57%	57%	57%	57%	57%	9%	34%	34%	9%	34%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Act Effct Green (s)	53.0	53.0	53.0	53.0	53.0	35.0	30.0	30.0	35.0	30.0
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.53	0.35	0.30	0.30	0.35	0.30
v/c Ratio	0.17	0.50	0.16	0.76	0.10	0.26	0.50	0.12	0.27	0.77
Uniform Delay, d1	12.1	14.6	12.0	18.5	0.0	19.3	28.8	0.0	19.6	30.0
Delay	10.2	10.8	12.6	22.1	2.8	19.7	29.4	7.4	20.3	33.4
LOS	B	B	B	C	A	B	C	A	C	C
Approach Delay		10.7		18.2			24.9			31.2
Approach LOS		B		B			C			C

Intersection Summary

Cycle Length: 100	
Offset: 69 (69%), Referenced to phase 6 NBSB Start of Green	
Natural Cycle: 70	
Control Type: Pretimed	
Maximum v/c Ratio: 0.77	
Intersection Signal Delay: 20.8	Intersection LOS: C
Intersection Capacity Utilization 82.6%	ICU Level of Service D

Splits and Phases: 14: Victoria Street & Belmont Ave

01	05	06
57s	9s	11s

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Protected Phases	1		1			5	6		5	6
Permitted Phases	1		1		1	6		6	6	
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0	10.0	10.0	10.0	8.0	22.0	22.0	8.0	22.0
Total Split (s)	57.0	57.0	57.0	57.0	57.0	9.0	34.0	34.0	9.0	34.0
Total Split (%)	57%	57%	57%	57%	57%	9%	34%	34%	9%	34%
Maximum Green (s)	51.0	51.0	51.0	51.0	51.0	7.0	28.0	28.0	7.0	28.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	2.0	4.0	4.0	2.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
Walk Time (s)							5.0	5.0		5.0
Flash Dont Walk (s)							11.0	11.0		11.0
Pedestrian Calls (#/hr)							0	0		0
90th %ile Green (s)	51.0	51.0	51.0	51.0	51.0	7.0	28.0	28.0	7.0	28.0
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Coord	Coord	MaxR	Coord
70th %ile Green (s)	51.0	51.0	51.0	51.0	51.0	7.0	28.0	28.0	7.0	28.0
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Coord	Coord	MaxR	Coord
50th %ile Green (s)	51.0	51.0	51.0	51.0	51.0	7.0	28.0	28.0	7.0	28.0
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Coord	Coord	MaxR	Coord
30th %ile Green (s)	51.0	51.0	51.0	51.0	51.0	7.0	28.0	28.0	7.0	28.0
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Coord	Coord	MaxR	Coord
10th %ile Green (s)	51.0	51.0	51.0	51.0	51.0	7.0	28.0	28.0	7.0	28.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Coord	Coord	MaxR	Coord

Intersection Summary

Cycle Length: 100

Offset: 69 (69%), Referenced to phase 6:NBSB Start of Green

Control Type: Pretimed