OPERATIONAL ANALYSIS AND SAFETY AUDIT FOR EAST YORK TRAFFIC NETWORK

by

Sumit Bhasin, B.Eng. (Civil), Chandigarh, India, June 2003

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Sumit Bhasin

Submitted to the Department of Civil Engineering at Ryerson University, Toronto, Ontario on May 16th, 2007 in partial fulfillment of the requirements for the degree of Master of Engineering in Civil Engineering, 2007
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Abstract

Enhancing the quality of road travel is one of the main challenges present day traffic engineers and planners face. Travel delays cause loss of millions of person hours each year; and the economic toll of road accidents is staggering. Thus, engineers are always looking at opportunities for reducing delays and accidents. This project evaluates the operational and safety deficiency in a traffic network of nine intersections in the East York region and recommends appropriate and feasible corrective measures. The first phase of the project deals with the evaluation of traffic operations in the network, using simulation and optimization techniques, while the second phase encompasses a road safety audit that attempts to reduce crashes and fatalities.

The study reveals that the majority of the intersections in the network are failing operationally, with level of service (LOS) F typical. Although a reduction in delays is achieved by optimization, no substantive improvement in LOS can be obtained by optimization alone. It is recommended that geometry and operations of the critical intersections be altered to enhance quality of service. Analysis of collision data was supported by a site investigation; recommendations for improving safety include relocating traffic signs, improving pavement condition and lighting and installing additional traffic control devices.

Acknowledgements

I am grateful to all who have given their whole-hearted support and assistance during the course of this project. I would like to thank my project supervisor, Dr. Bhagwant Persaud, for his guidance and motivation during this project and throughout my academic years. Dr. Bhagwant Persaud has been very supportive ever since I started my degree at Ryerson. I shall always remain deeply indebted to him and shall make sure I do him proud.

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1.0 Introduction

Transportation infrastructure represents one of the largest and most critical investments made today. The movement of goods and people is vital to social and economic development of a nation. The number of vehicles on the roads is ever increasing whereas the roads and the land available for building new roads is very limited. Managing, redirecting and decongesting traffic within the existing roads is a challenging task that traffic engineers and planners face today.

To streamline traffic-flow, reduce delays and make travel safer and more convenient for the daily road-user, we first need to identify the problem. Performance measurement provides critical information that helps detect potential problems and forms the basis for enforcing corrective measures [(1)].

The process of safety improvement involves network screening, site visits, collision and operational analysis. Delays at intersections are a major source of traffic congestion and in order to minimize vehicular delays at intersections, signal timings and phasing needs to be properly designed. Since manual analysis of traffic networks is a cumbersome and monotonous task, use of software is common in this era of technological advancement.

Traffic operations' software tools available today have a wide range of applications; encompassing highway capacity analysis procedures, simulation for evaluation of the impact of changing traffic patterns, network optimization, traffic impact studies and geometric designs.

For the road network, infrastructure performance is measured in three main categories: physical condition, operational efficiency and safety.

1.1 Objective

The aim of this project is to perform operational analysis and safety audit of a congested network of nine intersections in the East York region. The major area of interest in the network is the heavily congested Don Mills and O'Connor intersection where large inflow and outflow of traffic occurs to and from Don Valley Parkway. Commuters from outskirts of Toronto mostly use Don Valley Parkway to reach the Central Business District/ Centreville of city of Toronto. As a result Don Valley Parkway and the Don Mills - O'Connor intersection is mostly found to be operating at capacity.

In this research I have made an effort to enhance safety and improve upon the level of service which will in turn provide reduction in fuel consumption and average delays faced by daily commuters. Transyt and Synchro software have been used for simulation and optimization of the network. Site visits and analysis of collision data for last five years was performed in an effort to improve safety.

1.2 Site Selection

The selected road network comprises of nine signalized intersections situated in the congested area of East York, Toronto.

East York is a former suburb of Toronto. The area is populated with middle-class and working-class homes and is a major arrival point for immigrants, who have established their first Canadian residence in the Thorncliffe Park apartments [6].
The chosen network is bounded by Donlands Avenue on West, Coxwell Avenue on East, Mortimer Avenue on South and O'Connor on North.

This site evolves a lot of interest for research because of its proximity to Don Valley Parkway. Don Valley Parkway is one of Toronto's busiest commuter routes which was built as part of a grand plan initiated in the 1950s. The highways plan never got completed because of downtown objections to several of the expressway routes, leaving DVP and the Gardiner Expressway to carry the bulk of highway traffic into the core [5].

The population of the suburbs has grown tremendously eversince and has had a toll on the volumes on the DVP, resulting in frequent congestion. Don Valley Parkway and the Don Mills - O'Connor intersection in our network is a focus area where bottlenecks are common and large scale attention is required for alleviating the situation.

Figure 1: Network representation (www.earth.google.com)

Figure shows the proximity of Don Valley Parkway to the network. The DVP has been marked in red, the network in green and the intersections have been shown in orange.

1.3 Report Organization

This report is organized in four chapters; Introduction, Literature Review, Network Analysis and Optimization, Audit Report and Observations; followed by Conclusion and References.

Chapter 1 provides a brief introduction to the project, its purpose and the relevance of taking up the East York traffic network as the area of interest.

Chapter 2 summarizes the literature reviewed for the research. It includes case studies that consolidate the significance of providing treatments to the network, followed by overview of traffic operations and safety audit and brief introduction of software used in the project.

Chapter 3 discuses site features, presents volume data and collision data provided by the City of Toronto and details the methodology adopted. Network Analysis follows which provides summary of simulation and optimization results. Software analysis showed that little could be done to improve existing level of service as the traffic volumes are very high. Options for improvement included changing lane configuration, signal timings and phases; the results for which are summarized individually in the result analysis section of this report.

Chapter 4 presents the details of site investigation, backed up with pictures and graphical analysis of collision data. The section also describes findings of the safety audit followed by recommendations.

The report finishes with the conclusions and references.

2.0 Literature review

The purpose of measuring performance is to improve transportation services for customers [9]. It is a useful tool that can help inform the public as well as decision makers and legislators regarding the importance and the merits of making appropriate investments in the transportation system [8]. For the road network, the traffic engineers measure highway infrastructure performance in three main categories: physical condition, functional adequacy and utilization [9].

To support the purpose of this research, following cases were studied and it was concluded that optimization techniques when employed at appropriate sites result in improving level of service and corrective measures at accident prone sites improve safety of commuters.

The first portion of this report focuses on Level of Service analysis for which simulation modeling and optimization programs have been employed. Simulation techniques replicate conditions of the road and thus help in analyzing variety of complex vehicle interactions and evaluation of alternative treatments. The outputs obtained from the software are interpreted by traffic engineers and improvements are implemented.

2.1 Case Studies

In 2003, Al-Ghamdi [2] investigated a total of 1774 police-reported traffic accidents that occurred in the period 1996–1998 in Riyadh. Analysis depicted that about 50% of severe accidents involved a pedestrian, indicating the need for protecting pedestrians in Riyadh.
The analysis of accident causes in this study revealed that excess speed, failing to yield and disregarding the red light accounted for majority of all accident causes. The author concluded that reviewing and correcting existing intersection geometry for defects at the crash sites backed by strict law enforcement strategies and public education campaigns would help bring a reduction in crashes.

In 1997, Persaud et al. [10] studied the impact of converting signalised one-way street intersections in Philadelphia to all-way stop sign intersections. Empirical Bayesian procedure was used to estimate what would have been the impact on number of crashes if the intersections were not converted. On comparison of the Empirical Bayesian estimates with actual crash numbers after conversion, a 24% reduction in crashes was achieved. For all crash types, significant reductions were achieved for both day & night and percentage reduction in crashes involving severe injuries was substantially larger than those resulting in minor injuries.

In 2006, Sudani [11] conducted a road safety audit for a high risk corridor in the region of Waterloo, Ontario. The audit involved a detailed study of the accidents in that corridor for years 2000-2005. Site investigation and in depth examination revealed the shortcomings in the geometric design and suggested relocation of traffic signs, improvement of lighting and installation of traffic control devices like red light cameras be done to improve safety.

In 2002, Abbas [1] provided an assessment of traffic safety conditions for rural roads in Egypt. The author presented an analysis of accidents' causes which were categorized under six main categories, namely; driver related, pedestrian related, vehicle related, road related, environment-related causes and other causes. In the course of conducting the traffic safety assessment of rural roads in Egypt, the researcher suggested the lack of past sustainable and detailed accident data collection programs as well as a lack of accident prediction models. The author in his research developed a number of statistical models that could be utilized for prediction of the expected number of accidents, injuries, fatalities and casualties on the rural roads in Egypt.

In 2001, Eccles and Hummer [7] evaluated the safety effects of replacing existing yellow signs with fluorescent yellow warning signs at seven hazardous locations. A before and after study that used surrogate measures like signal violations, stopping behavior and speed, was conducted and it was found that use of fluorescent yellow sheeting in place of standard yellow sheeting provides an inexpensive method that increases conspicuity of the signs and helps increase safety. A substantial reduction in crashes was achieved at four of the seven sites while at the other three, little change was observed. However, since surrogate measures were used, actual collision savings was unknown. The authors recommended further research to find collision savings and long term effects.

In 2007, Ourston [4] conducted a case study on roundabouts constructed at Meadowbrook Drive/Hamilton Drive in the village of Ancaster (Hamilton) Ontario, Canada.
The objective was to reduce speeds on Wilson Street; the roundabout was constructed, between the 50 km/h (30 mph) speed limit in the village and the 80 km/h (50 mph) approach from Highway 403 to the west. A spot speed study was conducted to determine speed profiles eastbound and westbound on Wilson Street at six locations before and after the roundabout was opened.

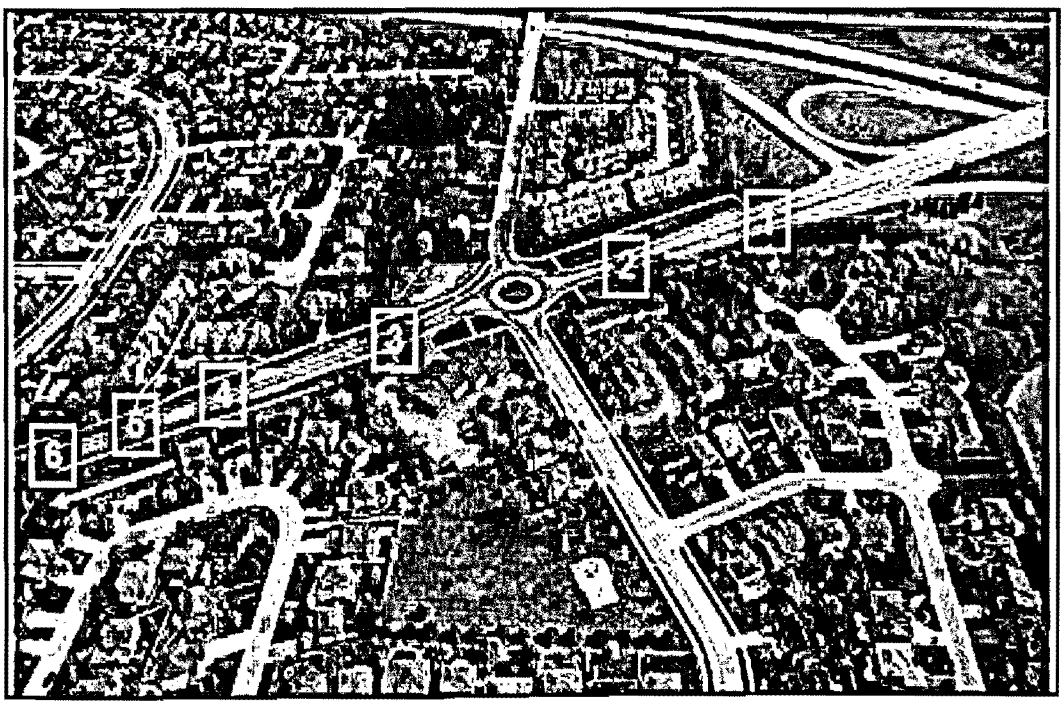

Figure 2: Roundabout Case Study

Location	Before Speed (km/h)	After Speed (km/h)	Difference (km/h)
Spot 1	78	63	-15
Spot 2	76	42	-34
Roundabout			
Spot 3	74	45	-29
Spot 4	70	60	-10
Spot 5	67	68	+1
Spot 6	67	67	0

Table 1: Eastbound Speed Profile

[redacted]			
Spot 6	69	66	-3
Spot 5	70	68	-2
Spot 4	76	58	-18
Spot 3	80	39	-41
Roundabout			
Spot 2	77	52	-25
Spot 1	77	58	-19

Table 2: Westbound Speed Profile

The study demonstrated that roundabout significantly reduced speeds eastbound on the high-speed approach before motorists reached the village. and westbound as they leave it. Roundabouts eliminate the potential for hazardous conflicts such as right-angle and left-turn head-on crashes and have fewer conflict points compared to conventional intersections. Lower speeds in roundabouts allow drivers more time to react to potential conflicts, helping to make roundabouts safer. Highly visible signs and markings, conspicuous central landscaping, and adequate illumination are also recommended to reduce approach speeds and crash potential at roundabouts.

In 2005, Bauer et al. [3] conducted a before/after study of same-direction, four- or five-lane urban freeways in California using the Empirical Bayes Method. The authors inferred that relieving congestion on an urban freeway by widening the existing roadbed to add an additional lane is a difficult and expensive option, however, re-striping the existing lanes, converting all or part of the shoulder to a travel lane, or a combination of both options is more practical. The study found that the accident frequency in four- to five-lane conversions was 10 to 11 percent, while smaller increases were demonstrated in five- to six-lane conversions. The authors attributed the increases in accident frequency to accident migration caused by relocation of traffic operational bottlenecks.

2.2 Traffic Operations

Traffic operations imply management of traffic on the road which encompasses controlling vehicles moving in conflicting directions by means of traffic signals, at the same time ensuring that no unnecessary delay occurs.

Traffic signals are control devices which can alternately direct the traffic to stop and proceed at intersections using red, yellow and green traffic light signals. The signals provide for orderly movement of traffic, increase the traffic handling capacity of intersections, reduce crashes, and increase the safety of pedestrian crossings.

The main objective of signal timing at the intersections is to reduce the average delays of all vehicles and the probability of crashes. The objective of reducing delay sometimes conflicts with the idea of crash prevention because number of phases need to be minimized for reduction of average delay, however, many additional distinct phases are required to eliminate conflicting movements of vehicles. Hence engineering judgment and experience needs to be resorted to at these times.

Traffic signals can operate in several different modes:

- Pre-timed Signal Control
- Traffic Actuated Signal Control
  - Semi-Actuated Control
  - Fully Actuated Control

Pre-timed signals are the simplest type of traffic signals in which the cycle length, the phases and all of the intervals are predetermined. Traffic-actuated control of intersections attempts to adjust green time continuously to handle fluctuating volumes. These adjustments occur in accordance with real-time measures of traffic demand obtained from vehicle detectors placed on the approaches to the intersection. Fully-actuated signals have detectors on all of the approaches while semi-actuated signals have detectors on only some of the approaches.

To elaborate on the mechanism of actuated signal control; when the detector registers a vehicle it makes a call to the controller. The controller then adjusts the phase lengths to meet the requirements of the prevailing traffic condition. When the detector is activated, it retains the right of way for a minimum time and allots additional time, if more cars are detected during the green light. Extensions are added to the phase, till it reaches the maximum green time. However, if no call is received during the green time, the phase ends. The cycle then progresses based on calls received and changes to the next phase in the phase sequence that has a call.

Another important aspect in traffic control is that of signal coordination. Coordinating signal timing allows a system of signals to work together so that vehicles are able to move through the signals without stopping. Good signal coordination can generate measurable safety benefits in two main ways. Firstly; coordinated signals produce platoons of vehicles that can proceed without stopping at multiple consecutive signalized intersections. Reducing the number and frequency of required stops and maintaining constant speeds for all vehicles reduce rear-end conflicts. Secondly; signal coordination can improve the operation of turning movements. Increased platooning can create more gaps of greater lengths for vehicle movements at intersections and can result in improved intersection operation which means reduced energy consumption and lesser pollution.

2.3 Transyt

TRANSYT-7F (TRAffic Network StudY Tool, version 7, Federal) is complete traffic signal timing optimization software for traffic networks which can cater extremely complex traffic conditions. TRANSYT has the capability of optimizing cycle length, phasing sequence, splits, and offsets. The program accepts user inputs on signal timing and phase sequences, geometric conditions, operational parameters, and traffic volumes [13].

To elaborate the data input procedure; we divide roads and lanes into links with shared signals and shared traffic movements, assign a saturation flow to each link, indicate the maximum traffic flow over the stop line during the green time and enter the signal timings that apply to each link. The output includes the maximum capacity, the degree of saturation, the maximum queue length during the cycle for each of the links.

For simulation, the program takes the inputs as fixed variables and reports the performance measures in terms of stops, delay, fuel consumption, and queuing.

Transyt can also optimise signal timings over the network to reduce delays, stops, and fuel consumption and total operating cost. When optimizing, TRANSYT-7F minimizes or maximizes an objective function, called the Performance Index (PI). The PI may be a combination of delay and stops; fuel consumption; and/or optionally selected excessive maximum back of queue, excess operating costs, or progression opportunities [13, 16].

TRANSYT-7F is also available in both DOS and Windows 95/NT versions.

2.4 Synchro

Synchro is a traffic signal timing tool designed to optimize cycle lengths, splits, offsets, and phase orders. Synchro requires mostly the same traffic flow and geometric data as Transyt-7F. The program can be used to evaluate existing traffic signal timing or to optimize settings for individual intersections, arteries, or a network.

The program performance measures include average approach delay, intersection delay, volume-to-capacity ratio, intersection level of service, total stops, travel time, emissions, and fuel consumption. Synchro offers a variety of user-specified reports, including capacity analysis, LOS, delay, stops, fuel consumption and signal timing settings [13].

Synchro's unique visual displays, including an interactive platoon dispersion diagram allow the user to can change the offsets and splits with a mouse, and observe the impacts on delay, stops, and LOS for the individual intersections, as well as the entire network.

Further, the program also optimizes multiple cycle lengths and performs coordination analysis in which Synchro determines which intersections need to be coordinated and those that should run free. The decision process is based on an analysis of each pair of adjacent intersections to determine what is called the "Coordinatability Factor" (CF) for the links between them. Synchro's "Coordinatability Analysis Report" shows each factor that affects CF along with the effect it has on the CF. CF ranges from 0 to 100 or more. Any value above 50 means that coordination is recommended. The higher the CF, the more likely that segment will benefit from coordination.

Another significant strength of Synchro is its ability to create data input streams for Transyt-7F and CORSIM. Once the user has entered the data to run Synchro successfully, it is possible to run any one of these programs without using any of their pre-processors [13].

Synchro runs under Windows 95/NT and OS/2.

2.5 Safety Audit

Traffic accidents are a cause of concern world-wide. Massive sums of money are being spent on emergency care, rehabilitation, and other costs that result from traffic collisions (Health Canada estimates that Canada spends $25 billion every year on costs related to road collisions). Besides the monetary expense, road crashes cause loss of life and suffering as many are left crippled for rest of their lives. The World Health Organization reports that an estimated million people are killed and over forty million injured around the world, every year due to traffic collisions.

Policy makers, road safety professionals and engineers are working to reduce the risk and cost of collisions and are conducting road safety audits that aim at identification of safety problems and suggestion of corrective measures.

Road Safety Audit entails an in-depth engineering study of a road using road safety principles with the purpose of identifying cost-effective countermeasures that would improve safety and operations for all road users [(15)]. Safety audits are generally most effective when conducted at locations where a high collision risk has been identified.

To elaborate the methodology of conducting an audit; it includes a comprehensive review of collision history, geometric characteristics, and traffic operational efficiency, and could also include traffic conflict observations and a human factors assessment.

3.0 Network Analysis & Optimization

Network Analysis includes determination of traffic operational efficiency. Simulation and Optimization software like Transyt and Synchro have been used in this research to determine Level of Service of the intersections in the network. Before elaborating on the methodology and discussion of analysis's results, I shall first provide a brief overview of the features of the site along with the sources from where the data has been acquired.

3.1 Site Features

Land-use in the region is mostly dominated by closely packed residences. Land areas are occupied by apartments, mixed-housing and small-business neighborhoods. Immediately north of the region, there is a huge employment area north of Overlea and south of Eglinton, and there are mixed-use areas south of the region, all along and south of Danforth as depicted in the figure below. More than half the houses built are apartments and rest is a mix of row houses and semidetached units. The region has schools and a hospital. Land use and community design have had an impact on mode choice. Auto remains the preferred mode of travel. As a result of the current scenario, with increasing rate of population and employment growth in the region existing roadway facilities are quite insufficient.

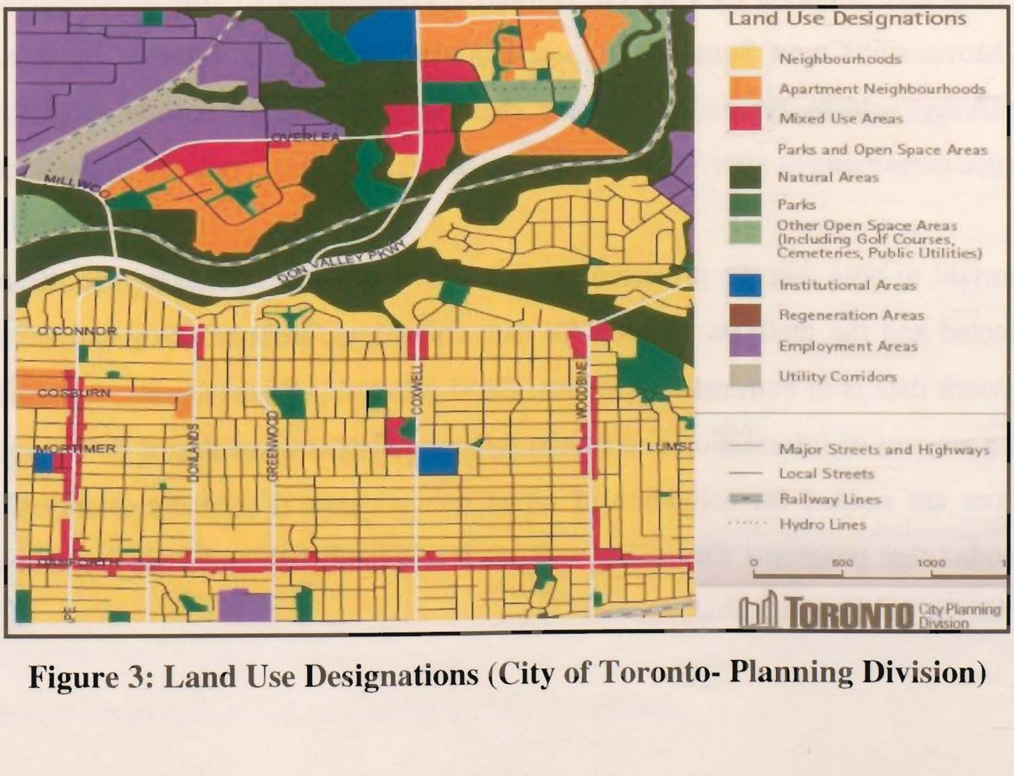

Figure 3: Land Use Designations (City of Toronto- Planning Division)

3.2 Data Collection

The site of selected road network was inspected for collection of signal timing data during P.M. peak period. Road geometry & lane configurations were also observed in the field. Cycles were observed for each intersection. From the field survey, it was observed that all of the signals are pre-timed with two splits. The signal cycle length was observed to be 100 seconds for all intersections. The traffic data pertaining to the volume, composition of vehicles and pedestrians was taken from the records of City of Toronto.

Distance between intersection to intersection was not field measured and was taken from help online. For speed limit, posted limits on the streets were coded. For major streets 50 km/hr was used. For the minor streets, 40 km/hr. was used. For the unsignalized intersections, traffic volumes were not provided by the City of Toronto. For the purpose of coding, traffic volumes at the unsignalized intersections were calculated by balancing the traffic from the nearest intersections.

3.2.1 Volume Data

Volume data was provided by City Of Toronto - Traffic Data Centre & Safety Bureau. The Turning Movement Count Summary Report included intersection volumes by direction, time period and by vehicle type. The volume data was fed into the simulation software for performance measurement after which corrective countermeasures could be implemented.

It is important to note that the precision of the calculated LOS depends on the accuracy of the data collected and the methods adopted for data collection. Thus accuracy and detail of urban street network data is of extreme importance. Good data holds the key to good decision making; Due to the amount of information and spatial & temporal characteristics of data, a large amount of resources are needed for collection of urban network data. To ensure quality of data, it is recommended that programs for quality assurance be established and agencies that collect and manage data be held accountable.

3.2.2 Collision Data

Traffic collisions involve complex interaction between vehicles, human behavior and environmental conditions. Factors responsible for a collision can be many; such as error in judgment, geometrical deficiency, roadway condition or environment condition. Corrective measures can only be exercised upon careful analysis of collision data and conclusions should be drawn upon appropriate qualification and supporting information.

The collision data are categorized into five types, namely;

- General collision,
- Angle -collision,
- Rear-end collision,
- Left-turn collision and
- Pedestrian collision

These collisions are also categorized into three levels of severity;

- Fatal,
- Non-fatal injury and
- Property damage only (PDO)

Collision Data for the research was provided by City of Toronto- Collision Reporting System and included details of:

- Collisions by year
- Collisions by month of the year
- Collisions by road surface condition
- Collisions by impact type
- Category of person involved by age group
- Collisions by severity of injury

3.3 Methodology

Level of service is measured in reference to delay at an intersection taking all turning volumes into account. It is the fundamental factor that contributes to the congestion and overall network performance. Transportation engineers determine measures to minimize the delay by analyzing and designing proper phasing, signal timing and lane configuration at the intersections. There are various tools and software available today to assist engineers in their effort to enhance the road network performance. This project represents the analysis of a typical heavily congested East York area network by using Transyt and Synchro with real facts and figures.

The methodology adopted for traffic operational analysis by use of software is as follows:
At first, field measured data is fed to the network in the software package and performance of the existing network evaluated, this is referred to as base condition. The signal offset optimization is then performed to improve the current level of service. To elaborate the procedure; first the lane configurations are input, then traffic volumes, followed by signal timing and phase configuration of each intersection.

Simulation for the network resulted in errors because the volume data input in the software did not cater the traffic coming from unsignalized intersections in the network. Volume balancing was done for both routes of the network and simulation was run.

The file was then executed for optimization in order to optimize the splits and cycle lengths. The optimized parametric data was again fed into the software to get the modified or optimized system performance.

The next section would elaborate software analysis along with the results and recommended countermeasures.

3.4 Analysis

A detailed analysis was performed with different strategies to enhance the LOS for the network for which traffic volume data was obtained from the City of Toronto, and signal timing plans, lane configurations, were determined from the field. This study is performed in two different stages. The first approach is to assess the existing condition of the network and problem identification. The second approach involves assessment of changes in the level of service using optimized signal splits and optimized cycle lengths followed by development of effective alternatives to resolve the problem.

3.4.1 Transyt Analysis

Base Case Assessment and Optimization Results for Transyt:

The base case evaluation showed O'Connor Avenue was the most poorly performing arterial with 2 signalized intersections at LOS F and 1 intersection at LOS E. The optimization improved the average delays to an extent with appreciable improvement only at Coxwell & O'Connor where the LOS changed from F to E. Two other failing intersections in the network remained at F; however, the average delay times were improved.

No	Name	Fuel Consumption (lit)		Average Delay (sec/veh)		Disutility Index		Level of Service	
		Sim.	Opt.	Sim.	Opt.	Sim.	Opt.	Sim.	Opt.
1	Coxwell-Mortimer	245	243	40	40	32	31	D	D
2	Coxwell-Cosburn	100	100	13	12	9	9	B	B
3	Coxwell-Plains	76	90	13	20	9	12	B	C
4	Coxwell-O'Connor	607	508	94	75	102	74	F	E
5	O'Connor-Don Mills	484	484	68	69	79	79	E	E
6	O'Connor-Donlands	1001	905	348	314	245	219	F	F
7	Donlands-Cosburn	144	143	14	14	12	12	B	B
8	Cosburn-Greenwood	100	98	20	19	11	11	C	B
9	Greenwood-Mortimer	228	239	84	92	42	45	F	F

Table 3: Transyt Results- Network Performance Summary

Table above shows Transyt simulation and split optimization results which lead us to development of rectification techniques. As seen from the results, split optimization alone does little to improve level of service so I shall now take up individual intersections case by case and try various options to reduce delays and better level of service.

1. Coxwell & Mortimer

Coxwell & Mortimer was node 1 of the network and had level of service D which is generally acceptable. Eastbound through traffic had greater delays due to higher traffic volumes and had an LOS of E but overall intersection was seen to function smoothly.

	EB			WB			NB			SB		
NODE 1	L	T	R	L	T	R	L	T	R	L	T	R
V (vph)		856	107	32	274			591		73	437	
Saturation (%)		107	12	40	27			46		32	67	
Avg. Delay (s/v)		64	17	33	12			22		46	41	
Fuel consumption (L)		120	10	2	16			41		7	45	
Effective green (s)		55	55	55	55			35		35	35	
Level of Service		E	B	C	B			C		D	D	
OVERALL INTERSECTION: LOS D												

Table 4: Base Case Analysis Results- Coxwell & Mortimer

	EB			WB			NB			SB			INTERS.
NODE 1	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)		64	17	33	12			22		46	41		40
Final delay (s/v)		61	17	30	12			22		49	45		40
Initial LOS		E	B	C	B			C		D	D		D
Final LOS		E	B	C	B			C		D	D		D

Table 5: Results after Split Optimization- Coxwell & Mortimer

	EB			WB			NB			SB			INTERS.
NODE 1	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)		64	17	33	12			22		46	41		40
Final delay (s/v)		61	18	56	15			29		43	48		43
Initial LOS		E	B	C	B			C		D	D		D
Final LOS		E	B	E	B			C		D	D		D

Table 6: Results after Cycle Length Optimization- Coxwell & Mortimer

2. Coxwell & Cosburn

Coxwell & Cosburn was also observed to function efficiently with a level of service at B.

NODE 2	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
V (vph)		331		40	253			651			587	
Saturation (%)		45		19	55			57			31	
Avg. Delay (s/v)		28		36	37			4			3	
Fuel consumption (L)		25		3	21			30			19	
Effective green (s)		25		25	25			65			65	
Level of Service		C		D	D			A			A	
OVERALL INTERSECTION: LOS B												

Table 7: Base Case Analysis Results- Coxwell & Cosburn

NODE 2	EB			WB			NB			SB			INTERS.
	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)		28		36	37			4			3		13
Final delay (s/v)		17		21	22			13			4		12
Initial LOS		C		D	D			A			A		B
Final LOS		B		C	C			B			A		B

Table 8: Results after Split Optimization- Coxwell & Cosburn

NODE 2	EB			WB			NB			SB			INTERS.
	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)		28		36	37			4			3		13
Final delay (s/v)		37		46	45			5			4		15
Initial LOS		C		D	D			A			A		B
Final LOS		D		D	D			A			A		B

Table 9: Results after Cycle Length Optimization- Coxwell & Cosburn

3. Coxwell & Plains

Coxwell & Plains had an LOS of B which means intersection is running smoothly with minimal delays. Optimization done in Transyt actually worsens the LOS from B to C as delays are seen to increase. Overall the results are acceptable and no corrective action needs to be implemented.

NODE 3	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
V (vph)		251			164			650			470	
Saturation (%)		59			42			41			22	
Avg. Delay (s/v)		27			22			10			6	
Fuel consumption (L)		18			11			23			22	
Effective green (s)		36			36			54			54	
Level of Service		C			C			B			A	
OVERALL INTERSECTION: LOS B												

Table 10: Base Case Analysis Results - Coxwell & Plains

NODE 3	EB			WB			NB			SB			INTERS.
	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)		27			22			10			6		13
Final delay (s/v)		27			22			27			7		20
Initial LOS		C			C			B			A		B
Final LOS		C			C			C			A		C

Table 11: Results after Split Optimization- Coxwell & Plains

NODE 3	EB			WB			NB			SB			INTERS.
	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)		27			22			10			6		13
Final delay (s/v)		32			28			37			7		25
Initial LOS		C			C			B			A		B
Final LOS		C			C			D			A		C

Table 12: Results after Cycle Length Optimization- Coxwell & Plains

4. Coxwell & O' Connor

Coxwell and O'Connor is an intersection that needs immediate attention. This intersection experiences large delays and has large number of crashes as well. The cause of the problem at this intersection is excessive eastbound through traffic which results in an LOS of F. Optimization in Transyt reduced average delays in individual directions and improved LOS of the intersection from F to E.

	EB			WB			NB			SB		
NODE 4	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
V (vph)		2176			1067			611			154	
Saturation (%)		85			94			196			29	
Avg. Delay (s/v)		12			21			530			32	
Fuel consumption (L)		249			68			276			12	
Effective green (s)		63			73			17			17	
Level of Service		B			C			F			C	
OVERALL INTERSECTION: LOS F												

Table 13: Base Case Analysis Results- Coxwell & O' Connor

	EB			WB			NB			SB			INTERS.
NODE 4	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
Initial delay (s/v)		12			21			530			32		94
Final delay (s/v)		5			8			691			44		75
Initial LOS		B			C			F			C		F
Final LOS		A			A			F			D		E

Table 14: Results after Split Optimization- Coxwell & O' Connor

	EB			WB			NB			SB			INTERS.
NODE 4	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
Initial delay (s/v)		12			21			530			32		94
Final delay (s/v)		25			24			314			42		59
Initial LOS		B			C			F			C		F
Final LOS		C			C			F			D		E

Table 15: Results after Cycle Length Optimization- Coxwell & O' Connor

Since optimization for splits and cycle length did not help reduce delays significantly, alteration in intersection geometry and lane configuration was resorted to. Options tried were introducing turn bay storage of 8 vehicles to the right turn lane in northbound direction and making northbound left turn exclusive. These directions had excessive traffic which caused congestion at the intersection. These changes made significant improvement in LOS and brought down intersection average delay from 94 seconds per vehicle to 36 seconds per vehicle. LOS achieved after adoption of countermeasures was D.

Overall Intersection Results for Simulation		**Overall Intersection Results after changes**	
Output Flow (vph)	4008	Output Flow (vph)	3877
Degree of Sat. (%)	196	Degree of Sat. (%)	102
Avg. Delay (sec/v)	94	Avg. Delay (sec/v)	36
Fuel Consumpt. (lit)	607	Fuel Consumpt. (lit)	421
Disutility Index	102	Disutility Index	48
Level of Service	F	Level of Service	D

Table 16: Results after changes in lane configuration- Coxwell & O' Connor

Effect of these changes bettered LOS for intersection 4; however, it had adverse effect on the adjacent intersection. Intersection 3- Coxwell and Plains's LOS suffered and became D from an initial LOS of B. The fuel consumption increased manifold and became 134 liters from an original 76 liters which is unfortunate from environmental viewpoint.

5. O' Connor & Don Mills

Simulation results show an LOS of E for the intersection which is generally acceptable. Optimization of existing conditions was done but it did not help reduce delays for the intersection. To improve LOS, intersection parameters were changed and input in Transyt. Factors were considered individually to determine the effect of each in improving the quality of traffic flow. Alterations made were addition of a hypothetical lane in eastbound direction and addition of protected left turning phase. Signal splits were also changed but little was achieved to better the intersection LOS despite all these alterations.

NODE 5	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
V (vph)	424	603			507	520				1560		394
Saturation (%)	100	49			137	38				96		45
Avg. Delay (s/v)	105	31			278	2				41		14
Fuel consumption (L)	53	48			171	45				141		24
Effective green (s)	45	35			35	85				45		57
Level of Service	F	C			F	A				D		B
OVERALL INTERSECTION: LOS E												

Table 17: Base Case Analysis Results - O' Connor & Don Mills

NODE 5	EB			WB			NB			SB			INTERS.
	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)	105	31			278	2				41		14	68
Final delay (s/v)	70	32			359	2				46		13	69
Initial LOS	F	C			F	A				D		B	E
Final LOS	E	C			F	A				D		B	E

Table 18: Results after Split Optimization- O' Connor & Don Mills

NODE 5	EB			WB			NB			SB			INTERS.
	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)	105	31			278	2				41		14	68
Final delay (s/v)	101	43			295	1				39		86	78
Initial LOS	F	C			F	A				D		B	E
Final LOS	F	D			F	A				D		F	E

Table 19: Results after Cycle Length Optimization- O' Connor & Don Mills

6. O' Connor & Donlands

Simulation results show that the intersection is failing as level of service is F. Even with optimization in Transyt, little improvement is seen in reduction of delays and fuel consumption.

NODE 6	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
V (vph)		590	44		626	48		770			949	20
Saturation (%)		85	8		194	7		52			232	3
Avg. Delay (s/v)		40	23		574	44		16			698	14
Fuel consumption (L)		52	3		315	8		53			567	1
Effective green (s)		33	33		43	43		47			47	47
Level of Service		D	C		F	D		B			F	B
OVERALL INTERSECTION: LOS F												

Table 20: Base Case Analysis Results - O' Connor & Donlands

NODE 6	EB			WB			NB			SB			INTERS.
	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)		40	23		574	44		16			698	14	348
Final delay (s/v)		44	24		463	45		15			672	13	314
Initial LOS		D	C		F	D		B			F	B	F
Final LOS		D	C		F	D		B			F	B	F

Table 21: Results after Split Optimization- O' Connor & Donlands

NODE 6	EB			WB			NB			SB			INTERS.
	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)		40	23		574	44		16			698	14	348
Final delay (s/v)		43	27		494	54		22			717	17	331
Initial LOS		D	C		F	D		B			F	B	F
Final LOS		D	C		F	D		C			F	B	F

Table 22: Results after Cycle Length Optimization- O' Connor & Donlands

To alleviate the traffic situation, variety of lane configurations were input and simulation was run for O'Connor and Donlands. Addition of 6 & 4 turn bay storage for left & right turn respectively for southbound traffic and addition of left turn bay storage of 8 vehicles for westbound traffic was done. No changes were made to phasing or signal timings. The results improved LOS as it changed from an initial F to D.

Overall Intersection Results for Simulation		**Overall Intersection Results after changes**	
Output Flow (vph)	3047	Output Flow (vph)	2453
Degree of Sat. (%)	232	Degree of Sat. (%)	116
Avg. Delay (sec/v)	348	Avg. Delay (sec/v)	54
Fuel Consumpt. (lit)	1001	Fuel Consumpt. (lit)	238
Disutility Index	245	Disutility Index	41
Level of Service	F	Level of Service	D

Table 23: Results after changes in lane configuration- O' Connor & Donlands

Changes made to lane configurations at intersection 6 had favorable results for intersection 5 as well. The LOS at O' Connor & Don Mills improved from E to D and fuel consumption reduced from an initial 484 liters to 406 liters.

7. Cosburn & Donlands

The intersection was seen to perform well under existing conditions. The level of service was B and traffic was moving well. This intersection had minimal crashes as well. The results for simulation and optimization have been shown below.

	EB			WB			NB			SB		
NODE 7	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
V (vph)	42	349	49	68	337			708			486	
Saturation (%)	15	47	8	23	48			36			36	
Avg. Delay (s/v)	25	24	19	14	16			12			7	
Fuel consumption (L)	3	25	3	3	19			41			47	
Effective green (s)	39	39	39	39	39			51			51	
Level of Service	C	C	B	B	B			B			A	
OVERALL INTERSECTION: LOS B												

Table 24: Base Case Analysis Results- Cosburn & Donlands

	EB			WB			NB			SB			INTERS.
NODE 7	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
Initial delay (s/v)	25	24	19	14	16			12			7		14
Final delay (s/v)	24	24	19	14	16			12			7		14
Initial LOS	C	C	B	B	B			B			A		B
Final LOS	C	C	B	B	B			B			A		B

Table 25: Results after Split Optimization- Cosburn & Donlands

	EB			WB			NB			SB			INTERS.
NODE 7	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	
Initial delay (s/v)	25	24	19	14	16			12			7		14
Final delay (s/v)	38	31	25	18	21			15			16		20
Initial LOS	C	C	B	B	B			B			A		B
Final LOS	D	C	C	B	C			B			B		C

Table 26: Results after Cycle Length Optimization- Cosburn & Donlands

8. Cosburn & Greenwood

Traffic at Cosburn and Greenwood was observed to be moving well. Overall intersection had an LOS of C which was improved to B after split optimization in Transyt.

NODE 8	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
V (vph)	33	489		46	307		99	133			396	
Saturation (%)	7	50		14	31		41	21			58	
Avg. Delay (s/v)	11	15		19	14		36	28			24	
Fuel consumption (L)	1	29		3	18		7	10			28	
Effective green (s)	52	52		52	52		38	38			38	
Level of Service	B	B		B	B		D	C			C	
OVERALL INTERSECTION: LOS C												

Table 27: Base Case Analysis Results- Cosburn & Greenwood

NODE 8	EB			WB			NB			SB			INTERS.
	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)	11	15		19	14		36	28			24		20
Final delay (s/v)	13	20		25	19		19	18			18		19
Initial LOS	B	B		B	B		D	C			C		C
Final LOS	B	C		C	B		B	B			B		B

Table 28: Results after Split Optimization- Cosburn & Greenwood

NODE 8	EB			WB			NB			SB			INTERS.
	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)	11	15		19	14		36	28			24		20
Final delay (s/v)	9	15		22	17		30	25			31		22
Initial LOS	B	B		B	B		D	C			C		C
Final LOS	A	B		C	B		C	C			C		C

Table 29: Results after Cycle Length Optimization- Cosburn & Greenwood

9. Mortimer & Greenwood

Traffic volumes were not very high but the intersection was seen to fail because only one lane catered for left, through and right turning movements. The Level of Service was acceptable in all directions but for southbound where it was failing. Changing signal timings did not improve the delays and thus LOS remained at F even after optimization.

	EB			WB			NB			SB		
NODE 9	L	T	R	L	T	R	L	T	R	L	T	R
V (vph)		753			316			374			391	
Saturation (%)		69			31			68			159	
Avg. Delay (s/v)		14			8			32			331	
Fuel consumption (L)		46			28			30			123	
Effective green (s)		59			59			31			31	
Level of Service		B			A			C			F	
OVERALL INTERSECTION: LOS F												

Table 30: Base Case Analysis Results - Mortimer & Greenwood

	EB			WB			NB			SB			INTERS.
NODE 9	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)		14			8			32			331		84
Final delay (s/v)		13			8			34			364		92
Initial LOS		B			A			C			F		F
Final LOS		B			A			C			F		F

Table 31: Results after Split Optimization- Mortimer & Greenwood

	EB			WB			NB			SB			INTERS.
NODE 9	L	T	R	L	T	R	L	T	R	L	T	R	
Initial delay (s/v)		14			8			32			331		84
Final delay (s/v)		17			8			41			355		92
Initial LOS		B			A			C			F		F
Final LOS		B			A			D			F		F

Table 32: Results after Cycle Length Optimization- Mortimer & Greenwood

Changes in lane configuration were made in an attempt to better LOS. An exclusive left turn was provided for southbound traffic which eased congestion in the intersection and improved level of service to D. Fuel consumption and delays reduced remarkably.

Overall Intersection Results for Simulation		**Overall Intersection Results after changes**	
Output Flow (vph)	1834	Output Flow (vph)	1836
Degree of Sat. (%)	159	Degree of Sat. (%)	114
Avg. Delay (sec/v)	84	Avg. Delay (sec/v)	38
Fuel Consumpt. (lit)	228	Fuel Consumpt. (lit)	162
Disutility Index	42	Disutility Index	22
Level of Service	F	Level of Service	D

Table 33: Results after changes in lane configuration- Mortimer & Greenwood

No repercussions were observed at the adjacent intersections and level of service remained normal for intersection numbers 8 and 1.

3.4.2 Synchro Analysis

Synchro analysis shows similar results to the Transyt analysis. There are few differences in between the two packages as made clear by the figure.

Program	Applications						Animation		Measures of Effectiveness	
	Evaluate Existing Timing	Optimize Cycle Length	Optimize Offsets	Optimize splits	Optimize HCS LOS	Lane-by-Lane Analysis	Dynamic	Static	LOS	Fuel Consumption
TRANSYT-7F	√	√	√	√	No	√	No	√	√	√
SYNCHRO	√	√	√	√	√	No	No	√	√	√
CORSIM	√	No	No	No	No	No	√	No	No	√

Figure 4: Synchro & Transyt comparison chart [13]

No.	Name	Intersection Signal Delay (secs)	Intersection Capacity Utilization (%)	Intersection LOS
1	Coxwell-Mortimer	255.9	114.8	F
2	Coxwell-Cosburn	17.5	98.3	B
3	Coxwell-Plains	13.8	69.5	B
4	Coxwell-O'Connor	323.5	135.1	F
5	O'Connor-DonMills	187	120.5	F
6	O'Connor-Donlands	688.5	167.2	F
7	Donlands-Cosburn	25.7	87.2	C
8	Cosburn-Greenwood	21.3	78.2	C
9	Greenwood-Mortimer	86.5	102.4	F

Table 34: Synchro Results- Network Performance Summary

Synchro implements Intersection Capacity Utilization method for determining intersection capacity. It compares current volumes to the intersection's maximum capacity. Intersection Capacity Utilization is similar to but not the same as intersection volume to capacity ratio. A value less than 100% indicates that the intersection has extra capacity. A value greater than 100% indicates the intersection is over capacity [12]. 5 intersections in the network are seen to operate over 100% ICU.

Measures of effectiveness in Synchro include delays, stops, fuel consumption and emissions and a variety of reports can be printed for analysis of simulation/optimization results. Majority of intersections in the network experience huge delays and are seen to have an LOS of F which is the lowest measurement of efficiency for a road's performance with every vehicle moving in lockstep with the vehicle in front of it.

The results in Transyt and Synchro analysis are similar and hence same treatment for the failing intersections is recommended. Note that ICU 2003 includes additional levels past F to further differentiate congested operation [12].

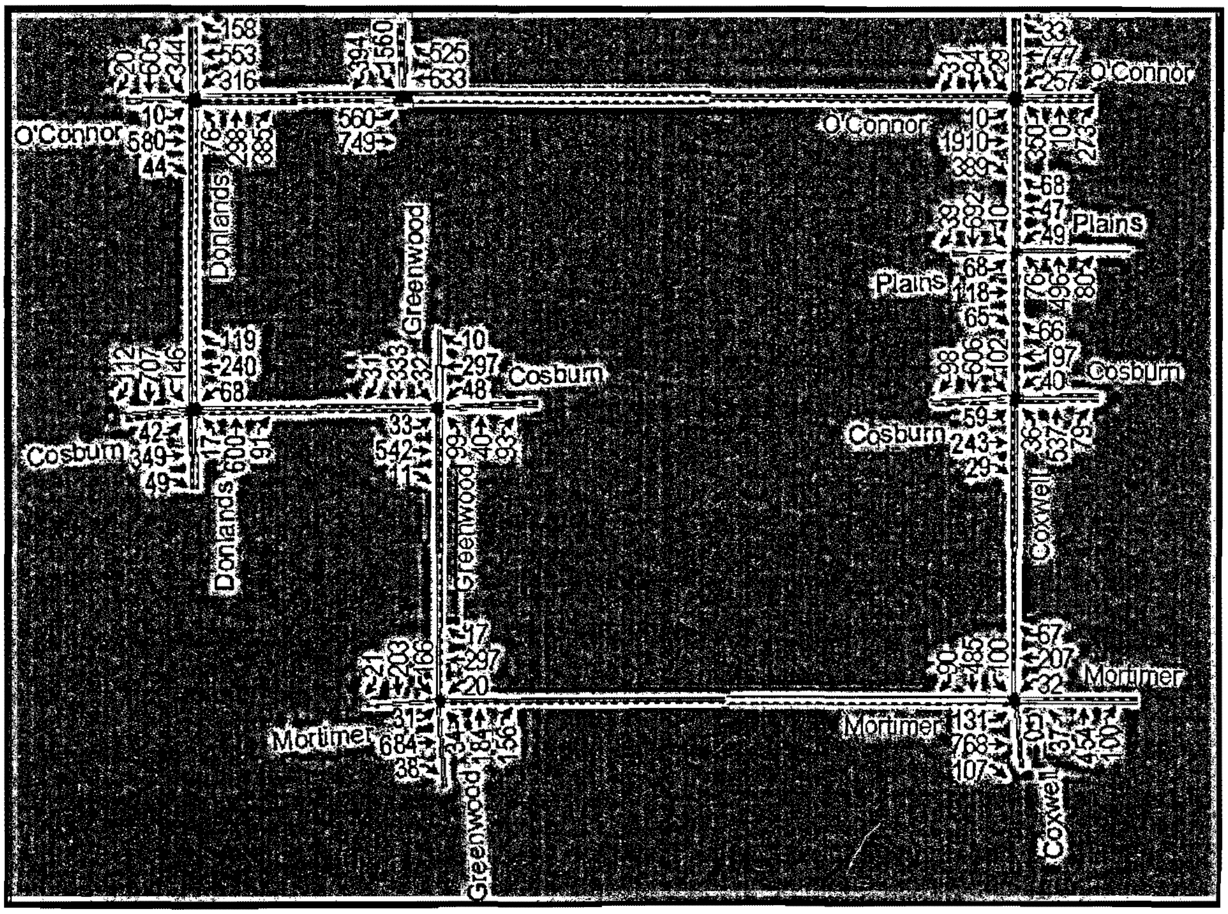

Figure 5: Synchro street network showing traffic volumes

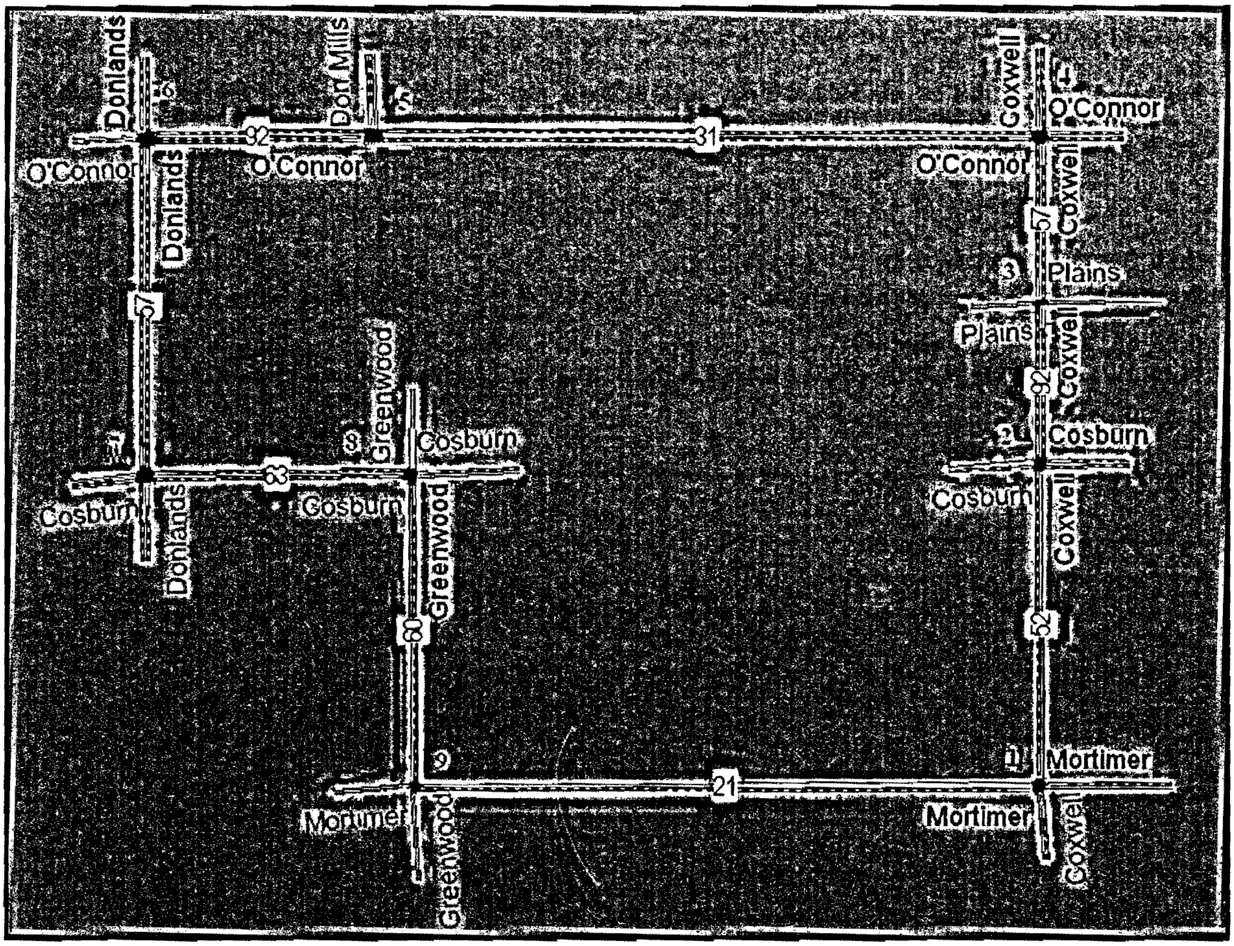

Figure 6: Synchro street network showing CF and street names

Synchro software calculates a factor to determine whether or not coordination between intersections should be done. This factor is called Coordinability Factor (CF), which ranges from 0 to 100 or more. A CF value over 50 means that coordination is recommended. The higher the CF, the more likely it is that segment will benefit from coordination.

CF takes travel times between intersections into account. Synchro recommends coordination if the travel time between intersections is less than 30 seconds [12]. Figure 6 shows CF for the streets on the intersection and it is clearly shown that streets joining intersections 1 & 9 and 4 & 5 have CF equal to 21 and 31 respectively; thus Synchro does not recommend coordination for them.

4.0 Audit Report & Observations

This audit report shall include analysis of collision data for each of the intersections showing high number of collisions. Only after detailed study of conditions and factors that have contributed to the crashes, recommendations for treatment shall be given. I would start by giving a brief introduction of safety audit and enumerate the steps involved in the exercise.

A road safety audit is an in-depth engineering study of an existing road with the objective of identifying cost-effective countermeasures that shall improve traffic operations and road safety [15].

It generally has a standard operating procedure which is as follows:

- Network screening for identification of high risk corridor
- Data collection
- Detailed study of collision data for previous years
- Level of Service analysis
- Identification of safety concerns by site visits and comprehensive investigations
- Providing recommendations to better safety

Having reviewed the collision data (courtesy-City of Toronto Collision Reporting System) for the intersections in the chosen network, it is observed that Coxwell, O'Connor and Donlands are three streets that have high number of collisions. So before conducting a detailed safety audit for the same, I shall provide a graphical analysis of the collision data to understand the factors and conditions that have contributed to the frequency of collisions and accordingly appropriate countermeasures are enforced.

4.1 Collision Analysis

1. Coxwell & Mortimer:

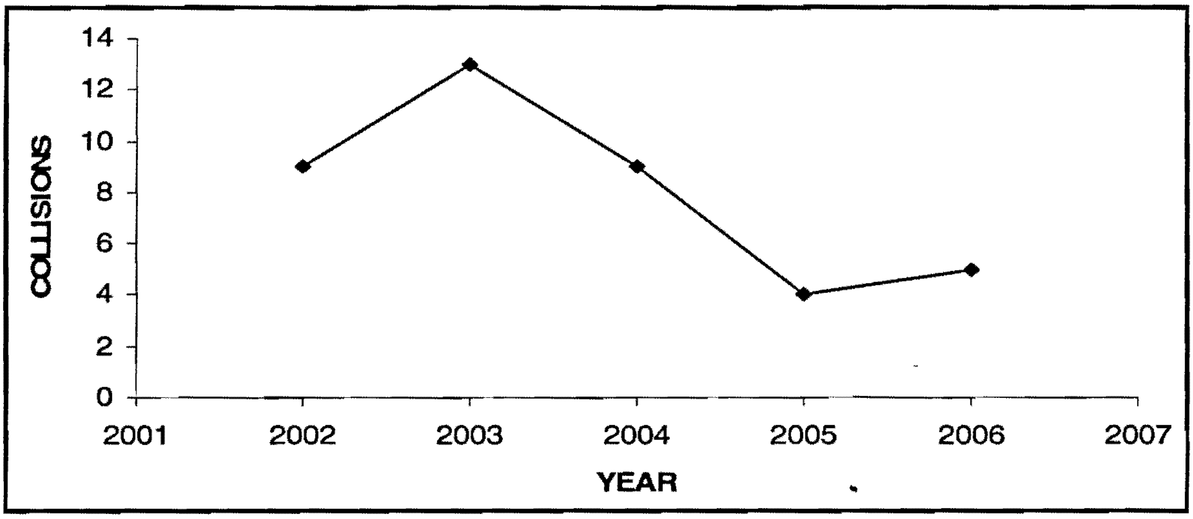

Figure 7: Collisions by year - Coxwell & Mortimer

Figure 7 shows the historical trend for motor vehicle collisions at Coxwell & Mortimer intersection. Data for years 2002-2006 has been provided by City of Toronto.

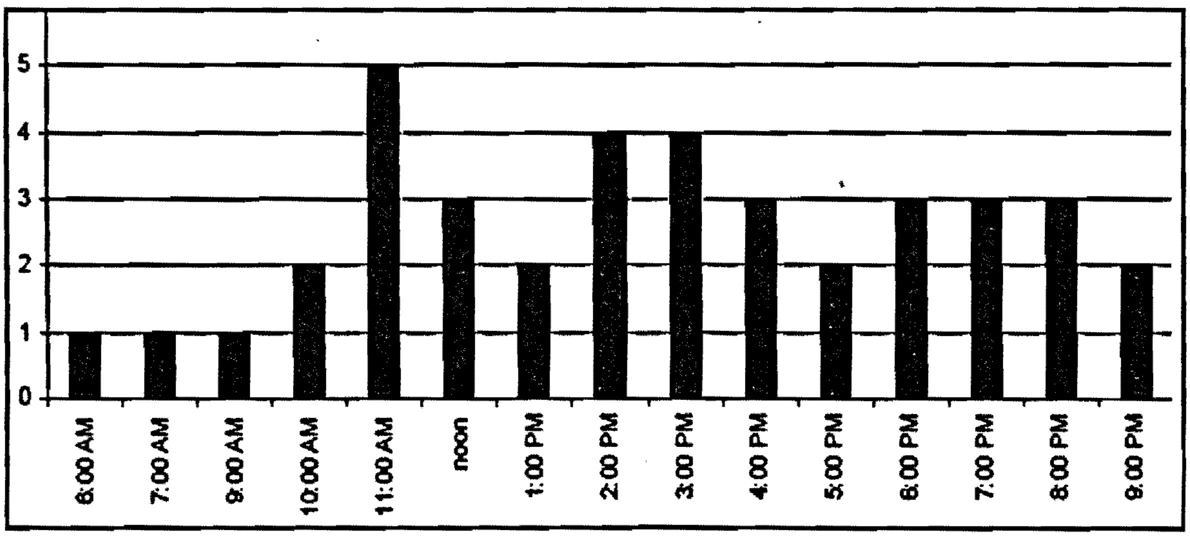

Figure 8: Collisions by hour- Coxwell & Mortimer

Figure 8 shows times at which greater than normal collisions have taken place. 11am and 2 to 3pm have been identified as times where as many as 13 collisions have taken place in last 5 years.

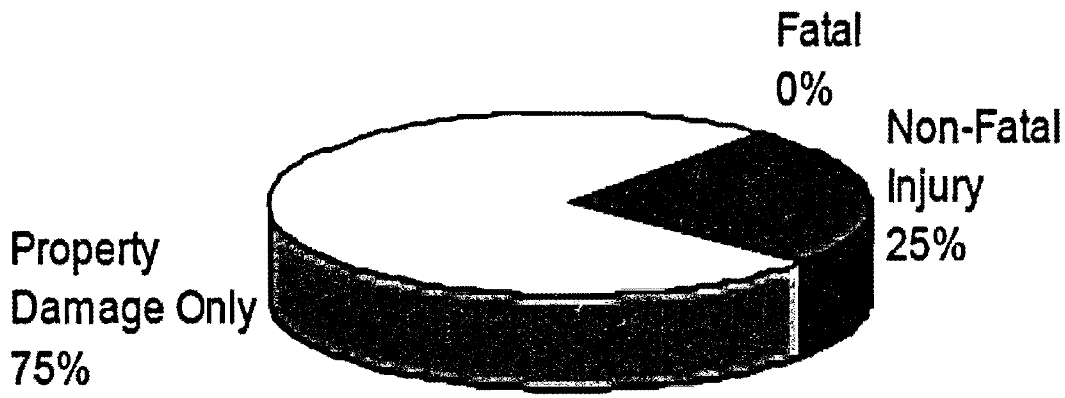

Figure 9: Collisions by classification - Coxwell & Mortimer

This pie-diagram indicates that majority of crashes at Coxwell & Mortimer have been property damage only and one-fourth have been non-fatal injury crashes. No fatalities have been recorded at this intersection.

Also observed is that majority of collisions have been rear end and turning movement and have taken place in dry conditions.

Initial Impact by Class of Collision

Initial Impact Type	Class of Collision			Total
	Fatal	Personal Injury	Property Damage	
Rear End	0	3	13	**16**
Turning Movement	0	2	10	**12**
Angle	0	2	3	**5**
Sideswipe	0	0	4	**4**
Pedestrian Collision	0	2	0	**2**
SMV Other	0	1	0	**1**
Uncoded	0	0	0	**0**
SMV Unattended Vehicle	0	0	0	**0**
Other	0	0	0	**0**
Cyclist Collision	0	0	0	**0**
Approaching	0	0	0	**0**
Total	**0**	**10**	**30**	**40**

Figure 10: Collisions by class of collision- Coxwell & Mortimer

2.0 Coxwell & Cosburn:

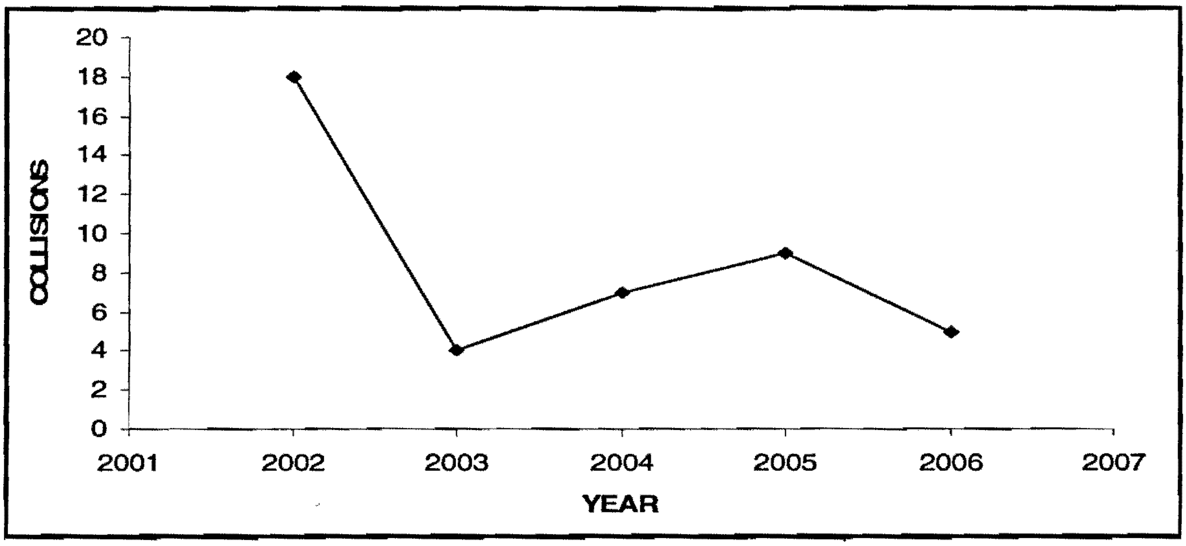

Figure 11: Collisions by year - Coxwell & Cosburn

Figure 11 shows the historical trend for motor vehicle collisions at Coxwell & Cosburn intersection from 2002 to 2006 inclusive.

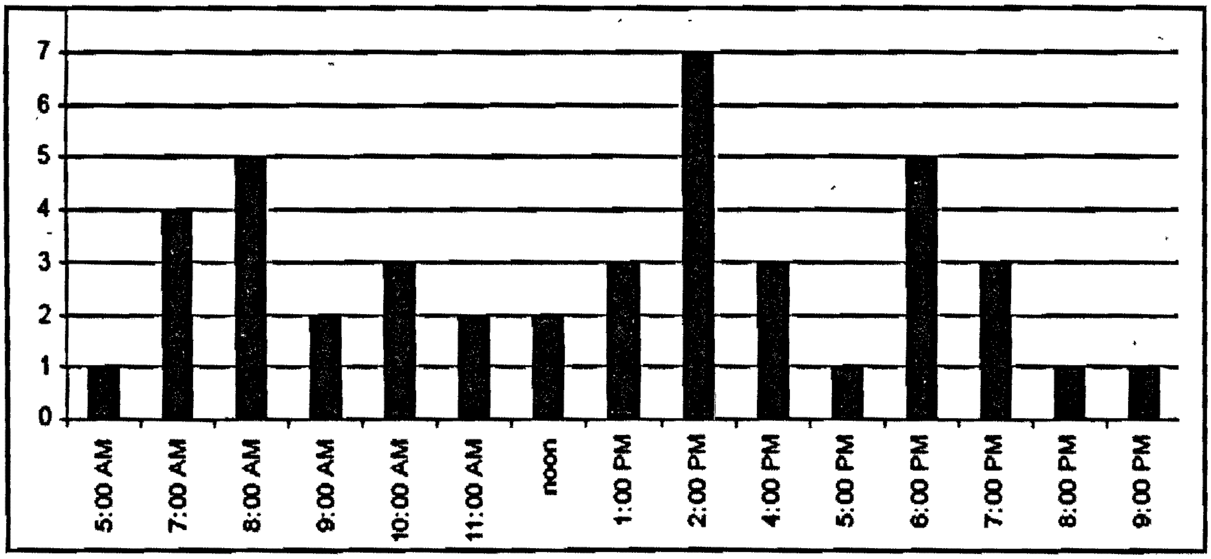

Figure 12: Collisions by hour - Coxwell & Cosburn

Figure 12 shows that large portion of collisions have taken place in the morning and evening rush hour. A unique observation is that 7 collisions have taken place at 2pm in last 5 years. This number could be attributed to the existence of East York Collegiate Institute right at the junction where student drop-off and pick up has been permitted at the road side.

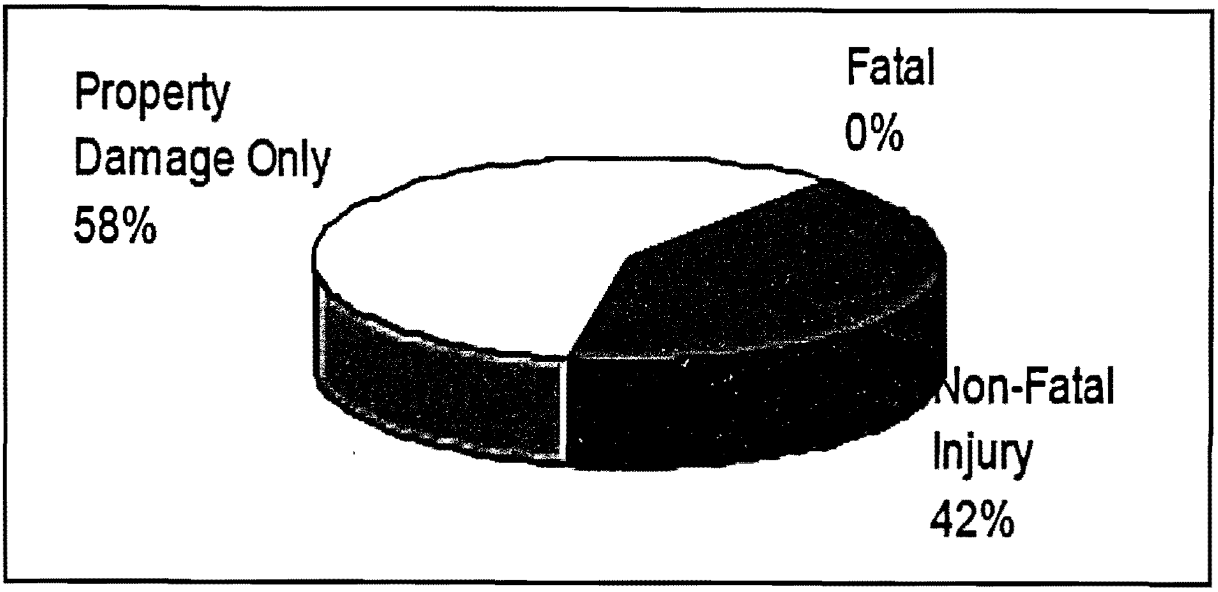

Figure 13: Collisions by classification- Coxwell & Cosburn

Analysis shows that angle, rear end and turning movement accidents contribute heavily to the total number of accidents at this location. 58% and 42% collisions are property damage only and non-fatal injury respectively.

Initial Impact by Class of Collision

Initial Impact Type	Class of Collision			Total
	Fatal	Personal Injury	Property Damage	
Angle	0	7	7	**14**
Rear End	0	5	8	**13**
Turning Movement	0	4	6	**10**
Sideswipe	0	0	4	**4**
SMV Other	0	1	0	**1**
Cyclist Collision	0	1	0	**1**
Uncoded	0	0	0	**0**
SMV Unattended Vehicle	0	0	0	**0**
Pedestrian Collision	0	0	0	**0**
Other	0	0	0	**0**
Approaching	0	0	0	**0**
Total	**0**	**18**	**25**	**43**

Figure 14: Collisions by class of collision- Coxwell & Cosburn

4. **Coxwell & O'Connor:**

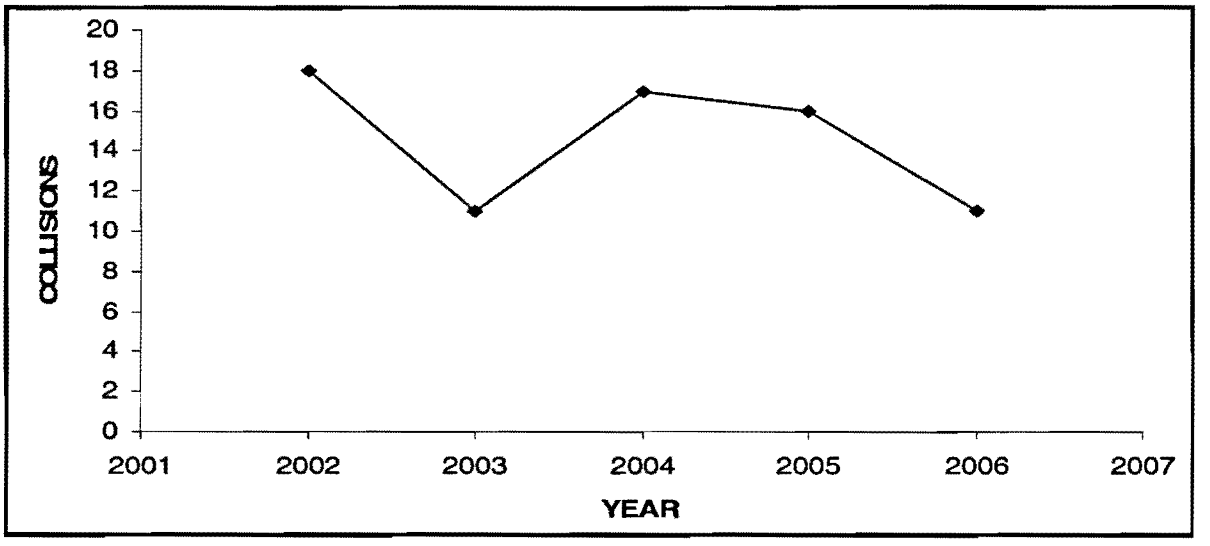

Figure 15: Collisions by year - Coxwell & O'Connor

As many as 73 accidents have taken place at this intersection between years 2002 to 2006. 52 out of those 73 have taken place in dry conditions.

Figure 16 shows that the morning rush hour has caused majority of crashes at the site.

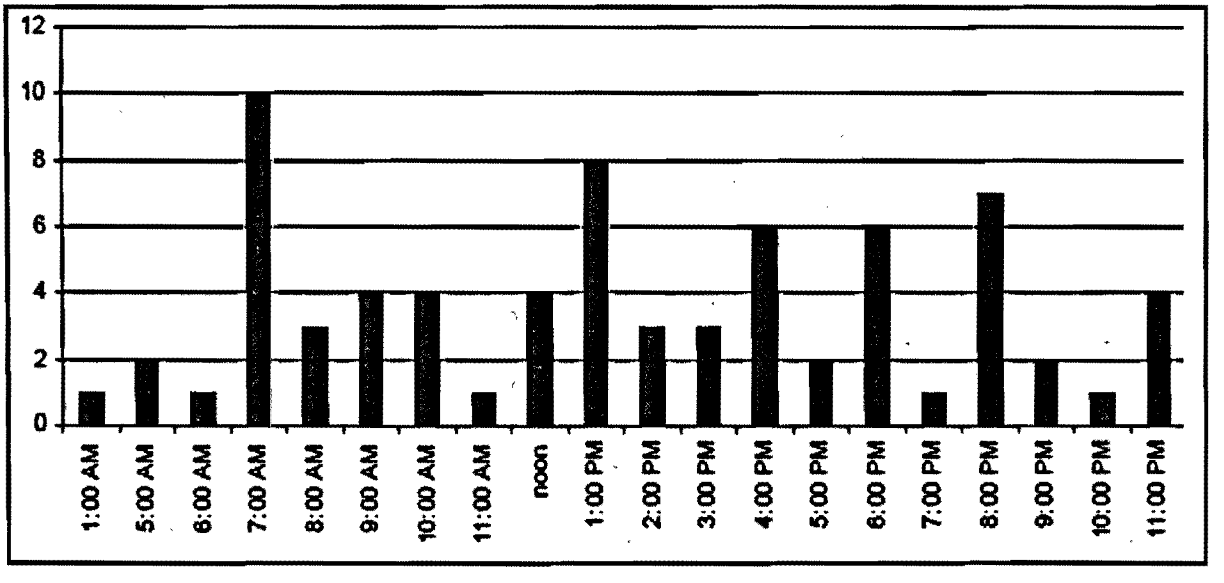

Figure 16: Collisions by hour - Coxwell & O'Connor

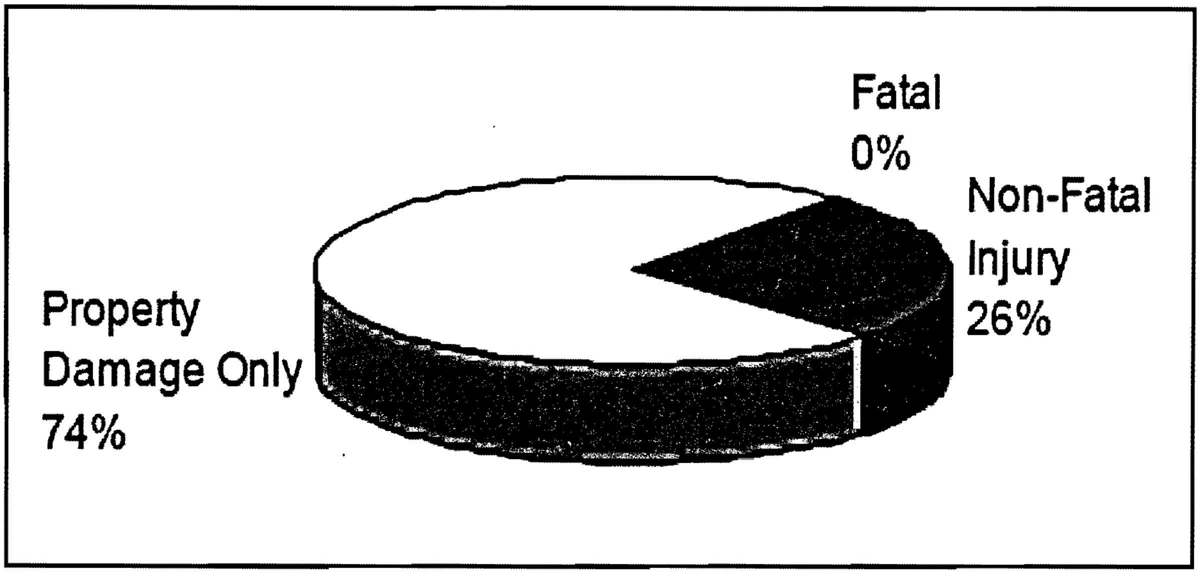

Figure 17: Collisions by classification - Coxwell & O'Connor

There have been 74% and 26% PDO and non-fatal accidents respectively. Majority of these have been rear-end and turning movement accidents.

Initial Impact by Class of Collision

Initial Impact Type	Class of Collision			Total
	Fatal	Personal Injury	Property Damage	
Rear End	0	10	26	36
Turning Movement	0	5	15	20
Angle	0	1	5	6
Sideswipe	0	0	5	5
Pedestrian Collision	0	2	0	2
Approaching	0	0	2	2
SMV Other	0	0	1	1
Cyclist Collision	0	1	0	1
Uncoded	0	0	0	0
SMV Unattended Vehicle	0	0	0	0
Other	0	0	0	0
Total	0	19	54	73

Figure 18: Collisions by class of collision - Coxwell & O'Connor

5.0 O'Connor & Don Mills:

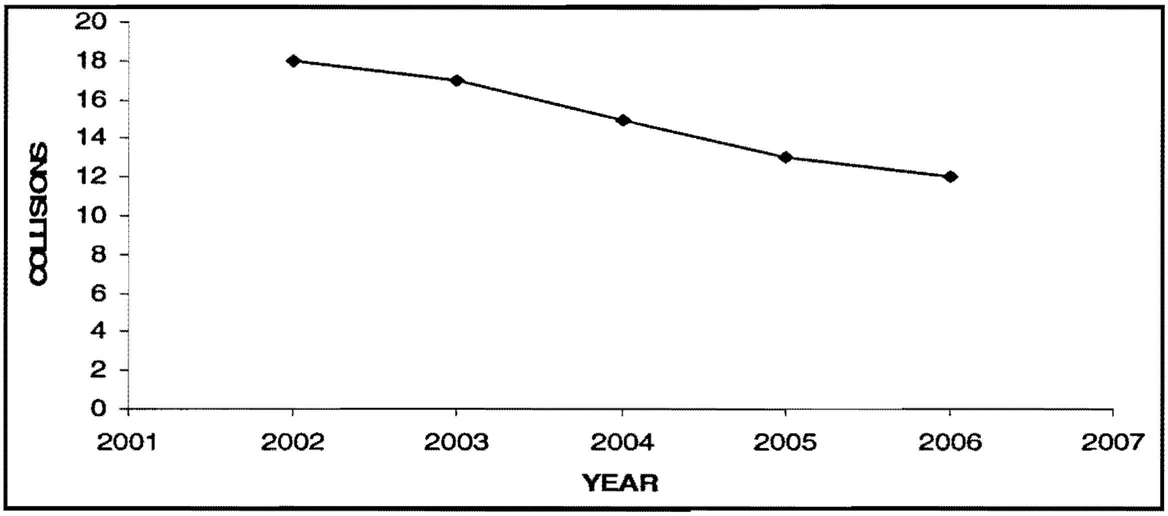

Figure 19: Collisions by year - O'Connor & Don Mills

Figure 19 shows the historical trend for motor vehicle collisions at O'Connor & Don Mills intersection from 2002 to 2006 inclusive. The graph shows a study decline in the number of collisions. A total of 75 accidents have taken place at this intersection.

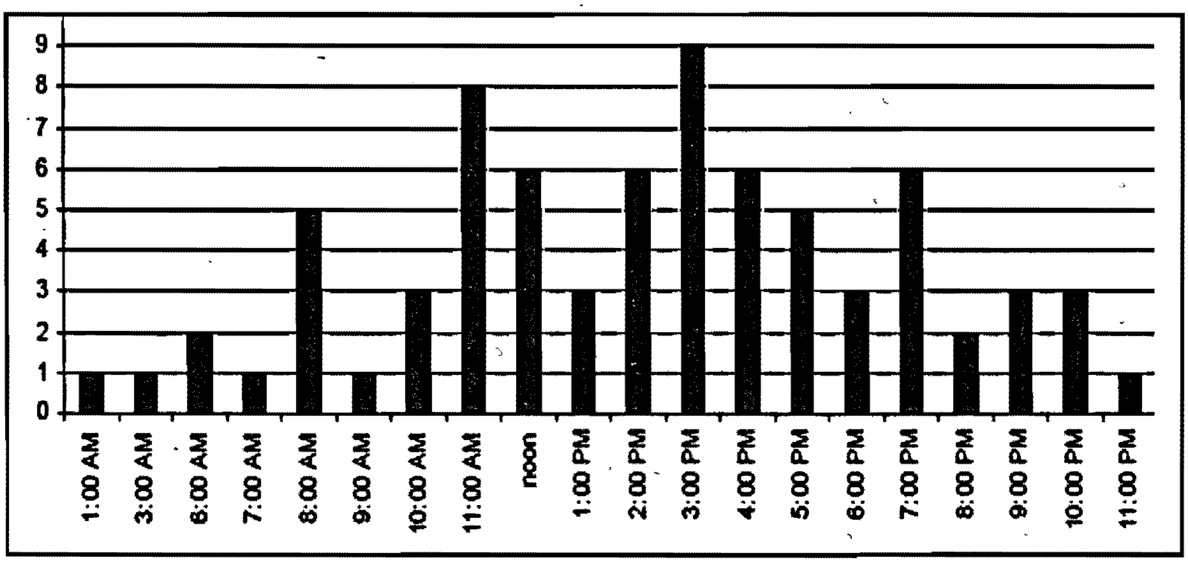

Figure 20: Collisions by hour - O'Connor & Don Mills

Bar graph shows that the accidents are fairly distributed. The number reduces only between 8pm to morning 7pm.

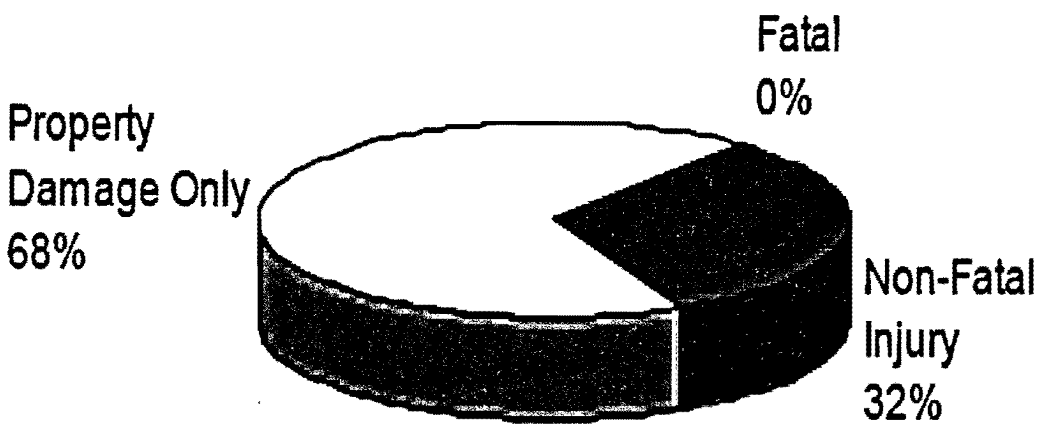

Figure 21: Collisions by classification -O'Connor & Don Mills

PDO contribute to 68% of all the accidents and remaining 32% are non-fatal injury accidents. This intersection also has a high proportion of rear-end and turning movement collisions.

Initial Impact by Class of Collision

Initial Impact Type	Class of Collision			Total
	Fatal	Personal Injury	Property Damage	
Rear End	0	18	26	**44**
Turning Movement	0	4	14	**18**
Angle	0	1	7	**8**
Sideswipe	0	0	4	**4**
Approaching	0	1	0	**1**
Uncoded	0	0	0	**0**
SMV Unattended Vehicle	0	0	0	**0**
SMV Other	0	0	0	**0**
Pedestrian Collision	0	0	0	**0**
Other	0	0	0	**0**
Cyclist Collision	0	0	0	**0**
Total	**0**	**24**	**51**	**75**

Figure 22: Collisions by class of collision - O'Connor & Don Mills

6.0 O' Connor & Donlands:

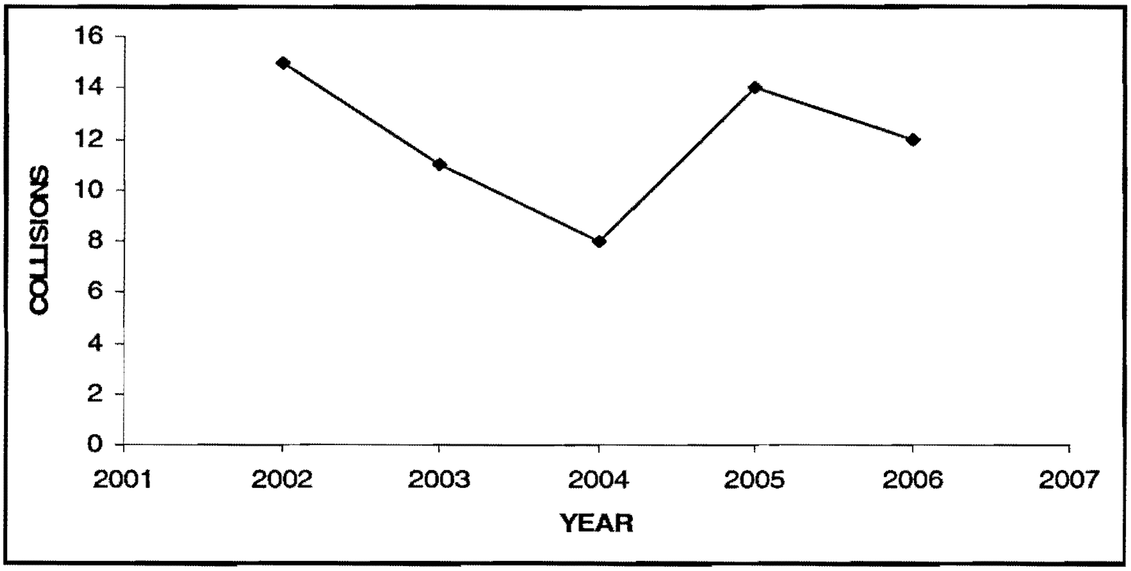

Figure 23: Collisions by year - O' Connor & Donlands

A total of 60 crashes have taken place in years 200-2006 at O' Connor & Donlands. 49 of those 60 have been in dry conditions. The trend of crashes is as depicted in the graph.

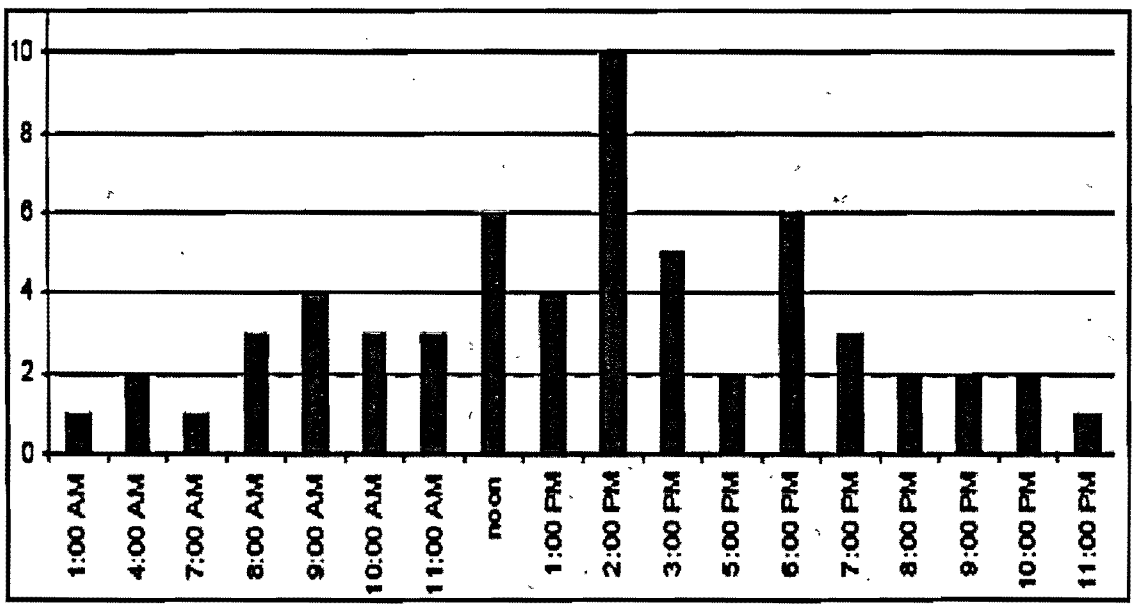

Figure 24: Collisions by hour - O' Connor & Donlands

The bar graph in Figure 24 shows that extremely high number of crashes have occurred in the afternoon.

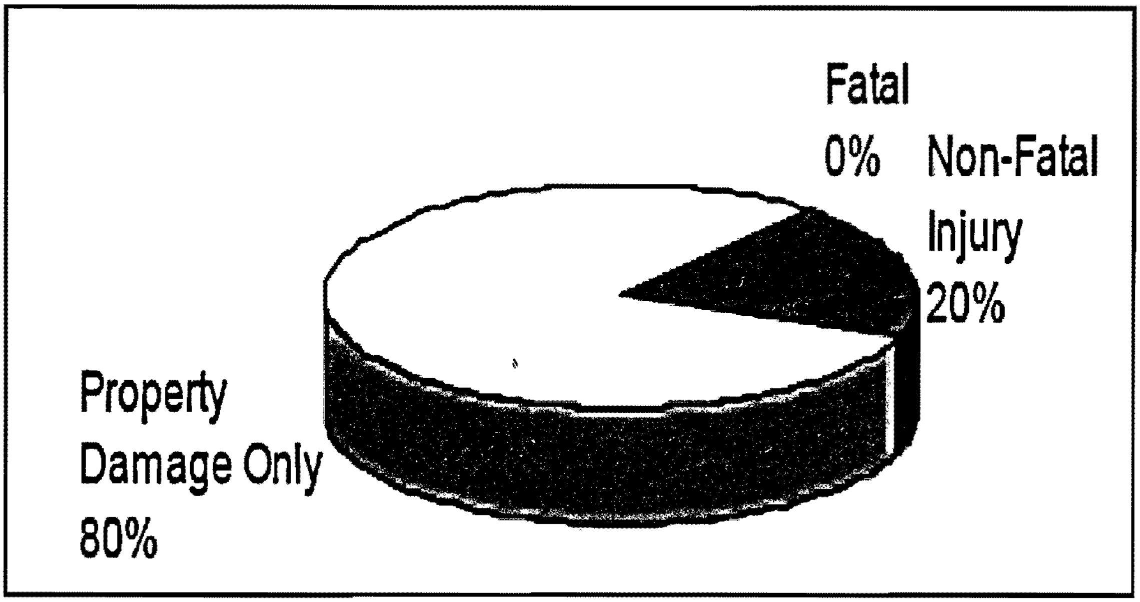

Figure 25: Collisions by classification - O' Connor & Donlands

There have been 80% and 20% PDO and non-fatal accidents at O' Connor & Donlands respectively. Majority of these have been rear-end and turning movement accidents.

Initial Impact by Class of Collision

Initial Impact Type	Class of Collision			Total
	Fatal	Personal Injury	Property Damage	
Rear End	0	3	22	**25**
Turning Movement	0	4	16	**20**
Sideswipe	0	0	6	**6**
Pedestrian Collision	0	4	0	**4**
Angle	0	1	2	**3**
SMV Other	0	0	1	**1**
Approaching	0	0	1	**1**
Uncoded	0	0	0	**0**
SMV Unattended Vehicle	0	0	0	**0**
Other	0	0	0	**0**
Cyclist Collision	0	0	0	**0**
Total	**0**	**12**	**48**	**60**

Figure 26: Collisions by class of collision - O' Connor & Donlands

7.0 Cosburn & Donlands:

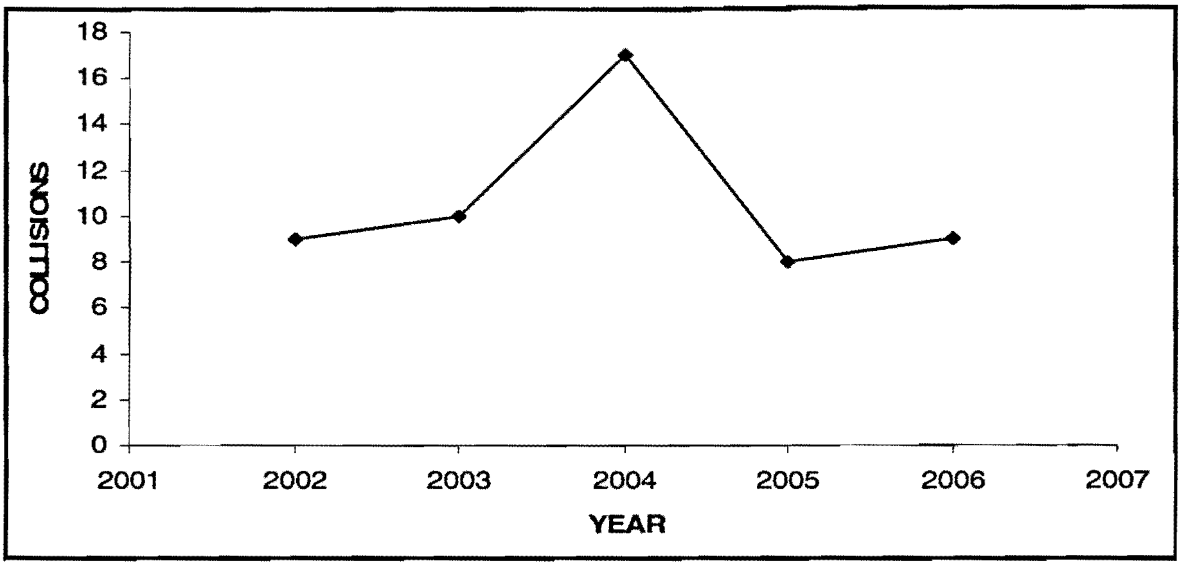

Figure 27: Collisions by hour- Cosburn & Donlands

As many as 53 accidents have taken place at this intersection between years 2002 to 2006. 13 and 15 out of the total 53 have taken place in dry and wet conditions respectively.

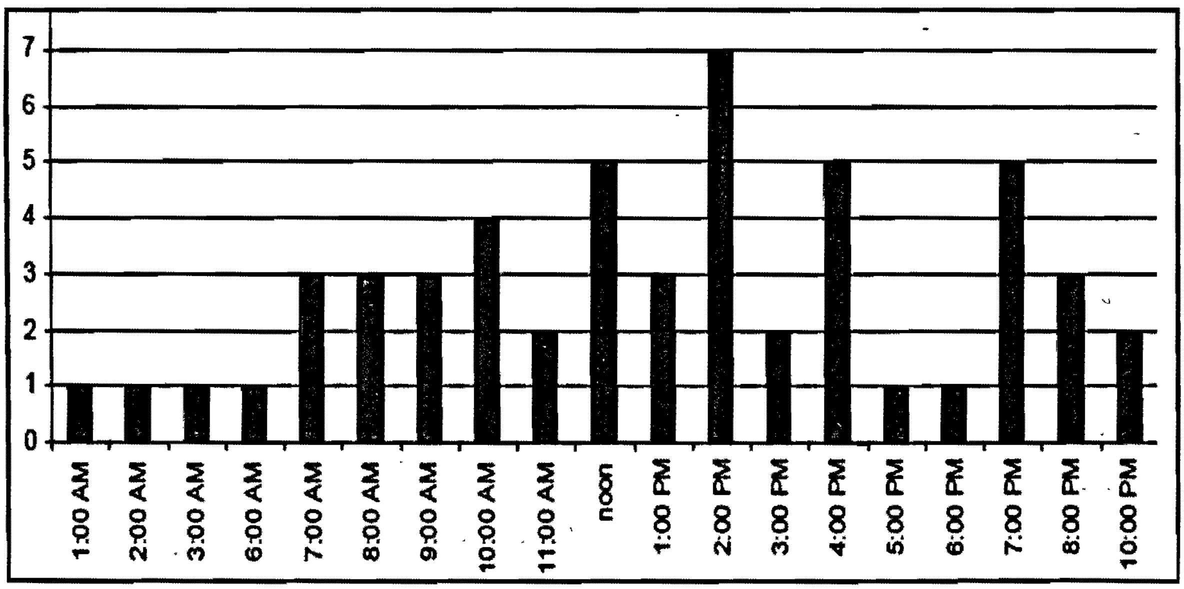

Figure 28: Collisions by hour - Cosburn & Donlands

Figure 28 shows a fairly distributed accident pattern for the whole day, the number of accidents going up as the day progresses with a maximum of 7 accidents occurring at 2pm.

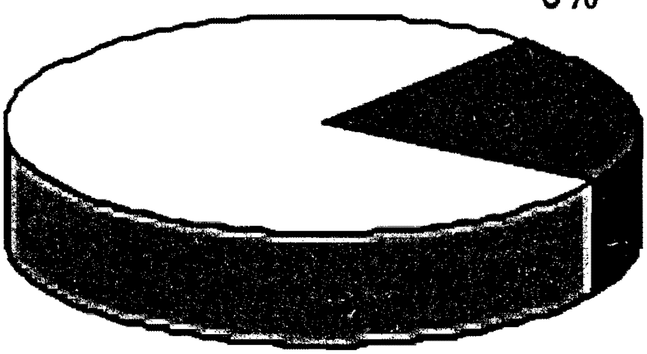

Figure 29: Collisions by classification - Cosburn & Donlands

PDO contribute to 77% of all the accidents and remaining 23% are non-fatal injury accidents. This intersection has a high proportion of rear-end turning movement and angle collisions.

Initial Impact by Class of Collision

Initial Impact Type	Class of Collision			Total
	Fatal	Personal Injury	Property Damage	
Turning Movement	0	4	13	**17**
Rear End	0	5	12	**17**
Angle	0	3	10	**13**
Sideswipe	0	0	3	**3**
SMV Other	0	0	2	**2**
Pedestrian Collision	0	0	1	**1**
Uncoded	0	0	0	**0**
SMV Unattended Vehicle	0	0	0	**0**
Other	0	0	0	**0**
Cyclist Collision	0	0	0	**0**
Approaching	0	0	0	**0**
Total	**0**	**12**	**41**	**53**

Figure 30: Collisions by class of collision - Cosburn & Donlands

4.2 Site visit:

The first site visit took place on March 2, 2007 in the evening peak hour. The purpose of the visit was to collect physical data, lane configuration, speed limits and to conduct a general reconnaissance of the region.

The second visit was made on April 6, 2007 from 12 noon to 4 PM. Detailed investigation of road conditions was done and potential safety hazards were recorded. Pictures of the site were taken so that careful analysis could be done and fitting corrections could be put into effect.

The safety audit site is in a mixed residential and a commercial area with ever increasing traffic growth because of proximity to Don Valley Parkway and the existence of a hospital and school in the area. Poor level of service and starvation delays at most of the intersections especially on the O' Connor avenue is a cause for concern.

4.3 General Findings of the Audit:

The site investigation found that the following were the most common safety concerns in the area audited:

- Inadequate pavement markings
- Insufficient lighting
- Improper land development (property lines extended right up to the pavement edge obstructing turning vehicle's sight at the junctions)
- Too many driveways close to intersection
- Poor location of signs

These along with poorly performing signals were the deficiencies found in the survey; delays and congestion contributed to erratic driver behavior and increased safety risks as it was observed that large number of collisions occurred in the morning rush hour.

I shall now provide intersection specific findings and recommendations based on software analysis and site investigation. The hazards have been shown clearly in the pictures that follow.

Coxwell & Mortimer:

Figures 31 & 32: Road side parking at Coxwell & Mortimer

Figures 31 and 32 show that there is parking allowed on both sides of the road which limits the capacity and because there is no center lane provided for vehicle entry to the hospital, turning vehicles block the road for through traffic.

Figures 33 & 34: No provision for bus bay - Coxwell & Mortimer

Figure 33 shows bus stop right at the intersection and no bus bay provided whereas there is plenty of available space, also made clear by Figure 34. Recommendations for this intersection are provision of bus bays to allow free movement of through traffic. This shall increase throughput and reduce delays. Also provision of center lane for entry and exit from the hospital shall better safety as conflicts shall be reduced.

Coxwell & Cosburn:

Figure 35: Sign hidden by overgrown tree - Coxwell & Cosburn

A number of recommendations can be suggested to reduce collisions at this intersection Signs need to be made more conspicuous; Figure 35 shows that speed limit sign has been blocked by an overgrown tree. A big flaw observed at the intersection was student pick up and drop-off area at the major street which blocks traffic and causes unnecessary delays (Refer Figure 36). The East York Collegiate Institute has a big parking lot which remains underutilized. Road side stopping poses a potential safety hazard which can be done away with easily.

Figure 36: Student pick up & drop-off area at Coxwell & Cosburn

Figure 37: View of Coxwell & Cosburn intersection

Dust bin and Canada Post mail collection box have been placed very close to the edge of pavement which block the right turning traffic's view and are therefore a potential hazard for pedestrian collisions

Figure 38: No bus bay provided at Coxwell & Cosburn

Traffic queuing occurs due to the bus stop location; either the bus stop should be located further back or a bus bay should be provided to better safety and reduce delays. Plenty of space is available for bus bay provision.

Coxwell & O'Connor:

Figure 39: Speed limit sign needs relocation- Coxwell & O'Connor

The maximum speed sign is awkwardly positioned; relocating the sign to improve visibility would help better safety for the intersection. Reverse parking is being used which should be replaced by parallel parking as the reversing vehicles block the roadway increasing delays and also increasing conflicts.

Figure 40: No bus bay at Coxwell & O'Connor

Figure 40 also shows the available space just next to the bus stop (located south of O'Connor- Coxwell intersection) which should be ideally utilized by providing a bus bay. Due to proximity of the bus stop to the intersection, the bus bay would alleviate queuing and improve flow of traffic.

Figure 42 shows oncoming traffic from gas station which creates conflicts and increases probability of collisions. While there is space available as shown in Figure 41, an extra center lane would have bettered safety by accommodating transition of vehicles from gas station with the street flow.

Figures 41 & 42: Entry/ Exit from gas station at Coxwell & O'Connor

O'Connor & Don Mills:

This is one of the major focus areas in the network. It accommodates outgoing and incoming traffic to and from the Don Valley Parkway.

Figure 43: Queues at O'Connor & Don Mills

As evident from the Figure 43 and 44, long queues hold traffic from getting on to and from the DVP. Queues line up as far as the adjacent intersection causing starvation delays. Figure 44 shows presence of an access point right next to the junction which causing conflicting movements.

Figure 44: O'Connor & Don Mills

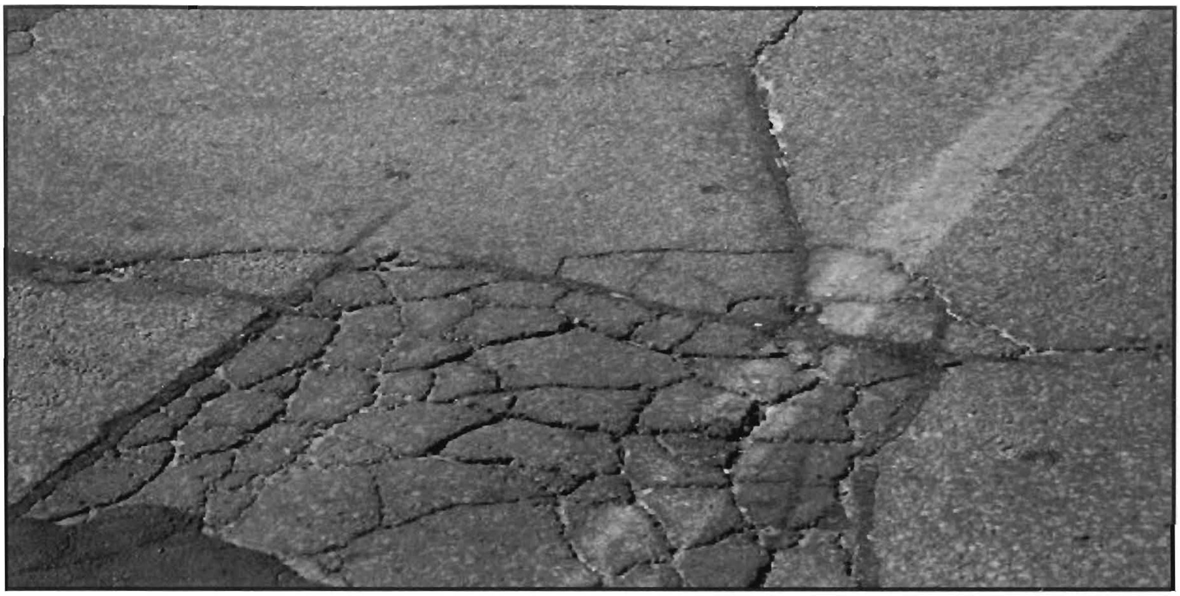

Figure 45: Pavement needs reconditioning at O'Connor & Don Mills

Pavement quality needs to be upgraded Cracks and potholes in pavement are commonly found on approaches to the intersection. Pavement markings need to be repainted as well. The signs need to be re-located to a place where they are more visible. Also some of the signs need re-painting like the one above the driveways sign. Regulations on these signs are hardly visible. Presence of large number of driveways on intersection approach also increases chances of side swipe and angle collisions.

Figure 46: Signs need relocation - O'Connor & Don Mills

O' Connor & Donlands:

Figure 47: Signs need to be relocated - O' Connor & Donlands

O' Connor & Donlands recorded a total of 60 accidents in a 5 year period (2002-2006) which shows the need for a comprehensive safety analysis for the site The signs need to be relocated to a conspicuous and safe place; the direction sign due to its low height has been struck by a truck as shown in Figure 47. Figure 47 shows existence of too many driveways close to the junction which increases probability of potential side swipe collisions. Reverse parking is in effect (Refer Figure 48); if replaced by parallel parking it would better safety. Pavement needs to be reconditioned; pot holes and cracks are plentiful.

Figure 48: Pot holes and cracks at O' Connor & Donlands

Figure 49: Congestion - O' Connor & Donlands

The stop line should be pulled back as the vehicles on the stop line block the turning traffic (Refer Figure 49). As many 20 turning movement accidents have been recorded at this intersection in years 2002-2006 (Refer Collision Data graphical analysis).

Figure 50: Long queues close to O' Connor & Donlands

Due to proximity of adjacent intersection and high volumes, starvation delays are frequent and queuing extends as far as the next intersection.

Cosburn & Donlands:

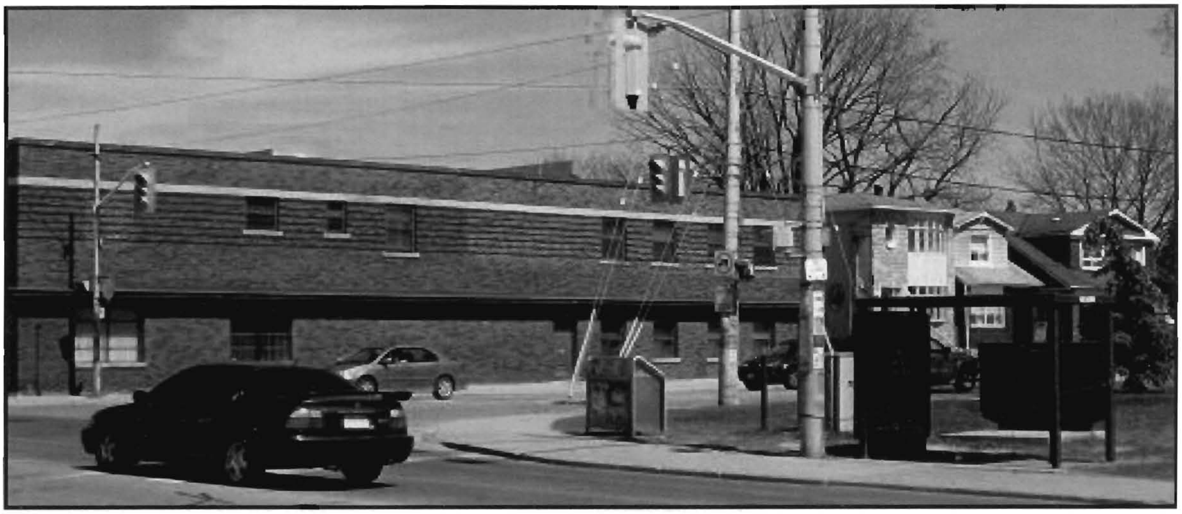

Figure 51: No bus bays at Cosburn & Donlands

As found in many of the other intersections inspected, no bus bays have been provided here as well. The stop is very close to the junction and hence blocks traffic flow and increases delays for auto users. The electric pole and its supporting cables (yellow color) block pedestrian walkway and could be a potential hazard to pedestrian safety.

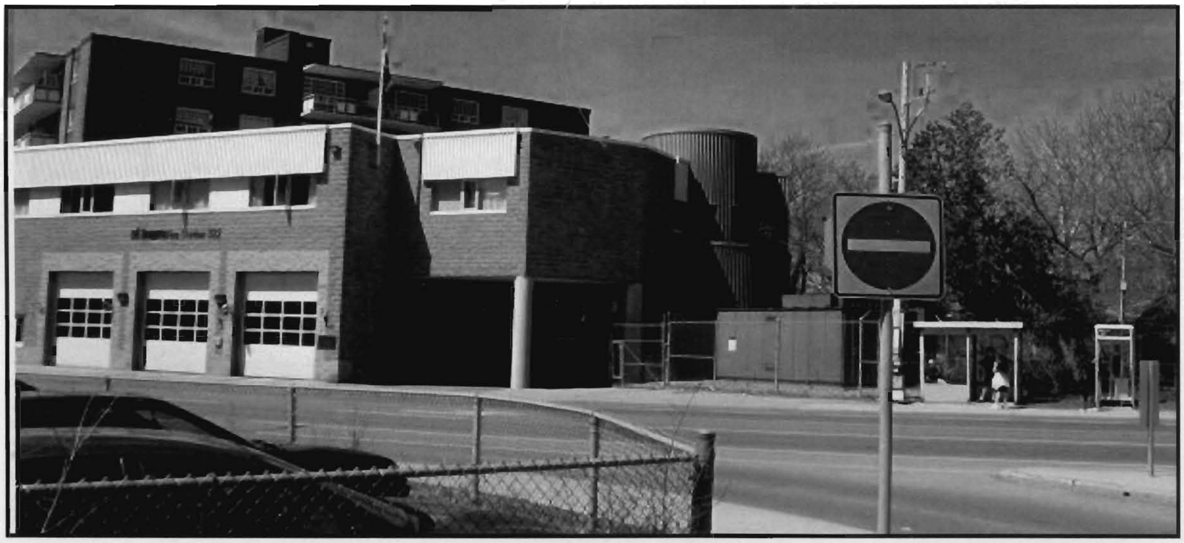

Figure 52: View of Cosburn & Donlands intersection

As evident from Figure 52 the fire station is extended right up to the edge of pavement and there exists a bus stop very close to the access of the fire station. This poses a safety threat as it could lead to delays and congestion close to the junction. The bus stop should either be moved further away from the intersection or a bus bay should be installed so it does not block the roadway.

Conclusions

In this study, a network of nine intersections in East York was selected for review for potential operational and safety improvement. This review was desirable because geometric and operational characteristics had become incompatible with present travel demands that have grown dramatically due to rapid growth in population, employment and land use. Simulation and optimization techniques were used to assess and improve existing level of service (LOS) for the intersections. For the safety review, the adopted approach was based on the "Road Safety Audit Guide" developed by Transportation Association of Canada (TAC). Site visits were performed to investigate lane configuration, phasing sequence and signal timing. Traffic volumes and collision data were provided by City of Toronto.

The data were analysed using Transyt and Synchro software to establish the level of service of the nine intersections in the network. Simulation and optimization in Transyt-7F revealed that, during the morning rush period, three out of the nine intersections in the network were failing with a LOS of F, while there was one intersection each with LOS of D and E, respectively. LOS of F was obtained for five intersections in Synchro simulation of the same data period. Although a reduction in delays was obtained through optimization, no significant change in level of service was achieved without altering lane configuration and geometry.

An analysis of collision data revealed three intersections- Coxwell Avenue, O'Connor Road and Donlands Avenue- as the most poorly performing streets in the entire network and pointed to a need for a detailed investigation of these intersections for possible safety improvement. The investigation revealed numerous safety problems and potential treatments such as relocation of traffic signs, re-timing signals, addition of bus bays, installation of active signals and replacing intersections with roundabouts. Further to these treatments, enhancing programs of law enforcement with public information and education campaigns would facilitate safety improvement in the network.

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Appendices

Appendix A

Transyt Report

Simulation Results

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
SIMULATION RESULTS

Node Number: 1

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		856	107	32	274			591		73	437	
Degree of Sat. (%)		107	12	40	27			46		32	67	
Tot. Travel (veh-km)		674	80	12	110			237		41	238	
Tot.TravTime (veh-h)		28.8	2.1	0.5	3.1			8.4		1.7	9.8	
Avg.TravTime (sec/v)		121	71	62	41			51		87	80	
Unif. Delay (veh-h)		4.3	0.5	0.1	0.9			3.4		0.8	4.3	
Rand. Delay (veh-h)		10.9	0.0	0.1	0.0			0.1		0.0	0.6	
Total Delay (veh-h)		15.3	0.5	0.2	0.9			3.6		0.9	5.0	
Avg. Delay (sec/v)		64	17	33	12			22		46	41	
Unif. Stops (vph)		632	72	27	135			401		62	379	
Unif. Stops (%)		74	68	85	50			68		85	87	
Rand. Stops (vph)		330	1	10	6			13		7	31	
Rand. Stops (%)		39	2	33	3			3		10	8	
Total Stops (vph)		963	73	37	141			415		69	410	
Total Stops (%)		113	69	118	52			71		96	94	
Unif. MBOQ (veh)		13.9	2.1	0.4	3.7			10.7		1.7	10.2	
Unif. MBOQ (m/lane)		107	15	0	30			42		15	76	
Rand. MBOQ (veh)		10.2	0.0	0.3	0.2			0.4		0.2	1.0	
Rand. MBOQ (m/lane)		78	0	2	1			2		2	7	
Total MBOQ (veh)		24.1	2.1	0.7	3.9			11.1		1.9	11.2	
Total MBOQ (m/lane)		185	15	2	31			44		17	83	
Q.Capacity (veh)		93.0	3.0	3.0	53.0			106.0		3.0	49.0	
Q.Capacity (m/lane)		709	23	23	404			404		23	373	
Time Full (%)		0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Critical Link (Y/N)		N	N	N	N			N		N	N	
Fuel Consumpt. (lit)		120	10	2	16			41		7	45	
EffectiveGreen (sec)		55.0	55.0	55.0	55.0			35.0		35.0	35.0	
Arrival Type (1-6)		1	2	3	3			3		1	1	
Level of Service		E	B	C	B			C		D	D	

Overall Intersection Results

Output Flow (vph)	2370
Degree of Sat. (%)	107
Tot. Travel (veh-km)	1395
Tot.TravTime (veh-h)	54
Unif. Delay (veh-h)	14.7
Rand. Delay (veh-h)	12.0
Total Delay (veh-h)	26.7
Avg. Delay (sec/v)	40
Unif. Stops (vph)	1710
Unif. Stops (%)	72
Rand. Stops (vph)	400
Rand. Stops (%)	17
Total Stops (vph)	2111
Total Stops (%)	89
Time Full (%)	0
Fuel Consumpt. (lit)	245
Disutility Index	32
Level of Service	D

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
SIMULATION RESULTS

Node Number: 2

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		331		40	253			651			587	
Degree of Sat. (%)		45		19	55			57			31	
Tot. Travel (veh-km)		133		16	101			270			164	
Tot.TravTime (veh-h)		5.3		0.7	4.6			6.3			3.8	
Avg.TravTime (sec/v)		57		65	66			34			23	
Unif. Delay (veh-h)		2.4		0.3	2.2			0.5			0.5	
Rand. Delay (veh-h)		0.1		0.0	0.3			0.3			0.0	
Total Delay (veh-h)		2.6		0.4	2.6			0.8			0.5	
Avg. Delay (sec/v)		28		36	37			4			3	
Unif. Stops (vph)		246		32	211			119			96	
Unif. Stops (%)		75		81	84			18			16	
Rand. Stops (vph)		13		3	19			17			7	
Rand. Stops (%)		4		10	8			3			2	
Total Stops (vph)		259		36	230			136			103	
Total Stops (%)		79		91	92			22			18	
Unif. MBOQ (veh)		6.7		0.9	5.8			3.3			2.7	
Unif. MBOQ (m/lane)		27		8	46			23			11	
Rand. MBOQ (veh)		0.4		0.1	0.6			0.5			0.2	
Rand. MBOQ (m/lane)		2		1	5			4			1	
Total MBOQ (veh)		7.1		1.0	6.4			3.9			2.9	
Total MBOQ (m/lane)		29		9	51			27			12	
Q.Capacity (veh)		106.0		3.0	52.0			53.0			54.0	
Q.Capacity (m/lane)		404		23	396			404			206	
Time Full (%)		0.0		0.0	0.0			0.0			0.0	
Critical Link (Y/N)		N		N	N			N			N	
Fuel Consumpt. (lit)		25		3	21			30			19	
EffectiveGreen (sec)		25.0		25.0	25.0			65.0			65.0	
Arrival Type (1-6)		3		3	3			1			1	
Level of Service		C		D	D			A			A	

Overall Intersection Results

Output Flow (vph)	1862
Degree of Sat. (%)	57
Tot. Travel (veh-km)	685
Tot.TravTime (veh-h)	20
Unif. Delay (veh-h)	6.2
Rand. Delay (veh-h)	0.9
Total Delay (veh-h)	7.1
Avg. Delay (sec/v)	13
Unif. Stops (vph)	706
Unif. Stops (%)	38
Rand. Stops (vph)	60
Rand. Stops (%)	3
Total Stops (vph)	767
Total Stops (%)	41
Time Full (%)	0
Fuel Consumpt. (lit)	100
Disutility Index	9
Level of Service	B

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
SIMULATION RESULTS

Node Number: 3

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		251			164			650			470	
Degree of Sat. (%)		59			42			41			22	
Tot. Travel (veh-km)		100			65			133			157	
Tot.TravTime (veh-h)		3.9			2.3			4.5			3.9	
Avg.TravTime (sec/v)		56			51			24			30	
Unif. Delay (veh-h)		1.4			0.8			1.7			0.8	
Rand. Delay (veh-h)		0.4			0.1			0.1			0.0	
Total Delay (veh-h)		1.8			1.0			1.8			0.8	
Avg. Delay (sec/v)		27			22			10			6	
Unif. Stops (vph)		172			104			254			248	
Unif. Stops (%)		69			64			39			53	
Rand. Stops (vph)		22			11			9			1	
Rand. Stops (%)		9			7			2			1	
Total Stops (vph)		194			116			263			249	
Total Stops (%)		78			71			41			54	
Unif. MBOQ (veh)		4.4			2.8			6.5			7.0	
Unif. MBOQ (m/lane)		30			23			27			27	
Rand. MBOQ (veh)		0.7			0.4			0.3			0.1	
Rand. MBOQ (m/lane)		5			3			1			0	
Total MBOQ (veh)		5.1			3.1			6.8			7.0	
Total MBOQ (m/lane)		35			26			28			27	
Q.Capacity (veh)		53.0			53.0			53.0			56.0	
Q.Capacity (m/lane)		404			404			202			213	
Time Full (%)		0.0			0.0			0.0			0.0	
Critical Link (Y/N)		N			N			N			N	
Fuel Consumpt. (lit)		18			11			23			22	
EffectiveGreen (sec)		36.0			36.0			54.0			54.0	
Arrival Type (1-6)		3			3			1			1	
Level of Service		C			C			B			A	

Overall Intersection Results

Output Flow (vph)	1535
Degree of Sat. (%)	59
Tot. Travel (veh-km)	457
Tot.TravTime (veh-h)	14
Unif. Delay (veh-h)	4.9
Rand. Delay (veh-h)	0.6
Total Delay (veh-h)	5.6
Avg. Delay (sec/v)	13
Unif. Stops (vph)	779
Unif. Stops (%)	51
Rand. Stops (vph)	44
Rand. Stops (%)	3
Total Stops (vph)	824
Total Stops (%)	54
Time Full (%)	0
Fuel Consumpt. (lit)	76
Disutility Index	9
Level of Service	B

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
SIMULATION RESULTS

Node Number: 4

	Eastbound LT	Eastbound TH	Eastbound RT	Westbound LT	Westbound TH	Westbound RT	Northbound LT	Northbound TH	Northbound RT	Southbound LT	Southbound TH	Southbound RT
Output Flow (vph)		2176			1067			611			154	
Degree of Sat. (%)		85			94			196			29	
Tot. Travel (veh-km)		1967			428			134			61	
Tot.TravTime (veh-h)		47.0			14.9			92.7			2.6	
Avg.TravTime (sec/v)		77			50			546			61	
Unif. Delay (veh-h)		6.8			1.6			14.5			1.3	
Rand. Delay (veh-h)		0.8			4.7			75.4			0.0	
Total Delay (veh-h)		7.6			6.3			90.0			1.4	
Avg. Delay (sec/v)		12			21			530			32	
Unif. Stops (vph)		1836			455			611			120	
Unif. Stops (%)		84			43			100			79	
Rand. Stops (vph)		33			163			1000			6	
Rand. Stops (%)		2			16			164			5	
Total Stops (vph)		1869			619			1611			127	
Total Stops (%)		86			59			264			83	
Unif. MBOQ (veh)		31.5			7.6			16.5			3.4	
Unif. MBOQ (m/lane)		122			30			65			11	
Rand. MBOQ (veh)		1.0			5.0			38.4			0.2	
Rand. MBOQ (m/lane)		4			19			146			1	
Total MBOQ (veh)		32.5			12.7			54.9			3.6	
Total MBOQ (m/lane)		126			49			211			12	
Q.Capacity (veh)		221.0			105.0			56.0			106.0	
Q.Capacity (m/lane)		842			400			213			404	
Time Full (%)		0.0			0.0			0.0			0.0	
Critical Link (Y/N)		N			N			N			N	
Fuel Consumpt. (lit)		249			68			276			12	
EffectiveGreen (sec)		63.0			73.0			17.0			17.0	
Arrival Type (1-6)		1			3			1			3	
Level of Service		B			C			F			C	

Overall Intersection Results

Output Flow (vph)	4008
Degree of Sat. (%)	196
Tot. Travel (veh-km)	2592
Tot.TravTime (veh-h)	157
Unif. Delay (veh-h)	24.3
Rand. Delay (veh-h)	81.1
Total Delay (veh-h)	105.5
Avg. Delay (sec/v)	94
Unif. Stops (vph)	3023
Unif. Stops (%)	75
Rand. Stops (vph)	1203
Rand. Stops (%)	30
Total Stops (vph)	4227
Total Stops (%)	105
Time Full (%)	0
Fuel Consumpt. (lit)	607
Disutility Index	102
Level of Service	F

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
SIMULATION RESULTS

Node Number: 5

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)	424	603			507	520				1560		394
Degree of Sat. (%)	100	49			137	38				96		45
Tot. Travel (veh-km)	164	219			539	447				627		158
Tot.TravTime (veh-h)	15.7	9.6			49.9	9.2				30.4		4.7
Avg.TravTime (sec/v)	133	57			355	63				70		42
Unif. Delay (veh-h)	9.2	5.0			15.4	0.2				11.5		1.3
Rand. Delay (veh-h)	3.2	0.1			23.7	0.0				6.3		0.1
Total Delay (veh-h)	12.4	5.2			39.2	0.2				17.9		1.5
Avg. Delay (sec/v)	105	31			278	2				41		14
Unif. Stops (vph)	145	586			506	105				1432		216
Unif. Stops (%)	34	97			100	20				92		55
Rand. Stops (vph)	103	9			562	2				214		13
Rand. Stops (%)	25	2			112	1				14		4
Total Stops (vph)	249	595			1069	107				1647		230
Total Stops (%)	59	99			211	21				106		59
Unif. MBOQ (veh)	12.5	15.5			20.2	3.0				32.9		5.6
Unif. MBOQ (m/lane)	91	57			152	23				126		46
Rand. MBOQ (veh)	3.2	0.3			17.4	0.1				6.6		0.4
Rand. MBOQ (m/lane)	24	1			132	1				25		3
Total MBOQ (veh)	15.7	15.8			37.6	3.0				39.6		6.0
Total MBOQ (m/lane)	115	58			284	24				151		49
Q.Capacity (veh)	12.0	76.0			96.0	12.0				10.0		10.0
Q.Capacity (m/lane)	91	290			732	91				38		76
Time Full (%)	58.0	0.0			0.0	0.0				52.0		0.0
Critical Link (Y/N)	Y	N			N	N				Y		N
Fuel Consumpt. (lit)	53	48			171	45				141		24
EffectiveGreen (sec)	45.0	35.0			35.0	85.0				45.0		57.0
Arrival Type (1-6)	4	1			3	3				3		3
Level of Service	F	C			F	A				D		B

Overall Intersection Results

Output Flow (vph)	4008
Degree of Sat. (%)	137
Tot. Travel (veh-km)	2155
Tot.TravTime (veh-h)	119
Unif. Delay (veh-h)	42.9
Rand. Delay (veh-h)	33.6
Total Delay (veh-h)	76.6
Avg. Delay (sec/v)	68
Unif. Stops (vph)	2993
Unif. Stops (%)	75
Rand. Stops (vph)	906
Rand. Stops (%)	23
Total Stops (vph)	3899
Total Stops (%)	97
Time Full (%)	110
Fuel Consumpt. (lit)	484
Disutility Index	79
Level of Service	E

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
SIMULATION RESULTS

Node Number: 6

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		590	44		626	48		770			949	20
Degree of Sat. (%)		85	8		194	7		52			232	3
Tot. Travel (veh-km)		237	17		254	46		329			381	8
Tot.TravTime (veh-h)		11.4	0.6		104.9	1.5		10.1			191.6	0.2
Avg.TravTime (sec/v)		69	52		603	113		47			727	43
Unif. Delay (veh-h)		4.5	0.2		24.7	0.5		3.2			25.1	0.0
Rand. Delay (veh-h)		2.1	0.0		75.1	0.0		0.2			158.8	0.0
Total Delay (veh-h)		6.6	0.2		99.8	0.5		3.5			184.0	0.0
Avg. Delay (sec/v)		40	23		574	44		16			698	14
Unif. Stops (vph)		507	28		626	108		548			949	10
Unif. Stops (%)		86	66		100	226		71			100	51
Rand. Stops (vph)		79	1		1000	0		16			1000	0
Rand. Stops (%)		14	4		160	1		3			106	3
Total Stops (vph)		587	30		1626	108		564			1949	10
Total Stops (%)		100	69		260	227		74			206	53
Unif. MBOQ (veh)		12.6	0.8		28.1	3.0		14.2			33.6	0.3
Unif. MBOQ (m/lane)		99	8		213	23		53			259	0
Rand. MBOQ (veh)		2.5	0.0		38.7	0.0		0.5			68.4	0.0
Rand. MBOQ (m/lane)		19	0		295	0		2			521	0
Total MBOQ (veh)		15.0	0.9		66.8	3.0		14.7			102.0	0.3
Total MBOQ (m/lane)		118	8		508	23		55			780	0
Q.Capacity (veh)		49.0	3.0		26.0	3.0		114.0			40.0	3.0
Q.Capacity (m/lane)		373	23		198	23		434			305	23
Time Full (%)		0.0	0.0		11.0	6.0		0.0			0.0	0.0
Critical Link (Y/N)		N	N		Y	N		N			N	N
Fuel Consumpt. (lit)		52	3		315	8		53			567	1
EffectiveGreen (sec)		33.0	33.0		43.0	43.0		47.0			47.0	47.0
Arrival Type (1-6)		3	3		1	1		1			3	3
Level of Service		D	C		F	D		B			F	B

Overall Intersection Results

Output Flow (vph)	3047
Degree of Sat. (%)	232
Tot. Travel (veh-km)	1274
Tot.TravTime (veh-h)	320
Unif. Delay (veh-h)	58.7
Rand. Delay (veh-h)	236.3
Total Delay (veh-h)	295.0
Avg. Delay (sec/v)	348
Unif. Stops (vph)	2779
Unif. Stops (%)	91
Rand. Stops (vph)	2097
Rand. Stops (%)	69
Total Stops (vph)	4877
Total Stops (%)	160
Time Full (%)	17
Fuel Consumpt. (lit)	1001
Disutility Index	245
Level of Service	F

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
SIMULATION RESULTS

Node Number: 7

	Eastbound LT	Eastbound TH	Eastbound RT	Westbound LT	Westbound TH	Westbound RT	Northbound LT	Northbound TH	Northbound RT	Southbound LT	Southbound TH	Southbound RT
Output Flow (vph)	42	349	49	68	337			708			486	
Degree of Sat. (%)	15	47	8	23	48			36			36	
Tot. Travel (veh-km)	16	140	19	23	123			284			417	
Tot.TravTime (veh-h)	0.6	5.2	0.6	0.7	3.9			8.1			9.4	
Avg.TravTime (sec/v)	54	53	48	39	42			41			69	
Unif. Delay (veh-h)	0.2	2.2	0.2	0.2	1.3			2.3			1.0	
Rand. Delay (veh-h)	0.0	0.2	0.0	0.0	0.2			0.1			0.0	
Total Delay (veh-h)	0.3	2.4	0.2	0.2	1.5			2.4			1.0	
Avg. Delay (sec/v)	25	24	19	14	16			12			7	
Unif. Stops (vph)	29	248	29	27	152			354			216	
Unif. Stops (%)	70	71	60	41	45			50			45	
Rand. Stops (vph)	2	14	1	4	13			9			2	
Rand. Stops (%)	7	5	3	7	5			2			1	
Total Stops (vph)	32	263	30	32	166			363			218	
Total Stops (%)	78	76	63	48	50			52			46	
Unif. MBOQ (veh)	0.8	6.7	0.8	0.5	4.2			9.7			5.7	
Unif. MBOQ (m/lane)	8	53	8	0	30			38			23	
Rand. MBOQ (veh)	0.1	0.4	0.0	0.1	0.4			0.3			0.1	
Rand. MBOQ (m/lane)	1	3	0	1	3			1			0	
Total MBOQ (veh)	0.9	7.1	0.9	0.6	4.6			10.0			5.8	
Total MBOQ (m/lane)	9	56	8	1	33			39			23	
Q.Capacity (veh)	3.0	52.0	3.0	3.0	44.0			106.0			113.0	
Q.Capacity (m/lane)	23	396	23	23	335			404			431	
Time Full (%)	0.0	0.0	0.0	0.0	0.0			0.0			0.0	
Critical Link (Y/N)	N	N	N	N	N			N			N	
Fuel Consumpt. (lit)	3	25	3	3	19			41			47	
EffectiveGreen (sec)	39.0	39.0	39.0	39.0	39.0			51.0			51.0	
Arrival Type (1-6)	3	3	3	5	1			3			1	
Level of Service	C	C	B	B	B			B			A	

Overall Intersection Results

Output Flow (vph)	2039
Degree of Sat. (%)	48
Tot. Travel (veh-km)	1025
Tot.TravTime (veh-h)	28
Unif. Delay (veh-h)	7.6
Rand. Delay (veh-h)	0.5
Total Delay (veh-h)	8.2
Avg. Delay (sec/v)	14
Unif. Stops (vph)	1059
Unif. Stops (%)	52
Rand. Stops (vph)	47
Rand. Stops (%)	2
Total Stops (vph)	1106
Total Stops (%)	54
Time Full (%)	0
Fuel Consumpt. (lit)	144
Disutility Index	12
Level of Service	B

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
SIMULATION RESULTS

Node Number: 8

	Eastbound LT	Eastbound TH	Eastbound RT	Westbound LT	Westbound TH	Westbound RT	Northbound LT	Northbound TH	Northbound RT	Southbound LT	Southbound TH	Southbound RT
Output Flow (vph)	33	489		46	307		99	133			396	
Degree of Sat. (%)	7	50		14	31		41	21			58	
Tot. Travel (veh-km)	11	189		18	123		41	55			159	
Tot.TravTime (veh-h)	0.3	5.9		0.6	3.7		1.8	2.1			5.8	
Avg.TravTime (sec/v)	35	43		47	43		66	58			53	
Unif. Delay (veh-h)	0.1	1.9		0.2	1.1		0.9	1.0			2.2	
Rand. Delay (veh-h)	0.0	0.2		0.0	0.0		0.1	0.0			0.4	
Total Delay (veh-h)	0.1	2.1		0.2	1.2		1.0	1.0			2.6	
Avg. Delay (sec/v)	11	15		19	14		36	28			24	
Unif. Stops (vph)	10	254		27	165		55	87			274	
Unif. Stops (%)	32	52		59	54		56	66			69	
Rand. Stops (vph)	1	14		2	7		7	3			22	
Rand. Stops (%)	4	3		6	3		8	3			6	
Total Stops (vph)	11	268		29	173		63	90			296	
Total Stops (%)	35	55		65	57		64	69			75	
Unif. MBOQ (veh)	0.3	6.9		0.8	4.5		1.5	2.4			7.1	
Unif. MBOQ (m/lane)	0	53		8	38		15	15			53	
Rand. MBOQ (veh)	0.0	0.4		0.1	0.2		0.2	0.1			0.7	
Rand. MBOQ (m/lane)	0	3		1	2		2	1			5	
Total MBOQ (veh)	0.3	7.3		0.8	4.7		1.8	2.5			7.8	
Total MBOQ (m/lane)	0	56		9	40		17	16			58	
Q.Capacity (veh)	3.0	44.0		3.0	53.0		3.0	54.0			52.0	
Q.Capacity (m/lane)	23	335		23	404		23	411			396	
Time Full (%)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Critical Link (Y/N)	N	N		N	N		N	N			N	
Fuel Consumpt. (lit)	1	29		3	18		7	10			28	
EffectiveGreen (sec)	52.0	52.0		52.0	52.0		38.0	38.0			38.0	
Arrival Type (1-6)	4	1		3	3		3	1			3	
Level of Service	B	B		B	B		D	C			C	

Overall Intersection Results

Output Flow (vph)	1503
Degree of Sat. (%)	58
Tot. Travel (veh-km)	598
Tot.TravTime (veh-h)	20
Unif. Delay (veh-h)	7.6
Rand. Delay (veh-h)	0.8
Total Delay (veh-h)	8.5
Avg. Delay (sec/v)	20
Unif. Stops (vph)	874
Unif. Stops (%)	58
Rand. Stops (vph)	58
Rand. Stops (%)	4
Total Stops (vph)	933
Total Stops (%)	62
Time Full (%)	0
Fuel Consumpt. (lit)	100
Disutility Index	11
Level of Service	C

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
SIMULATION RESULTS

Node Number: 9

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		753			316			374			391	
Degree of Sat. (%)		69			31			68			159	
Tot. Travel (veh-km)		302			250			150			161	
Tot.TravTime (veh-h)		9.0			5.7			6.3			39.2	
Avg.TravTime (sec/v)		43			65			61			361	
Unif. Delay (veh-h)		2.3			0.7			2.7			5.0	
Rand. Delay (veh-h)		0.7			0.0			0.6			30.9	
Total Delay (veh-h)		3.0			0.7			3.3			35.9	
Avg. Delay (sec/v)		14			8			32			331	
Unif. Stops (vph)		424			114			290			365	
Unif. Stops (%)		56			36			78			93	
Rand. Stops (vph)		34			6			32			625	
Rand. Stops (%)		5			3			9			161	
Total Stops (vph)		459			121			322			991	
Total Stops (%)		61			39			87			254	
Unif. MBOQ (veh)		10.0			3.3			7.5			7.7	
Unif. MBOQ (m/lane)		76			23			61			61	
Rand. MBOQ (veh)		1.1			0.2			1.0			19.3	
Rand. MBOQ (m/lane)		8			2			8			147	
Total MBOQ (veh)		11.0			3.5			8.5			27.1	
Total MBOQ (m/lane)		84			25			69			208	
Q.Capacity (veh)		52.0			98.0			53.0			52.0	
Q.Capacity (m/lane)		396			747			404			396	
Time Full (%)		0.0			0.0			0.0			0.0	
Critical Link (Y/N)		N			N			N			N	
Fuel Consumpt. (lit)		46			28			30			123	
EffectiveGreen (sec)		59.0			59.0			31.0			31.0	
Arrival Type (1-6)		3			1			3			1	
Level of Service		B			A			C			F	

Overall Intersection Results

Output Flow (vph)	1834
Degree of Sat. (%)	159
Tot. Travel (veh-km)	865
Tot.TravTime (veh-h)	60
Unif. Delay (veh-h)	10.7
Rand. Delay (veh-h)	32.3
Total Delay (veh-h)	43.1
Avg. Delay (sec/v)	84
Unif. Stops (vph)	1194
Unif. Stops (%)	65
Rand. Stops (vph)	699
Rand. Stops (%)	38
Total Stops (vph)	1894
Total Stops (%)	103
Time Full (%)	0
Fuel Consumpt. (lit)	228
Disutility Index	42
Level of Service	F

Optimization for Splits Results

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR SPLITS

Node Number: 1

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		848	107	32	274			591		74	442	
Degree of Sat. (%)		106	12	38	27			46		33	68	
Tot. Travel (veh-km)		674	80	12	110			237		41	238	
Tot.TravTime (veh-h)		27.8	2.1	0.5	3.1			8.4		1.8	10.4	
Avg.TravTime (sec/v)		118	71	59	41			51		89	84	
Unif. Delay (veh-h)		4.1	0.5	0.1	0.9			3.4		0.9	4.9	
Rand. Delay (veh-h)		10.1	0.0	0.1	0.0			0.1		0.0	0.6	
Total Delay (veh-h)		14.3	0.5	0.2	0.9			3.6		1.0	5.6	
Avg. Delay (sec/v)		61	17	30	12			22		49	45	
Unif. Stops (vph)		609	70	26	135			401		61	383	
Unif. Stops (%)		72	66	83	50			68		84	87	
Rand. Stops (vph)		309	1	9	6			13		7	31	
Rand. Stops (%)		37	2	30	3			3		10	8	
Total Stops (vph)		919	72	35	141			415		69	414	
Total Stops (%)		109	68	113	52			71		94	94	
Unif. MBOQ (veh)		13.4	2.0	0.4	3.7			10.7		1.7	10.5	
Unif. MBOQ (m/lane)		99	15	0	30			42		15	84	
Rand. MBOQ (veh)		9.6	0.0	0.3	0.2			0.4		0.2	1.0	
Rand. MBOQ (m/lane)		73	0	2	1			2		2	7	
Total MBOQ (veh)		23.0	2.0	0.7	3.9			11.1		1.9	11.5	
Total MBOQ (m/lane)		172	15	2	31			44		17	91	
Q.Capacity (veh)		93.0	3.0	3.0	53.0			106.0		3.0	50.0	
Q.Capacity (m/lane)		709	23	23	404			404		23	381	
Time Full (%)		0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Critical Link (Y/N)		N	N	N	N			N		N	N	
Fuel Consumpt. (lit)		117	10	2	16			41		8	46	
EffectiveGreen (sec)		55.0	55.0	55.0	55.0			35.0		35.0	35.0	
Arrival Type (1-6)		1	2	3	3			3		1	1	
Level of Service		E	B	C	B			C		D	D	

Overall Intersection Results

Output Flow (vph)	2368
Degree of Sat. (%)	106
Tot. Travel (veh-km)	1395
Tot.TravTime (veh-h)	54
Unif. Delay (veh-h)	15.1
Rand. Delay (veh-h)	11.2
Total Delay (veh-h)	26.4
Avg. Delay (sec/v)	40
Unif. Stops (vph)	1689
Unif. Stops (%)	71
Rand. Stops (vph)	378
Rand. Stops (%)	16
Total Stops (vph)	2067
Total Stops (%)	87
Time Full (%)	0
Fuel Consumpt. (lit)	243
Disutility Index	31
Level of Service	D

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR SPLITS

Node Number: 2

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)			331		40	253			651			594
Degree of Sat. (%)			30		10	34			73			40
Tot. Travel (veh-km)			133		16	101			270			164
Tot.TravTime (veh-h)			4.2		0.5	3.5			7.9			4.1
Avg.TravTime (sec/v)			46		50	51			43			24
Unif. Delay (veh-h)			1.5		0.2	1.4			1.7			0.6
Rand. Delay (veh-h)			0.0		0.0	0.0			0.7			0.1
Total Delay (veh-h)			1.5		0.2	1.5			2.5			0.8
Avg. Delay (sec/v)			17		21	22			13			4
Unif. Stops (vph)			190		25	168			230			112
Unif. Stops (%)			58		64	66			35			19
Rand. Stops (vph)			6		1	8			34			10
Rand. Stops (%)			3		5	4			6			2
Total Stops (vph)			197		27	176			264			123
Total Stops (%)			60		69	70			41			21
Unif. MBOQ (veh)			5.2		0.7	4.6			6.0			3.2
Unif. MBOQ (m/lane)			19		8	38			46			11
Rand. MBOQ (veh)			0.2		0.1	0.3			1.0			0.3
Rand. MBOQ (m/lane)			1		0	2			8			1
Total MBOQ (veh)			5.5		0.8	4.8			7.0			3.5
Total MBOQ (m/lane)			20		8	40			54			12
Q.Capacity (veh)			106.0		3.0	53.0			52.0			54.0
Q.Capacity (m/lane)			404		23	404			396			206
Time Full (%)			0.0		0.0	0.0			0.0			0.0
Critical Link (Y/N)			N		N	N			N			N
Fuel Consumpt. (lit)			21		2	17			37			20
EffectiveGreen (sec)			40.0		40.0	40.0			50.0			50.0
Arrival Type (1-6)			3		3	3			1			1
Level of Service			B		C	C			B			A

Overall Intersection Results

Output Flow (vph)	1869
Degree of Sat. (%)	73
Tot. Travel (veh-km)	685
Tot.TravTime (veh-h)	20
Unif. Delay (veh-h)	5.6
Rand. Delay (veh-h)	1.0
Total Delay (veh-h)	6.7
Avg. Delay (sec/v)	12
Unif. Stops (vph)	727
Unif. Stops (%)	39
Rand. Stops (vph)	61
Rand. Stops (%)	3
Total Stops (vph)	788
Total Stops (%)	42
Time Full (%)	0
Fuel Consumpt. (lit)	100
Disutility Index	9
Level of Service	B

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR SPLITS

Node Number: 3

	Eastbound LT	Eastbound TH	Eastbound RT	Westbound LT	Westbound TH	Westbound RT	Northbound LT	Northbound TH	Northbound RT	Southbound LT	Southbound TH	Southbound RT
Output Flow (vph)		251			164			647			480	
Degree of Sat. (%)		59			42			59			22	
Tot. Travel (veh-km)		100			65			133			157	
Tot.TravTime (veh-h)		3.9			2.3			7.5			4.0	
Avg.TravTime (sec/v)		56			51			42			30	
Unif. Delay (veh-h)		1.4			0.8			4.5			0.9	
Rand. Delay (veh-h)		0.4			0.1			0.3			0.0	
Total Delay (veh-h)		1.8			1.0			4.8			0.9	
Avg. Delay (sec/v)		27			22			27			7	
Unif. Stops (vph)		172			104			416			304	
Unif. Stops (%)		69			64			64			63	
Rand. Stops (vph)		22			11			17			2	
Rand. Stops (%)		9			7			3			1	
Total Stops (vph)		194			116			433			306	
Total Stops (%)		78			71			67			64	
Unif. MBOQ (veh)		4.4			2.8			5.3			8.6	
Unif. MBOQ (m/lane)		30			23			19			34	
Rand. MBOQ (veh)		0.7			0.4			0.5			0.1	
Rand. MBOQ (m/lane)		5			3			2			0	
Total MBOQ (veh)		5.1			3.1			5.8			8.7	
Total MBOQ (m/lane)		35			26			21			34	
Q.Capacity (veh)		53.0			53.0			53.0			56.0	
Q.Capacity (m/lane)		404			404			202			213	
Time Full (%)		0.0			0.0			0.0			0.0	
Critical Link (Y/N)		N			N			N			N	
Fuel Consumpt. (lit)		18			11			35			24	
EffectiveGreen (sec)		36.0			36.0			54.0			54.0	
Arrival Type (1-6)		3			3			1			1	
Level of Service		C			C			C			A	

Overall Intersection Results

Output Flow (vph)	1542
Degree of Sat. (%)	59
Tot. Travel (veh-km)	457
Tot.TravTime (veh-h)	17
Unif. Delay (veh-h)	7.8
Rand. Delay (veh-h)	0.8
Total Delay (veh-h)	8.7
Avg. Delay (sec/v)	20
Unif. Stops (vph)	997
Unif. Stops (%)	65
Rand. Stops (vph)	53
Rand. Stops (%)	3
Total Stops (vph)	1050
Total Stops (%)	68
Time Full (%)	0
Fuel Consumpt. (lit)	90
Disutility Index	12
Level of Service	C

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR SPLITS

Node Number: 4

	Eastbound LT	Eastbound TH	Eastbound RT	Westbound LT	Westbound TH	Westbound RT	Northbound LT	Northbound TH	Northbound RT	Southbound LT	Southbound TH	Southbound RT
Output Flow (vph)		2186			1067			372			154	
Degree of Sat. (%)		76			84			213			49	
Tot. Travel (veh-km)		1967			428			134			61	
Tot.TravTime (veh-h)		42.3			11.2			74.1			3.1	
Avg.TravTime (sec/v)		69			37			717			73	
Unif. Delay (veh-h)		2.6			0.5			17.0			1.6	
Rand. Delay (veh-h)		0.3			2.0			54.3			0.2	
Total Delay (veh-h)		3.0			2.6			71.4			1.9	
Avg. Delay (sec/v)		5			8			691			44	
Unif. Stops (vph)		1174			237			371			135	
Unif. Stops (%)		54			22			100			88	
Rand. Stops (vph)		16			79			823			15	
Rand. Stops (%)		1			8			222			10	
Total Stops (vph)		1191			316			1195			150	
Total Stops (%)		55			30			322			98	
Unif. MBOQ (veh)		16.8			4.4			17.3			3.8	
Unif. MBOQ (m/lane)		65			15			65			15	
Rand. MBOQ (veh)		0.5			2.4			25.4			0.5	
Rand. MBOQ (m/lane)		2			9			97			2	
Total MBOQ (veh)		17.4			6.8			42.7			4.2	
Total MBOQ (m/lane)		67			24			162			17	
Q.Capacity (veh)		222.0			105.0			56.0			106.0	
Q.Capacity (m/lane)		846			400			213			404	
Time Full (%)		0.0			0.0			0.0			0.0	
Critical Link (Y/N)		N			N			N			N	
Fuel Consumpt. (lit)		221			53			219			14	
EffectiveGreen (sec)		72.0			82.0			8.0			8.0	
Arrival Type (1-6)		1			3			1			3	
Level of Service		A			A			F			D	

Overall Intersection Results

Output Flow (vph)	3779
Degree of Sat. (%)	213
Tot. Travel (veh-km)	2592
Tot.TravTime (veh-h)	130
Unif. Delay (veh-h)	21.9
Rand. Delay (veh-h)	57.0
Total Delay (veh-h)	78.9
Avg. Delay (sec/v)	75
Unif. Stops (vph)	1918
Unif. Stops (%)	51
Rand. Stops (vph)	934
Rand. Stops (%)	25
Total Stops (vph)	2853
Total Stops (%)	76
Time Full (%)	0
Fuel Consumpt. (lit)	508
Disutility Index	74
Level of Service	E

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR SPLITS

Node Number: 5

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)	524	608			393	525				1560		394
Degree of Sat. (%)	97	49			154	39				98		43
Tot. Travel (veh-km)	164	219			539	447				627		158
Tot.TravTime (veh-h)	13.5	9.8			49.9	9.2				32.6		4.6
Avg.TravTime (sec/v)	92	58			457	63				75		42
Unif. Delay (veh-h)	7.7	5.2			12.0	0.2				11.9		1.3
Rand. Delay (veh-h)	2.5	0.1			27.1	0.0				8.1		0.1
Total Delay (veh-h)	10.2	5.4			39.1	0.3				20.0		1.5
Avg. Delay (sec/v)	70	32			359	2				46		13
Unif. Stops (vph)	188	591			392	108				1460		209
Unif. Stops (%)	36	97			100	21				94		53
Rand. Stops (vph)	84	9			570	4				267		12
Rand. Stops (%)	17	2			146	1				18		4
Total Stops (vph)	272	600			962	112				1727		221
Total Stops (%)	53	99			245	22				111		57
Unif. MBOQ (veh)	12.2	15.7			16.9	3.0				33.8		5.6
Unif. MBOQ (m/lane)	91	61			130	23				130		46
Rand. MBOQ (veh)	2.6	0.3			17.6	0.1				8.3		0.4
Rand. MBOQ (m/lane)	20	1			134	1				31		3
Total MBOQ (veh)	14.8	16.0			34.5	3.2				42.1		6.0
Total MBOQ (m/lane)	111	62			264	24				161		49
Q.Capacity (veh)	12.0	76.0			97.0	12.0				10.0		10.0
Q.Capacity (m/lane)	91	290			739	91				38		76
Time Full (%)	48.0	0.0			0.0	0.0				54.0		0.0
Critical Link (Y/N)	Y	N			N	N				Y		N
Fuel Consumpt. (lit)	48	49			168	45				148		23
EffectiveGreen (sec)	46.0	35.0			35.0	84.0				44.0		57.0
Arrival Type (1-6)	3	1			3	3				3		3
Level of Service	E	C			F	A				D		B

Overall Intersection Results

Output Flow (vph)	4004
Degree of Sat. (%)	154
Tot. Travel (veh-km)	2155
Tot.TravTime (veh-h)	119
Unif. Delay (veh-h)	38.6
Rand. Delay (veh-h)	38.1
Total Delay (veh-h)	76.7
Avg. Delay (sec/v)	69
Unif. Stops (vph)	2950
Unif. Stops (%)	74
Rand. Stops (vph)	947
Rand. Stops (%)	24
Total Stops (vph)	3898
Total Stops (%)	97
Time Full (%)	102
Fuel Consumpt. (lit)	484
Disutility Index	79
Level of Service	E

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR SPLITS

Node Number: 6

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		590	44		557	62		762			949	20
Degree of Sat. (%)		88	9		166	9		50			227	3
Tot. Travel (veh-km)		237	17		254	46		329			381	8
Tot.TravTime (veh-h)		11.9	0.6		76.7	1.7		9.9			185.0	0.2
Avg.TravTime (sec/v)		73	53		496	98		46			701	42
Unif. Delay (veh-h)		4.7	0.2		23.9	0.7		3.0			24.2	0.0
Rand. Delay (veh-h)		2.4	0.0		47.7	0.0		0.2			153.1	0.0
Total Delay (veh-h)		7.2	0.2		71.6	0.7		3.3			177.3	0.0
Avg. Delay (sec/v)		44	24		463	45		15			672	13
Unif. Stops (vph)		516	29		556	109		545			949	9
Unif. Stops (%)		87	67		100	177		72			100	50
Rand. Stops (vph)		91	1		928	0		15			1000	0
Rand. Stops (%)		16	4		167	1		2			106	3
Total Stops (vph)		607	30		1484	109		561			1949	10
Total Stops (%)		103	71		267	177		74			206	52
Unif. MBOQ (veh)		12.9	0.8		26.2	3.0		14.1			31.6	0.3
Unif. MBOQ (m/lane)		99	8		198	23		53			244	0
Rand. MBOQ (veh)		2.8	0.0		28.6	0.0		0.5			67.3	0.0
Rand. MBOQ (m/lane)		22	0		218	0		2			513	0
Total MBOQ (veh)		15.7	0.9		54.8	3.0		14.5			98.9	0.3
Total MBOQ (m/lane)		121	8		416	23		55			757	0
Q.Capacity (veh)		49.0	3.0		26.0	3.0		114.0			40.0	3.0
Q.Capacity (m/lane)		373	23		198	23		434			305	23
Time Full (%)		0.0	0.0		19.0	6.0		0.0			0.0	0.0
Critical Link (Y/N)		N	N		Y	N		N			N	N
Fuel Consumpt. (lit)		54	3		235	9		52			549	1
EffectiveGreen (sec)		32.0	32.0		42.0	42.0		48.0			48.0	48.0
Arrival Type (1-6)		3	3		1	1		1			3	3
Level of Service		D	C		F	D		B			F	B

Overall Intersection Results

Output Flow (vph)	2984
Degree of Sat. (%)	227
Tot. Travel (veh-km)	1274
Tot.TravTime (veh-h)	286
Unif. Delay (veh-h)	57.1
Rand. Delay (veh-h)	203.6
Total Delay (veh-h)	260.7
Avg. Delay (sec/v)	314
Unif. Stops (vph)	2716
Unif. Stops (%)	91
Rand. Stops (vph)	2036
Rand. Stops (%)	68
Total Stops (vph)	4752
Total Stops (%)	159
Time Full (%)	25
Fuel Consumpt. (lit)	905
Disutility Index	219
Level of Service	F

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR SPLITS

Node Number: 7

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)	42	349	49	68	347			708			482	
Degree of Sat. (%)	16	47	8	23	49			36			35	
Tot. Travel (veh-km)	16	140	19	23	123			284			417	
Tot.TravTime (veh-h)	0.6	5.2	0.6	0.7	4.0			8.1			9.3	
Avg.TravTime (sec/v)	53	53	48	39	41			41			70	
Unif. Delay (veh-h)	0.2	2.2	0.2	0.2	1.3			2.3			1.0	
Rand. Delay (veh-h)	0.0	0.2	0.0	0.0	0.2			0.1			0.0	
Total Delay (veh-h)	0.2	2.4	0.2	0.2	1.5			2.4			1.0	
Avg. Delay (sec/v)	24	24	19	14	16			12			7	
Unif. Stops (vph)	28	248	29	18	145			354			219	
Unif. Stops (%)	67	71	60	26	42			50			45	
Rand. Stops (vph)	3	14	1	4	14			9			2	
Rand. Stops (%)	8	5	3	7	5			2			1	
Total Stops (vph)	31	263	30	22	159			363			221	
Total Stops (%)	75	76	63	34	47			52			46	
Unif. MBOQ (veh)	0.8	6.7	0.8	0.5	3.9			9.7			5.8	
Unif. MBOQ (m/lane)	8	53	8	0	30			38			23	
Rand. MBOQ (veh)	0.1	0.4	0.0	0.1	0.5			0.3			0.1	
Rand. MBOQ (m/lane)	1	3	0	1	3			1			0	
Total MBOQ (veh)	0.9	7.1	0.9	0.6	4.4			10.0			5.8	
Total MBOQ (m/lane)	9	56	8	1	33			39			23	
Q.Capacity (veh)	3.0	52.0	3.0	3.0	44.0			106.0			113.0	
Q.Capacity (m/lane)	23	396	23	23	335			404			431	
Time Full (%)	0.0	0.0	0.0	0.0	0.0			0.0			0.0	
Critical Link (Y/N)	N	N	N	N	N			N			N	
Fuel Consumpt. (lit)	3	25	3	3	19			41			47	
EffectiveGreen (sec)	39.0	39.0	39.0	39.0	39.0			51.0			51.0	
Arrival Type (1-6)	3	3	3	5	1			3			1	
Level of Service	C	C	B	B	B			B			A	

Overall Intersection Results

Output Flow (vph)	2045
Degree of Sat. (%)	49
Tot. Travel (veh-km)	1025
Tot.TravTime (veh-h)	28
Unif. Delay (veh-h)	7.6
Rand. Delay (veh-h)	0.6
Total Delay (veh-h)	8.2
Avg. Delay (sec/v)	14
Unif. Stops (vph)	1042
Unif. Stops (%)	51
Rand. Stops (vph)	49
Rand. Stops (%)	2
Total Stops (vph)	1091
Total Stops (%)	53
Time Full (%)	0
Fuel Consumpt. (lit)	143
Disutility Index	12
Level of Service	B

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR SPLITS

Node Number: 8

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)	33	490		46	307		99	133			396	
Degree of Sat. (%)	8	58		19	36		30	17			50	
Tot. Travel (veh-km)	11	189		18	123		41	55			159	
Tot.TravTime (veh-h)	0.3	6.6		0.6	4.1		1.3	1.7			5.1	
Avg.TravTime (sec/v)	38	48		54	48		49	48			47	
Unif. Delay (veh-h)	0.1	2.4		0.3	1.5		0.5	0.6			1.7	
Rand. Delay (veh-h)	0.0	0.3		0.0	0.1		0.0	0.0			0.2	
Total Delay (veh-h)	0.1	2.8		0.3	1.6		0.5	0.6			2.0	
Avg. Delay (sec/v)	13	20		25	19		19	18			18	
Unif. Stops (vph)	10	273		30	191		34	63			238	
Unif. Stops (%)	32	56		67	62		35	48			60	
Rand. Stops (vph)	1	19		3	9		4	2			16	
Rand. Stops (%)	4	5		9	3		5	3			5	
Total Stops (vph)	11	293		34	200		39	66			254	
Total Stops (%)	36	60		75	66		40	50			65	
Unif. MBOQ (veh)	0.3	7.5		0.9	5.2		1.0	1.7			6.2	
Unif. MBOQ (m/lane)	0	53		8	38		8	15			46	
Rand. MBOQ (veh)	0.0	0.6		0.1	0.3		0.1	0.1			0.5	
Rand. MBOQ (m/lane)	0	5		1	2		1	1			4	
Total MBOQ (veh)	0.3	8.1		1.0	5.5		1.1	1.8			6.7	
Total MBOQ (m/lane)	0	58		9	40		9	16			50	
Q.Capacity (veh)	3.0	43.0		3.0	52.0		3.0	54.0			52.0	
Q.Capacity (m/lane)	23	328		23	396		23	411			396	
Time Full (%)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Critical Link (Y/N)	N	N		N	N		N	N			N	
Fuel Consumpt. (lit)	1	31		3	20		6	8			26	
EffectiveGreen (sec)	45.0	45.0		45.0	45.0		45.0	45.0			45.0	
Arrival Type (1-6)	4	1		3	3		4	1			3	
Level of Service	B	C		C	B		B	B			B	

Overall Intersection Results

Output Flow (vph)	1504
Degree of Sat. (%)	58
Tot. Travel (veh-km)	598
Tot.TravTime (veh-h)	20
Unif. Delay (veh-h)	7.3
Rand. Delay (veh-h)	0.7
Total Delay (veh-h)	8.1
Avg. Delay (sec/v)	19
Unif. Stops (vph)	842
Unif. Stops (%)	56
Rand. Stops (vph)	57
Rand. Stops (%)	4
Total Stops (vph)	899
Total Stops (%)	60
Time Full (%)	0
Fuel Consumpt. (lit)	98
Disutility Index	11
Level of Service	B

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR SPLITS

Node Number: 9

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		753			316			374			392	
Degree of Sat. (%)		67			30			70			166	
Tot. Travel (veh-km)		302			250			150			161	
Tot.TravTime (veh-h)		8.9			5.7			6.5			42.9	
Avg.TravTime (sec/v)		42			65			63			394	
Unif. Delay (veh-h)		2.1			0.6			2.7			5.3	
Rand. Delay (veh-h)		0.6			0.0			0.7			34.3	
Total Delay (veh-h)		2.8			0.7			3.5			39.7	
Avg. Delay (sec/v)		13			8			34			364	
Unif. Stops (vph)		411			113			295			383	
Unif. Stops (%)		55			36			79			98	
Rand. Stops (vph)		32			6			35			667	
Rand. Stops (%)		5			3			10			171	
Total Stops (vph)		444			119			330			1051	
Total Stops (%)		60			38			89			269	
Unif. MBOQ (veh)		9.8			3.2			7.6			7.9	
Unif. MBOQ (m/lane)		76			23			61			61	
Rand. MBOQ (veh)		1.0			0.2			1.1			20.6	
Rand. MBOQ (m/lane)		8			2			8			157	
Total MBOQ (veh)		10.8			3.4			8.7			28.5	
Total MBOQ (m/lane)		84			25			69			218	
Q.Capacity (veh)		52.0			98.0			53.0			52.0	
Q.Capacity (m/lane)		396			747			404			396	
Time Full (%)		0.0			0.0			0.0			0.0	
Critical Link (Y/N)		N			N			N			N	
Fuel Consumpt. (lit)		45			28			30			134	
EffectiveGreen (sec)		60.0			60.0			30.0			30.0	
Arrival Type (1-6)		3			1			3			1	
Level of Service		B			A			C			F	

Overall Intersection Results

Output Flow (vph)	1835
Degree of Sat. (%)	166
Tot. Travel (veh-km)	865
Tot.TravTime (veh-h)	64
Unif. Delay (veh-h)	10.9
Rand. Delay (veh-h)	35.9
Total Delay (veh-h)	46.8
Avg. Delay (sec/v)	92
Unif. Stops (vph)	1203
Unif. Stops (%)	66
Rand. Stops (vph)	742
Rand. Stops (%)	40
Total Stops (vph)	1945
Total Stops (%)	106
Time Full (%)	0
Fuel Consumpt. (lit)	239
Disutility Index	45
Level of Service	F

Optimization for Cycle Length Results

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR CYCLE LENGTH

Node Number: 1

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		850	107	32	274			591		97	561	
Degree of Sat. (%)		107	12	52	27			46		42	84	
Tot. Travel (veh-km)		674	80	12	110			237		41	238	
Tot.TravTime (veh-h)		28.0	2.1	0.7	3.3			9.5		2.0	12.3	
Avg.TravTime (sec/v)		118	72	85	44			57		74	79	
Unif. Delay (veh-h)		4.1	0.5	0.2	1.1			4.5		1.0	5.8	
Rand. Delay (veh-h)		10.3	0.0	0.2	0.0			0.1		0.1	1.7	
Total Delay (veh-h)		14.5	0.5	0.5	1.1			4.7		1.1	7.5	
Avg. Delay (sec/v)		61	18	56	15			29		43	48	
Unif. Stops (vph)		540	56	46	133			407		69	447	
Unif. Stops (%)		64	53	144	49			69		72	80	
Rand. Stops (vph)		242	1	11	4			10		8	50	
Rand. Stops (%)		29	2	38	2			2		9	10	
Total Stops (vph)		783	58	58	138			417		77	497	
Total Stops (%)		93	55	182	51			71		81	89	
Unif. MBOQ (veh)		14.5	2.1	0.5	4.7			14.0		2.5	14.3	
Unif. MBOQ (m/lane)		114	15	0	38			53		23	107	
Rand. MBOQ (veh)		9.7	0.0	0.5	0.2			0.4		0.3	2.0	
Rand. MBOQ (m/lane)		74	0	4	1			2		2	15	
Total MBOQ (veh)		24.2	2.1	1.0	4.9			14.4		2.8	16.3	
Total MBOQ (m/lane)		188	15	4	39			55		25	122	
Q.Capacity (veh)		93.0	3.0	3.0	53.0			106.0		3.0	50.0	
Q.Capacity (m/lane)		709	23	23	404			404		23	381	
Time Full (%)		0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Critical Link (Y/N)		N	N	N	N			N		N	N	
Fuel Consumpt. (lit)		116	10	3	16			44		8	53	
EffectiveGreen (sec)		73.0	73.0	73.0	73.0			47.0		47.0	47.0	
Arrival Type (1-6)		1	2	3	3			3		2	1	
Level of Service		E	B	E	B			C		D	D	

Overall Intersection Results

Output Flow (vph)	2512
Degree of Sat. (%)	107
Tot. Travel (veh-km)	1395
Tot.TravTime (veh-h)	58
Unif. Delay (veh-h)	17.5
Rand. Delay (veh-h)	12.7
Total Delay (veh-h)	30.2
Avg. Delay (sec/v)	43
Unif. Stops (vph)	1701
Unif. Stops (%)	68
Rand. Stops (vph)	329
Rand. Stops (%)	13
Total Stops (vph)	2031
Total Stops (%)	81
Time Full (%)	0
Fuel Consumpt. (lit)	254
Disutility Index	34
Level of Service	D

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR CYCLE LENGTH

Node Number: 2

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		331		40	253			652			812	
Degree of Sat. (%)		45		19	53			57			43	
Tot. Travel (veh-km)		133		16	101			270			164	
Tot.TravTime (veh-h)		6.0		0.8	5.2			6.4			4.2	
Avg.TravTime (sec/v)		66		74	74			35			18	
Unif. Delay (veh-h)		3.2		0.4	2.8			0.7			0.7	
Rand. Delay (veh-h)		0.1		0.0	0.2			0.3			0.1	
Total Delay (veh-h)		3.4		0.5	3.1			1.0			0.9	
Avg. Delay (sec/v)		37		46	45			5			4	
Unif. Stops (vph)		250		32	210			127			101	
Unif. Stops (%)		76		81	83			20			13	
Rand. Stops (vph)		10		2	13			13			9	
Rand. Stops (%)		4		8	6			3			2	
Total Stops (vph)		260		35	224			141			110	
Total Stops (%)		79		89	89			22			14	
Unif. MBOQ (veh)		8.7		1.2	7.4			3.9			3.5	
Unif. MBOQ (m/lane)		34		8	53			30			11	
Rand. MBOQ (veh)		0.4		0.1	0.5			0.5			0.4	
Rand. MBOQ (m/lane)		2		1	4			4			1	
Total MBOQ (veh)		9.1		1.3	7.9			4.4			3.8	
Total MBOQ (m/lane)		36		9	57			34			12	
Q.Capacity (veh)		106.0		3.0	52.0			53.0			54.0	
Q.Capacity (m/lane)		404		23	396			404			206	
Time Full (%)		0.0		0.0	0.0			0.0			0.0	
Critical Link (Y/N)		N		N	N			N			N	
Fuel Consumpt. (lit)		27		3	23			31			20	
EffectiveGreen (sec)		34.0		34.0	34.0			86.0			86.0	
Arrival Type (1-6)		3		3	3			1			1	
Level of Service		D		D	D			A			A	

Overall Intersection Results

Output Flow (vph)	2088
Degree of Sat. (%)	57
Tot. Travel (veh-km)	685
Tot.TravTime (veh-h)	22
Unif. Delay (veh-h)	8.0
Rand. Delay (veh-h)	0.9
Total Delay (veh-h)	9.0
Avg. Delay (sec/v)	15
Unif. Stops (vph)	723
Unif. Stops (%)	35
Rand. Stops (vph)	48
Rand. Stops (%)	2
Total Stops (vph)	772
Total Stops (%)	37
Time Full (%)	0
Fuel Consumpt. (lit)	106
Disutility Index	11
Level of Service	B

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR CYCLE LENGTH

Node Number: 3

	Eastbound LT	Eastbound TH	Eastbound RT	Westbound LT	Westbound TH	Westbound RT	Northbound LT	Northbound TH	Northbound RT	Southbound LT	Southbound TH	Southbound RT
Output Flow (vph)		251			164			651			584	
Degree of Sat. (%)		58			41			63			27	
Tot. Travel (veh-km)		100			65			133			157	
Tot.TravTime (veh-h)		4.3			2.6			9.4			4.3	
Avg.TravTime (sec/v)		61			57			52			26	
Unif. Delay (veh-h)		1.9			1.1			6.3			1.1	
Rand. Delay (veh-h)		0.3			0.1			0.4			0.0	
Total Delay (veh-h)		2.2			1.2			6.8			1.2	
Avg. Delay (sec/v)		32			28			37			7	
Unif. Stops (vph)		173			105			451			278	
Unif. Stops (%)		69			64			69			48	
Rand. Stops (vph)		16			8			16			1	
Rand. Stops (%)		7			6			3			1	
Total Stops (vph)		190			114			468			279	
Total Stops (%)		76			70			72			48	
Unif. MBOQ (veh)		5.7			3.6			7.3			10.0	
Unif. MBOQ (m/lane)		46			30			27			38	
Rand. MBOQ (veh)		0.7			0.3			0.7			0.1	
Rand. MBOQ (m/lane)		5			3			3			0	
Total MBOQ (veh)		6.4			3.9			8.0			10.1	
Total MBOQ (m/lane)		51			33			30			38	
Q.Capacity (veh)		53.0			53.0			53.0			56.0	
Q.Capacity (m/lane)		404			404			202			213	
Time Full (%)		0.0			0.0			0.0			0.0	
Critical Link (Y/N)		N			N			N			N	
Fuel Consumpt. (lit)		19			12			41			24	
EffectiveGreen (sec)		49.0			49.0			71.0			71.0	
Arrival Type (1-6)		3			3			1			1	
Level of Service		C			C			D			A	

Overall Intersection Results

Output Flow (vph)	1650
Degree of Sat. (%)	63
Tot. Travel (veh-km)	457
Tot.TravTime (veh-h)	20
Unif. Delay (veh-h)	10.6
Rand. Delay (veh-h)	0.9
Total Delay (veh-h)	11.6
Avg. Delay (sec/v)	25
Unif. Stops (vph)	1008
Unif. Stops (%)	61
Rand. Stops (vph)	44
Rand. Stops (%)	3
Total Stops (vph)	1052
Total Stops (%)	64
Time Full (%)	0
Fuel Consumpt. (lit)	98
Disutility Index	14
Level of Service	C

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR CYCLE LENGTH

Node Number: 4

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		2251			1067			461			154	
Degree of Sat. (%)		86			95			143			29	
Tot. Travel (veh-km)		1967			428			134			61	
Tot.TravTime (veh-h)		55.2			15.7			42.9			3.0	
Avg.TravTime (sec/v)		88			53			335			70	
Unif. Delay (veh-h)		14.7			2.1			13.2			1.7	
Rand. Delay (veh-h)		1.1			5.0			26.9			0.0	
Total Delay (veh-h)		15.9			7.1			40.2			1.8	
Avg. Delay (sec/v)		25			24			314			42	
Unif. Stops (vph)		2402			481			461			121	
Unif. Stops (%)		107			45			100			79	
Rand. Stops (vph)		33			132			466			5	
Rand. Stops (%)		2			13			102			4	
Total Stops (vph)		2436			613			927			126	
Total Stops (%)		109			58			202			83	
Unif. MBOQ (veh)		74.0			10.3			16.3			4.4	
Unif. MBOQ (m/lane)		282			38			61			15	
Rand. MBOQ (veh)		1.4			5.3			18.7			0.2	
Rand. MBOQ (m/lane)		5			20			71			1	
Total MBOQ (veh)		75.4			15.6			35.1			4.6	
Total MBOQ (m/lane)		287			58			132			16	
Q.Capacity (veh)		221.0			105.0			56.0			106.0	
Q.Capacity (m/lane)		842			400			213			404	
Time Full (%)		0.0			0.0			0.0			0.0	
Critical Link (Y/N)		N			N			N			N	
Fuel Consumpt. (lit)		285			71			134			13	
EffectiveGreen (sec)		86.0			96.0			24.0			24.0	
Arrival Type (1-6)		1			3			1			3	
Level of Service		C			C			F			D	

Overall Intersection Results

Output Flow (vph)	3933
Degree of Sat. (%)	143
Tot. Travel (veh-km)	2592
Tot.TravTime (veh-h)	116
Unif. Delay (veh-h)	31.9
Rand. Delay (veh-h)	33.2
Total Delay (veh-h)	65.1
Avg. Delay (sec/v)	59
Unif. Stops (vph)	3466
Unif. Stops (%)	88
Rand. Stops (vph)	637
Rand. Stops (%)	16
Total Stops (vph)	4104
Total Stops (%)	104
Time Full (%)	0
Fuel Consumpt. (lit)	505
Disutility Index	72
Level of Service	E

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR CYCLE LENGTH

Node Number: 5

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)	407	606			510	523				1560		394
Degree of Sat. (%)	97	43			140	37				91		97
Tot. Travel (veh-km)	164	219			539	447				627		158
Tot.TravTime (veh-h)	14.7	11.7			52.6	9.1				29.7		12.6
Avg.TravTime (sec/v)	130	69			371	63				68		115
Unif. Delay (veh-h)	8.7	7.2			16.0	0.1				13.5		5.4
Rand. Delay (veh-h)	2.7	0.1			25.8	0.0				3.6		4.0
Total Delay (veh-h)	11.4	7.3			41.8	0.2				17.2		9.4
Avg. Delay (sec/v)	101	43			295	1				39		86
Unif. Stops (vph)	27	575			510	76				1377		385
Unif. Stops (%)	7	95			100	15				88		98
Rand. Stops (vph)	70	5			460	1				100		104
Rand. Stops (%)	18	1			91	1				7		27
Total Stops (vph)	98	581			970	77				1477		490
Total Stops (%)	25	96			191	15				95		125
Unif. MBOQ (veh)	12.1	20.7			26.8	2.9				41.2		12.9
Unif. MBOQ (m/lane)	91	80			206	23				156		99
Rand. MBOQ (veh)	2.8	0.2			18.5	0.1				4.0		4.2
Rand. MBOQ (m/lane)	22	1			141	0				15		32
Total MBOQ (veh)	15.0	20.9			45.3	2.9				45.2		17.1
Total MBOQ (m/lane)	113	81			347	23				171		131
Q.Capacity (veh)	12.0	76.0			96.0	12.0				10.0		10.0
Q.Capacity (m/lane)	91	290			732	91				38		76
Time Full (%)	49.2	0.0			0.0	0.0				54.6		20.0
Critical Link (Y/N)	Y	N			N	N				Y		N
Fuel Consumpt. (lit)	48	54			178	44				138		50
EffectiveGreen (sec)	58.0	48.0			48.0	115.0				62.0		74.0
Arrival Type (1-6)	6	1			4	3				3		3
Level of Service	F	D			F	A				D		F

Overall Intersection Results

Output Flow (vph)	4000
Degree of Sat. (%)	140
Tot. Travel (veh-km)	2155
Tot.TravTime (veh-h)	130
Unif. Delay (veh-h)	51.2
Rand. Delay (veh-h)	36.3
Total Delay (veh-h)	87.6
Avg. Delay (sec/v)	78
Unif. Stops (vph)	2952
Unif. Stops (%)	74
Rand. Stops (vph)	742
Rand. Stops (%)	19
Total Stops (vph)	3694
Total Stops (%)	92
Time Full (%)	123
Fuel Consumpt. (lit)	514
Disutility Index	86
Level of Service	E

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR CYCLE LENGTH

Node Number: 6

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		590	44		523	92		763			949	20
Degree of Sat. (%)		81	8		168	13		51			230	3
Tot. Travel (veh-km)		237	17		254	46		329			381	8
Tot.TravTime (veh-h)		11.9	0.6		76.9	2.3		11.3			196.7	0.2
Avg.TravTime (sec/v)		72	56		529	90		53			746	46
Unif. Delay (veh-h)		5.5	0.3		26.8	1.3		4.5			32.2	0.1
Rand. Delay (veh-h)		1.5	0.0		44.9	0.0		0.2			156.8	0.0
Total Delay (veh-h)		7.1	0.3		71.8	1.3		4.7			189.1	0.1
Avg. Delay (sec/v)		43	27		494	54		22			717	17
Unif. Stops (vph)		496	28		523	83		545			949	9
Unif. Stops (%)		84	64		100	91		71			100	50
Rand. Stops (vph)		48	1		665	0		12			1000	0
Rand. Stops (%)		9	3		128	1		2			106	2
Total Stops (vph)		545	29		1188	83		557			1949	10
Total Stops (%)		93	66		228	91		74			206	52
Unif. MBOQ (veh)		16.0	1.0		26.3	3.0		18.5			42.5	0.4
Unif. MBOQ (m/lane)		122	8		198	23		72			328	0
Rand. MBOQ (veh)		1.9	0.0		26.7	0.0		0.5			68.0	0.0
Rand. MBOQ (m/lane)		15	0		203	0		2			518	0
Total MBOQ (veh)		17.9	1.1		52.9	3.0		19.0			110.6	0.4
Total MBOQ (m/lane)		137	8		401	23		74			846	0
Q.Capacity (veh)		50.0	3.0		26.0	3.0		114.0			40.0	3.0
Q.Capacity (m/lane)		381	23		198	23		434			305	23
Time Full (%)		0.0	0.0		50.8	8.5		0.0			0.0	0.0
Critical Link (Y/N)		N	N		Y	N		N			N	N
Fuel Consumpt. (lit)		53	3		235	10		56			581	1
EffectiveGreen (sec)		47.0	47.0		57.0	57.0		63.0			63.0	63.0
Arrival Type (1-6)		3	3		1	1		1			3	3
Level of Service		D	C		F	D		C			F	B

Overall Intersection Results

Output Flow (vph)	2981
Degree of Sat. (%)	230
Tot. Travel (veh-km)	1274
Tot.TravTime (veh-h)	300
Unif. Delay (veh-h)	71.0
Rand. Delay (veh-h)	203.6
Total Delay (veh-h)	274.6
Avg. Delay (sec/v)	331
Unif. Stops (vph)	2635
Unif. Stops (%)	88
Rand. Stops (vph)	1727
Rand. Stops (%)	58
Total Stops (vph)	4362
Total Stops (%)	146
Time Full (%)	59
Fuel Consumpt. (lit)	941
Disutility Index	227
Level of Service	F

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR CYCLE LENGTH

Node Number: 7

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)	42	349	49	68	348			708			489	
Degree of Sat. (%)	15	47	8	23	49			35			35	
Tot. Travel (veh-km)	16	140	19	23	123			284			417	
Tot.TravTime (veh-h)	0.7	5.8	0.7	0.8	4.5			8.6			10.5	
Avg.TravTime (sec/v)	67	60	54	43	47			44			77	
Unif. Delay (veh-h)	0.4	2.8	0.3	0.3	1.8			2.8			2.1	
Rand. Delay (veh-h)	0.0	0.2	0.0	0.0	0.2			0.1			0.0	
Total Delay (veh-h)	0.4	3.0	0.3	0.3	2.0			2.9			2.1	
Avg. Delay (sec/v)	38	31	25	18	21			15			16	
Unif. Stops (vph)	31	250	29	45	255			353			297	
Unif. Stops (%)	75	72	61	66	73			50			61	
Rand. Stops (vph)	2	10	1	3	11			6			1	
Rand. Stops (%)	6	4	3	6	4			1			1	
Total Stops (vph)	33	261	30	48	266			360			298	
Total Stops (%)	81	75	63	72	77			51			62	
Unif. MBOQ (veh)	1.1	8.6	1.1	1.1	7.6			12.3			9.9	
Unif. MBOQ (m/lane)	8	69	8	8	61			46			38	
Rand. MBOQ (veh)	0.1	0.4	0.0	0.1	0.4			0.3			0.1	
Rand. MBOQ (m/lane)	1	3	0	1	3			1			0	
Total MBOQ (veh)	1.2	9.1	1.1	1.3	8.0			12.5			10.0	
Total MBOQ (m/lane)	9	72	8	9	64			47			38	
Q.Capacity (veh)	3.0	52.0	3.0	3.0	44.0			106.0			113.0	
Q.Capacity (m/lane)	23	396	23	23	335			404			431	
Time Full (%)	0.0	0.0	0.0	0.0	0.0			0.0			0.0	
Critical Link (Y/N)	N	N	N	N	N			N			N	
Fuel Consumpt. (lit)	3	27	3	4	23			43			52	
EffectiveGreen (sec)	51.0	51.0	51.0	51.0	51.0			69.0			69.0	
Arrival Type (1-6)	3	3	3	5	1			3			1	
Level of Service	D	C	C	B	C			B			B	

Overall Intersection Results

Output Flow (vph)	2053
Degree of Sat. (%)	49
Tot. Travel (veh-km)	1025
Tot.TravTime (veh-h)	31
Unif. Delay (veh-h)	10.8
Rand. Delay (veh-h)	0.5
Total Delay (veh-h)	11.4
Avg. Delay (sec/v)	20
Unif. Stops (vph)	1262
Unif. Stops (%)	62
Rand. Stops (vph)	37
Rand. Stops (%)	2
Total Stops (vph)	1299
Total Stops (%)	63
Time Full (%)	0
Fuel Consumpt. (lit)	157
Disutility Index	16
Level of Service	C

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR CYCLE LENGTH

Node Number: 8

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)	33	489		46	307		99	133			396	
Degree of Sat. (%)	6	48		13	30		42	20			59	
Tot. Travel (veh-km)	11	189		18	123		41	55			159	
Tot.TravTime (veh-h)	0.3	5.9		0.6	3.9		1.6	2.0			6.6	
Avg.TravTime (sec/v)	34	43		51	46		60	55			60	
Unif. Delay (veh-h)	0.0	1.9		0.2	1.4		0.7	0.9			3.0	
Rand. Delay (veh-h)	0.0	0.2		0.0	0.0		0.1	0.0			0.4	
Total Delay (veh-h)	0.0	2.1		0.2	1.4		0.8	0.9			3.4	
Avg. Delay (sec/v)	9	15		22	17		30	25			31	
Unif. Stops (vph)	6	221		27	161		33	62			282	
Unif. Stops (%)	21	45		59	53		34	47			71	
Rand. Stops (vph)	0	10		1	5		6	2			17	
Rand. Stops (%)	3	3		5	2		7	2			5	
Total Stops (vph)	7	232		28	166		39	65			300	
Total Stops (%)	24	48		63	55		40	49			76	
Unif. MBOQ (veh)	0.2	7.8		0.9	5.7		1.2	2.2			9.4	
Unif. MBOQ (m/lane)	0	61		8	46		8	15			69	
Rand. MBOQ (veh)	0.0	0.4		0.1	0.2		0.2	0.1			0.7	
Rand. MBOQ (m/lane)	0	3		1	2		2	1			5	
Total MBOQ (veh)	0.3	8.3		1.0	5.9		1.4	2.3			10.1	
Total MBOQ (m/lane)	0	64		9	48		10	16			74	
Q.Capacity (veh)	3.0	44.0		3.0	53.0		3.0	54.0			52.0	
Q.Capacity (m/lane)	23	335		23	404		23	411			396	
Time Full (%)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Critical Link (Y/N)	N	N		N	N		N	N			N	
Fuel Consumpt. (lit)	1	28		3	19		6	9			31	
EffectiveGreen (sec)	70.0	70.0		70.0	70.0		50.0	50.0			50.0	
Arrival Type (1-6)	4	1		3	3		5	1			3	
Level of Service	A	B		C	B		C	C			C	

Overall Intersection Results

Output Flow (vph)	1503
Degree of Sat. (%)	59
Tot. Travel (veh-km)	598
Tot.TravTime (veh-h)	21
Unif. Delay (veh-h)	8.4
Rand. Delay (veh-h)	0.8
Total Delay (veh-h)	9.2
Avg. Delay (sec/v)	22
Unif. Stops (vph)	795
Unif. Stops (%)	53
Rand. Stops (vph)	44
Rand. Stops (%)	3
Total Stops (vph)	839
Total Stops (%)	56
Time Full (%)	0
Fuel Consumpt. (lit)	100
Disutility Index	11
Level of Service	C

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
OPTIMIZATION FOR CYCLE LENGTH

Node Number: 9

	Eastbound LT	Eastbound TH	Eastbound RT	Westbound LT	Westbound TH	Westbound RT	Northbound LT	Northbound TH	Northbound RT	Southbound LT	Southbound TH	Southbound RT
Output Flow (vph)		753			317			374			390	
Degree of Sat. (%)		68			31			69			163	
Tot. Travel (veh-km)		302			250			150			161	
Tot.TravTime (veh-h)		9.6			5.7			7.3			41.7	
Avg.TravTime (sec/v)		46			65			70			385	
Unif. Delay (veh-h)		2.9			0.6			3.5			5.8	
Rand. Delay (veh-h)		0.7			0.0			0.7			32.6	
Total Delay (veh-h)		3.6			0.7			4.3			38.5	
Avg. Delay (sec/v)		17			8			41			355	
Unif. Stops (vph)		426			102			297			364	
Unif. Stops (%)		57			32			79			93	
Rand. Stops (vph)		25			4			26			497	
Rand. Stops (%)		4			2			8			128	
Total Stops (vph)		452			107			323			861	
Total Stops (%)		61			35			87			221	
Unif. MBOQ (veh)		12.9			3.7			9.9			7.5	
Unif. MBOQ (m/lane)		99			30			76			53	
Rand. MBOQ (veh)		1.0			0.2			1.1			20.0	
Rand. MBOQ (m/lane)		8			1			8			152	
Total MBOQ (veh)		13.9			3.9			11.0			27.4	
Total MBOQ (m/lane)		107			31			84			205	
Q.Capacity (veh)		52.0			98.0			53.0			52.0	
Q.Capacity (m/lane)		396			747			404			396	
Time Full (%)		0.0			0.0			0.0			0.0	
Critical Link (Y/N)		N			N			N			N	
Fuel Consumpt. (lit)		48			28			32			130	
EffectiveGreen (sec)		79.0			79.0			41.0			41.0	
Arrival Type (1-6)		3			1			3			1	
Level of Service		B			A			D			F	

Overall Intersection Results

Output Flow (vph)	1834
Degree of Sat. (%)	163
Tot. Travel (veh-km)	865
Tot.TravTime (veh-h)	64
Unif. Delay (veh-h)	13.0
Rand. Delay (veh-h)	34.1
Total Delay (veh-h)	47.2
Avg. Delay (sec/v)	92
Unif. Stops (vph)	1191
Unif. Stops (%)	65
Rand. Stops (vph)	554
Rand. Stops (%)	30
Total Stops (vph)	1745
Total Stops (%)	95
Time Full (%)	0
Fuel Consumpt. (lit)	240
Disutility Index	44
Level of Service	F

Results for Nodes 4, 6 and 9

after changes

NOTE: CHANGES: ADDED TURN BAY STORAGE OF 8 TO RIGHT TURN AND MADE LEFT TURN EXCLUSIVE. NO OTHER CHANGES WERE MADE.
TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
Node Number: 4

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		2176			1067		197	10	273		154	
Degree of Sat. (%)		85			94		102	3	99		28	
Tot. Travel (veh-km)		1967			428		74	2	58		61	
Tot.TravTime (veh-h)		47.0			14.9		18.4	0.1	8.3		2.6	
Avg.TravTime (sec/v)		77			50		337	41	109		61	
Unif. Delay (veh-h)		6.8			1.6		14.2	0.0	3.1		1.3	
Rand. Delay (veh-h)		0.8			4.7		2.7	0.0	4.0		0.0	
Total Delay (veh-h)		7.6			6.3		16.9	0.0	7.1		1.3	
Avg. Delay (sec/v)		12			21		310	26	94		32	
Unif. Stops (vph)		1836			455		197	6	263		120	
Unif. Stops (%)		84			43		100	61	96		79	
Rand. Stops (vph)		33			163		86	0	130		6	
Rand. Stops (%)		2			16		44	4	48		5	
Total Stops (vph)		1869			619		283	6	394		127	
Total Stops (%)		86			59		144	66	145		83	
Unif. MBOQ (veh)		31.5			7.6		16.4	0.2	7.1		3.4	
Unif. MBOQ (m/lane)		122			30		122	0	53		11	
Rand. MBOQ (veh)		1.0			5.0		2.7	0.0	4.0		0.2	
Rand. MBOQ (m/lane)		4			19		20	0	31		1	
Total MBOQ (veh)		32.5			12.7		19.0	0.2	11.1		3.6	
Total MBOQ (m/lane)		126			49		142	0	84		12	
Q.Capacity (veh)		221.0			105.0		16.0	28.0	8.0		106.0	
Q.Capacity (m/lane)		842			400		122	213	61		404	
Time Full (%)		0.0			0.0		64.0	0.0	0.0		0.0	
Critical Link (Y/N)		N			N		Y	N	N		N	
Fuel Consumpt. (lit)		249			68		58	0	31		12	
EffectiveGreen (sec)		63.0			73.0		17.0	17.0	17.0		17.0	
Arrival Type (1-6)		1			3		1	5	3		3	
Level of Service		B			C		F	C	F		C	

Overall Intersection Results

Output Flow (vph)	3877
Degree of Sat. (%)	102
Tot. Travel (veh-km)	2592
Tot.TravTime (veh-h)	91
Unif. Delay (veh-h)	27.2
Rand. Delay (veh-h)	12.4
Total Delay (veh-h)	39.6
Avg. Delay (sec/v)	36
Unif. Stops (vph)	2879
Unif. Stops (%)	74
Rand. Stops (vph)	420
Rand. Stops (%)	11
Total Stops (vph)	3299
Total Stops (%)	85
Time Full (%)	64
Fuel Consumpt. (lit)	421
Disutility Index	48
Level of Service	D

NOTE: EFFECT OF CHANGES MADE IN NODE 4 TO NODE 3
TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
Node Number: 3

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		251			164			644			470	
Degree of Sat. (%)		59			42			83			22	
Tot. Travel (veh-km)		100			65			133			157	
Tot.TravTime (veh-h)		3.9			2.3			21.7			3.9	
Avg.TravTime (sec/v)		56			51			121			30	
Unif. Delay (veh-h)		1.4			0.8			17.5			0.8	
Rand. Delay (veh-h)		0.4			0.1			1.5			0.0	
Total Delay (veh-h)		1.8			1.0			19.0			0.8	
Avg. Delay (sec/v)		27			22			106			6	
Unif. Stops (vph)		172			104			705			248	
Unif. Stops (%)		69			64			110			53	
Rand. Stops (vph)		22			11			58			1	
Rand. Stops (%)		9			7			10			1	
Total Stops (vph)		194			116			763			249	
Total Stops (%)		78			71			119			54	
Unif. MBOQ (veh)		4.4			2.8			20.5			7.0	
Unif. MBOQ (m/lane)		30			23			80			27	
Rand. MBOQ (veh)		0.7			0.4			1.8			0.1	
Rand. MBOQ (m/lane)		5			3			7			0	
Total MBOQ (veh)		5.1			3.1			22.3			7.0	
Total MBOQ (m/lane)		35			26			87			27	
Q.Capacity (veh)		53.0			53.0			53.0			56.0	
Q.Capacity (m/lane)		404			404			202			213	
Time Full (%)		0.0			0.0			0.0			0.0	
Critical Link (Y/N)		N			N			N			N	
Fuel Consumpt. (lit)		18			11			81			22	
EffectiveGreen (sec)		36.0			36.0			54.0			54.0	
Arrival Type (1-6)		3			3			1			1	
Level of Service		C			C			F			A	

Overall Intersection Results

Output Flow (vph)	1529
Degree of Sat. (%)	83
Tot. Travel (veh-km)	457
Tot.TravTime (veh-h)	31
Unif. Delay (veh-h)	20.7
Rand. Delay (veh-h)	2.0
Total Delay (veh-h)	22.8
Avg. Delay (sec/v)	53
Unif. Stops (vph)	1230
Unif. Stops (%)	80
Rand. Stops (vph)	93
Rand. Stops (%)	6
Total Stops (vph)	1324
Total Stops (%)	87
Time Full (%)	0
Fuel Consumpt. (lit)	134
Disutility Index	24
Level of Service	D

NOTE: CHANGES: ADDED 6 & 4 TURN BAY STORAGE FOR LEFT & RIGHT TURN RESPECTIVELY FOR SOUTHBOUND. ADDED LEFT TURN BAY STORAGE OF 8 VEHILCES FOR WESTBOUND

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)

Node Number: 6

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		590	44	239	266			770		344	100	100
Degree of Sat. (%)		85	8	100	40			49		116	11	13
Tot. Travel (veh-km)		237	17	92	75			329		138	40	40
Tot.TravTime (veh-h)		11.3	0.6	10.9	4.3			10.0		16.8	1.2	1.2
Avg.TravTime (sec/v)		69	52	164	58			46		176	44	44
Unif. Delay (veh-h)		4.5	0.2	6.2	2.6			3.2		4.2	0.4	0.4
Rand. Delay (veh-h)		2.0	0.0	2.8	0.1			0.2		9.9	0.0	0.0
Total Delay (veh-h)		6.6	0.2	9.0	2.7			3.4		14.1	0.4	0.4
Avg. Delay (sec/v)		40	23	136	37			16		147	15	15
Unif. Stops (vph)		506	28	187	189			543		344	52	53
Unif. Stops (%)		86	66	79	71			71		100	53	54
Rand. Stops (vph)		78	1	93	10			14		276	2	2
Rand. Stops (%)		14	4	40	4			2		81	3	3
Total Stops (vph)		584	30	281	200			558		620	54	56
Total Stops (%)		99	69	118	76			73		181	55	57
Unif. MBOQ (veh)		12.6	0.8	8.1	5.0			14.2		7.3	1.5	1.5
Unif. MBOQ (m/lane)		99	8	61	38			53		53	15	15
Rand. MBOQ (veh)		2.4	0.0	2.9	0.3			0.5		8.5	0.1	0.1
Rand. MBOQ (m/lane)		18	0	22	2			2		65	0	1
Total MBOQ (veh)		15.0	0.9	11.0	5.3			14.7		15.8	1.6	1.6
Total MBOQ (m/lane)		117	8	83	40			55		118	15	16
Q.Capacity (veh)		49.0	3.0	8.0	38.0			114.0		6.0	53.0	4.0
Q.Capacity (m/lane)		373	23	61	290			434		46	404	30
Time Full (%)		0.0	0.0	53.0	0.0			0.0		0.0	0.0	0.0
Critical Link (Y/N)		N	N	Y	N			N		N	N	N
Fuel Consumpt. (lit)		52	3	38	19			53		60	6	6
EffectiveGreen (sec)		33.0	33.0	43.0	43.0			47.0		47.0	47.0	47.0
Arrival Type (1-6)		3	3	4	3			1		3	3	3
Level of Service		D	C	F	D			B		F	B	B

Overall Intersection Results

Output Flow (vph)	2453
Degree of Sat. (%)	116
Tot. Travel (veh-km)	971
Tot.TravTime (veh-h)	56
Unif. Delay (veh-h)	21.9
Rand. Delay (veh-h)	15.2
Total Delay (veh-h)	37.1
Avg. Delay (sec/v)	54
Unif. Stops (vph)	1906
Unif. Stops (%)	78
Rand. Stops (vph)	478
Rand. Stops (%)	20
Total Stops (vph)	2384
Total Stops (%)	97
Time Full (%)	52
Fuel Consumpt. (lit)	238
Disutility Index	41
Level of Service	D

NOTE: EFFECT OF CHANGES MADE IN NODE 6 TO NODE 5
TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)
Node Number: 5

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)	218	706			500	520				1560		394
Degree of Sat. (%)	98	62			75	38				96		43
Tot. Travel (veh-km)	164	219			539	447				627		158
Tot.TravTime (veh-h)	15.6	10.6			20.7	9.2				30.4		4.6
Avg.TravTime (sec/v)	257	54			149	63				70		42
Unif. Delay (veh-h)	10.2	5.9			9.7	0.2				11.5		1.3
Rand. Delay (veh-h)	2.0	0.3			0.2	0.0				6.3		0.1
Total Delay (veh-h)	12.3	6.2			9.9	0.2				17.9		1.5
Avg. Delay (sec/v)	203	31			71	2				41		13
Unif. Stops (vph)	148	691			413	105				1432		209
Unif. Stops (%)	68	98			83	20				92		53
Rand. Stops (vph)	68	15			10	2				214		12
Rand. Stops (%)	32	3			3	1				14		4
Total Stops (vph)	216	706			424	107				1647		221
Total Stops (%)	100	101			85	21				106		57
Unif. MBOQ (veh)	12.1	18.6			19.7	3.0				32.9		5.6
Unif. MBOQ (m/lane)	91	72			152	23				126		46
Rand. MBOQ (veh)	2.1	0.5			0.3	0.1				6.6		0.4
Rand. MBOQ (m/lane)	16	2			3	1				25		3
Total MBOQ (veh)	14.2	19.1			20.1	3.0				39.6		6.0
Total MBOQ (m/lane)	107	74			155	24				151		49
Q.Capacity (veh)	12.0	76.0			96.0	12.0				10.0		10.0
Q.Capacity (m/lane)	91	290			732	91				38		76
Time Full (%)	69.0	0.0			0.0	0.0				52.0		0.0
Critical Link (Y/N)	Y	N			N	N				Y		N
Fuel Consumpt. (lit)	53	53			88	45				141		23
EffectiveGreen (sec)	45.0	35.0			35.0	85.0				45.0		57.0
Arrival Type (1-6)	5	1			3	3				3		3
Level of Service	F	C			E	A				D		B

Overall Intersection Results

Output Flow (vph)	3898
Degree of Sat. (%)	98
Tot. Travel (veh-km)	2155
Tot.TravTime (veh-h)	91
Unif. Delay (veh-h)	39.0
Rand. Delay (veh-h)	9.1
Total Delay (veh-h)	48.2
Avg. Delay (sec/v)	44
Unif. Stops (vph)	3000
Unif. Stops (%)	77
Rand. Stops (vph)	323
Rand. Stops (%)	8
Total Stops (vph)	3324
Total Stops (%)	85
Time Full (%)	121
Fuel Consumpt. (lit)	406
Disutility Index	55
Level of Service	D

NOTE: CHANGES IN LANE CONFIGURATION FOR NODE 9. ADDED EXCLUSIVE LEFT TURN SOR SOUTHBOUND.

TRANSYT-7F Release 10.2 -- Node Output Summary (Detailed)

Node Number: 9

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Output Flow (vph)		753			319			374		166	224	
Degree of Sat. (%)		67			30			71		114	39	
Tot. Travel (veh-km)		302			250			150		68	92	
Tot.TravTime (veh-h)		9.6			5.7			7.8		9.4	4.3	
Avg.TravTime (sec/v)		46			64			75		204	70	
Unif. Delay (veh-h)		2.9			0.6			4.0		3.0	2.3	
Rand. Delay (veh-h)		0.6			0.0			0.8		5.0	0.1	
Total Delay (veh-h)		3.6			0.7			4.8		8.0	2.5	
Avg. Delay (sec/v)		17			8			46		174	40	
Unif. Stops (vph)		415			98			303		153	171	
Unif. Stops (%)		55			31			81		93	76	
Rand. Stops (vph)		22			4			27		101	7	
Rand. Stops (%)		4			2			8		62	4	
Total Stops (vph)		437			102			331		255	178	
Total Stops (%)		59			33			89		154	80	
Unif. MBOQ (veh)		13.3			3.8			10.8		3.8	6.5	
Unif. MBOQ (m/lane)		99			30			84		30	53	
Rand. MBOQ (veh)		1.0			0.2			1.2		4.4	0.3	
Rand. MBOQ (m/lane)		7			1			9		33	2	
Total MBOQ (veh)		14.3			3.9			12.0		8.2	6.8	
Total MBOQ (m/lane)		106			31			93		63	55	
Q.Capacity (veh)		52.0			98.0			53.0		53.0	53.0	
Q.Capacity (m/lane)		396			747			404		404	404	
Time Full (%)		0.0			0.0			0.0		0.0	0.0	
Critical Link (Y/N)		N			N			N		N	N	
Fuel Consumpt. (lit)		48			28			34		32	19	
EffectiveGreen (sec)		87.0			87.0			43.0		43.0	43.0	
Arrival Type (1-6)		3			1			3		4	3	
Level of Service		B			A			D		F	D	

Overall Intersection Results

Output Flow (vph)	1836
Degree of Sat. (%)	114
Tot. Travel (veh-km)	865
Tot.TravTime (veh-h)	37
Unif. Delay (veh-h)	13.0
Rand. Delay (veh-h)	6.6
Total Delay (veh-h)	19.6
Avg. Delay (sec/v)	38
Unif. Stops (vph)	1141
Unif. Stops (%)	62
Rand. Stops (vph)	163
Rand. Stops (%)	9
Total Stops (vph)	1305
Total Stops (%)	71
Time Full (%)	0
Fuel Consumpt. (lit)	162
Disutility Index	22
Level of Service	D

Appendix B

Synchro Report

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	0	<1	1	1	1>	0	<1	1>	0	1	1>	0
Volume (vph)	131	768	107	32	207	67	37	454	100	100	485	90
Satd. Flow (prot)	0	1870	1601	1789	1814	0	1789	1833	0	1789	1838	0
Flt Permitted		0.712		0.080			0.133			0.133		
Satd. Flow (perm)	0	1341	1601	151	1814	0	250	1833	0	250	1838	0
Satd. Flow (RTOR)			63		16			8			7	
Lane Group Flow (vph)	0	977	116	35	298	0	40	602	0	109	625	0
Turn Type	custom		custom	custom			custom			custom		
Protected Phases											4	
Permitted Phases	2	2	2	2	2		1	1		1		
Total Split (s)	55.0	55.0	55.0	55.0	55.0	0.0	35.0	35.0	0.0	35.0	35.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0	4.0
Act Effct Green (s)		50.0	50.0	50.0	50.0		30.0	30.0		30.0	31.0	
Actuated g/C Ratio		0.40	0.40	0.40	0.40		0.24	0.24		0.24	0.25	
v/c Ratio		1.82	0.17	0.58	0.41		0.67	1.35		1.82	1.36	
Control Delay		403.7	12.3	71.1	27.4		93.0	208.8		454.5	210.6	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		403.7	12.3	71.1	27.4		93.0	208.8		454.5	210.6	
LOS		F	B	E	C		F	F		F	F	
Approach Delay		362.1			32.0			201.6			246.8	
Approach LOS		F			C			F			F	
Stops (vph)		600	32	26	182		32	425		65	441	
Fuel Used(l)		364	11	3	13		3	101		40	125	
CO Emissions (g/hr)		6738	195	50	246		64	1863		746	2308	
NOx Emissions (g/hr)		1311	38	10	48		13	362		145	449	
VOC Emissions (g/hr)		1563	45	12	57		15	432		173	535	
Dilemma Vehicles (#)		0	0	0	0		0	0		0	0	
Queue Length 50th (m)		~362.3	8.0	6.6	48.9		9.0	~193.4		~40.4	~201.6	
Queue Length 95th (m)		#439.4	20.1	#24.4	72.8		#28.6	#263.5		#77.2	#272.2	
Internal Link Dist (m)		778.0			146.4			71.0			391.0	
Turn Bay Length (m)												
Base Capacity (vph)		536	678	60	735		60	446		60	461	
Starvation Cap Reductn		0	0	0	0		0	0		0	0	
Spillback Cap Reductn		0	0	0	0		0	0		0	0	
Storage Cap Reductn		0	0	0	0		0	0		0	0	
Reduced v/c Ratio		1.82	0.17	0.58	0.41		0.67	1.35		1.82	1.36	

Intersection Summary
Cycle Length: 125
Actuated Cycle Length: 125
Offset: 0 (0%), Referenced to phase 2: EBWB and 6:, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 1.82
Intersection Signal Delay: 255.9 Intersection LOS: F
Intersection Capacity Utilization 114.8% ICU Level of Service H
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.

Lanes, Volumes, Timings
2: Cosburn & Coxwell 4/2/2007

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	0	<2>	0	1	1>	0	0	<1>	0	0	<2>	0
Volume (vph)	59	243	29	40	197	66	36	537	79	102	606	98
Satd. Flow (prot)	0	3500	0	1789	1812	0	0	1848	0	0	3493	0
Flt Permitted		0.683		0.450				0.922			0.763	
Satd. Flow (perm)	0	2412	0	848	1812	0	0	1709	0	0	2681	0
Satd. Flow (RTOR)		10			17			17			36	
Lane Group Flow (vph)	0	360	0	43	286	0	0	709	0	0	877	0
Turn Type	custom			custom			custom			custom		
Protected Phases												
Permitted Phases	2	2		2	2		1	1		1	1	
Total Split (s)	25.0	25.0	0.0	25.0	25.0	0.0	65.0	65.0	0.0	65.0	65.0	0.0
Total Lost Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Act Effct Green (s)		20.0		20.0	20.0			60.0			60.0	
Actuated g/C Ratio		0.22		0.22	0.22			0.67			0.67	
v/c Ratio		0.66		0.23	0.69			0.62			0.49	
Control Delay		37.7		32.5	39.9			11.2			6.3	
Queue Delay		0.0		0.0	0.0			0.0			0.0	
Total Delay		37.7		32.5	39.9			11.2			6.3	
LOS		D		C	D			B			A	
Approach Delay		37.7			38.9			11.2			6.3	
Approach LOS		D			D			B			A	
Stops (vph)		288		33	223			346			379	
Fuel Used(l)		18		2	14			39			27	
CO Emissions (g/hr)		330		36	268			726			495	
NOx Emissions (g/hr)		64		7	52			141			96	
VOC Emissions (g/hr)		76		8	62			168			115	
Dilemma Vehicles (#)		0		0	0			0			0	
Queue Length 50th (m)		29.2		6.1	42.9			59.6			21.4	
Queue Length 95th (m)		44.0		15.3	#69.8			91.3			24.8	
Internal Link Dist (m)		92.3			90.9			391.0			180.0	
Turn Bay Length (m)												
Base Capacity (vph)		544		188	416			1145			1799	
Starvation Cap Reductn		0		0	0			0			0	
Spillback Cap Reductn		0		0	0			0			0	
Storage Cap Reductn		0		0	0			0			0	
Reduced v/c Ratio		0.66		0.23	0.69			0.62			0.49	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBWB and 6:, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 17.5 Intersection LOS: B
Intersection Capacity Utilization 98.3% ICU Level of Service F
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	0	<1>	0	0	<1>	0	0	<2>	0	0	<2>	0
Volume (vph)	68	118	65	49	47	68	76	496	80	10	692	39
Satd. Flow (prot)	0	1794	0	0	1751	0	0	3493	0	0	3546	0
Flt Permitted		0.876			0.852			0.750			0.944	
Satd. Flow (perm)	0	1592	0	0	1515	0	0	2636	0	0	3351	0
Satd. Flow (RTOR)		21			43			27			10	
Lane Group Flow (vph)	0	273	0	0	178	0	0	709	0	0	805	0
Turn Type	custom			custom			custom			custom		
Protected Phases												
Permitted Phases	2	2		2	2		1	1		1	1	
Total Split (s)	36.0	36.0	0.0	36.0	36.0	0.0	54.0	54.0	0.0	54.0	54.0	0.0
Total Lost Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Act Effct Green (s)		31.0			31.0			49.0			49.0	
Actuated g/C Ratio		0.34			0.34			0.54			0.54	
v/c Ratio		0.49			0.32			0.49			0.44	
Control Delay		24.9			18.2			9.3			13.1	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		24.9			18.2			9.3			13.1	
LOS		C			B			A			B	
Approach Delay		24.9			18.2			9.3			13.1	
Approach LOS		C			B			A			B	
Stops (vph)		178			89			332			414	
Fuel Used(l)		10			6			24			30	
CO Emissions (g/hr)		179			117			435			557	
NOx Emissions (g/hr)		35			23			85			108	
VOC Emissions (g/hr)		42			27			101			129	
Dilemma Vehicles (#)		0			0			0			0	
Queue Length 50th (m)		33.7			16.6			24.0			40.6	
Queue Length 95th (m)		56.5			32.7			30.3			54.0	
Internal Link Dist (m)		63.7			132.9			180.0			189.0	
Turn Bay Length (m)												
Base Capacity (vph)		562			550			1447			1829	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.49			0.32			0.49			0.44	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBWB and 6:, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 0.49
Intersection Signal Delay: 13.8 Intersection LOS: B
Intersection Capacity Utilization 69.5% ICU Level of Service C
Analysis Period (min) 15

Lanes, Volumes, Timings
4: O'Connor & Coxwell 4/2/2007

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	0	<2>	0	0	<2>	0	0	<2>	0	0	<2>	0
Volume (vph)	10	1910	389	257	777	33	350	10	273	29	94	31
Satd. Flow (prot)	0	3489	0	0	3518	0	0	3256	0	0	3440	0
Flt Permitted		0.947			0.529			0.673			0.591	
Satd. Flow (perm)	0	3304	0	0	1884	0	0	2252	0	0	2051	0
Satd. Flow (RTOR)		18			8			92			15	
Lane Group Flow (vph)	0	2510	0	0	1160	0	0	688	0	0	168	0
Turn Type	custom			custom			custom			custom		
Protected Phases				1	1							
Permitted Phases	2	2		2	2		3	3		3	3	
Total Split (s)	72.0	72.0	0.0	72.0	72.0	0.0	18.0	18.0	0.0	18.0	18.0	0.0
Total Lost Time (s)	2.0	2.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Act Effct Green (s)		70.0			134.0			13.0			13.0	
Actuated g/C Ratio		0.43			0.83			0.08			0.08	
v/c Ratio		1.75			0.52			2.60			0.94	
Control Delay		368.0			3.5			750.6			119.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		368.0			3.5			750.6			119.8	
LOS		F			A			F			F	
Approach Delay		368.0			3.5			750.6			119.8	
Approach LOS		F			A			F			F	
Stops (vph)		1495			223			291			124	
Fuel Used(l)		884			18			384			18	
CO Emissions (g/hr)		16346			337			7106			331	
NOx Emissions (g/hr)		3181			66			1383			64	
VOC Emissions (g/hr)		3791			78			1648			77	
Dilemma Vehicles (#)		0			0			0			0	
Queue Length 50th (m)		~631.9			32.4			~181.6			26.3	
Queue Length 95th (m)		#667.1			37.8			#222.2			#51.4	
Internal Link Dist (m)		828.0			83.4			189.0			87.2	
Turn Bay Length (m)												
Base Capacity (vph)		1438			2236			265			178	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		1.75			0.52			2.60			0.94	

Intersection Summary
Cycle Length: 162
Actuated Cycle Length: 162
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 2.60
Intersection Signal Delay: 323.5 Intersection LOS: F
Intersection Capacity Utilization 135.1% ICU Level of Service H
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	1	2			1	1				2		1
Volume (vph)	560	749			633	525				1560		394
Satd. Flow (prot)	1789	3579			1883	1601				3471		1601
Flt Permitted	0.133									0.950		
Satd. Flow (perm)	250	3579			1883	1601				3471		1601
Satd. Flow (RTOR)												76
Lane Group Flow (vph)	609	814			688	571				1696		428
Turn Type	custom					custom						custom
Protected Phases	1					3						1
Permitted Phases	2	2			2	2				3		3
Total Split (s)	7.0	35.0			35.0	45.0				45.0		7.0
Total Lost Time (s)	3.0	5.0			5.0	5.0				5.0		3.0
Act Effct Green (s)	36.0	30.0			30.0	75.0				40.0		49.0
Actuated g/C Ratio	0.41	0.34			0.34	0.86				0.46		0.56
v/c Ratio	3.50	0.66			1.06	0.41				1.06		0.46
Control Delay	1153.0	27.3			82.2	2.3				66.0		10.9
Queue Delay	0.0	0.0			0.0	0.0				0.0		0.0
Total Delay	1153.0	27.3			82.2	2.3				66.0		10.9
LOS	F	C			F	A				E		B
Approach Delay		509.1			45.9					54.9		
Approach LOS		F			D					D		
Stops (vph)	435	614			530	90				1333		184
Fuel Used(l)	520	48			105	50				116		10
CO Emissions (g/hr)	9629	884			1938	917				2137		190
NOx Emissions (g/hr)	1874	172			377	178				416		37
VOC Emissions (g/hr)	2233	205			449	213				496		44
Dilemma Vehicles (#)	0	0			0	0				0		0
Queue Length 50th (m)	~183.0	59.7			~127.4	11.3				~162.3		31.2
Queue Length 95th (m)	#244.0	79.1			#190.9	17.6				#202.6		52.2
Internal Link Dist (m)		269.0			828.0					79.7		
Turn Bay Length (m)												
Base Capacity (vph)	174	1234			649	1380				1596		935
Starvation Cap Reductn	0	0			0	0				0		0
Spillback Cap Reductn	0	0			0	0				0		0
Storage Cap Reductn	0	0			0	0				0		0
Reduced v/c Ratio	3.50	0.66			1.06	0.41				1.06		0.46

Intersection Summary
Cycle Length: 87
Actuated Cycle Length: 87
Offset: 20 (23%), Referenced to phase 2:EBWB and 6:, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 3.50
Intersection Signal Delay: 187.0 Intersection LOS: F
Intersection Capacity Utilization 120.5% ICU Level of Service H
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.

Lanes, Volumes, Timings
6: O'Connor & Donlands 4/2/2007

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	0	<1	1	0	<1	1	0	<2>	0	0	<1	1
Volume (vph)	10	580	44	316	553	158	76	298	385	344	605	20
Satd. Flow (prot)	0	1882	1601	0	1850	1601	0	3290	0	0	1850	1601
Flt Permitted		0.580			0.097			0.497			0.318	
Satd. Flow (perm)	0	1092	1601	0	183	1601	0	1643	0	0	599	1601
Satd. Flow (RTOR)			35			144		262				12
Lane Group Flow (vph)	0	641	48	0	944	172	0	825	0	0	1032	22
Turn Type	custom		custom	custom		custom	custom			custom		custom
Protected Phases				1	1	1						
Permitted Phases	2	2	2	2	2	2	3	3		3	3	3
Total Split (s)	33.0	33.0	33.0	33.0	33.0	33.0	47.0	47.0	0.0	47.0	47.0	47.0
Total Lost Time (s)	5.0	5.0	5.0	3.0	3.0	3.0	5.0	5.0	4.0	5.0	5.0	5.0
Act Effct Green (s)		28.0	28.0		60.0	63.0		42.0			42.0	42.0
Actuated g/C Ratio		0.25	0.25		0.53	0.56		0.37			0.37	0.37
v/c Ratio		2.37	0.11		1.75	0.18		1.06			4.63	0.04
Control Delay		647.9	15.5		370.2	3.4		75.5			1654.6	14.7
Queue Delay		0.0	0.0		0.0	0.0		0.0			0.0	0.0
Total Delay		647.9	15.5		370.2	3.4		75.5			1654.6	14.7
LOS		F	B		F	A		E			F	B
Approach Delay		603.9			313.7			75.5			1620.3	
Approach LOS		F			F			E			F	
Stops (vph)		391	16		556	18		488			824	8
Fuel Used(l)		306	1		282	6		86			1230	1
CO Emissions (g/hr)		5652	22		5220	103		1589			22757	10
NOx Emissions (g/hr)		1100	4		1016	20		309			4428	2
VOC Emissions (g/hr)		1311	5		1211	24		369			5277	2
Dilemma Vehicles (#)		0	0		0	0		0			0	0
Queue Length 50th (m)		~232.9	2.2		~302.2	2.6		~85.5			~382.5	1.4
Queue Length 95th (m)		#300.5	11.5		#378.1	12.2		#124.5			#459.9	6.6
Internal Link Dist (m)		67.7			269.0			409.0			75.2	
Turn Bay Length (m)												
Base Capacity (vph)		271	423		540	956		775			223	603
Starvation Cap Reductn		0	0		0	0		0			0	0
Spillback Cap Reductn		0	0		0	0		0			0	0
Storage Cap Reductn		0	0		0	0		0			0	0
Reduced v/c Ratio		2.37	0.11		1.75	0.18		1.06			4.63	0.04

Intersection Summary
Cycle Length: 113
Actuated Cycle Length: 113
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 4.63
Intersection Signal Delay: 688.5 Intersection LOS: F
Intersection Capacity Utilization 167.2% ICU Level of Service H
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	1	1	1	1	1>	0	0	<2>	0	0	<2>	0
Volume (vph)	42	349	49	68	240	119	17	600	91	146	707	112
Satd. Flow (prot)	1789	1883	1601	1789	1789	0	0	3507	0	0	3490	0
Flt Permitted	0.377			0.389				0.917			0.639	
Satd. Flow (perm)	710	1883	1601	733	1789	0	0	3219	0	0	2248	0
Satd. Flow (RTOR)			53		32			25			22	
Lane Group Flow (vph)	46	379	53	74	390	0	0	769	0	0	1049	0
Turn Type	custom		custom	custom			custom			custom		
Protected Phases												
Permitted Phases	2	2	2	2	2		1	1		1	1	
Total Split (s)	41.0	41.0	41.0	41.0	41.0	0.0	51.0	51.0	0.0	51.0	51.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Act Effct Green (s)	36.0	36.0	36.0	36.0	36.0			46.0			46.0	
Actuated g/C Ratio	0.39	0.39	0.39	0.39	0.39			0.50			0.50	
v/c Ratio	0.17	0.51	0.08	0.26	0.54			0.47			0.92	
Control Delay	20.3	24.4	5.6	22.1	23.1			15.7			35.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0			0.0	
Total Delay	20.3	24.4	5.6	22.1	23.1			15.7			35.9	
LOS	C	C	A	C	C			B			D	
Approach Delay		21.9			23.0			15.7			35.9	
Approach LOS		C			C			B			D	
Stops (vph)	28	259	9	46	249			426			797	
Fuel Used(l)	1	14	1	4	23			23			82	
CO Emissions (g/hr)	27	254	15	79	425			426			1524	
NOx Emissions (g/hr)	5	49	3	15	83			83			297	
VOC Emissions (g/hr)	6	59	4	18	99			99			353	
Dilemma Vehicles (#)	0	0	0	0	0			0			0	
Queue Length 50th (m)	5.2	50.1	0.0	8.7	47.9			43.2			85.4	
Queue Length 95th (m)	12.9	76.1	6.8	19.4	75.1			58.0			#131.7	
Internal Link Dist (m)		69.7			319.0			87.9			409.0	
Turn Bay Length (m)												
Base Capacity (vph)	278	737	659	287	720			1622			1135	
Starvation Cap Reductn	0	0	0	0	0			0			0	
Spillback Cap Reductn	0	0	0	0	0			0			0	
Storage Cap Reductn	0	0	0	0	0			0			0	
Reduced v/c Ratio	0.17	0.51	0.08	0.26	0.54			0.47			0.92	

Intersection Summary
Cycle Length: 92
Actuated Cycle Length: 92
Offset: 0 (0%), Referenced to phase 2:EBWB and 6:, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 25.7 Intersection LOS: C
Intersection Capacity Utilization 87.2% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lanes, Volumes, Timings
8: Cosburn & Greenwood 4/2/2007

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	1	1>	0	1	1>	0	1	1>	0	0	<1>	0
Volume (vph)	33	542	11	48	297	10	99	40	93	32	333	31
Satd. Flow (prot)	1789	1878	0	1789	1874	0	1789	1686	0	0	1855	0
Flt Permitted	0.502			0.283			0.377				0.967	
Satd. Flow (perm)	945	1878	0	533	1874	0	710	1686	0	0	1801	0
Satd. Flow (RTOR)		2			3			101			5	
Lane Group Flow (vph)	36	601	0	52	334	0	108	144	0	0	431	0
Turn Type	custom			custom			custom			custom		
Protected Phases												
Permitted Phases	2	2		2	2		1	1		1	1	
Total Split (s)	52.0	52.0	0.0	52.0	52.0	0.0	38.0	38.0	0.0	38.0	38.0	0.0
Total Lost Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Act Effct Green (s)	47.0	47.0		47.0	47.0		33.0	33.0			33.0	
Actuated g/C Ratio	0.52	0.52		0.52	0.52		0.37	0.37			0.37	
v/c Ratio	0.07	0.61		0.19	0.34		0.42	0.21			0.65	
Control Delay	11.3	18.4		13.6	13.6		38.7	21.0			28.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay	11.3	18.4		13.6	13.6		38.7	21.0			28.9	
LOS	B	B		B	B		D	C			C	
Approach Delay		18.0			13.6			28.6			28.9	
Approach LOS		B			B			C			C	
Stops (vph)	16	374		26	168		92	132			320	
Fuel Used(l)	2	33		2	10		8	10			18	
CO Emissions (g/hr)	32	616		29	187		156	178			333	
NOx Emissions (g/hr)	6	120		6	36		30	35			65	
VOC Emissions (g/hr)	7	143		7	43		36	41			77	
Dilemma Vehicles (#)	0	0		0	0		0	0			0	
Queue Length 50th (m)	2.9	68.8		4.5	31.4		18.5	14.6			60.2	
Queue Length 95th (m)	7.6	101.7		11.3	48.9		m24.3	m20.6			91.7	
Internal Link Dist (m)		319.0			113.8			375.0			85.3	
Turn Bay Length (m)												
Base Capacity (vph)	494	982		278	980		260	682			664	
Starvation Cap Reductn	0	0		0	0		0	0			0	
Spillback Cap Reductn	0	0		0	0		0	0			0	
Storage Cap Reductn	0	0		0	0		0	0			0	
Reduced v/c Ratio	0.07	0.61		0.19	0.34		0.42	0.21			0.65	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBWB and 6:, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 0.65
Intersection Signal Delay: 21.3 Intersection LOS: C
Intersection Capacity Utilization 78.2% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	0	<1>	0	0	<1>	0	0	<1>	0	0	<1>	0
Volume (vph)	31	684	38	20	297	17	34	184	156	166	203	21
Satd. Flow (prot)	0	1867	0	0	1865	0	0	1769	0	0	1831	0
Flt Permitted		0.975			0.938			0.929			0.480	
Satd. Flow (perm)	0	1824	0	0	1754	0	0	1652	0	0	898	0
Satd. Flow (RTOR)		5			5			40			3	
Lane Group Flow (vph)	0	818	0	0	363	0	0	407	0	0	424	0
Turn Type	custom			custom			custom			custom		
Protected Phases												
Permitted Phases	2	2		2	2		1	1		1	1	
Total Split (s)	59.0	59.0	0.0	59.0	59.0	0.0	31.0	31.0	0.0	31.0	31.0	0.0
Total Lost Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0
Act Effct Green (s)		54.0			54.0			26.0			26.0	
Actuated g/C Ratio		0.60			0.60			0.29			0.29	
v/c Ratio		0.75			0.34			0.80			1.62	
Control Delay		18.3			10.1			40.7			327.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		18.3			10.1			40.7			327.6	
LOS		B			B			D			F	
Approach Delay		18.3			10.1			40.7			327.6	
Approach LOS		B			B			D			F	
Stops (vph)		529			156			299			433	
Fuel Used(l)		26			33			21			121	
CO Emissions (g/hr)		484			614			385			2238	
NOx Emissions (g/hr)		94			119			75			436	
VOC Emissions (g/hr)		112			142			89			519	
Dilemma Vehicles (#)		0			0			0			0	
Queue Length 50th (m)		93.3			28.6			59.0			~110.5	
Queue Length 95th (m)		140.7			44.5			#104.8			#167.6	
Internal Link Dist (m)		75.6			778.0			97.1			375.0	
Turn Bay Length (m)												
Base Capacity (vph)		1096			1054			506			262	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.75			0.34			0.80			1.62	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBWB and 6:, Start of Green
Control Type: Pretimed
Maximum v/c Ratio: 1.62
Intersection Signal Delay: 86.5 Intersection LOS: F
Intersection Capacity Utilization 102.4% ICU Level of Service G
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.