Region of Peel
Working for you

Final Report

Cawthra Road Pre-Environmental Assessment
(QEW to Highway 403/Eastgate Parkway)

Multi-Modal Transportation Report
Project No. 11-4350

IBI

Prepared for Region of Peel
by IBI Group

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Appendices

1 Introduction

This is the Multi-Modal Transportation Report is the first of two primary deliverables for the Cawthra Road Pre-Environmental Assessment (EA) Study. This report only includes aspects of the Study Area Profile relevant to transportation and traffic. The second deliverable will be the Technical Feasibility Study Report. The latter will build on the findings of this study and document the development and assessment of design concepts.

1.1 Study Purpose

Cawthra Road is a major arterial road under the jurisdiction of the Regional Municipality of Peel. It extends from Lakeshore Road to Highway 403/Eastgate Parkway, with interchanges available at Highway 403 and the Queen Elizabeth Way (QEW). The Region of Peel Long Range Transportation Plan Update 2012 (LRTP) identifies Cawthra Road as a candidate for widening to six lanes from Eastgate Parkway to Burnhamthorpe Road, and from Dundas Street to QEW. Active transportation plans for both the Region of Peel and the City of Mississauga also identify Cawthra Road as a key active transportation route.

The purpose of the Pre-EA Technical Feasibility Study is to:

- Confirm future capacity and operational needs for all modes of transportation including pedestrians, cyclists, transit users, and motorists;
- Identify long term improvements that address capacity and operational requirements;
- Identify technically feasible transportation improvements that benefit pedestrians, cyclists, transit users, and motorists;
- Compile and summarize existing transportation issues, constraints and opportunities;
- Develop and evaluate realistic design concepts that address the identified issues, constraints and opportunities; and,
- Select a recommended design concept and prepare a study report.

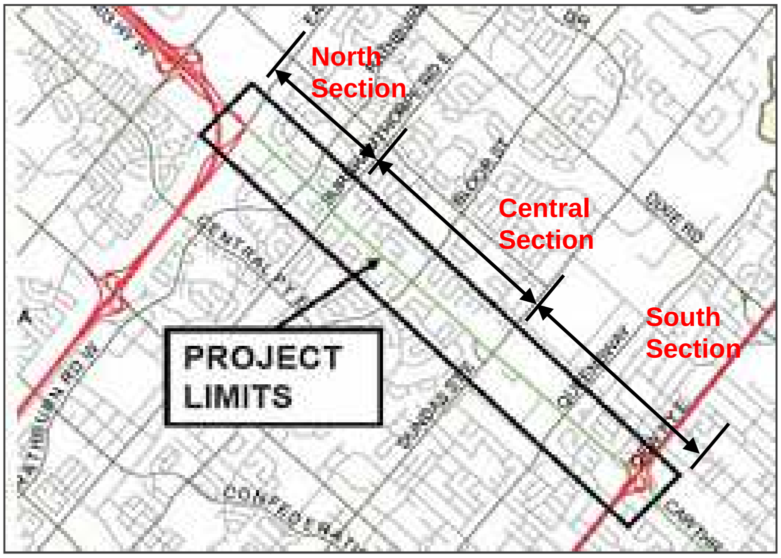
The Multi-Modal Transportation Report responds to all but the last two objectives listed which will be the focus of the next stage of the project.

1.2 Project Limits

This study focuses on Cawthra Road between QEW and Highway 403/Eastgate Parkway (approx. 6km), as illustrated in **Exhibit 1**.

While the traffic operational analysis herein is limited to intersections along Cawthra Road, for the transportation modelling component, a larger study area has been considered which includes Hurontario Street, Dixie Road, Highway 403 and the QEW.

Exhibit 1: Project Limits



North Section - Eastgate Parkway to Burnhamthorpe Road

Central Section - Burnhamthorpe Road to Dundas Street

South Section - Dundas Street to the QEW

1.3 Related Projects

There are several relevant transportation projects underway in the City of Mississauga which may influence transportation patterns in the City and along Cawthra Road. A short description of each is provided below. Additional information on these studies is available online.

- **Mississauga Bus Rapid Transitway:** The Mississauga Bus Rapid Transit (BRT) is an element of the GO Transit initiative to create a highly efficient transit corridor. There will be a dedicated right of way for transit vehicles that will include 12 stations at key connection points that will run east to west across Mississauga along Highway 403 and Eastgate Parkway. A BRT station is under construction at the intersection of Cawthra Road and Eastgate Parkway.
- **Burnhamthope Road East Improvements:** A Class EA study was completed for improvements along Burnhamthorpe Road East from Arista Way to Dixie Road by the City of Mississauga. The recommended design consists of enhancements to the Burnhamthorpe trail, cycle/pedestrian bridges across major watercourses, intersection improvements, transit queue jump lanes, noise mitigation, streetscaping and road resurfacing.
- **Mississauga City Centre (MCC) Watermain Construction:** This project is underway and involves the construction of a sub-transmission watermain from the Hanlan Reservoir to Eastgate Parkway, along Tomken Road then west towards Cawthra Road, and south on Cawthra Road to Burnhamthorpe Road.
- **Multi-Use Trail Construction:** A multi-use trail has recently been constructed on the west side of Cawthra Road between Meadow Boulevard and Eastgate Parkway by the City of Mississauga and between Burhamthorpe and Meadows Boulevard in conjunction with the MCC Watermain project. An additional multi-use trail is proposed as a local connection to the Cawthra BRT Station east of Cawthra Road.
- **Silverthorn Feedermain Construction:** The Region of Peel is planning to construct a watermain from Silvertorn Pumping Station on Bloor Street to an existing watermain on Queensway. Potential coordination may be considered to explore the possibility of coordinating construction schedules (it is slated to be constructed for 2023).

2 Study Area Profile

As a first step, a study area profile was compiled to establish familiarity with the overall road network, adjacent land use, and environmental setting. The profile identifies relevant policy items and projects outlined in the various planning documents for the Region and the City of Mississauga, adjacent land use context, and an overview of the major transportation facilities in the corridor.

2.1 Policy and Planning Framework

There are several policy and planning documents for the local area which provide context and guidance to this study. These are summarized below.

- **Official Plan** - Aims to develop an effective and efficient integrated transportation network and encourages an increased public transit modal share;
- **City of Mississauga Official Plan** - Identifies Cawthra Road as a corridor that intersects with Burnhamthorpe Road. Cawthra Road also intersects with Dundas Street, which is identified as an intensification and a higher order transit corridor;
- **Long Range Transportation Plan (Update 2012)** - Identifies Cawthra Road as subject to widening from 4 to 6 lanes for the sections from QEW to Dundas Street (Year 2019) and Burnhamthorpe Road to Eastgate Parkway (Year 2030);
- **Strategic Goods Movement Network Study** – identifies Cawthra Road as a Primary Truck Route south of Dundas Street, and as a Connector Truck Route to the north;
- **Road Characterization Study** - Identifies section of Cawthra Road from the Queensway to Dundas Street as an industrial connector, and the remaining section as a suburban connector;
- **Active Transportation Plan** - Identifies Cawthra Road as part of the Regional pedestrian and cyclist network, and recommends active transportation improvements to the corridor;
- **Moving Mississauga Transportation Strategy** – Outlines the current and future transportation challenges and issues facing Mississauga. It sets 46 actions plans to be pursued including implementing the City's Cycling Master Plan; and,
- **Mississauga Cycling Master Plan** - Identifies Cawthra Road as a primary cycling route.

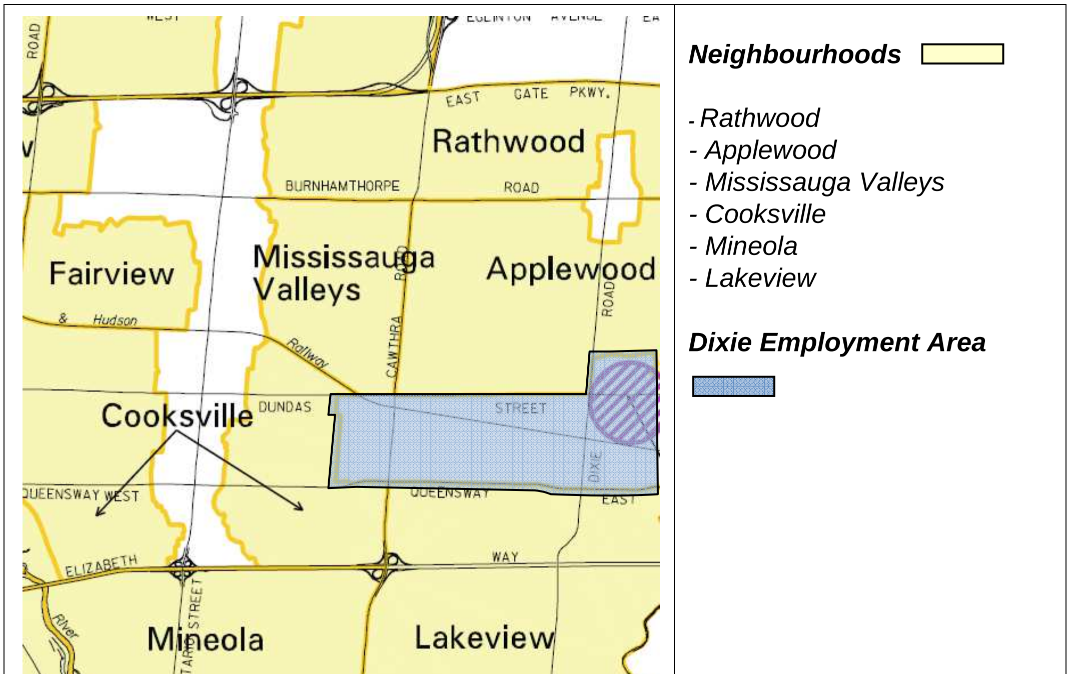
2.2 Adjacent Land Use

Existing land uses within the study area include residential, commercial and industrial/ employment areas. Specific details in this regard, as outlined by the City of Mississauga Official Plan, are described below and illustrated in **Exhibit 2**.

Residential neighbourhoods adjacent to the Cawthra Road include:

- **Rathwood** is a mature residential community containing a broad mix of low, medium and high density housing types. There are some retail commercial facilities in the neighbourhood. There are lands identified as Special Site 1 located west of Cawthra Road and north of Rathburn Road East. The redevelopment of all lands designated Residential Low Density I (detached, semi-detached and duplex dwellings to a maximum density of 17 units per net residential hectare) will minimize access points to Cawthra Road to preserve the integrity of Cawthra Road as a major arterial roadway.

Exhibit 2: Adjacent Land Use



Source: Mississauga Official Plan

- **Applewood** is a stable established area with a number of sites remaining to be developed or redeveloped. There are a number of retail commercial facilities that serve the area and linear retail development along Dundas Street.
- **Mississauga Valleys** is a stable, established residential community with only a few sites remaining to be developed. Detached and semi-detached dwellings, which comprise approximately one-quarter of the total residential units in the character area, are concentrated in the easterly part of the character area, while apartments and townhouses are concentrated in the westerly part of the character area, and along major roads. Mississauga will encourage landowners to coordinate the eventual replacement of fences to enhance the appearance of the area from the street. Special consideration should be given to Burnhamthorpe Road East, Cawthra Road, Bloor Street and Cliff Road North. Where existing noise attenuation walls or rear yard privacy fencing are exposed to public streets, supplementary planting and upgraded landscape features should be added, where feasible, as a condition of development or road reconstruction.
- **Cooksville** is a mixture of commercial and residential uses. Existing residential land uses consist primarily of detached and semi-detached dwellings which comprise most of the established neighbourhoods in the area. The focal point of Cooksville is the historic "Cooksville Corners" area surrounding the intersection of Dundas Street and Hurontario Street, located west of the Cawthra Road corridor.
- **Mineola** is a stable residential community, with limited potential for development, characterized by low density housing on large, spacious and heavily treed lots. The area is served by a number of small retail commercial facilities.

- **Lakeview** is a stable, established area with few sites remaining to be developed. Existing residential land uses are a combination of low density detached and semi-detached units, medium density townhouses and high density apartments. The City is currently undertaking a local area plan study of Lakeview.

Based on the City's new Official Plan, the land use within the **Dixie Employment Area** include business employment, mixed use and greenbelt. Most of the lands in this character area are developed for commercial and employment uses. Development along Dundas Street East has evolved over the last 15 years to be predominantly retail commercial in nature, dominated by retail warehouse uses, largely in the form of home furnishing outlets, as well as motor vehicle commercial uses, restaurants and motels. There are a few remaining general industrial uses between Dundas Street East and the St. Lawrence & Hudson Railway line, some of which have frontage on Dundas Street East.

2.3 Road Network

2.3.1 Cawthra Road

Within the project limits, Cawthra Road has a basic four lane urban cross section with auxiliary turn lanes typically provided at intersections. North of Dundas Street a centre left turn lane is provided to accommodate access to the many driveways fronting directly onto Cawthra Road.

Major east-west roads intersecting Cawthra Road are signalized except for the intersection with Dundas Street which is grade separated. Access to and from Dundas Street is provided by a full move ramp / connecting link in the northwest quadrant of the intersection. At this location, Cawthra Road passes beneath both Dundas Street and the Lakeshore West rail corridor. Both structures span approximately 33.5m (face to face of outer retaining wall) and therefore it will be difficult to accommodate six travel lanes along Cawthra Road plus on-road bike lanes or a multi-use trail (further discussed in Section 7.3).

Sidewalks are currently provided on both sides of Cawthra Road from the QEW to Burnhamthorpe Road. North of Burnhamthorpe Road, a multi-use trail (MUT) was recently constructed on the west side of Cawthra Road between Burnamthorpe Road and Eastgate Parkway. There is no sidewalk on the east side of Cawthra Road north of Burnhamthorpe Road; only a splash pad adjacent to the existing curb.

The existing right-of-way (ROW) north of Burnhamthorpe Road varies from 36 to 45m. South of Burhamthorpe Road the existing right-of-way is typically 36m, with several exceptions (including adjacent to Mount Peace Catholic Cemetery, where the existing right-of-way is 28m). The designated right-of-way of Cawthra Road, as identified in the Region of Peel Official Plan, is as follows:

- North Section (Burnhamthorpe Road to Eastgate Parkway) – 45 m
- Central Section (Dundas Street to Burnhamthorpe Road) – 36 m
- South Section (QEW to Dundas Street) – 45 m

The Long Range Transportation Plan Update (2012) identifies potential widening of Cawthra Road to six lanes from north of Burnhamthorpe Road to Eastgate Parkway and south of Dundas Street to the QEW. Although widening to six lanes can likely be accommodated within the North Section with limited property impacts, six laning south of Dundas Street (if required) will be much more difficult given the limited right-of-way and number properties potentially affected.

2.3.2 Signalized Intersections

Traffic signals are installed along Cawthra Road at the following east-west intersecting streets:

- Eastgate Parkway
- Meadows Boulevard
- Rathburn Road East
- Burnhamthorpe Road
- Bloor Street
- Silver Creek Boulevard
- Dundas Street (ramp)
- Queensway East
- Tedwyn Drive
- North Service Road
- QEW EB Off-Ramp
- QEW WB Off-Ramp
- South Service Road

Signalized intersections with major east-west roads (Eastgate, Burnhamthorpe, Bloor, Dundas, and the Queensway) have historically had channelized right turns with ‘pork chop’ islands. Intersections with Eastgate Parkway and Burnhamthorpe Road have recently been reconfigured to remove these channelizations; however, they are still in place at Bloor Street, Dundas Ramp and the Queensway. Signalized intersections typically have advance green phases and at the Queensway there are dual left turn lanes (westbound and southbound) with fully protected left turn phases. The Dundas Ramp intersection operates with split phasing; with a separate phase to the Dixie Presbyterian Church (as required) located directly opposite the Dundas Ramp. There are two driveways opposite Silver Creek Boulevard which are within the intersection.

2.3.3 Unsignalized Intersections

There are nine unsignalized intersections along the corridor, not including driveways, with stop (sign) control provided on the following side street approaches:

- Hassall Road
- Runningbrooke Drive
- Brekenridge Road
- Hyancinthe Boulevard
- Schomberg Avenue
- Santee Gate
- Needham Lane
- Orwell Street
- Melton Drive

There are no hard (median) or soft (signage) turning restrictions in place at these intersections. Modifications to some of these intersections will likely be required to accommodate future demands. This may include restricting turning movements or signalization to facilitate adequate levels of service.

2.3.4 Driveways

Cawthra Road, for much of its length, has low density residential frontage. Between Burnhamthorpe Road and Dundas Street there is a relatively high concentration of residential frontage and many of these residences have driveways directly on Cawthra Road. To improve access and egress to/from the many driveways on Cawthra Road, a two-way centre left turn lane exists between Meadows Boulevard and Dundas Street. South of Dundas Street there are several commercial driveways; however they are spaced farther apart and generally have dedicated left turn lanes; commercial driveways would also have fewer (if any) instances of vehicles reversing out. The frequency of driveways is a key issue of the corridor and will influence the evaluation of alternatives.

2.4 Transit Network

Cawthra Road is served by the local Mississauga Transit Route 8 (Cawthra). A route map is provided in **Appendix A**.

The route provides service between the City Centre Transit Terminal at Square One and Port Credit GO Station and travels on Cawthra Road between Bloor Street and Atwater Avenue. The route operates at headways of approximately 20 minutes during weekday AM and PM peak periods and does not run on Sundays. There are currently no transit priority features installed on Cawthra Road such as Transit Signal Priority (TSP) or queue jump lanes. Bus stops are located at all major intersections often with one placed mid-way in between these intersections. There are no transit terminals on or near Cawthra Road.

While Cawthra Road itself does not currently accommodate significant north-south transit, there is a Bus Rapid Transit (BRT) planned for Dundas Street and the MiWay BRT Station at Eastgate Parkway. These two east-west routes will create interchange opportunities and may lead to increased transit use on the corridor; however, the full potential is not yet clear. Densities are fairly low and even with new east-west connectivity, there may be little opportunity.

2.5 Goods Movement

Cawthra Road is identified as a truck route in the Peel Region Goods Movement Strategic Plan 2012 to 2016 (see truck network plan in **Appendix A**). North of Dundas Street to Eastgate Parkway, Cawthra Road is designated a ‘Connector Truck Route’. South of Dundas Street to the QEW, Cawthra Road is designated a ‘Primary Truck Route’.

The lands between Dundas Street and Queensway East are light industrial/commercial and require truck access. Turning movement counts indicate relative high heavy vehicle percentages at the driveway opposite Needham Lane. While percentages are high, the volume is relatively low. There are also relatively high truck percentages on some turning movements at the Cawthra Road / Queensway intersection. The intersections of Bloor Street, Dundas Street and the Queensway have right turn channelizations, offering larger turn radii for truck turning movements. At Burnhamthorpe Road, the right turn channelizations were removed. While channelizations may continue to be removed to accommodate transit operations or to improve the pedestrian environment, sufficient pavement width will be provided for truck movements.

3 Active Transportation Network

Cawthra Road is identified as a future cycling route. As such, a review of active transportation conditions, plans and design criteria is summarized below. A detailed memo in this regard is included in **Appendix B.**

3.1 Existing Conditions

The sidewalks are available on both sides of Cawthra Road from the QEW to Burnhamthorpe Road. North of Burnhamthorpe Road, the sidewalk on the west side was recently replaced with a multi-use trail. North of Meadows Blvd, a new 3.5m multi-use trail was constructed on the west side of Cawthra Road (per plans from Peel Region dated January 2, 2013). There is no sidewalk on the east side of Cawthra Road between Burnhamthorpe Road and Eastgate Parkway (only a splash pad exists, adjacent to the curb).

With exception of the multi-use trail noted above, there are no cycling facilities along Cawthra Road; however bikeways intersect Cawthra Road at the following locations:

- Multi-use trail on the north side of Rathburn Road (east approach)
- Multi-use trail on the north side of Burnhamthorpe Road
- Multi-use trail on the south side of the Queensway
- Signed route on Silver Creek Boulevard (west approach)

The transportation master plans for the Region of Peel and the City of Mississauga both include plans for bicycle facilities on Cawthra Road.

3.2 Policy Review

3.2.1 Peel Active Transportation Master Plan (2012)

The Active Transportation Master Plan (ATMP) provides the Region with a framework for how to increase walking and cycling trips and to create a more walk- and bike-friendly environment. According to the Long-Term Pedestrian and Cycling Networks, Cawthra Road is proposed for active transportation facilities as follows:

- the sections from Eastgate Parkway to the QEW, are proposed for multi-use trail on one side and sidewalks on the other (it is noted that separated bike lanes are also being considered from Dundas Street to Burnhamthorpe Road);
- the section from north of Dundas Street (likely Silver Creek Boulevard) to the QEW is proposed for Amenity Improvements; and,
- the existing hydro corridor is proposed for a multi-use trail that will cross Cawthra Road just north of the intersection of North Service Road.

These type of active transportation facilities and treatments are described based on guidance provided in the ATMP.

3.2.2 Mississauga Cycling Master Plan (2010)

According to the Mississauga Cycling Route Network, Cawthra Road is categorized as follows:

- the section from Eastgate Parkway to Dundas Street is proposed as a Primary Boulevard Route; and
- the section from Dundas Street to the QEW is proposed as a Primary On-Road Route.

The primary cycling routes are intended to serve as the backbone of the cycling network in Mississauga, providing direct and safe access to key city destinations. Those destinations may include the Downtown and other nodes, as well as the transit network.

Therefore, the bike facilities on Cawthra Road must serve to provide direct and safe access to these key destinations, as well as transit routes. For those destinations in adjacent corridors, the intersecting primary routes are important to connect to, namely: Highway 403 Utility Corridor Trail, Rathburn Road, Burnhamthorpe Road, Bloor Street, Dundas Street, Queensway, and Hydro One Corridor Trail.

3.2.3 Peel Road Characterization Study (2013)

The Road Characterization Study (RCS) provided the Region with design guidelines and access management measures for Regional Roads. As part of this study, the section from Eastgate Parkway to Dundas Street (North and Central Sections) is classified as a Suburban Connector, and the section from Dundas Street to the QEW (South Section) is classified as an Industrial

Connector. These two Road Characters, as they relate to active transportation, are described below:

Suburban Connectors are generally characterized as having some residential area with reverse frontage; 4 to 6 through lanes; and a desire operating speed between 50 to 70 km/hr. Pedestrians are to be accommodated with minimum 1.5m walkway behind wide boulevards. Cyclists are to be accommodated in a multi-use trail or bicycle lane.

Industrial Connectors are generally characterized as having access to industrial and warehousing areas connecting to 400 Series Highways; 4 to 6 through lanes; and a desire operating speed between 60 to 80 km/hr. Pedestrians are to be accommodated with minimum 1.5m walkway behind wide boulevards. Professional judgement is recommended to determine appropriate bike facilities in areas with high truck volume or where accesses / intersections are less than 300m apart.

3.3 Basic Design Criteria

The basic design of a cycling facility can be based on a combination of speeds and volume of traffic. These two factors directly affect the perceived and actual safety of cyclists using on-road facilities. They can be used to help determine an appropriate type of facility for Cawthra Road.

The existing annual average daily traffic (AADT) ranges from 28,000 to 33,000 vpd. There is generally more traffic southbound towards the QEW (as AADT drops below 25,000 vpd further south). During the PM peak hour, these volumes translate to approximately 1,100 vehicles northbound and 1,400 vehicles southbound.

The posted speed on Cawthra Road is 50 km/h; however, the 85^{th} percentile operating speed is 70 km/h. The Ontario Traffic Manual (OTM) Book 18: Bicycle Facilities (May 2013) provide some guidance in the pre-selection of the desirable type of bike facility based on the speed and volume conditions, and reflects the first of a three step process to assess . Subsequent steps include completing a more detailed assessment based on a number of factors, including: road function, vehicle mix, collision history, space available, level of use, costs, intersection frequency, and compatibility of the bicycle facility.

Other design guidelines and research of best practices throughout North America, which were considered in determining an appropriate type of facility for Cawthra Road, include:

- Peel Road Characterisation Study (2012);
- Region of Peel Active Transportation Study: Chapter 8 Active Transportation Facilities Reference Guide;
- Transportation Association of Canada (TAC) Geometric Design Guidelines for Canadian Roads (1999): Chapter 3.4 Bikeways; and,
- American Association for State Highway and Transportation Officials (AASHTO) Guide.

The TAC standards suggest the following with respect to the application of multi-use trails:

- Path users may not be visible to drivers reversing out of driveways;
- Used for travel in both directions, resulting in cyclists riding off the path against the flow of traffic on the roadway;
- “Extremely hazardous situation” at signalized intersections – cyclists required to dismount and walk across crosswalk but likely do not; turning motorists do not expect cyclist to enter crosswalk at speed; and,

- Considered suitable for relatively short trips at low speed and should only be used under exceptional circumstances when no alternatives are available.

Similarly, AASHTO guidelines suggest the following regarding the use of multi-use trails:

- Where high-volume and speeds discourage many cyclists from riding on the roadway, potentially increasing sidewalk riding, and there are no practical alternatives for improving the roadway or nearby parallel bikeway; and,
- Most applicable where there are few roadway and driveway crossings.

Design Standards considered appropriate for the corridor are as illustrated in **Exhibit 3**.

Exhibit 3: Design Standards for Cawthra Road

Road Element	Minimum Width	Desirable Width
Bike lanes	1.5 m	1.8 m
Buffered bike lanes	1.5 m bike lane + 0.5 m painted buffer	1.5m bike lane + 1.0 m painted buffer
Segregated bike lanes	1.5 m bike lane + 0.5 m separator	2.0 m bike lane + 0.5 m separator
Multi-use trail (MUT)	3.0 m	3.5 - 5.0 m
Sidewalk	1.5m 1.8m (curbface)	1.8m

Based on the characteristics of Cawthra Road, a physical separation of motor vehicle and bicycle facility is most appropriate. Separated facilities such as buffered bike lanes, cycle track or a multi-use trail in the boulevard are generally desirable.

Appropriate treatments include (but are not limited to) providing 1.5 m on-road bike lanes with a 0.5m buffer, or providing a 3.5m multi-use trail in the boulevard. Given the numerous low volume driveways and unsignalized intersections along Cawthra Road, bike lanes may be more appropriate than boulevard facilities since motorists are more likely to be aware of cyclists on the roadway rather than adjacent to the road.

If the roadway is to remain four lanes, there is an opportunity to also consider a multi-use trails on both sides of the roadway or a multi-use trail in combination with bike lanes, if/where appropriate. However, given the right-of-way constraints, if six lanes are required along Cawthra Road, options will generally are limited to either a multi-use trail on one side of the roadway or bike lanes without a multi-use trail.

4 Traffic Safety

- The Region of Peel provided historical collision data for the study area, summarizing the reported intersection and midblock collisions along the corridor for the five-year period from January 1, 2008 through December 31, 2012.

Exhibit 4 presents the five-year collision distribution for the corridor.

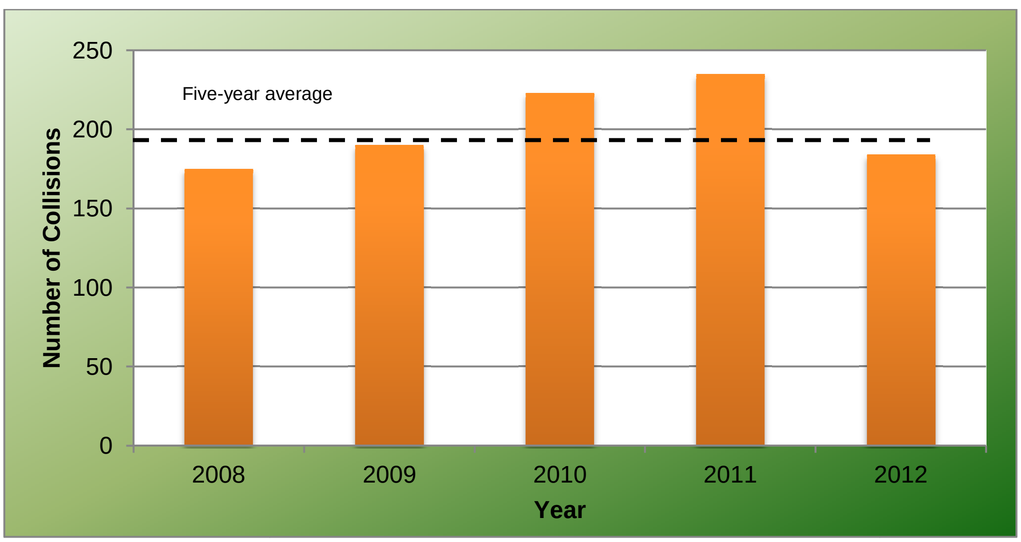
Along with the collision data, vehicle speed, counts and classification data were provided for consideration as part of the safety review. The speed, volume and classification data were collected on September 10, 11 and 12, 2012 at various locations in the corridor similar to the segments identified in the demand forecasting analysis.

Based on the safety analysis, the following overall conclusions were reached:

- There were a total of 1007 collisions reported for the corridor over the 5-year analysis period, and the majority (890) occurred at intersections;
- There were 143 non-fatal injury collisions, most of which were rear end (53) or turning movement (53), and 2 fatal collisions, both of which were angle collisions;
- The dominant collision impact type in the corridor was rear-end collision (45%), followed by turning movement collision (33%);
- Weather and compromised road surface conditions were also a factor in a significant number of collisions, at 20% and 30%, respectively; however, these distributions may not constitute statistical over-representations.

Exhibit 4: Five-year Collision Distribution

Year	2008	2009	2010	2011	2012	Total
Collisions	175	190	223	235	184	1007



In addition to the above, the following conclusions apply to individual intersections along the corridor:

- The intersection of Cawthra Road at Eastgate Parkway/Highway 403 exhibited the second highest frequency and rate of collisions over the five-year study period, contributed by a transition from highway to arterial speeds in both the north-south and east-west directions.
- Turning movement collisions were the dominant collision type at the intersection of Cawthra Road and Burnhamthorpe Road East, which differed from all other intersections. The southbound left turning vehicles colliding with northbound through vehicles comprised 70 and the 87 turning movement collisions at the intersection indicating a significant problem. Recent geometric improvements may have partially addressed the southbound left problem; further study once several

years of collision data are available is recommended to assess the new intersection geometry performance.

- The midblock segment at 3643 Cawthra Road, 120 metres south of Burnhamthorpe Road East, was found to have a high frequency of collisions at a plaza entrance, with left-turns into the plaza using a centre left-turn lane. Further analysis of midblock operations may determine if changes are warranted at this location.
- Excessive speeding, as observed along the entire corridor, was likely a factor contributing to the history of collisions at the intersection of Cawthra Road and Bloor Street, with 85^{th} percentile speeds often reaching above 70 km/h.
- Inconsistent lane markings at the intersection of Cawthra Road and the Dundas Street ramp may be contributing to rear-end collisions caused by drivers misjudging the southbound merge from the right-turn channel. Clear merge lane markings would help alleviate the ambiguity of lane configuration and right-of-way.
- The midblock segment immediately north of Queensway East was found to have an exceptionally large number of left-turn collisions into the commercial driveway at 655 Queensway East. Similar to the other midblock segment noted above, there is a centre left-turn lane and an opposing lane configuration over 3 lanes wide.
- The intersection of Cawthra Road and Queensway East was found to have a large frequency and rate of collisions, with potential sightline issues related to the asymmetry of the left-turn lanes. Traffic operations should be further analyzed to determine if turning volumes may warrant a reconfiguration of the left-turn lanes to fully protected, dual left-turns.
- Both the North and South Service Roads were identified to have a high incidence of collisions related to drivers misjudging the sharpness of the eastbound and westbound approach curves. Improved signage and the use of auxiliary signal heads may help to better warn drivers of the signalized intersection ahead.
- The downhill grade and right-hand bend on the southbound approach to the intersection of Cawthra Road and the eastbound QEW off-ramp may have contributed to the prevalence of southbound rear-end collisions at this location. Similar treatments as described for the Service Roads could be applied to mitigate the safety concerns at this intersection.

Corridor speed and volume data suggest that overall, **excessive speeding is a concern along Cawthra Road**, with 85^{th} percentile speeds frequently reaching over 20 km/h above the posted speed limit. Recurring congestion was not found to be a crucial issue throughout the corridor. Therefore, caution should be exercised as to not create conditions that further encourage higher speeds in an effort to alleviate peak period congestion.

5 Existing Traffic Volumes

There are two primary sources of traffic data used for this project: Annual Average Daily Traffic (AADT) and Turning Movement Counts (TMC).

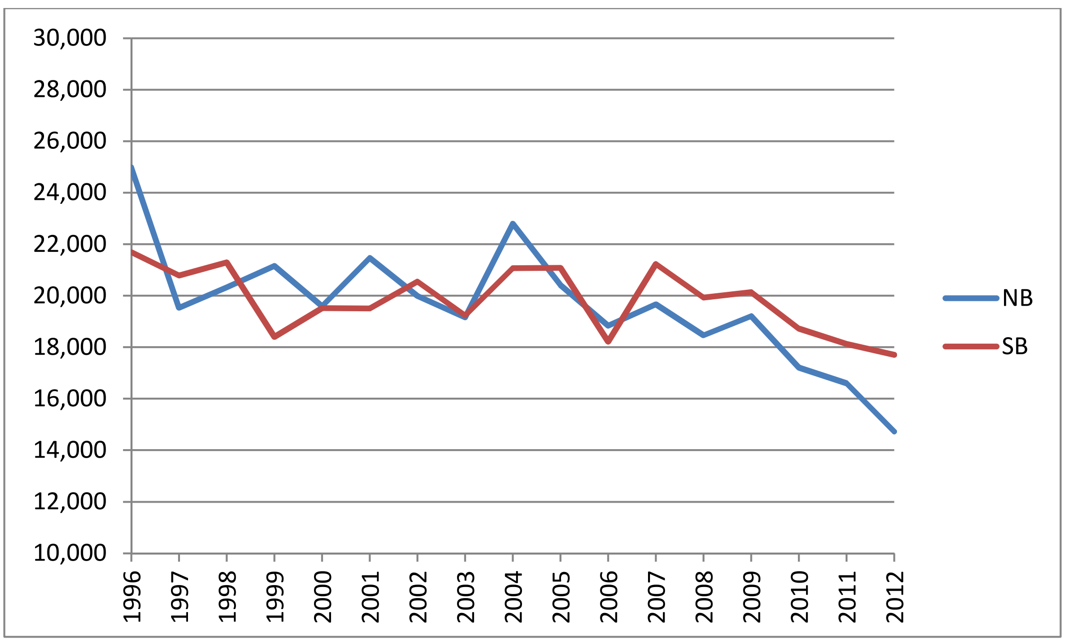
5.1 Annual Average Daily Traffic

Although traffic forecasts are derived mainly from the Region's EMME model; historical AADT and background growth rates were also reviewed to provide an awareness of potential trends. **Exhibit 5** illustrates northbound and southbound AADT volumes along

Cawrthra Road between 1996 and 2011 (recorded near Bloor Street). Prior to 2009/2010, volumes along Cawthra Road trended sideways or slightly downward in a range between 18,000 and 22,000 veh/day. During the same period, AADT volumes along the Queensway trended in a similar pattern and ranged from 14,000 to 18,000 veh/day. Since 2009/2010, there has been a significant drop in AADT on both Cawthra Road and on the Queensway. The decrease observed is not fully understood but could be associated with the following factors:

- Construction of the Mississauga BRT in recent years may have restricted volumes in the north end of the corridor;
- Construction along the Queensway west of Dixie could affect volumes on the Queensway;
- Increasing congestion on Highway 403 between Hurontario Street and Highway 401 may be restricting entry and exit volumes to Cawthra Road; and,
- A reduction in manufacturing in Ontario and the economic recession from 2008 until 2012 could be reducing employment and commercial traffic in areas in south Mississauga.

Exhibit 5: Cawthra Road AADT near Bloor Street



5.2 Turning Movement Counts

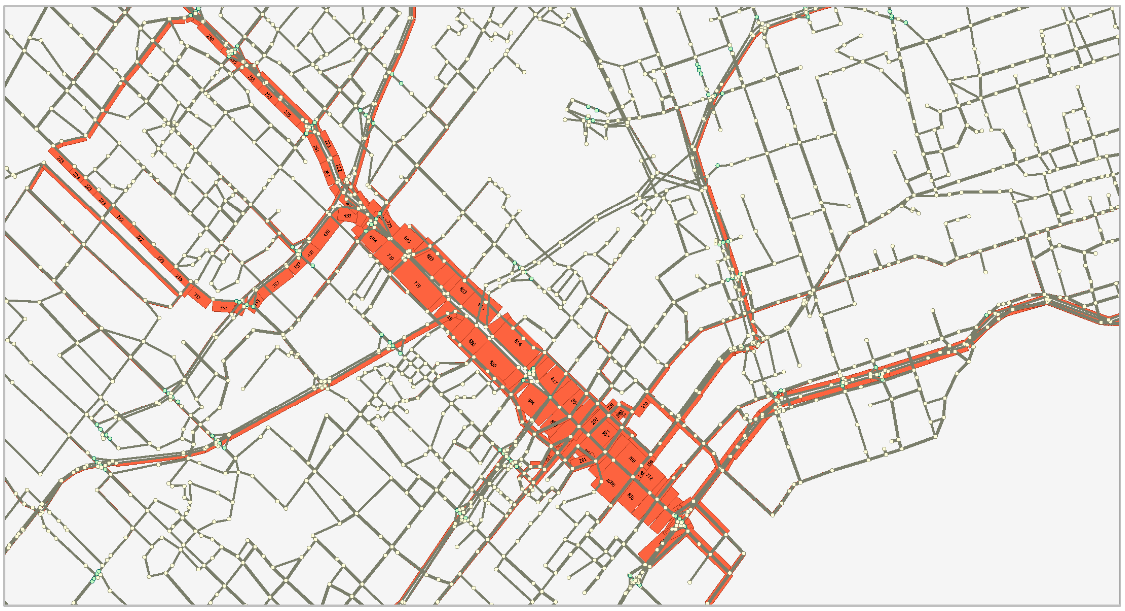
Turning movement counts were provided by the Region of Peel for signalized and unsignalized intersections along the entire corridor. Counts at the Cawthra Road / Dundas Ramp intersection appear higher than adjacent intersections in both the AM and PM peak hours. The volumes were analyzed as is; no adjustments were made to consolidate peaks, balance volumes or account for seasonal variation. Traffic volumes provided by the Region for the signalized intersections at the QEW ramps do not contain volumes on the unsignalized on-ramps. Any subsequent EA work should include a data collection program to confirm traffic volumes at the QEW ramps.

5.3 2001 EMME Model

The 2001 EMME model provided by the Region includes a four lane cross section for Cawthra Road from Eastgate Parkway to the QEW (the addition of the third southbound lane along Cawthra Road between the Queensway and the QEW is included in the 2031 EMME model).

Given it's positioning within the transportation modelling network, Cawthra Road is an attractive route for through traffic traveling between Highway 403/410 and QEW. Based on a select link analysis, a significant amount of traffic using Cawthra Road appears to be doing so as a primary route between Brampton and Downtown Toronto via Highways 401, 407, 410 and the QEW. Burnhamthorpe Road, Bloor Street and Dundas Street also all appear to carry some traffic from Cawthra Road to Highways 427 and 401.

Exhibit 6: Cawthra Select Link Analysis



As noted in Section 5.1, based on AADT data published by Peel Region, traffic volumes along Cawthra Rod have decreased by approximately 25 percent since 2001. The 2001 volumes in the EMME model were also noted to be lower than observed counts and in some cases the EMME model reflected 2001 demands which were less than half of recorded volumes.

Given the insights gained by the AADT analysis and discrepancy between observed and modelled volumes for 2001, the volumes from the EMME model were not used directly. Instead, existing counted hourly volumes were factored up according to the growth rates suggested by EMME using a 'pivot' approach.

6 Traffic Growth Projections

This section of the report documents the development of growth rates to be applied to existing traffic volumes to determine 2031 traffic projections. Section 7 – Traffic Operations Analysis – contains the subsequent operational assessment from a link capacity and intersection level of service perspective.

6.1 Approach

To develop forecast future traffic demands, IBI Group completed a review of EMME models and AADT data. Growth rates were determined for the following potential improvement scenarios, based on a comparison of the Region's 2001 and 2031 EMME demand model results:

- **Four Lanes** - assumes a four lane cross section with two through lanes northbound and southbound throughout the entire corridor except for southbound between the Queensway and the QEW which is currently three lanes.
- **Base Case** - reflects widening of Cawthra Road to six lanes from Eastgate Parkway Burnhamthorpe Road (North Section) and from Dundas Street to the QEW (South Section), in keeping with the needs identified as part of the LRTP Update (2012).
- **Six Lanes** - reflects widening of Cawthra Road to three through lanes per direction throughout the corridor from Eastgate Parkway to the QEW.

IBI Group also investigated impacts of the Hurontario Street LRT on the overall corridor demands. Although, no explicit modelling of transit included in this exercise; the City of Mississauga provided factors which were used to adjust the future base scenarios to account for the Hurontario LRT. Details in this regard are provided in later sections.

6.2 Background Growth

6.2.1 Regional EMME Model

Region of Peel provided a preliminary set of model outputs for 2001 and for what has been identified herein as the future (2031) 'Base Case' scenario. The 2031 model incorporates and planned improvements as outlined in Region of Peel Road Improvement Program. For reference purposes, EMME Model outputs and a list of the planned improvements are provided in **Appendix D**. The 2031 model also accounts for increased transit use in line with development of rapid transit corridors in the Greater Toronto Area (GTA) through increased transit mode share, except for the Hurontario LRT.

6.2.2 Analysis Segments and Screenlines

For the purposes of assessing background growth rates, the Region's 2031 EMME model was updated to reflect the Four Lane Condition (also referred to herein as the Do Nothing Condition). Northbound and southbound demand volumes were extracted for arterial/major collector roads between McLaughlin Road and Dixie Road, crossing Cawthra Road at the following screenlines:

- **North Screenline** - South of Highway 403 / Eastgate Intersection
- **South Screenline** - South of Dundas Street

Detailed calculation sheets comparing 2001 and 2031 screenline volumes are provided in **Appendix E**. Corresponding annual growth rates were then calculated assuming a straight line projection. These growth rates are summarized in **Exhibit 7.**

Exhibit 7: 2031 Future Background Growth (Maintain Four Lanes)

Screenline	Growth/Year (Compounded)		
North Screenline (South of Eastgate Parkway)	**Northbound**	**Southbound**	**Total**
McLaughlin/Confederation Parkway	18.8%	11.3%	14.1%
Hurontario Street	0.8%	-0.4%	0.2%
Central Pkwy/Cliff	-0.2%	0.3%	0.1%
Highway 403/Cawthra Road	0.5%	1.9%	1.1%
Tomken/Haines/Stanfield	0.6%	n/a	0.9%
Dixie Road	0.6%	-6.5%	0.1%
Average	**0.9%**	**0.7%**	**0.8%**
South Screenline (South of Dundas Street)	**Northbound**	**Southbound**	**Total**
McLaughlin/Confed Parkway	-0.7%	0.8%	0.2%
Hurontario Street	-0.4%	0.5%	0.1%
Central Pkwy/Cliff	n/a	n/a	n/a
Highway 403/Cawthra	-0.5%	0.7%	0.1%
Tomken/Haines/Stanfield	n/a	n/a	n/a
Dixie Road	1.8%	0.6%	1.2%
Average	**0.9%**	**0.7%**	**0.8%**

The results of the screenline analysis indicates that, on average, traffic demands crossing both the north and south screenlines increase by 0.8% per year (compounded) . Based on this anlaysis, an annual growth rate of 0.8% (compounded) was selected for the all segments of Cawthra Road and applied to existing TMC data to forecast 2031 background traffic demands.

6.2.3 Population Growth Forecasts

The Region of Peel & Mississauga's population and trip-end growth forecasts were consulted in the preparation of the traffic growth forecast (Mississauga: "Population, Demographics & Housing" [2013] and "Moving Mississauga" [2011]; Peel Region: "Long Range Transportation Plan" [2012]). Population growth is expected to be 0.5% to 0.6% per year between 2011 and 2031; Trip ends are forecasted to increase 0.9% to 1.0% per year. Based on the above review, along with the EMME model results described, the growth rates derived based on a comparison of EMME results appear reasonable for development of background forecasts.

6.3 Induced Demands (Road Widening)

For the purposes of developing induced growth (i.e. additional demands along Cawthra Road as a result of widening along the corridor), an additional EMME model was created for Six Laning Cawthra Road. The EMME results for each scenario, as outlined in Section 6.1, were aggregated into segments and across screenlines. The future demand assessment is summarized in **Exhibit 8**. In comparing, the Four Lane scenario with the Base Case and Six Lane scenarios, the model reflects a slightly higher increase in demands north of Burnhamthorpe Road compared to south of Burnhamthorpe Road.

Exhibit 8: Induced Growth

Cawthra Road	EMME Volumes 2031						Induced Growth 2031			
	Four Lanes		Base Case		Six Lane		Base Case		Six Lane	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
South of 403/Eastgate	1,359	1,177	1,860	1,582	1,901	1,636	**501**	**405**	**542**	**459**
South of Dundas	770	894	991	1,154	1,077	1,256	**221**	**260**	**307**	**362**

Based on the above, link volumes along Cawthra Road during the peak hour conditions are expected increase by between 200 and 500 vehicles/hr/direction due to widening Cawthra Road from 4 to 6 lanes. Since the additional volumes associated with the Base Case and Six-Lane scenarios are relatively similar (differing by less 100 veh/hr) the same increase was applied to each scenario. **Exhibit 9** reflects the volumes added to the background growth for each of the three segments of Cawthra Road to establish the overall traffic demand for the Base Case and Six Laning scenarios.

Exhibit 9: Induced Demand with Road Widening

Corridor Section	Base Case Induced Growth (veh)	
	NBT	SBT
North - (Eastgate Pkwy - Burnhamthorpe Road)	400	500
Central - (Burnhamthorpe Road - Dundas Street)	300	350
South - (Dundas Street - QEW)	250	200

6.4 Hurontario Street LRT

For comparative purposes, an additional scenario was considered to assess the influence of the Hurontario LRT. Corridor volumes were adjusted based on factors provided by the City of Mississauga (not independently reviewed by IBI Group). These adjustments were applied to the Base Case scenario only. Overall, the introduction of the LRT will only have a minor impact on traffic volumes on Cawthra Road. The greatest impact is on Cawthra Road northbound north of the QEW, which could be the result of some demand taking the earlier exit from the highway. **Exhibit 10** presents the adjustments made to the Base Case to account for the Hurontario LRT.

Exhibit 10: Effect of Hurontario LRT on Cawthra Road

Section		Southbound	Northbound
North	North of Eastgate	n/a	n/a
	Eastgate to Burnhamthorpe	+1%	+4%
Central	Burnhamthorpe to Dundas	+4%	+2%
South	Dundas to Queensway	+1%	+3%
	Queensway to QEW	+0%	+10%

7 Traffic Operations Analysis

This section summarizes the findings of the traffic operations analysis undertaken for existing conditions and the various scenarios generated as part of the traffic forecasts. The assessment was carried in three steps as follows:

- Firstly, a link-level assessment is presented which considers a long list of alternatives and provides a comparative assessment based on link volume to capacity (V/C) ratios;
- Secondly, in recognition of the exiting right-of-way constraints, a variety of median treatments and the feasibility to accommodate a six lane cross-section (with bike lanes and/or multi-use trail) are assessed; and,
- Finally, the preferred option (s) from a traffic perspective is advanced to the intersection assessment level of detail.

Each of the above steps is provided with as summary of findings and options to be carried forward.

7.1 Link-Assessment

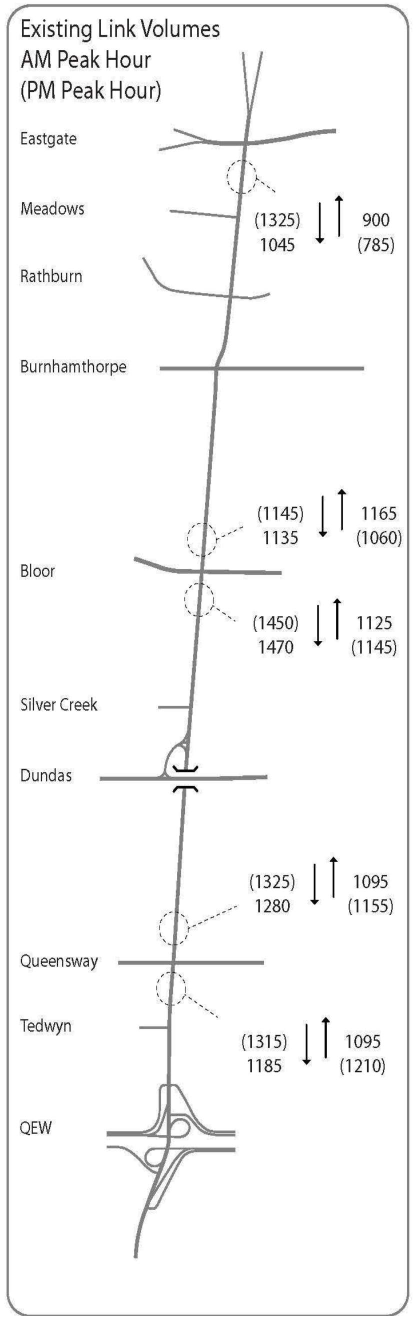
The purpose of the link-level analysis is to initially compare and screen road widening options at a planning level of detail based on Volume/ Capacity ratios. Automated Traffic Recorder (ATR) data provided the basis for the analysis and V/C ratios were calculated for each of the ATR stations along the corridor; these stations correspond to the analysis segments defined for the traffic forecasts. **Exhibit 11** presents the stations and corresponding segments.

Exhibit 11: ATR Station and Corresponding Analysis Segment

Section	ATR Station	Corresponding Segment
North	1.0 km north of Burnhamthorpe	Rathburn to Burnhamthorpe
Central	0.2 km north of Bloor	Burnhamthorpe to Central/Bloor
	0.5 km north of Silvercreek	Central/Bloor to Dundas
South	0.2 km north of Queensway	Dundas to Queensway
	0.1 km north of Tedwyn	Queensway to QEW

Scenarios assessed at this stage include: Existing Conditions, 2031 Four Lanes, 2031 Base Case, 2031 Six-Laning and Hurontario Street LRT. For this assessment, all V/C ratios are based on a capacity of 900 vehicles per hour per lane (vphpl). The results are summarized in **Exhibit 12**.

Exhibit 12: ATR Volumes and Link Analysis



Peak period	Direction	Location	ATR traffic volumes: Existing 2012	4-Lane: Growth rate/Year	4-Lane: Volumes 2031	Base Case: Induced Growth	Base Case: Volumes 2031	Hurontario LRT: Change w.r.t. Base Case	Hurontario LRT: Volumes 2031	No. of lanes: Existing	No. of lanes: 4-Lane	No. of lanes: Base case	No. of lanes: Six lanes	Lane capacity: All scenarios	v/c ratios: Existing 2012	v/c ratios: 4-Lane 2031	v/c ratios: Base case 2031	v/c ratios: Six lanes 2031	v/c ratios: Hurontario LRT 2031
AM peak	Southbound	1.0 km north of Burnhamthorpe Rd.	1,043	0.8%	1,213	500	1,713	0%	1,713	2	2	3	3	900	0.58	0.67	0.63	0.63	0.63
		0.2 km north of Bloor St.	1,135	0.8%	1,321	350	1,671	1%	1,687	2	2	2	3	900	0.63	0.73	0.93	0.62	0.94
		0.5 km north of Silvercreek Blvd.	1,470	0.8%	1,710	350	2,060	4%	2,143	2	2	2	3	900	0.82	0.95	1.14	0.76	1.19
		0.2 km north of Queensway (RR20)	1,280	0.8%	1,489	200	1,689	1%	1,706	2	2	3	3	900	0.71	0.83	0.63	0.63	0.63
		0.1 km north of Tedwyn Dr.	1,183	0.8%	1,376	200	1,576	0%	1,576	3	3	3	3	900	0.44	0.51	0.58	0.58	0.58
	Northbound	1.0 km north of Burnhamthorpe Rd.	901	0.8%	1,048	400	1,448	0%	1,448	2	2	3	3	900	0.50	0.58	0.54	0.54	0.54
		0.2 km north of Bloor St.	1,164	0.8%	1,354	300	1,654	4%	1,720	2	2	2	3	900	0.65	0.75	0.92	0.61	0.96
		0.5 km north of Silvercreek Blvd.	1,125	0.8%	1,309	300	1,609	2%	1,641	2	2	2	3	900	0.63	0.73	0.89	0.60	0.91
		0.2 km north of Queensway (RR20)	1,093	0.8%	1,272	250	1,522	3%	1,567	2	2	3	3	900	0.61	0.71	0.56	0.56	0.58
		0.1 km north of Tedwyn Dr.	1,093	0.8%	1,272	250	1,522	10%	1,674	2	2	3	3	900	0.61	0.71	0.56	0.56	0.62
PM peak	Southbound	1.0 km north of Burnhamthorpe Rd.	1,327	0.8%	1,544	500	2,044	0%	2,044	2	2	3	3	900	0.74	0.86	0.76	0.76	0.76
		0.2 km north of Bloor St.	1,146	0.8%	1,333	350	1,683	1%	1,700	2	2	2	3	900	0.64	0.74	0.94	0.62	0.94
		0.5 km north of Silvercreek Blvd.	1,451	0.8%	1,688	350	2,038	4%	2,120	2	2	2	3	900	0.81	0.94	1.13	0.75	1.18
		0.2 km north of Queensway (RR20)	1,324	0.8%	1,540	200	1,740	1%	1,758	2	2	3	3	900	0.74	0.86	0.64	0.64	0.65
		0.1 km north of Tedwyn Dr.	1,317	0.8%	1,532	200	1,732	0%	1,732	3	3	3	3	900	0.49	0.57	0.64	0.64	0.64
	Northbound	1.0 km north of Burnhamthorpe Rd.	783	0.8%	911	400	1,311	0%	1,311	2	2	3	3	900	0.44	0.51	0.49	0.49	0.49
		0.2 km north of Bloor St.	1,062	0.8%	1,236	300	1,536	4%	1,597	2	2	2	3	900	0.59	0.69	0.85	0.57	0.89
		0.5 km north of Silvercreek Blvd.	1,147	0.8%	1,334	300	1,634	2%	1,667	2	2	2	3	900	0.64	0.74	0.91	0.61	0.93
		0.2 km north of Queensway (RR20)	1,154	0.8%	1,343	250	1,593	3%	1,640	2	2	3	3	900	0.64	0.75	0.59	0.59	0.61
		0.1 km north of Tedwyn Dr.	1,209	0.8%	1,407	250	1,657	10%	1,822	2	2	3	3	900	0.67	0.78	0.61	0.61	0.67

Induced Absolute Growth 'Base Case':	NBT	SBT
North Section (Eastgate Pkwy - Burnhamthorpe Road)	400	500
Central Section (Burnhamthorpe Road - Dundas Street)	300	350
South Section (Dundas Street - QEW)	250	200
Lane Capacity (Vehicles/hour/lane):	900	

<u>For illustration purposes in above Exhibit:</u>

- Critical Link are highlighted as Yellow where v/c ratio >0.85 & <1.0

- Overcapacity are highlighted as Red v/c ratio >=1.0

The following provides a summary of the link-level analysis for each scenario based on 900 vehicles/hour/lane capacity.

- **Existing (2012)** conditions volume to capacity assessment was undertaken using ATR data published on the Peel Region website for 2012. Most counts are from January to April 2012; the count for Cawthra Road/Eastgate Parkway is from March 2013. Under existing conditions, all the segments operate well within capacity during both AM and PM peak hour.
- **Four Lane (2031)** represents future demand operation under existing geometry. Under this scenario, all links operate under capacity. Road improvements will be limited to localized intersections improvements, as well as development of active transportation facilities.
- Analysis of the **Base Case (2031)** when compared to Four Lane scenario suggests that Cawthra Road will get busier with additional (induced) demand resulting from the proposed widening north of Burnhamthorpe Road and south of Dundas Street (i.e. North and South Sections of Cawthra Road). Traffic volumes within the Central Section of the project limits, between Burnhamthorpe Road and Dundas Street, will approach capacity in the northbound direction and exceed capacity in southbound direction.
- The **Six-Lane (2031)** scenario results in overall improved operations in the central section. With the provision of six lanes along the corridor, all the links are expected to operate well within capacity. However, the ability to undertake the widening within the existing right-of-way requires further review. Given the constraints of the corridor, it is likely that this option may not be feasible without compromising various cross-sections elements and significant impacts such as property acquisitions, utilities relocation, etc.
- The introduction of the **Hurontario LRT** will further increase the northbound and southbound demands. Within the Central Section demands are expected to exceed capacity during both the AM and PM peak hours, when considered in conjunction with the Base Case, however will remain below capacity under the Four Lane condition. Although Hurontario LRT is a priority for the City as is part of the Big Move regional transportation plan, given its limited impact this scenario was not evaluated in detail as a separate option to the Base Case.

Summary

<u>Based on the link assessment, both the Four Lane and Base Case scenarios were carried forward for more detailed analysis of intersection operations</u>, using Synchro Traffic Software. The option of widening Cawthra Road to six lanes throughout the corridor was carried forward for further review of potential median treatments and cross-section requirements to assess the ability to undertake the widening within the existing right-of-way (ref. Sections 7.2 and 7.3). The option of Six Laning throughout would then only be carried forward if deemed feasible from a geometric perspective.

The Hurontario LRT scenario is a realistic future scenario, however, would be very similar to the Base Case given the minimal (one to four percent) change in volumes and only incremental changes expected to operating conditions. As such, this scenario was not carried forward as a separate alternative.

7.2 Median Treatment Options

This section assesses potential median treatment options to be considered in conjunction with options to widen Cawthra Road to six lanes. In this regard, the following three options were assessed:

- Six-Lanes with no median
- Six-Lanes with two-way left turn lane (TWLTL) or Mountable Median
- Six-Lanes with Raised Median

For all alternatives, dedicated left turn lanes will be maintained at intersections. The subsequent sections discuss individual alternatives and any key issues which may arise under each.

In all cases, cross sections must be developed to determine if widening is indeed physically feasible given right-of-way constraints. For example, residential properties on the east side of Cawthra Road south of the Queensway are located close to the roadway; widening in this section may not be possible without significant impacts or buy-out of several homes.

a) Six Lanes with No Median

This scenario includes a basic six lane cross section with no TWLTL. Exclusive left turn lanes would be provided at signalized intersections and generally required localized road widening. Left turns to driveways would be undertaken from the median/through lane which increases the likelihood of rear-end collisions due to motorists slowing within the travel lane. Removal of the TWLTL would also mean elimination the refuse area for entry vehicles and may lead to an increase in turning movement collisions. Approaching and opposite direction sideswipe collisions will also likely increase under this scenario, due to the removal of the “buffer” that is created between opposing traffic streams by the existing TWLTL. Based on the available collision modification factors (CMF), removal of the TWLTL may result in an increase in mid-block collisions of 25% or more.

b) Six Lanes with Centre TWLTL or Mountable Median

This scenario is similar to the existing condition in many locations; however, there would be six travel lanes, instead of four, plus the TWLTL. For minor side streets and driveways, operations are expected to be similar to existing conditions in terms of capacity and delay. The primary constraint of this alternative is space and whether six lanes, a 4m TWLTL and bicycle facilities could fit within the corridor. Additionally, there may be an increase in the risk of collisions, due to the higher conflict potential that comes with the additional through lane, higher traffic volumes, and potentially higher speeds that are typical of 6-lane facilities.

c) Six Lanes with Raised Median

A raised median would eliminate mid-block left turns and force u-turns at intersections. Despite the narrower pavement width, the raised median is not expected to significantly reduce speeds. The only significant safety concern related to this scenario is that u-turns are relatively uncommon, and therefore the treatment could result in violations of driver expectations at the intersections. As a result, rear-end collisions (between successive left turning vehicles) and u-turn/right-turn collisions could increase.

<u>North Section - North of Burnhamthorpe</u>

There are several residential properties on the west side with direct access onto Cawthra Road which will be impacted by a centre median. The local street grid to the west (i.e. Wilcox Road) along with u-turns at Meadows Boulevard and Rathburn Road could provide sufficient access and routing opportunities.

Central Section - Burnhamthorpe to Dundas

In this scenario, a new signalized intersection would likely be implemented at Breckenridge Road to provide turning and u-turn opportunities. Mississauga Valley Boulevard and Cedar Creek Driveway run parallel to Cawthra Road to the west and east, respectively. Breckenridge provides connections to both of these streets which could be used to provide routing options for local traffic.

South Section - Dundas to Queensway

In this section, there adjacent minor grid network does not lend itself to providing alternative routes for motorists and significant re-routing on the larger arterial grid may be required. Given the volume of trucks accessing the employment lands in this area, relying on u-turns at intersections is also not a feasible operation.

South Section - Queensway to QEW

There are several direct frontage properties on the east side of Cawthra Road in this section. These properties would be restricted to right-in/right-out. Implementing a raised median would likely include restricting access to Melton Drive. Although Melton Drive can alternatively be accessed from Stanfield Road (1.2 km to the east) this will require significant out-of-way travel.

Given the proximity of Melton Drive to the Queensway intersection, if necessary to accommodate left turn storage or widening along Cawthra Road, consideration should be given to restricting Melton Drive to right-in/right-out; however since there are limited alternative routing opportunities, if pursued as part of a future EA, a connection between Cody Lane and the Queensway should also be investigated (even if only as a right-in/ right-out connection).

d) Summary of Median Treatment Options

The following conclusions can also be drawn regarding the preferred median treatment with six laning:

- A six-lane basic cross section (i.e. no median) would provide more capacity north-south (compared to four lanes) but would lead to an increase in turning movement and rear-end collisions along the corridor. This configuration is not recommended.
- A six lane cross section with TWLTL would provide adequate turning opportunities for the many driveways with direct access to Cawthra Road; however, six lanes plus a TWLTL and bicycle facilities will mean a wide cross section and must be geometrically reviewed.
- Six lanes with a raised centre median would provide additional capacity and reduce the potential for mid-block turning movement collisions. Operationally, a raised median could be implemented north of Dundas Street as alternative routes are available to traffic given the local grid networks in the area. However, south of Dundas Street, a centre median would be excessively restrictive given the limited local grid for re-routing options and high proportion of trucks which cannot rely on u-turns.

Therefore, if widening to six lanes is deemed: a) warranted from a volume perspective, b) desirable from a network planning perspective and c) feasible from a geometric perspective, the following six lane cross-sections should be considered:

- North of Burnhamthorpe Road, a TWLTL or a raised median is desirable;

- Between Burnhamthorpe Road and Dundas Street, a TWLTL is desirable given the number of homes directly fronting onto Cawthra Road (however a raised median with u- turns at intersections can be considered);
- Between Dundas Street and the Queensway, a TWLTL should be provided given the limited routing opportunities; and
- Between the Queensway and the QEW, a TWLTL is desirable. However given the limited number of homes directly fronting onto Cawthra Road, a raised median may be considered if necessary to accommodate six lanes within the restricted right-of-way.

In general, a centre TWLTL is preferable throughout the project limits and therefore included in the development of cross-sections in Section 7.3

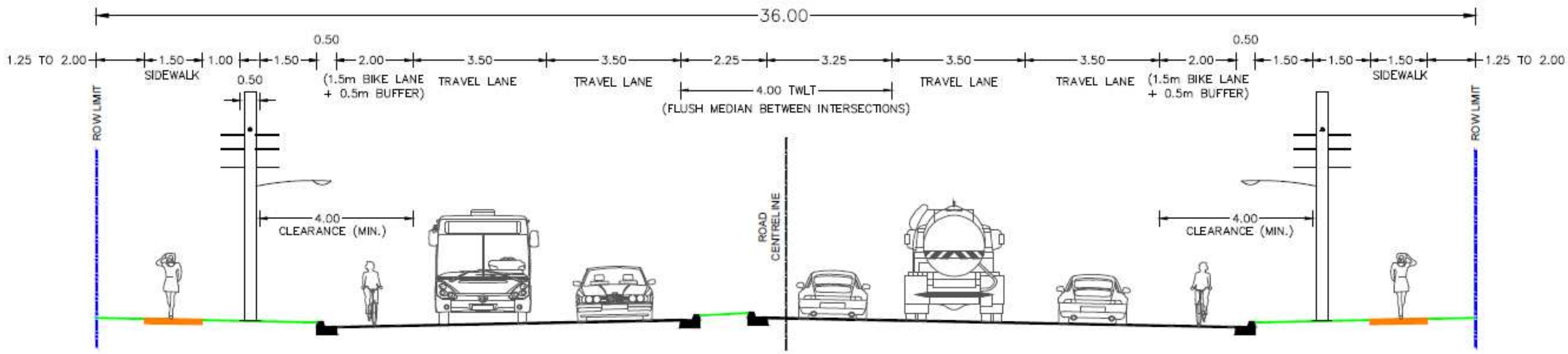
7.3 Cross-Section

The existing right-of-way along Cawthra Road south of Burnhamthorpe Road is typically 36m. North of Burnhamthorpe Road a 45m right-of-way width is generally available.

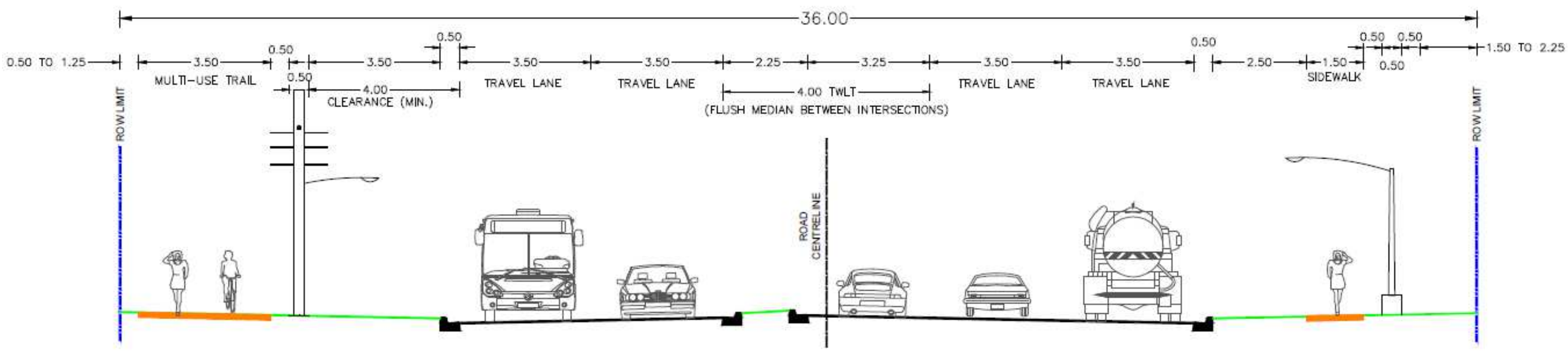
Several representative cross-sections were developed to assist in determining the extent of widening that could reasonably be accommodated along Cawthra Road. **Exhibit 13** reflects a typical 4 lane cross-section within a 36m right-of-way. **Exhibit 14** reflects a typical 6 lane cross-section within a 36-45m right-of-way.

These cross-section assume a typical 3.5m lane width (3.35m min); 4.0 to 5.5 median width; 1.5m minimum sidewalk; 1.5m on-road bike lane width and 0.5 m buffer, or 3.5m multi-use trail (as applicable); and 4m desirable offset to light standards/ hydro poles based on 70km/h design speed.

Exhibit 13: Typical 4 Lane Cross-Section (36m ROW) - Representative Only



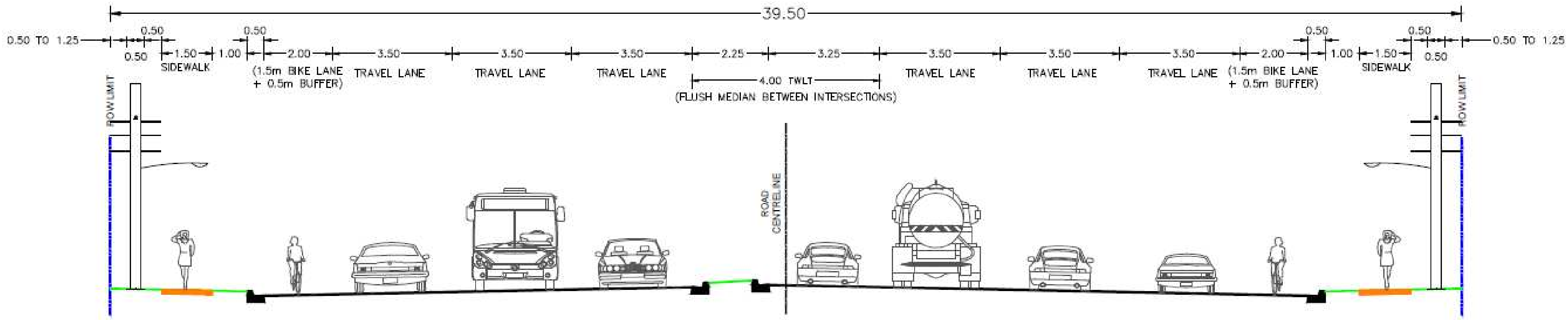
4 LANES WITH ON-ROAD BIKE LANES



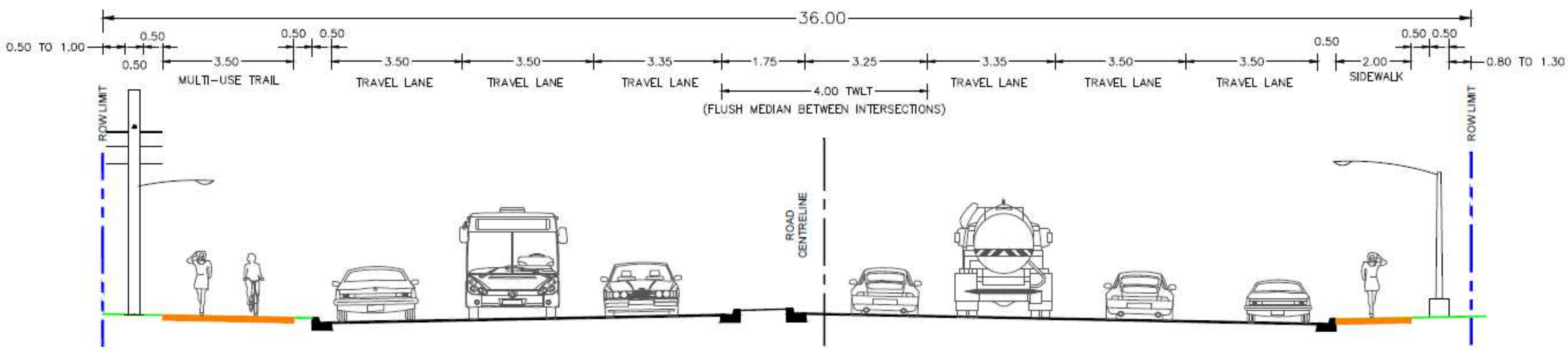
4 LANES WITH MULTI-USE TRAIL

Notes: A 5.0m hydro (swing) easement will also be required adjacent to overhead hydro lines.

Exhibit 14: Typical 6 Lane Cross-Section (36 - 45m ROW) - Representative Only



6 LANES WITH ON-ROAD BIKE LANES



6 LANES WITH MULTI-USE TRAIL

Notes: A 5.0m hydro (swing) easement will also be required adjacent to overhead hydro lines.

A review of these sections leads to the following high level conclusions:

- A four lane cross-section with centre turn lane and either on-road bike lanes or mutli-use trail can reasonably be accommodated within a 36m right-of-way.
- Although it is possible to construct six lanes with a centre turn lane and a multi-use trail within a 36m right-of-way it will be significantly constrained. Easements will be required beyond the 36m to allow for hydro clearances/guying, grading, noise walls, bus stops/bays, etc. These elements can otherwise generally be accommodated within a 45m, where available.
- It is not feasible to construct six lanes with a centre turn lane and on-road bike lanes within a 36m right-of-way (requiring a minimum of 39.5m, plus for additional right-of-way or easements for hydro clearances/guying, grading, noise walls, bus stops/bays, etc.). In the event that six lanes are recommended, a multi-use trail (rather than on-road bike lanes) could minimize property impacts, however may not be the preferable from an active transportation perspective (given frequency of driveways).
- At a number of locations along Cawthra Road, the existing right-of-way is less than 36m. For example: adjacent to the Mount Peace Catholic Cemetery, the available right-of-way is 28m. Widening to six lanes at this location is not possible without significant impacts to the cemetery or properties on the east side. To accommodate a four lane cross-section with a multi-use trail within the existing right-of-way, the centre turn lane will need to be reduced to 3.5m, the multi-use trail provided on the west side within a reduced 6.5m boulevard , and the sidewalk provided on the east side within a reduced 4.0m boulevard. [6.5m blvd and curb + 7.0m SBL + 3.5m flush median + 7.0 m NBL + 4.0m blvd and curb]. Alternatively, on-road bike lanes can be provided but will require a further 0.5m reduction of the median width.
- Both the Dundas Street and the Lakeshore West rail underpass structures span 33.5m. (face of barrier to face of barrier). Sufficient width is available to accommodate four lanes and bike lanes and/or multi-use trail. However, if six travel lanes are to be accommodated along Cawthra Road in conjunction with on-road bike lanes, boulevard, through lane, and median width reductions will be necessary [i.e. (1.8m elevated sidewalk + 0.85 blvd and curb + 1.8 bike lane + no buffer + 10.35 pavement width + 1.5m blvd and curb + 0.45 ½ centre pier) x 2]. The option of a multi-use trail in conjunction with six lanes is not feasible.

Summary

<u>Widening Cawthra Road to six lanes will have significant impact</u> on existing features resulting in increased costs, property buy-outs, easements, utilities relocation, widening/replacing existing bridge structures etc (particularly within the Central and South Sections). The right-of-way will be significantly constrained with little/no opportunity for streetscaping, separation of pedestrian facilities from the roadway, and require tightening of all design elements (i.e. lane widths, boulevard, clearance, etc) to absolute minimum. Based on this review, the option to widen Cawthra Road to six lanes throughout the project length is not carried forward.

Based on a review of geometric constraints and associated impacts, <u>unless the subsequent operations analysis of the Base Case scenario (ref. Section 7.4.3.) demonstrates that widening provides a significant benefit from a transportation perspective (i.e. traffic operations as well as active transportation), it is desirable to maintain Cawthra Road as a Four Lane section with localized intersection improvements.</u>

7.4 Intersection Analysis

The scenarios carried forward for intersection analysis were:

- Existing conditions (2012)
- Future Four Lane conditions (2031)
- Future Base Case conditions (2031)

A detailed traffic operations assessment was undertaken for these scenarios to identify key operating issues which could be addressed as part of the alternative solutions. The Synchro assessment is based on HCM 2000 methodology which reports volume to capacity (V/C) ratios, delay (seconds) and level of service (LOS) for each movement at the intersections. Only critical movements with a LOS E or F and/or V/C ratio > 0.85 are discussed in depth as part this section; full results of the analysis are included in the **Appendix F**.

Potential intersection improvements have been included with the future scenarios of Four Lane and Base Case for comparison purposes. These improvements are discussed on an individual intersection basis in Sections 7.4.2 and 7.4.3. During Phase 2 of this study, the feasibility will be further reviewed for the recommended concept.

The signal control strategy for Cawthra Road is based on a 140 second cycle length with protected-permissive turn phases provided at intersections when and where necessary. At minor intersections, side street green time is generally kept to the minimum required for pedestrian clearances to prioritize progression north-south.

7.4.1 Existing Conditions (2012)

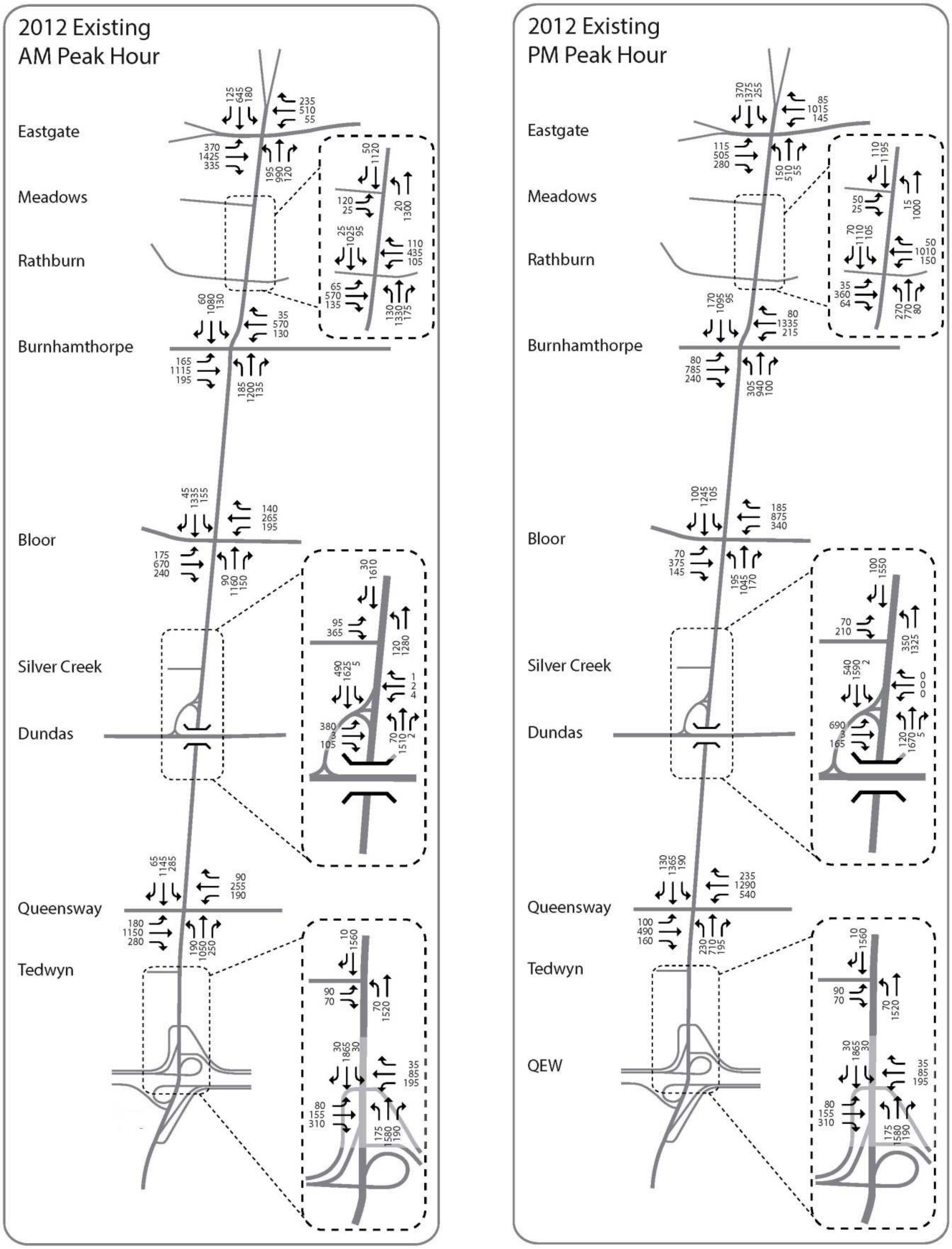
Traffic volumes used for the existing condition analysis were extracted directly from the Region's turning movement counts (unbalanced). These volumes are summarized in **Exhibit 15.**

a) Signalized Intersection Summary

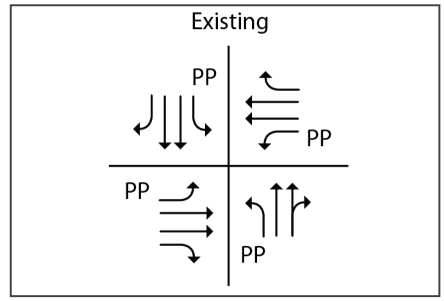
The corridor is busy under existing conditions with overall intersection performance ranging from LOS A to E in the AM peak hour and LOS A to F during the PM peak hour. All intersections have one or more movements operating at LOS D or higher, either due to busy opposing flows at major intersections or due to maintaining progression on Cawthra Road which scarifies minor street green time.

The description is provided below for each intersection which highlights the overall intersection LOS, critical movements, and key safety concerns. Results are summarized in **Exhibit 16.**

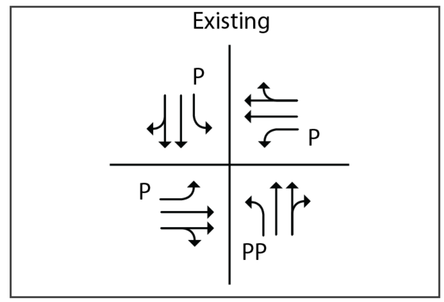
Exhibit 15: Existing Traffic Volumes



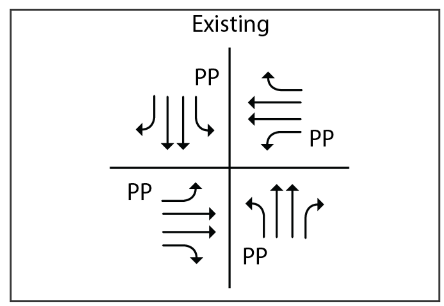
The **Eastgate Parkway** intersection is a gateway intersection with the west and north legs providing direct access to and from Highway 403. The intersection operates at LOS E in the AM and PM peak hours. Opposing through and left turn volumes are relatively high and compete for available green time. The northbound left turn had the highest frequency of left turn collisions potentially due to misjudging gaps in southbound traffic.



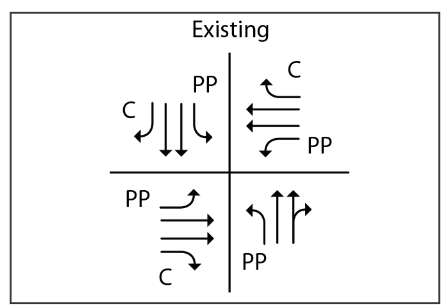
The **Rathburn Road** operates at LOS C during the AM peak hour and LOS E during the PM peak hour. Northbound and southbound left turns operate above capacity and drivers experience significant delays. Rear end and angle collisions are the most prevalent at this location.



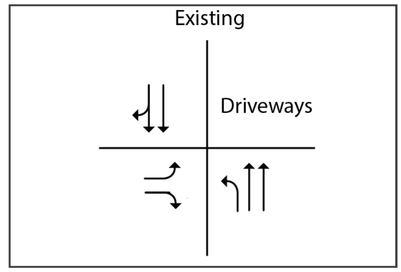
The **Burnhamthorpe Road** operates at LOS D during the AM peak hour and LOS E during the PM peak hour. During the AM peak hour, the northbound and southbound left turns operate over capacity. During the PM peak, the northbound left turn exceeds 300 veh/hr and is opposed by a heavy southbound through movement. The dominant type of collision at this intersection is turning related with the majority of conflicts occurring between the southbound left turn and the northbound through movements.



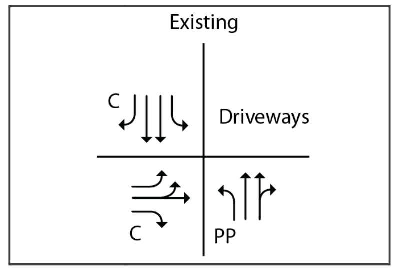
The **Bloor Street** operates at LOS D during both the AM and PM peak hour conditions. There are several left turn movements operating at LOS E or F during the peak hours. The dominant type of collision type is rear-end; likely due to excessive speeding along this section of the corridor. The safety analysis also notes that the majority of rear-end collisions are in the northbound direction which is the only direction without a dedicated right turn lane.



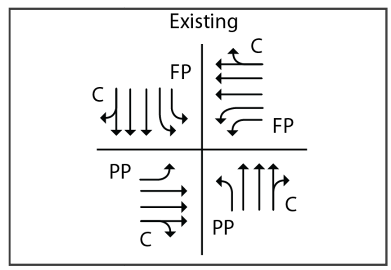
The **Silver Creek** intersection operates at LOS C during the AM and PM peak hours. It is a three-leg intersection. There are two driveways on the east side, at the intersection. To access properties on eastside, a southbound left is available; however does not affect signal phasing. The northbound left is heavy during the PM peak and exceeds 350 veh/hr.



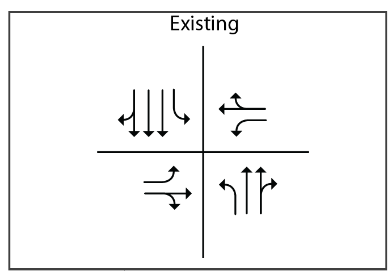
The **Dundas Ramp** intersection operates at LOS C during the AM and PM peak hours. The intersection operates under split phasing for east-west movements (given the low demand on the east leg). The safety analysis at the Dundas Ramp indicates a clear trend of rear-end collisions immediately south of the ramp. The safety analysis also indicates that NBL turn vehicles may be misjudging gaps in southbound traffic likely due to high speeds.



The **Queensway** intersection is busy during both the AM and PM peaks and operates at LOS E overall. During the AM peak hour the southbound and westbound left turns operate at LOS E but are under capacity. The eastbound through movements operate at LOS F; however the capacity provided by the right turn channel is not accurately reflected. During the PM peak hour, the westbound approach operates over capacity; the northbound left and southbound right are competing for green time. The safety analysis indicates a relatively high proportion of turning movement collisions on the eastbound and northbound left turns which both operate as protected-permissive.

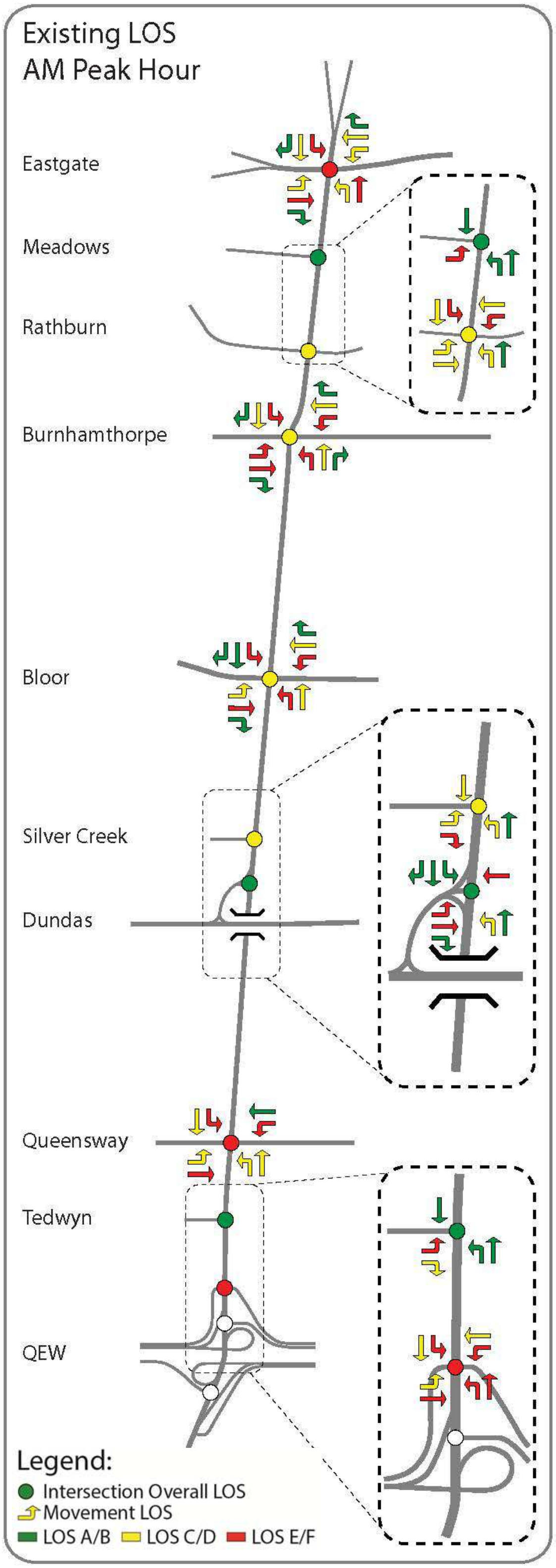


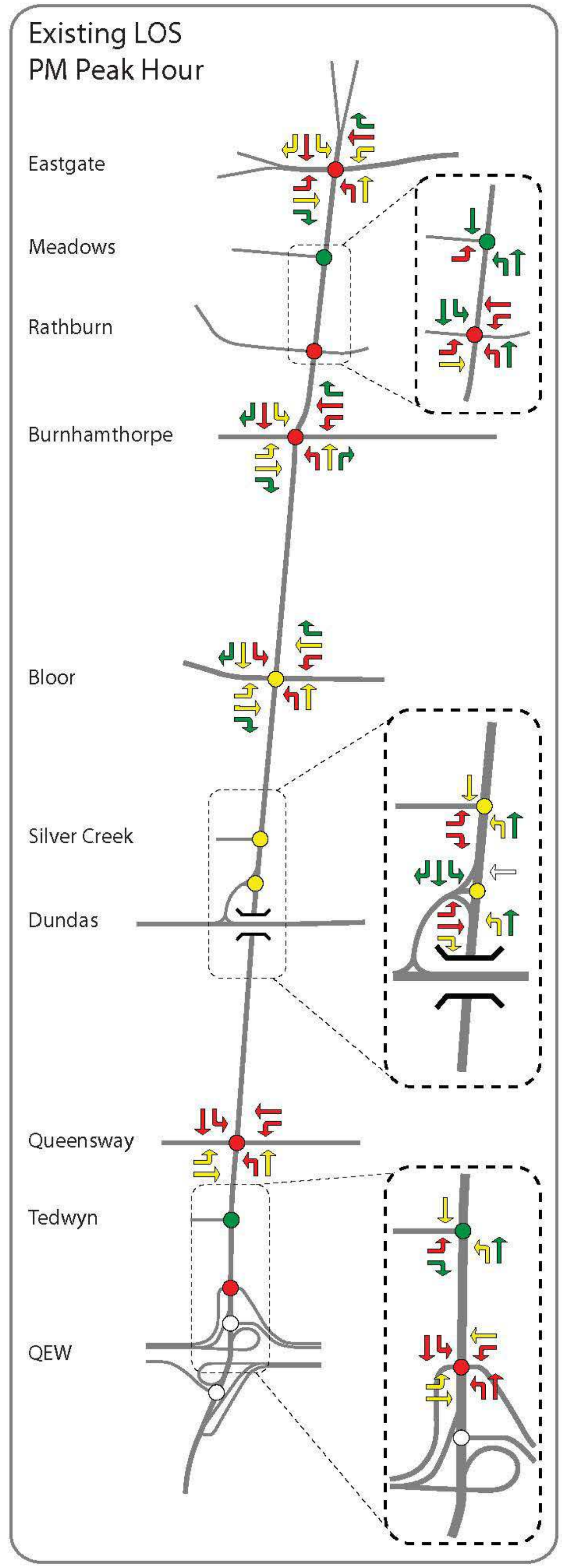
The **North Service Road** intersection is one of poorest performing intersections along the corridor, operating at LOS E in AM peak hour and LOS F in the PM peak hour. During the AM peak hour the eastbound through/right lane operates at LOS F, the westbound left turn operates over capacity; the northbound approach is also at capacity. During the PM peak hour the westbound left exceeds 500 veh/hr and operates at capacity. The safety analysis indicates that many of the collisions are due to loss of control given the tight turn radii on the approaches; several collisions were also due to motorists disobeying the signals northbound and southbound.



The minor intersections of **Meadows and Tedwyn** operate at LOS B or better, but have side street movements at LOS E or F. This is generally due to maintaining progression north-south but could be mitigated if more time were allocated to the side streets.

Exhibit 16: Existing Level of Service





b) Unsignalized Intersection Summary

There are six unsignalized intersections located within the Central Section of Cawthra Road. All of these intersections operate satisfactorily. Of these, the poorest performing intersections are **Hyancinthe Boulevard** and **Running Brook Drive**. At both intersections, the eastbound left turn movement operates at LOS E during the AM peak hour.

The three remaining unsignalized intersections within the project limits are located within the South Section. The left turns from **Needham Lane** and **Orwell Avenue** (located between Dundas Street and the Queensway) both operate at LOS F (overcapacity) during the AM and PM peak hours. At both intersections, volumes are relatively low, while the percentage of trucks is high. Although no safety concerns have been identified at the Needham Lane intersection, there has been a high occurrence of collisions along between the Queensway and at Orwell Street. The Melton Drive intersection (located south of the Queensway) operates satisfactorily at LOS B during the AM and PM peak hour.

7.4.2 2031 Four Lanes with Intersection Improvements

The Four Lane scenario assumes a four lane cross section with two through lanes northbound and southbound throughout the entire corridor except between the Queensway and the QEW where three southbound lanes are available.

The traffic volumes used for the Four Lanes scenario analysis were established by applying a 0.8%/year compounded growth rate to the existing turning movement counts (all movements). These volumes are summarized in **Exhibit 17.**

The 2031 AM and PM Synchro models for the Four Lane scenaio were coded with local intersection improvements (i.e. mitigation measures) such as signal timing adjustments and geometric improvement for better intersection performance. The following is a summary of the analysis with potential mitigation measures under this scenario.

a) Signalized Intersection Summary

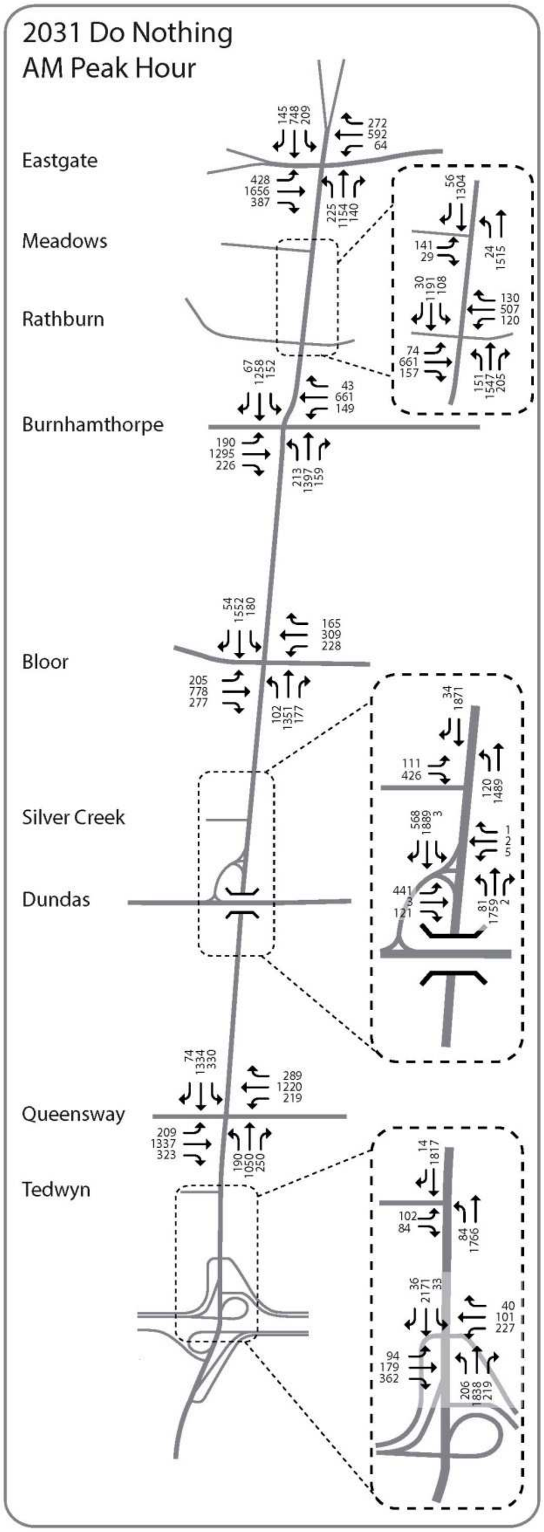
The description below highlights potential mitigation measures to address operational and safety concerns at individual intersections, as well as the resulting overall intersection LOS and critical movements. Results are summarized in **Exhibits 18 and 19.**

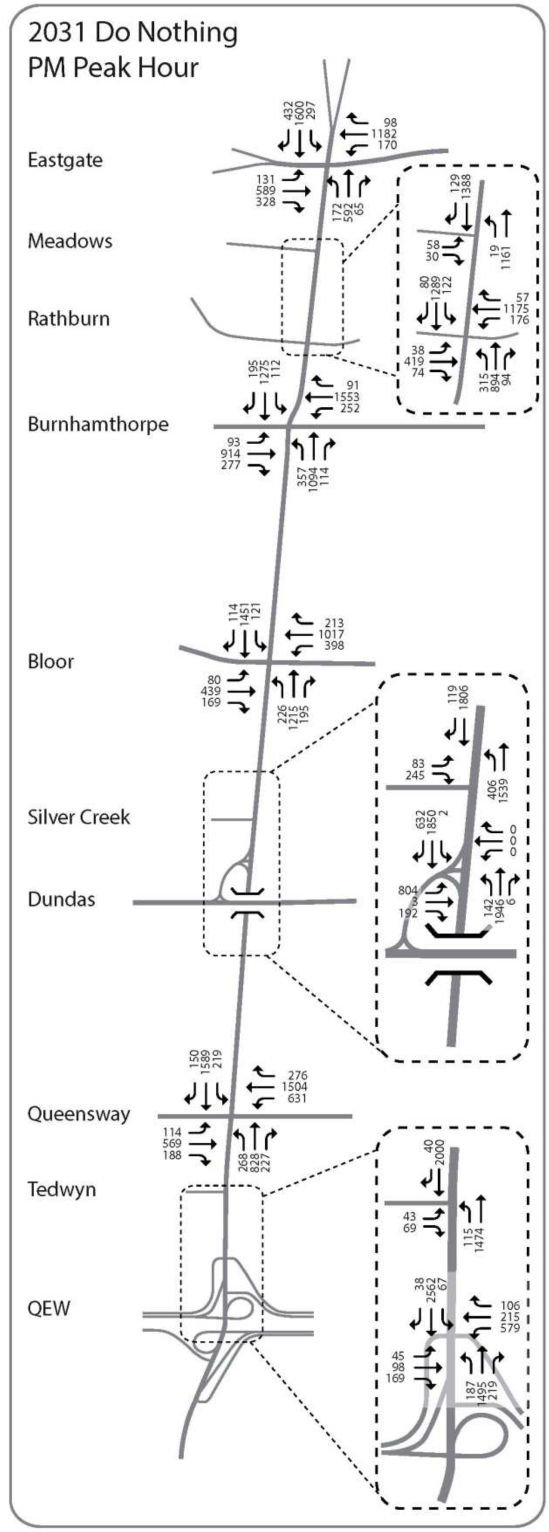
The **Eastgate Parkway** intersection is expected to operate at LOS F in the AM and PM peak hours with opposing left turn and through movements competing for time in the cycle. The EBT, NBT, and SBL would operate beyond capacity during AM peak hour. As a result longer delays are expected for these movements. During the PM peak hour, the EBL, WBT, NBL, and SBT will operate overcapacity. Potential improvements such as provision of a dual NBL and SBL would help addressing capacity issues.

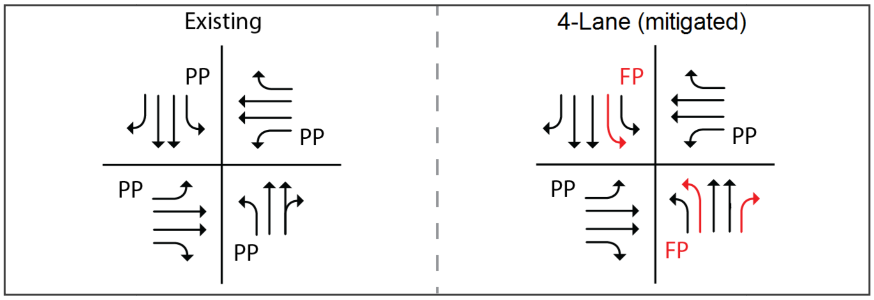
Potential improvements:

- A fully protected dual SBL turn lane should be considered to accommodate demand future demands (particularly during the PM peak when the SBL equals approximately 300 veh/hr). This option would also reduce the probability of turning movement collisions since the motorists would no longer be attempting turns through gaps in opposing traffic.
- An exclusive NBR turn lane would help improve northbound traffic operations.
- Although less critical and potentially more difficult to implement from a geometric perspective (to avoid overlapping lefts) a dual NBL may also be considered.

Exhibit 17: 2031 Four Lanes – Traffic Projections





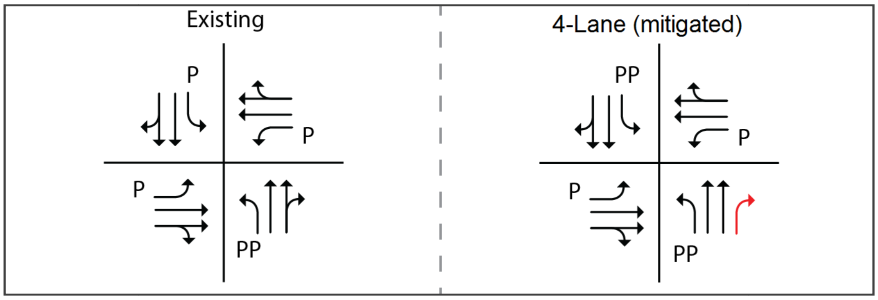


* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

The **Rathburn Road** intersection is expected to operate at LOS E during the AM peak hour and LOS F during the PM peak hour. The higher delays and overcapacity issues are related to the WBL & NBT movements during the AM peak hour, and the WBTR, NBL & SBTR movements during the PM peak hour. Among all these movements, the NBL will operate the worst with high turning volume.

Potential improvements:

- The southbound left turn movement would benefit with permitted-protected phase.
- Providing an exclusive NBR turn lane would improve traffic operations and may help reduce the occurrence of rear-end collisions.

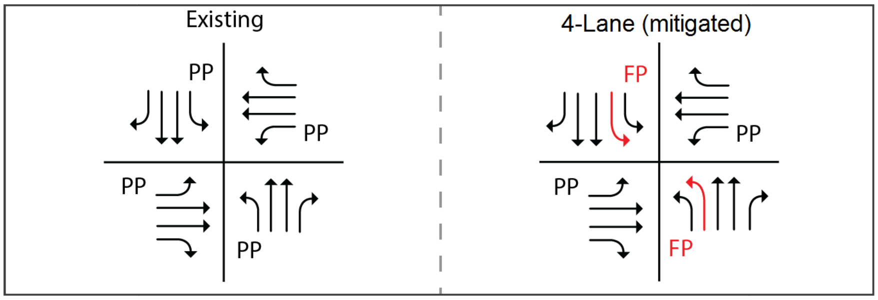


* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

The **Burnhamthorpe Road** intersection is expected to operate at LOS F during both the AM and PM peak hours. During the AM peak hour the EBT, WBL, NBL, NBT, and SBL movements will operate over capacity. During the PM peak hour the WBL, WBT, NBL, and SBT will operate overcapacity. Based on the safety analysis, the most prevalent collision at this intersection are conflicts between the southbound left turn and northbound through movements. To overcome capacity issues and safety concerns, potential improvements such as dual NBL & SBL turns would improve traffic safety and provide better intersection performance.

Potential improvements:

- Consider a dual northbound left turn lane (this movement exceeds 350 veh/hr during the PM peak but remains critical during both the AM and PM peak periods).
- Although less critical and potentially more difficult to implement from a geometric perspective (to avoid overlapping lefts) a dual SBL may also be considered (although remains a low priority given the lower demands).

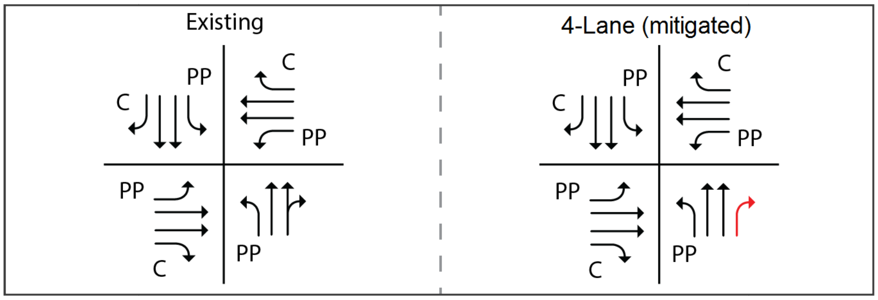


* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

The **Bloor Street** intersection is expected to operate at LOS E during the AM and PM peak hours. As indicated earlier under existing conditions, the dominant collision type is rear-end collisions which are likely due to excessive speeding and the absence of a dedicated turn lane.

Potential improvements:

- Improvements can be made with adjustments to the signal timings to provide more east-west time and extend advance phases.
- The addition of a NBR turn lane would reduce number of vehicles slowing in the through lane, hence improving traffic operations and may help reducing rear-end collisions.



* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

The **Silver Creek** and **Dundas Ramp** intersection are expected to operate at LOS C during the AM peak hour and LOS D & E during the PM peak hour respectively. The safety analysis indicates that the predominant type of collision at Silver Creek Boulevard is southbound rear-end collisions at the intersection. For the Dundas Street Ramp, the safety analysis indicates a high proportion of collisions on the eastbound to southbound merge and on the northbound left turn. The NBL at Silver Creek Boulevard exceeds 400 veh/hr during the PM peak hour.

Potential improvements:

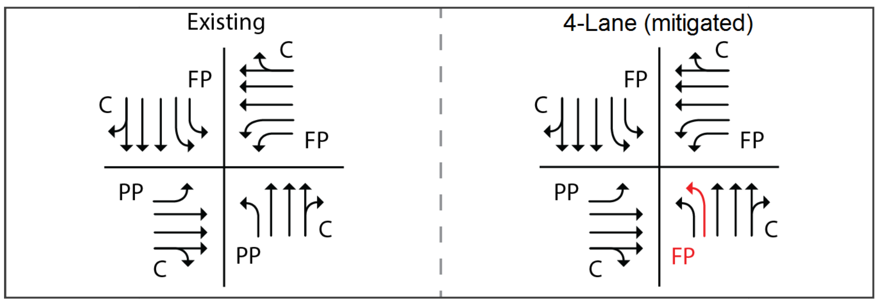
- Relatively minor signal timing adjustments could be implemented to provide more eastbound green time to help serve demand at the expense of north-south green time.
- From traffic safety perspective, a clearer yield point should be established for the EBR turn channel at Dundas Street Ramp. The suggested improvement may be geometrically reviewed in road design.
- Extend the existing NBL turn lane at Silver Creek Boulevard to accommodate expected queues and reduce the probability for spillback into the northbound through lanes. The median area at this location is currently hatched with space available to extend the left turn lane.

In addition to the above, the benefits and impacts of providing a fully protected northbound left turn phase to address safety concerns should be further considered during Phase 2 of the study.

The **Queensway** intersection is expected to operate at LOS F during both the AM and PM peak hours. With the right turn channelization on each approach there is still sufficient space for two vehicles to queue at the stop bar and for a right turning motorist to slip behind. There is also a lane drop approximately 100 metres downstream in EB/WB and NB directions which may result in a lower utilization of the curb lane.

Potential improvements:

- Undertake adjustments to signal timings to improve overall operations.
- Although less critical and potentially more difficult to implement from a geometric perspective (to avoid overlapping lefts) a dual NBL may also be considered

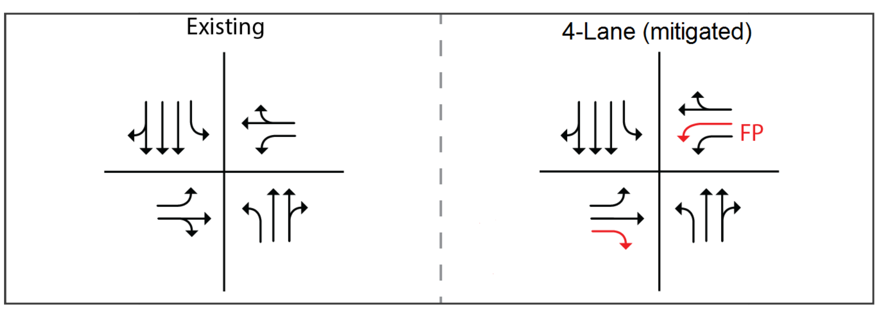


* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

The **North Service Road** intersection, as noted under existing conditions, is one of poorest performing intersections along the corridor. The intersection is expected to operate at LOS E during the AM and LOS F during the PM peak hour.

Potential improvements:

- Add an exclusive EBR turn lane
- Add fully protected dual WBL to accommodate heavy demands. Westbound left turn demands are expected to exceed 500 veh/hr during the PM peak hour.



* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

The minor intersections of **Meadows and Tedwyn** are expected to operate at LOS B or better under a Four Lane scenario.

Exhibit 18: Summary of Intersection Operations (Four Lane Scenario)

2031 AM Peak Conditions

2031 Four Lane with Intersection Improvements	V/C	Delay	LOS	Critical	Over Capacity
Eastgate Pkwy	1.10	95.1	F	EBL, NBL	EBT, NBT, SBL
Meadows Blvd	0.63	16.3	B		
Rathburn Rd	1.07	70.5	E	NBL, SBTR	WBL, NBT
Burnhamthorpe Rd	1.17	89.0	F	SBT	EBT, WBL, NBL, NBT, SBL
Bloor St	1.00	64.7	E	NBT	EBT, WBL, SBL, SBT
Silver Creek Blvd	1.02	33.2	C	NBL	EBR, SBTR
Dundas St Ramp	0.98	23.9	C	EBL, EBT, SBT	
Queensway	1.07	81.8	F	SBTR	EBTR, WBL, NBTR, SBL
Tedwyn Dr	0.75	4.8	A		
North Service Rd	1.02	55.5	E	EBR, WBL, NBL, SBTR	NBTR
Eastgate Pkwy	1.10	95.1	F	EBL, NBL	EBT, NBT, SBL
Meadows Blvd	0.63	16.3	B		
Rathburn Rd	1.07	70.5	E	NBL, SBTR	WBL, NBT

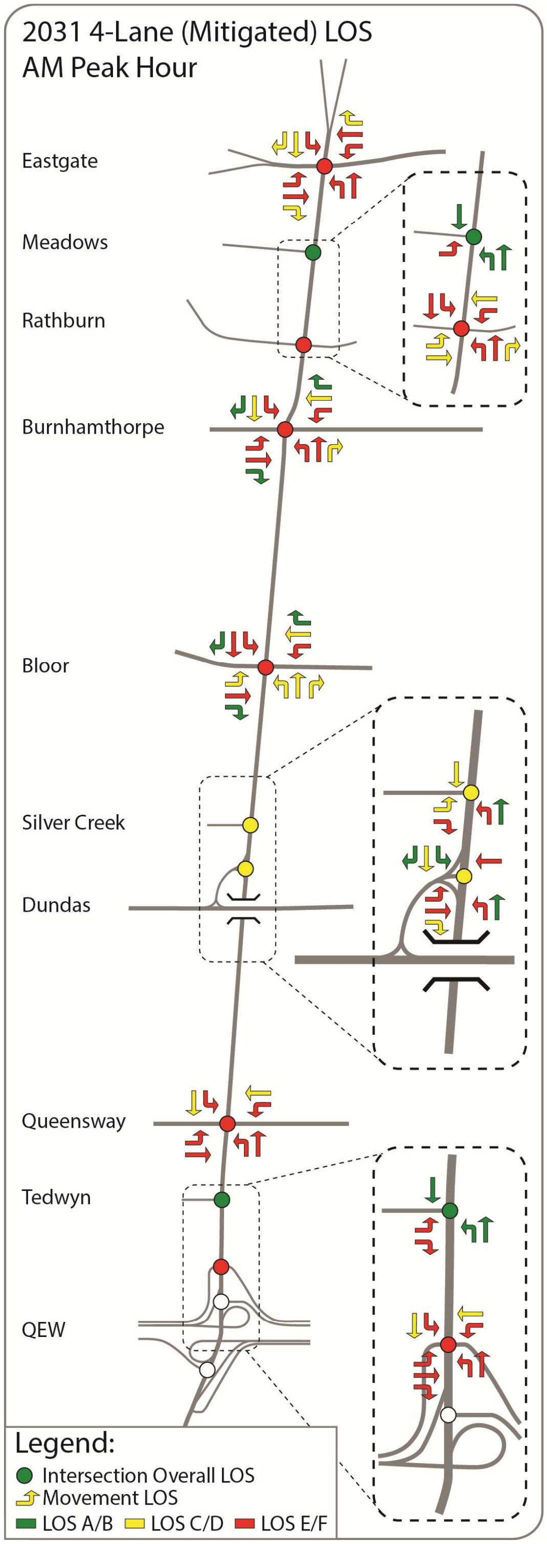
* Shading highlights those intersections where V/C ≥ 1.2 or Intersection Delay ≥ 100 sec

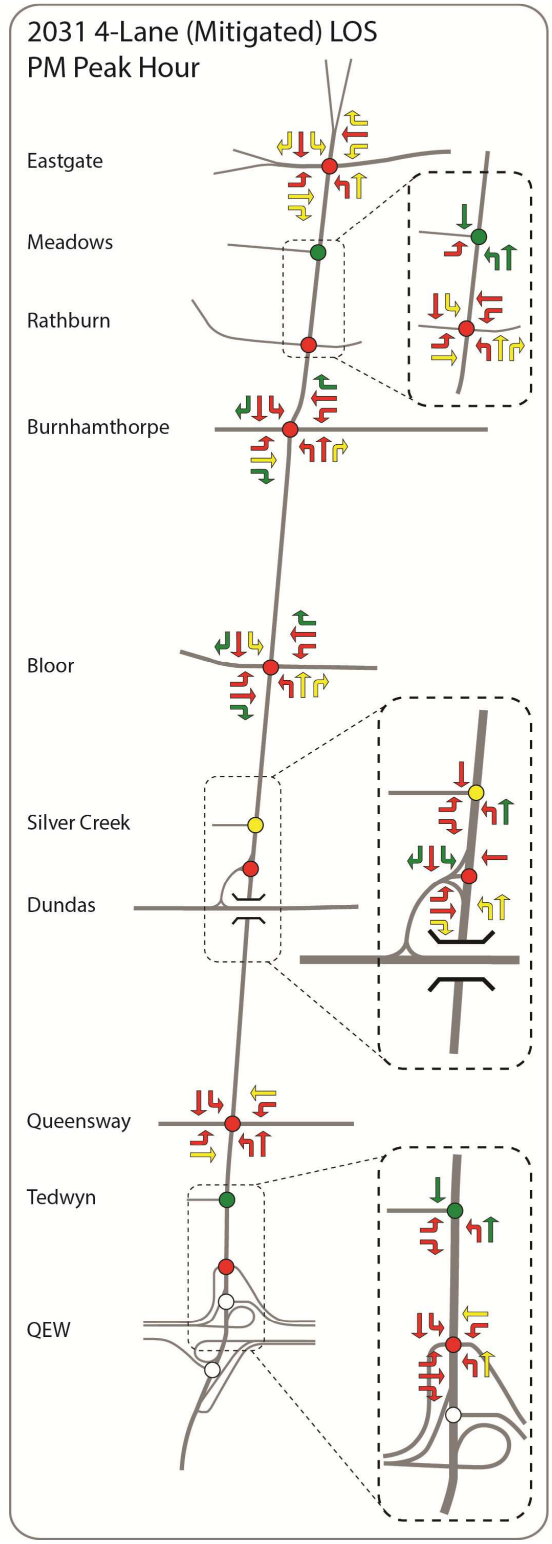
2031 PM Peak Hour Conditions

2031 Four Lane with Intersection Improvements	V/C	Delay	LOS	Critical	Over Capacity
Eastgate Pkwy	1.13	91.1	F		EBL, WBT, NBL, SBT
Meadows Blvd	0.58	4.3	A		
Rathburn Rd	1.12	87.9	F	WBL	WBTR, NBL, SBTR
Burnhamthorpe Rd	1.22	130.0	F	NBT, SBL	WBL, WBT, NBL, SBT
Bloor St	1.08	71.3	E	EBT	WBL, WBT, NBL, SBT
Silver Creek Blvd	1.00	46.9	D	NBL	SBTR
Dundas St Ramp	1.13	56.3	E	NBT	EBL, EBT, SBT
Queensway	1.73	138.8	F	NBTR	EBL, WBL, NBL, SBTR
Tedwyn Dr	1.23	11.1	B		NBL
North Service Rd	1.27	88.3	F	NBTR	WBL, NBL, SBL, SBTR
Eastgate Pkwy	1.13	91.1	F		EBL, WBT, NBL, SBT
Meadows Blvd	0.58	4.3	A		
Rathburn Rd	1.12	87.9	F	WBL	WBTR, NBL, SBTR

* Shading highlights those intersections where V/C ≥ 1.2 or Intersection Delay ≥ 100 sec

Exhibit 19: 2031 Four Lanes with Intersection improvements (Mitigated) - Level of Service





b) Unsignalized Intersection Summary

Of the six unsignalized intersections located within the Central Section of **Cawthra Road,** the **Hyancinthe Boulevard** and **Running Brook Drive** intersections operate the poorest. At both intersections, the eastbound left turn onto Cawthra Road will operate at LOS F during AM peak hour. The eastbound left turn movement at **Breckenridge Road** is expected to operate at LOS F during PM peak hour. In all three cases, the left turn movement will remain well below capacity.

At the three remaining unsignalized intersections within the project limits (i.e. **Needham Lane** and **Orwell Avenue** during both the AM and PM peaks, and at **Melton Drive** during AM peak), the left turn onto Cawthra Road operates overcapacity and drivers experience long delays (LOS F). Traffic signals should be installed at Needham Lane and Orwell Avenue based on warrants. The available intersection spacing would not allow a traffic signal to be provided at the Melton Drive intersection, and therefore the intersection is to be monitored and, if necessary, left turns restricted at the intersection.

Based on a signal warrant analysis carried out for the Orwell Avenue and Needham Lane intersections, neither of the two intersections met signal warrants justification based on the Four Lane scenario (Warrant 1 is 57% satisfied; Warrant 2 is 41% satisfied). Output from the signal warrant analysis is provided in **Appendix G** for reference purpose.

7.4.3 2031 Base Case

Traffic growth associated with the Base Case will result in an overall deterioration of traffic operations throughout the corridor. The proposed widening under the Base Case scenario will add capacity to the North and South Sections but will also induce additional through traffic demand along the corridor; as such, intersections are expected to remain capacity constrained in the future. Projected 2031 traffic demands are summarized in **Exhibit 20.**

Unsignalized intersection operations deteriorate with the increased demand; however given that most of the unsignalized intersections (and driveways) are between Burnhamthorpe Road and the Queensway where growth is lowest, operations are generally still acceptable.

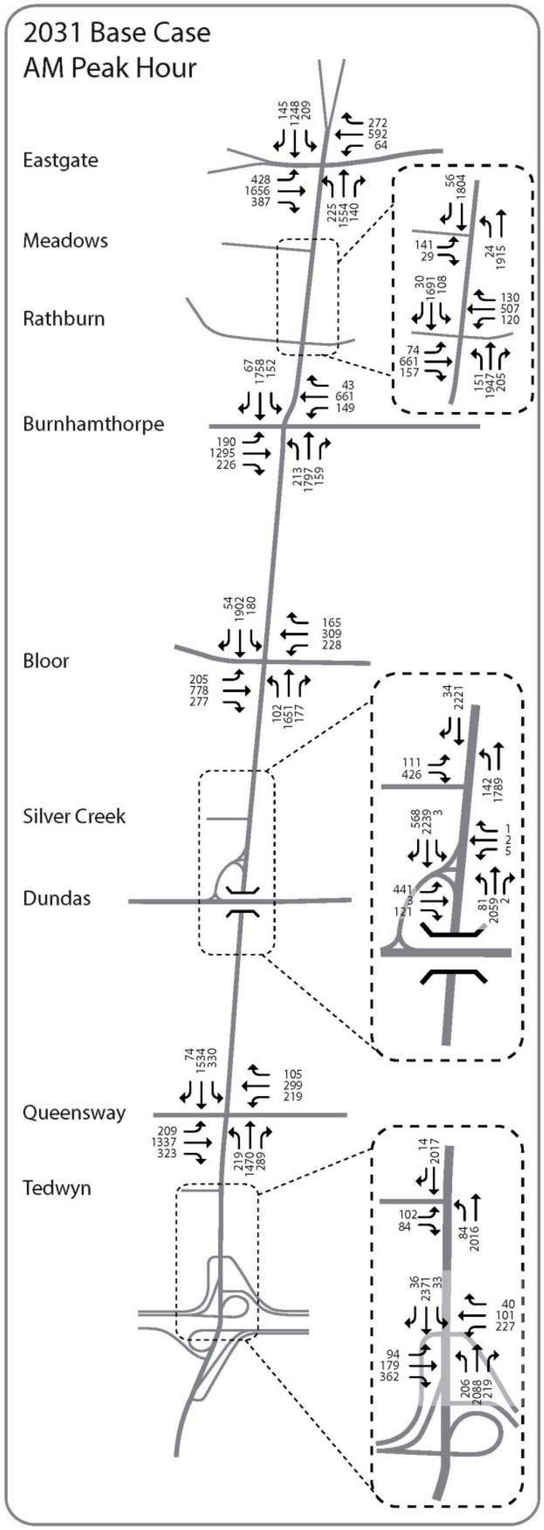
The operations analysis reflects only the proposed widening of Cawthra Road to six lanes north of Burnhamthorpe Road and south of Dundas Street Ramp. For the Base Case, key intersection improvements (mitigating measures) are repeated, as appropriate, and a series of additional mitigating measures similar to the Four Lane condition are identified. A final ‘mitigated’ analysis will be prepared once the preferred alternative design is determined.

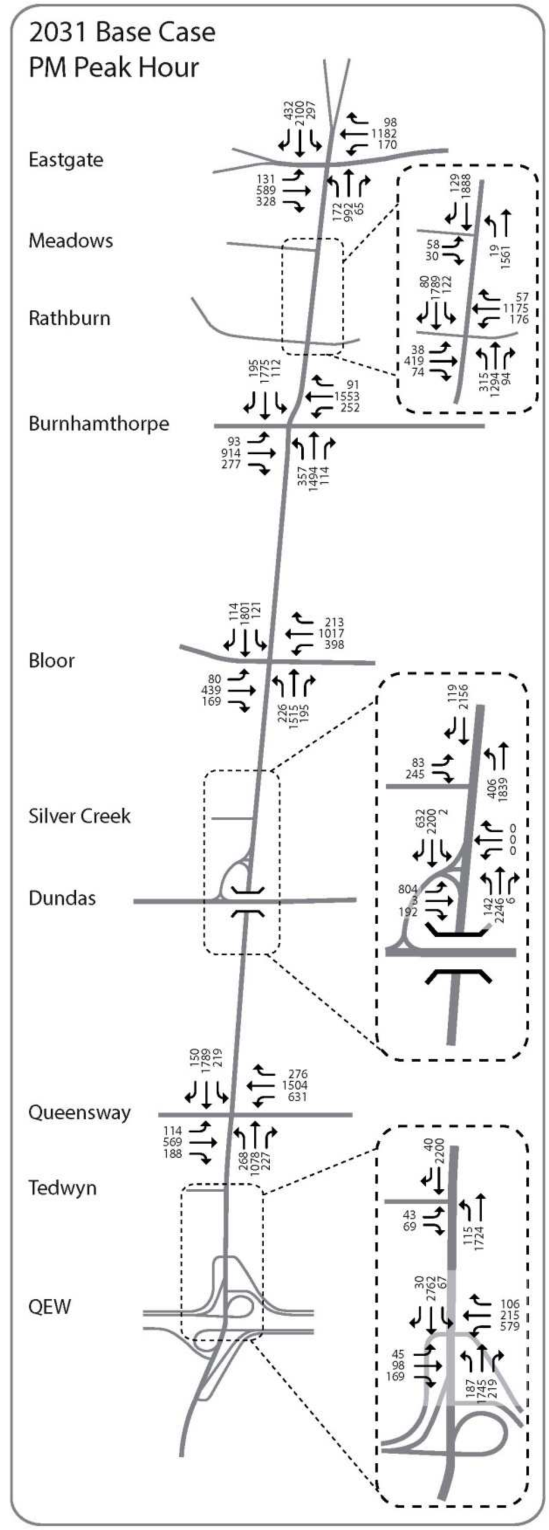
a) Signalized Intersection Summary

With this option, north-south through volumes within the corridor will increase by 200 to 500 veh/hr. Intersection performance will range from LOS A to F during the AM peak hour and PM peak hour. Most of the intersections have one or more movements operating at LOS E or F with some left turn movements well over capacity. Operational improvements such as the additional of dual left turn lanes, right turn lanes and localized widening will be required to accommodate future demand.

The overall intersection LOS, critical movements, and key safety concerns, and potential improvements are highlighted below. Results are summarized in **Exhibits 21 and 22.**

Exhibit 20: 2031 Base Case - Traffic Projections

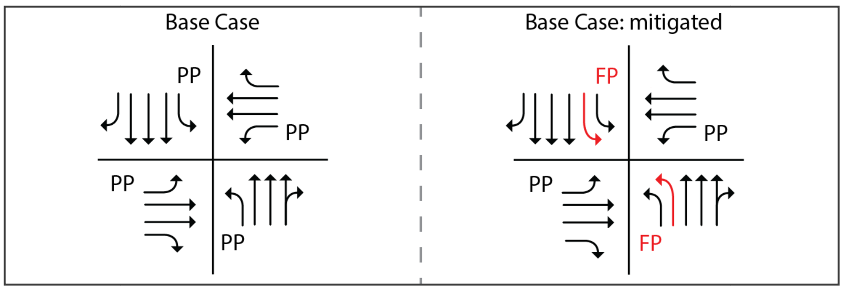




The **Eastgate Parkway** intersection is expected operate at LOS F during the AM and PM peak hours. Several movements will operate at LOS D or above due to opposing flows in all directions. The northbound left turn had the highest frequency of left turn collisions.

Potential Improvements:

- A fully protected dual SBL turn lane should be considered to accommodate demand future demands (particularly during the PM peak when the SBL equals approximately 300 veh/hr). This option would also reduce the probability of turning movement collisions since the motorists would no longer be attempting turns through gaps in opposing traffic.
- Although less critical and potentially more difficult to implement from a geometric perspective (to avoid overlapping lefts) a dual NBL may also be considered.

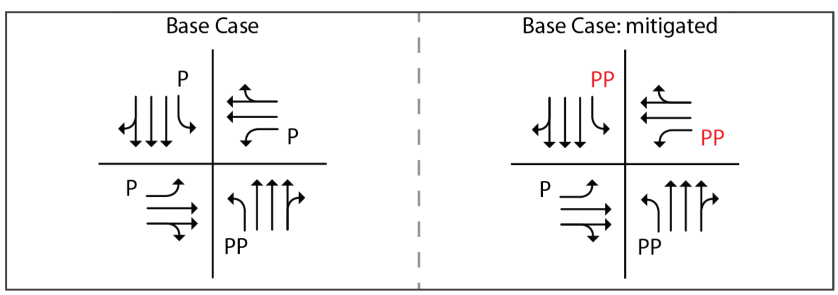


* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

The **Rathburn Road** intersection is expected to operate at LOS E during AM and PM peak hour. During the AM peak hour the intersection operations will benefit from the addition of advance left turn phases however even with these additions the intersection is still expected to operate near or at capacity.

Potential improvements:

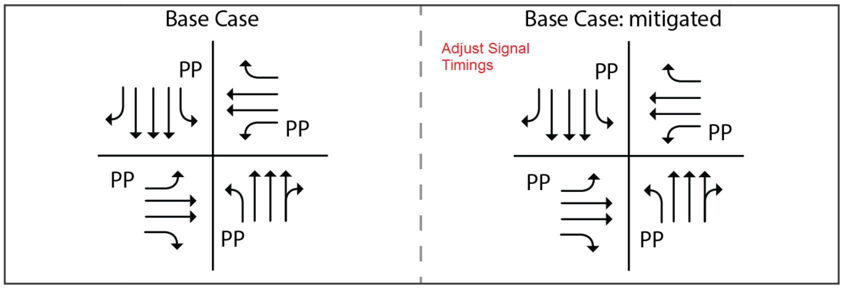
- The southbound left turn movement would benefit with permitted-protected phase.



* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

The character of the intersection is not well-suited to the addition of dual left turn lanes even though they would help operations. Although adding northbound and southbound right turn lanes may help reduce the occurrence of rear-end collisions; however, they are not required from an operational perspective. In conjunction with widening to six lanes, there is limited opportunity to add right turn lanes.

The **Burnhamthorpe Road** intersection is expected to operate at LOS F during both peak hours. During the AM peak hour, SBL & NBL turns are both expected to be well over capacity. During the PM peak hour the NBL turn is again expected to be over capacity. Suggested mitigating measure is providing fully protected additional northbound and southbound through lane and adjust signal timings.



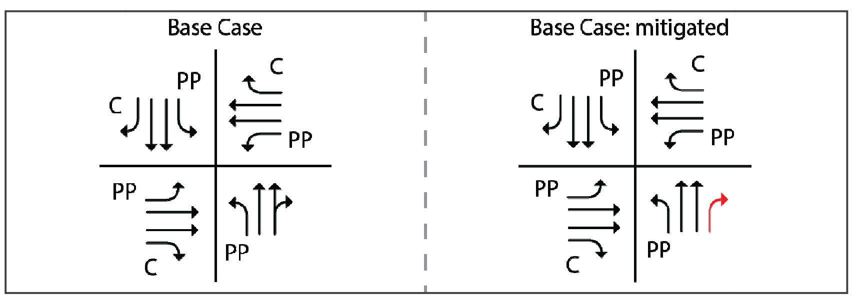
* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

Consideration was given to maintaining the southbound downstream merge so that three southbound through lanes can be provided. This will provide some benefit however utilization of the lane will remain low. The southbound merge is to be located sufficiently downstream to avoid back-up into the intersections.

The **Bloor Street** intersection is expected to operate with an overall LOS F during both the AM and PM peak hours. During both periods left turns compete for available green time; however dual left turn lanes are not appropriate for the area.

Potential improvements:

- The addition of a NBR turn lane would reduce the number of vehicles slowing in the through lane and may help to reduce rear-end collisions; it would also improve traffic operations.



* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

The Region/City may also wish to consider removing the right turn channelization to reduce the effective pedestrian crossing distance and create a more urban character to the intersection and also to enable using the right turn lanes as queue jump lanes. Such an intervention should only be considered with improved transit service on the corridor.

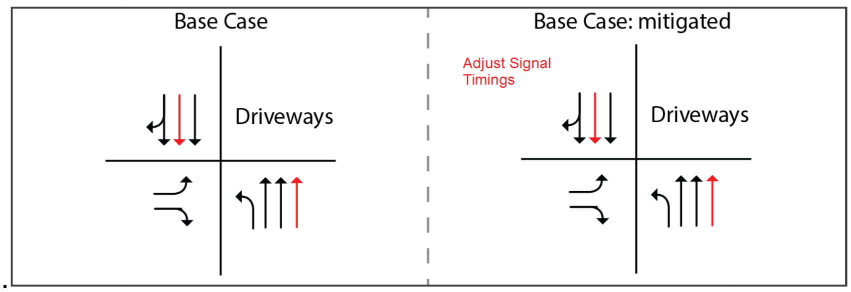
The **Silver Creek** and **Dundas Ramp** intersections are expected to operate at LOS C & D during the AM peak hour, and LOS B & E during the PM peak hour respectively.

Potential improvements:

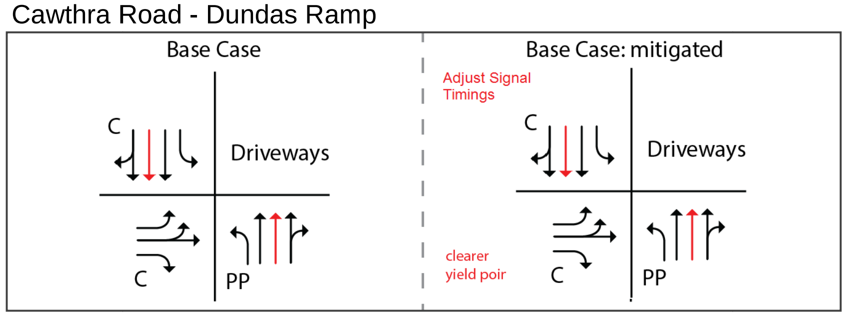
- A third southbound through lane should be provided between Silver Creek Boulevard and Dundas Street to accommodate future demand and reduce queue spillback between intersections. The third lane would begin as an extension of the existing southbound bus bay north of Silver Creek Boulevard. There appears to be sufficient land to accommodate the widening. The three through lanes should be maintained throughout with the eastbound right turn channel merging into the curb lane. The heavy southbound right turn movement at the Dundas Ramp would still be channelized ideally with a parallel deceleration lane and/or taper.

- With the widening noted above, the eastbound to southbound right channel and merge will need to be modified and a clear yield point should be implemented to help reduce collisions on this movement.
- A fully-protected northbound left turn phase should be considered to improve safety for left turning vehicles; the phase would still have sufficient capacity to accommodate demand.

Cawthra Road - Silver Creek



Cawthra Road - Dundas Ramp



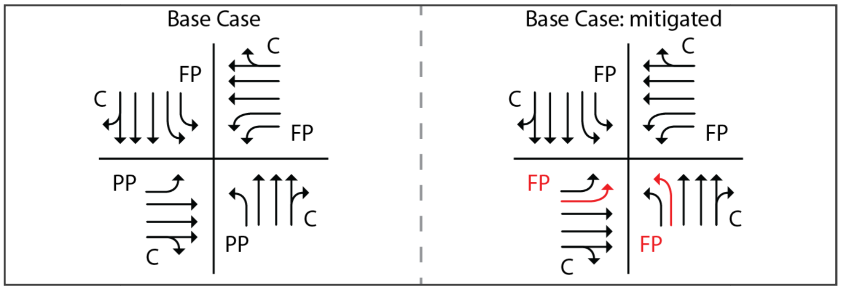
* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

At the Dundas Street Ramp, the Region may also wish to consider modifying the southbound to westbound channel such that there is only one departure lane westbound at the intersection so the southbound to westbound movement can run free into a dedicated lane without a yield.

The **Queensway** intersection is expected to operate at LOS F during both peak hours. During AM peak hour the EBTR, WBL, NBT & SBL, and during PM peak hour, WBL, WBT, NBL & SBTR would be overcapacity. The safety analysis indicates a relatively high proportion of turning movement collisions on the eastbound and northbound left turns which both currently operate and protected-permissive.

Potential improvements:

- Undertake adjustments to signal timings to improve overall operations.
- Although less critical and potentially more difficult to implement from a geometric perspective (to avoid overlapping lefts) a dual NBL and EBL may also be considered

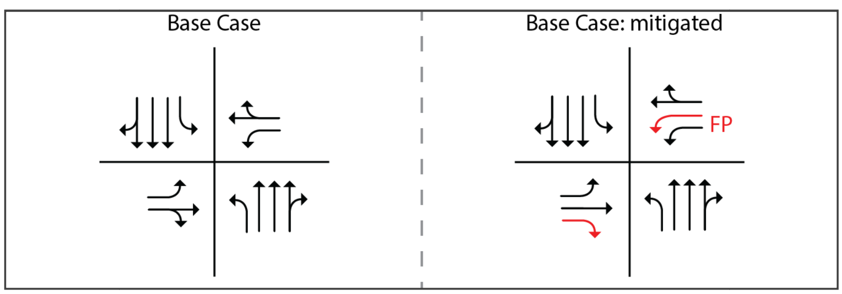


* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

The **North Service Road** intersection is expected to operate at LOS D during AM and LOS E during PM peak hour. Several movements continue to operate at LOS F in every direction with the northbound left turn movement and southbound through movement competing for time in the cycle. In addition to a third NBT Lane, the mitigating measures proposed for the Four Lane scenario are repeated here.

Potential improvements:

- Add an exclusive EBR turn lane
- Add fully protected dual WBL to accommodate heavy demands. Westbound left turn demands are expected to exceed 500 veh/hr during the PM peak hour.



* PP - Permissive Protected; FP -Fully Protected; P - Permissive Only

The minor intersections of **Meadows and Tedwyn** will continue to operate at LOS B or better under the Base Case scenario. However, the side streets are expected to operate at LOS D or E due to optimizing progression on Cawthra Road. No modifications are currently proposed to these intersections.

Exhibit 21: Summary of Intersection Operations (Base Case Scenario)

2031 AM Peak Conditions

2031 Base Case with Intersection Improvements	V/C	Delay	LOS	Critical	Over Capacity
Eastgate Pkwy	1.26	95.3	F	EBL, SBT	EBT, NBL, NBT, SBL
Meadows Blvd	0.57	16.1	B		
Rathburn Rd	0.98	60.4	E	SBTR	EBTR, NBTR
Burnhamthorpe Rd	1.32	88.0	F		EBT, WBL, NBL, NBTR, SBL, SBT
Bloor St	1.14	117.8	F	SBL	EBT, WBL, NBT, SBT
Silver Creek Blvd	0.88	32.0	C	EBR, SBTR	
Dundas St Ramp	1.01	50.6	D	EBL, EBT	SBTR
Queensway	1.21	94.9	F	NBL, SBTR	EBTR, WBL, NBTR, SBL
Tedwyn Dr	1.02	8.2	A		NBL
North Service Rd	1.00	48.6	D	WBL	EBR, NBL, SBTR
Eastgate Pkwy	1.26	95.3	F	EBL, SBT	EBT, NBL, NBT, SBL
Meadows Blvd	0.57	16.1	B		
Rathburn Rd	0.98	60.4	E	SBTR	EBTR, NBTR

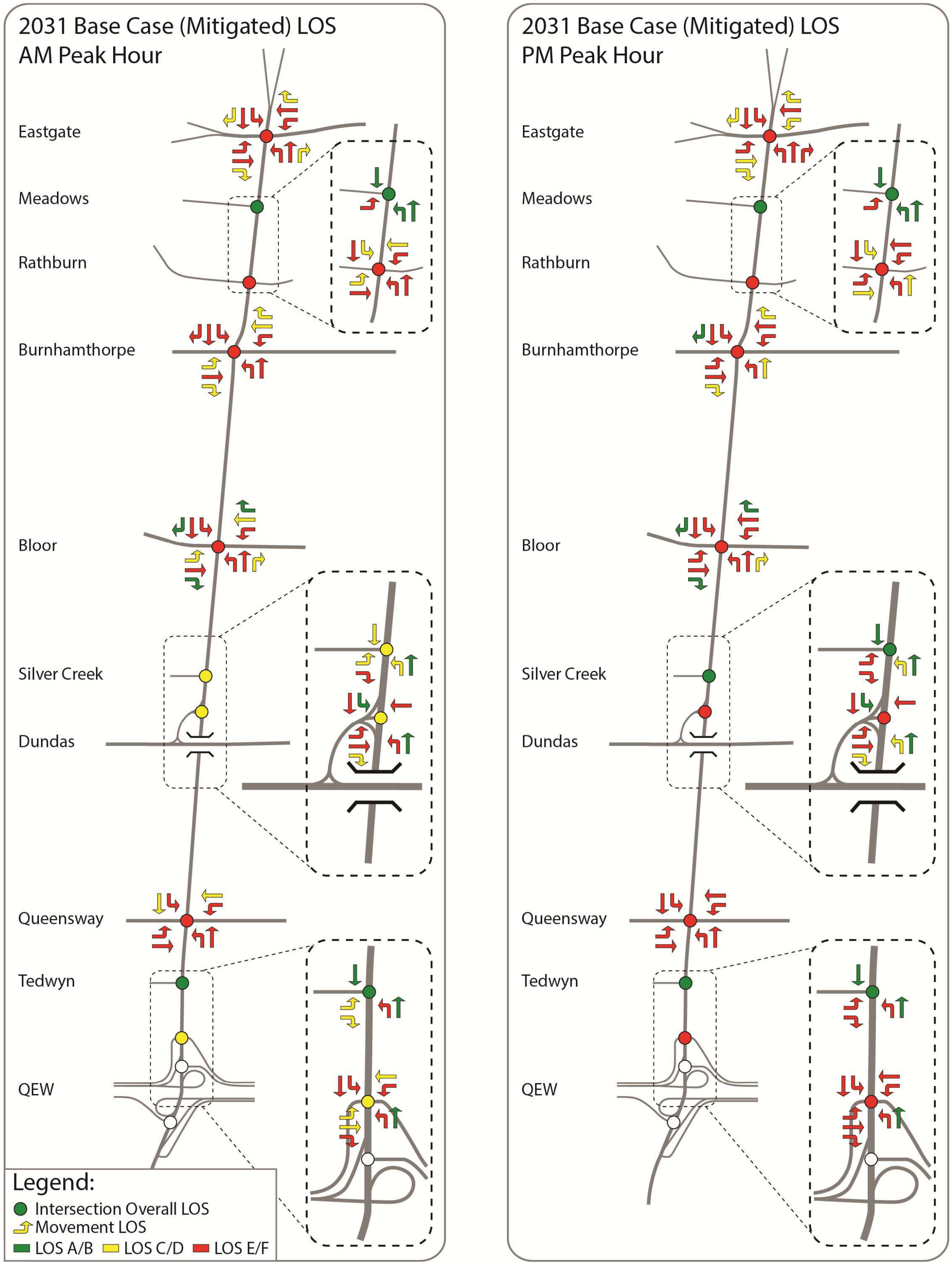
* Shading highlights those intersections where V/C $\geq$ 1.2 or Intersection Delay $\geq$ 100 sec

2031 PM Peak Hour Conditions

2031 Base Case with Intersection Improvements	V/C	Delay	LOS	Critical	Over Capacity
Eastgate Pkwy	1.19	85.1	F	SBL	EBL, WBT, NBL, SBT
Meadows Blvd	0.54	2.5	A		
Rathburn Rd	1.07	79.6	E		WBTR, NBL, SBTR
Burnhamthorpe Rd	1.30	109.9	F	EBL, EBT, NBTR, SBL	WBL, WBT, NBL, SBT
Bloor St	1.30	96.9	F	NBT	WBL, WBT, NBL, SBL, SBT
Silver Creek Blvd	0.88	19.4	B	NBL	
Dundas St Ramp	1.16	77.4	E		EBL, EBT, SBTR
Queensway	1.20	104.1	F		WBL, WBTR, NBL, SBTR
Tedwyn Dr	1.64	14.8	B		NBL
North Service Rd	1.14	71.2	E	EBR	WBL, NBL, SBL, SBTR
Eastgate Pkwy	1.19	85.1	F	SBL	EBL, WBT, NBL, SBT
Meadows Blvd	0.54	2.5	A		
Rathburn Rd	1.07	79.6	E		WBTR, NBL, SBTR

* Shading highlights those intersections where V/C $\geq$ 1.2 or Intersection Delay $\geq$ 100 sec

Exhibit 22: 2031 Base Case (Mitigated) - Level of Service



b) Unsignalized Intersections

Operations for unsignalized intersections are expected to deteriorate with many movements operating at LOS C to F, but significantly below capacity.

As a result of the additional (induced) demands along Cawthra Road associated with this scenario, the left turn movements at **Hyancinthe Boulevard** and **Running Brook Drive** (which operated at v/c < 0.8 during the AM peak under the Four Lane scenario) will now exceed capacity (v/c = 1.06 and 1.09 respectively). The eastbound left turn movement at **Breckenridge Road** is expected to operate at LOS of F during PM peak hour. Similarly, left turns onto Cawthra Road at the remaining intersections and driveways within the Central Sections will become more difficult but remain below capacity.

Similar to Four Lane scenario, left turn movements at the three remaining unsignalized intersections within the project limits (i.e. **Needham Lane** and **Orwell Avenue** during both the AM and PM peaks and at **Melton Drive** during AM peak) operate overcapacity with significant delays (LOS F). A signal warrant analysis carried out for both Orwell Avenue and Needham Lane under Base Case scenario confirmed neither intersection met signal warrant justification.

c) Summary

A comparison with the Four Lane and Base Case scenarios reveals that they operate similarly and there is <u>no significant advantage from a traffic operations standpoint to widen Cawthra Road to six lanes within the north and south sections</u>. During the AM peak, the signalized intersections tend to operate slightly better than under the Four Lane scenario while during the PM peak they operate slightly worse. In both cases, the total number of movements operating V/C > 0.85 is 36, in both the AM and PM peak hours.

In the end, the road widening in the north and south sections under the Base Case scenario introduces additional through traffic demands to the corridor which further worsen operations with the Central Section (which cannot be widened) and increases delays entering / exiting from the numerous unsignalized side roads and driveways along the corridor.

8 Summary and Conclusions

The following is a summary of results and conclusions of the traffic analysis:

a) Study Area Profile

- Cawthra Road is surrounded by fairly stable land use with many mature neighbourhoods. There are no significant major developments planned along the corridor which would contribute to a major increase in local traffic. As such, much of the growth in traffic along the corridor is expected to be through traffic originating outside of the immediate study area.
- The designated right-of way along Cawthra Road is as follows:
  - North Section (Eastgate Pakway to Burnhamthorpe Road) – 45 m
  - Central Section (Burnhamthorpe Road to Dundas Street) – 36 m
  - South Section (Dundas Street to QEW) – 45 m (versus 36m existing)
- Transit is limited on Cawthra Road with only one local bus route which does not serve the entire corridor. The addition of the MiWay BRT at Eastgate Parkway and the Dundas BRT would provide new interchange opportunities and may result in more transit on Cawthra Road, however the extent of this benefit is not quantified in the current regional modelling framework.
- Goods movement is not a high priority for Cawthra Road however the lands south of Cawthra Road are general light industrial and the design alternatives should be mindful of this activity especially how it relates to safe interrelation with active transportation facilities.

b) Active Transportation Facilities

- Cawthra Road is part of the cycling master plans for both Peel Region and the City of Mississauga.
- Based on the characteristics of Cawthra Road (i.e. traffic volumes, traffic speeds, road classification, etc) a physical separation of motor vehicle and bicycle facility is desirable. Appropriate treatments include (but are not limited to) providing 1.5 m on-road bike lanes with a 0.5m buffer; providing 1.8 to 2.0 m cycle track; or providing a 3.0 to 3.5m multi-use trail in the boulevard.
- Given the numerous driveways and unsignalized intersections along Cawthra Road, bike lanes may be more appropriate than a multi-use trail since motorists are more likely to be aware of cyclists on the roadway rather than adjacent to the road. If located on-street, bike lanes have priority over traffic entering from driveways.

c) Traffic Safety

- Traffic speeds recorded on Cawthra Road are high; the 85^{th} percentile speed is approximately 20 km/h above the posted speed limit. Where possible, opportunities to incorporate appropriate speed reduction measures (i.e. reduced lane/ pavement widths, etc) should be considered.
- Most of the collisions occurred at intersections with the highest proportion being rear-end collisions (45%), followed by turning movement collisions (33%).
- Sight and visibility should be enhanced where possible, including measures to improve safety of left turning vehicles such as fully protected left turns.

d) Existing Traffic Volumes

- Existing traffic volumes along Cawthra Road range from 900 to 1500 vehicles/hr/direction during peak hour conditions. Although generally balanced, volumes tend to be slightly higher in the southbound direction of travel. These volumes also tend to be heaviest during the PM peak period.
- Traffic volumes on Cawthra Road were fairly steady from 1998 to 2008 with a significant reduction in traffic (25 to 30 percent) recorded in the 5 years since the onset of the global recession in 2008.
- Turning movements count volumes collected during 2012 and 2013 are generally consistent with the recorded Automatic Traffic Recorder (ATR) data. Pedestrian volumes at intersections are generally below 50 persons per hour per crosswalk. Bicycle volumes are low with fewer than 5 observations on any particular movement during the peak hours.
- Cawthra Road is identified as a connector truck route from Eastgate Parkway to Dundas Street and as a primary truck route from Dundas Street to the QEW. Trucks generally make up is 4.5 - 6.5% of demands. Truck restrictions are in place between 7PM to 7AM within the Central Section.
- Cawthra Road is often used as a connector between the 400 series highways to the north (403, 401, 407 and 410) and the Queen Elizabeth Way. Based on a select link analysis along Cawthra Road between Burnhamthorpe Road and Dundas Street, the average trip duration is estimated to be 35 minutes (approximately 16% of trips are expected to be under 15 minutes and 65% of trips are expected to be over 30 minutes in duration).

e) Traffic Growth Projections

- Growth rates were determined for the following potential improvement scenarios.
  - **Four Lanes**: reflects two through lanes northbound and southbound throughout the entire corridor except for between the Queensway and the QEW which is currently three lanes southbound;
  - **Base Case**: reflects six lanes from Eastgate Parkway Burnhamthorpe Road (North Section) and from Dundas Street to the QEW (South Section), in keeping with the needs identified as part of the LRTP Update (2012).
  - **Six Lane**: reflects widening of Cawthra Road to three through lanes per direction throughout the corridor from Eastgate Parkway to the QEW.
- Background traffic volumes along Cawthra Road are expected to increase between 0.1% and 1.1% per year over the next 20 years. Based on a comparison with adjacent corridors, modest growth (0.7% to 0.9% per year) is expected. As a result, a compounded growth rate of 0.8% per year was used to forecast future demand.
- Maintaining the Central Section of Cawthra Road as four lanes somewhat constrains demands within the corridor. If Cawthra Road is widened to six lanes throughout the corridor, future through traffic demands are expected to increase by 200-500 veh/hr, largely due to a shift from adjacent corridors (rather than new growth).

f) Traffic Operations Analysis

- The existing intersection analysis reveals a number of congested intersections and movements along the corridor, primarily due to conflicting heavy left turn and opposing through traffic demands.

- The heavy southbound right turn at Cawthra Road and Eastgate Parkway during the PM peak is likely due to drivers attempting to short cut congestion on the Highway 403.
- Unsignalized intersections generally operate with high delays but well below capacity; the centre two-way left turn lane along Cawthra Road provides reasonable turning opportunities for side streets and driveways along the corridor.
- The 2031 link and intersection analysis indicates that maintaining the current four lanes with a centre turn lane and localized improvements (herein referred to as Four Lane option) represents the best overall solution for Cawthra Road, and operates superior to six laning; even though many intersections will continue to operate at or near capacity.
- Widening Cawthra Road to six lanes does not provide a significant benefit from a traffic operations perspective (compared to maintaining the existing Four Lane option), primarily due to the additional induced demands associated with widening. The additional traffic worsens operations within the Central Section (which cannot be widened) and increases delays entering / exiting from the numerous unsignalized side roads and driveways along the corridor.
- Since six laning offers little/no advantage from a traffic operations perspective, is more restrictive from an active transportation standpoint, and is more difficult to fit within the existing right-of-way, it is less desirable from an overall transportation perspective.

g) Cross-section

- A four lane cross-section with centre turn lane and either on-road bike lanes or multi-use trail can reasonably be accommodated within a 36m right-of-way.
- Although it is possible to construct six lanes with a centre turn lane and a multi-use trail within a 36m right-of-way, it will be significantly constrained. Additional right-of-way and/or easements will be required beyond the 36m to allow for hydro clearances/guying, grading, noise walls, bus stops/bays, turn lanes, etc. These elements can otherwise generally be accommodated within a 45m, where available.
- It will not be feasible to construct six lanes with a centre turn lane and on-road bike lanes within a 36m right-of-way (requiring a minimum of 39.5m, plus for additional right-of-way or easements for hydro clearances/guying, grading, noise walls, bus stops/bays, turn lanes, etc.).
- Although widening to six lanes can be accommodated within the North Section (north of Burnhamthorpe Road) with limited property impacts, within the South Section (south of Dundas Street) will be much more difficult, given the limited right-of-way and number properties potentially affected. Six laning within the Central Section is not feasible within the existing right-of-way.
- Both the Dundas Street and the Lakeshore West rail underpass structures span 33.5m (face of barrier to face of barrier) and represent a significant constraint to widening to six lanes in conjunction with either a multi-use trail or bike lanes.

9 Recommendations

Based on the analysis presented in this report, as a minimum, the following potential improvements are to be assessed as part of Phase 2 of the Pre-EA for Cawthra Road. These improvements are intended to accommodate demands along the corridor within a 20 year horizon:

a) Potential Corridor Improvements (including Active Transportation)

North Section - Eastgate Parkway to Burnhamthorpe Road:

- Maintain four lanes with intersection improvements and a centre turn lane.
- Maintain the multi-use trail recently reconstructed along the west side of Cawthra Road.

Central Section - Burnhamthorpe Road to Dundas Street

- Given the constraints of adjacent residential development and numerous residential properties directly fronting onto Cawthra Road, four lanes with centre turn lane should be maintained within this section.
- Provide either on-road bike lanes or a multi-use trail along Cawthra Road (bike lanes may be more preferable given the significant number of driveways within the corridor).

South Section - Dundas Street to the QEW

- The Dundas Street and the Lakeshore West rail underpass structures represent significant constraints to widening within the corridor in conjunction with bike lanes. Based on a review of geometric constraints, additional right-of-way requirements, and traffic operations, it is desirable to maintain Cawthra Road as a four lane section with centre left turn at intersections/ entrances and localized intersection improvements.
- Widening within this section is constrained by adjacent residential development, and it is recommended to maintain three lanes southbound and two northbound lanes.
- Provide a multi-use trail or bike lanes along Cawthra Road. Both options are to be investigated in detail during Phase 2 considering boulevard width, utility impacts, driveway frequency, etc.

b) Potential Intersection Improvements

- At **Eastgate Parkway**, adding a dual left turn lane should be considered on the southbound approach (along with fully protected left turn advance phasing), as well as an exclusive northbound right turn lane.
- At **Rathburn Road**, the signal should be modified to include left turn advance phasing (protected-permissive) for the southbound left turn movement. Adding a northbound right turn lane should also be considered to reduce the occurrence of rear-end collisions.
- At **Burnhamthorpe Road**, consider adding a fully protected dual northbound left turn lane at the intersection.
- At **Bloor Street**, adjustment signal timings to provide more east-west green time, extend advance phases, and consider adding an exclusive northbound right turn lane.
- Minor signal timing adjustments should be considered at **Silver Creek Boulevard** to provide more eastbound green time. It is desirable to extend the northbound left turn lane to avoid queue spillback into the through lane.

- At the **Dundas Street Ramp**, the eastbound right turn channel should be modified to include a clear yield point to improve safety on the merge.
- At the **Queensway**, undertake adjustments to signal timings to improve overall operations.
- Given the proximity of **Melton Drive** to the Queensway intersection, potentially restrict Melton Drive to right-in/right-out at Cawthra Road.
- At the **North Service Road**, add a dual westbound left turn and an exclusive eastbound right turn lane to accommodate heavy demands.

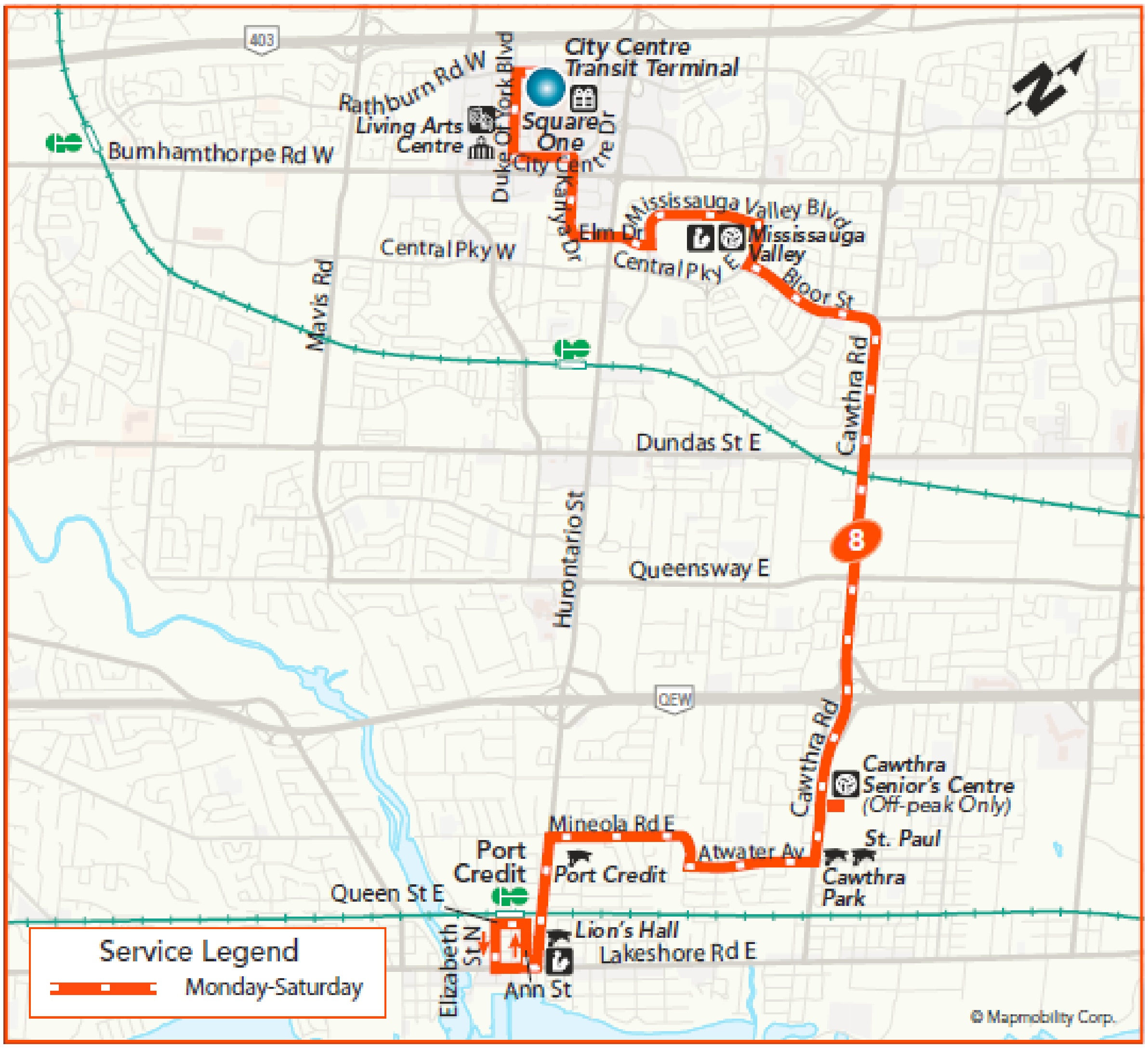
Appendices

Study Area Maps

8 Cawthra

Monday-Saturday Service

Effective: January 28, 2013



Legend

Islington — TTC Subway Station
Clarkson — GO Train Station
Major Transit Terminal
Hospital
Ice Rink
Shopping Centre
High School, University or College
Recreation or Community Centre
Public Library
Living Arts Centre
Civic Centre (City Hall)

Find customized route and schedule information:

Click n' Ride — ONLINE TRIP PLANNER — Visit miway.ca and get click n'.

Mobile site — m.miway.ca

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citylink — 905-615-4BUS(4287) — Call and enter a four-digit bus stop number for scheduled departure times.

Contact Us — 905-615-INFO (4636) — TTY: 905-615-3886 — miway.info@mississauga.ca

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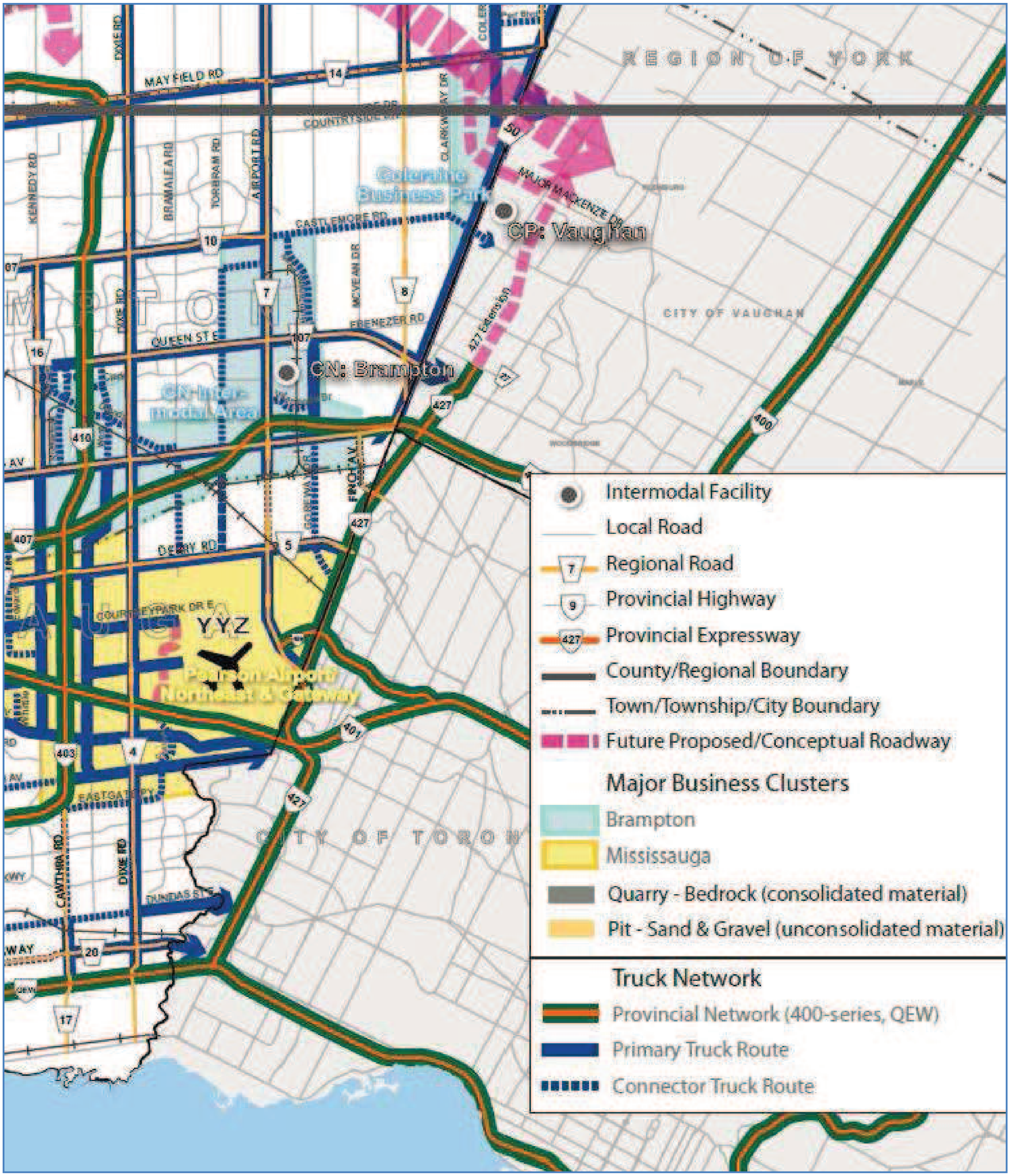
REGION OF YORK
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EBENEZER RD
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COURTNEYPARK DR E
EASTGATE PKY
DUNDAS ST E
KENNEDY RD
BRAMALEA RD
TORBRAM RD
AIRPORT RD
DIXIE RD
CLARKWAY DR
MCVEAN DR
FINCH AV
CAWTHRA RD
MAJOR MACKENZIE DR
427 Extension
Coleraine Business Park
CP: Vaughan
CN: Brampton
CN Inter-modal Area
YYZ
Pearson Airport Northeast & Gateway
Intermodal Facility
Local Road
Regional Road
Provincial Highway
Provincial Expressway
County/Regional Boundary
Town/Township/City Boundary
Future Proposed/Conceptual Roadway
Major Business Clusters
Brampton
Mississauga
Quarry - Bedrock (consolidated material)
Pit - Sand & Gravel (unconsolidated material)
Truck Network
Provincial Network (400-series, QEW)
Primary Truck Route
Connector Truck Route

Active Transportation

IBI
GROUP

IBI Group
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Hamilton ON L8L 1H5 Canada

tel 905 546 1010
fax 905 546 1011

Memorandum

To/Attention	Margie Chung, Peel Region	**Date**	March 27, 2014
From	Marian Saavedra, IBI Group	**Project No**	35303
cc	Norma Moores, IBI Group Brian Hollingworth, IBI Group	**Steno**	ms
Subject	Dixie Road and Cawthra Road Bikeway Feasibility Studies: Background and Alternatives		

Introduction

The purpose of this memo is to document findings to date of the Dixie Road and Cawthra Road Bikeway Feasibility Studies.

The Region of Peel's *Active Transportation Stud*y, recommends providing bicycle lanes on: Dixie Road, from Rometown Drive to Lakeshore Road, and Cawthra Road, from South Service Road to Lakeshore Road. IBI Group was retained to undertake the bikeway feasibility study for both these streets. The study is intended to build on the recommendations of the *Active Transportation Study* with additional site-specific conditions to determine the feasibility of implementation at a more detailed level not possible within a master plan. To date, the following tasks have been completed:

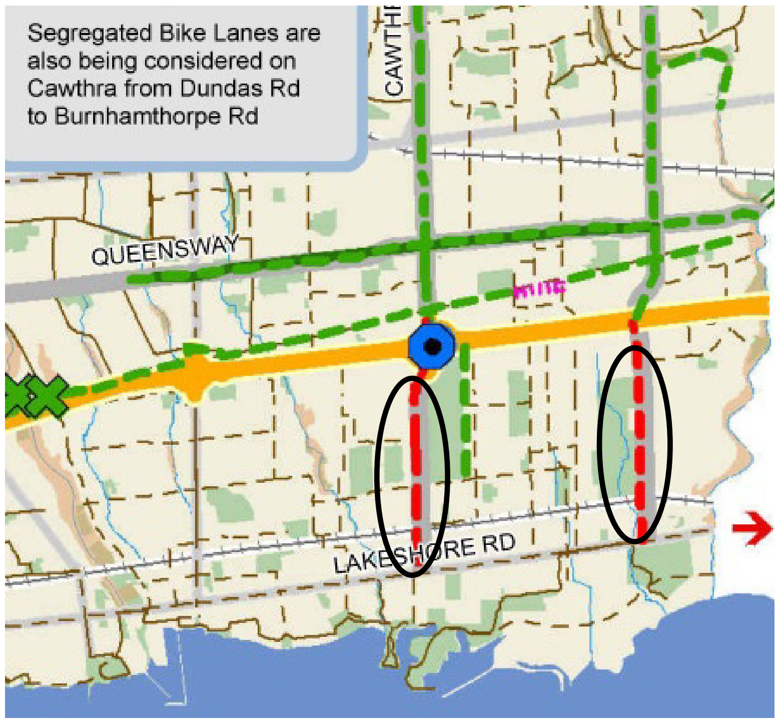
1. Review of site-specific conditions: site visit to verify conditions along the corridors; preparation of an annotated base map with site constraints; development of typical cross-sections to represent existing conditions.
2. Identification of bikeway implementation strategies: development of design criteria for road elements and cycling facilities based on relevant design guidelines and best practices associated with various implementation strategies; development of typical cross-sections for various strategies to accommodate cyclists; review of background information about the proposed QEW ramp at Dixie Road.

This memo documents the following items:

Existing conditions and Background Information

Exhibit 1 shows the proposed bike lanes on Dixie Road and Cawthra Road Proposed Long-term Regional Cycling Network in Mississauga as per the Region's *Active Transportation Study*.

Exhibit 1: Study Area



(Bike lanes are indicated by the dashed red lines. Solid lines indicate existing facilities. Green lines represent multi-use trails and brown lines represent the cycling network proposed by the City of Mississauga's Cycling Master Plan.)

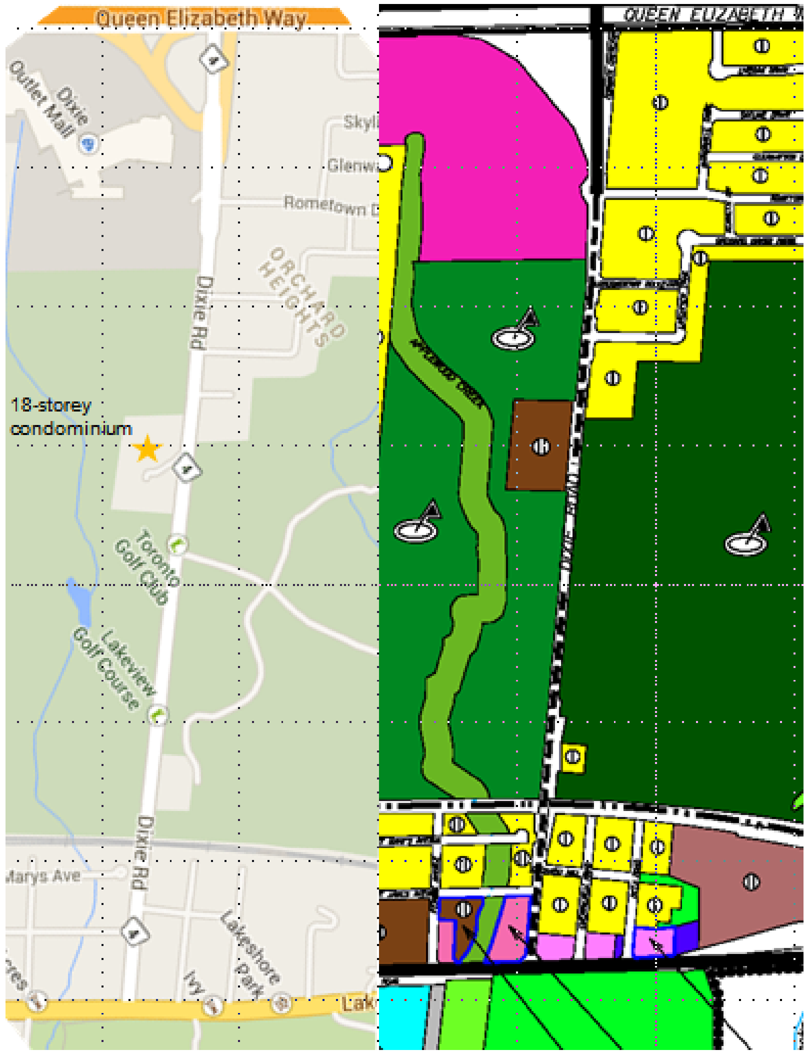
Attachment A is an annotated basemap of both corridors. It shows aerial imagery, delineation of the right-of-way and edge of pavement, and highlights some of the corridor constraints. **Attachment B** shows the typical cross-sections for both corridors. However, each corridor is described in the following sections.

Dixie Road

Dixie Road is a 4-lane within the Lakeview Community. Fronting the street are: a plaza mall; residential areas and two (2) golf courses. **Exhibit 2** shows the designated land use in the Lakeview Area Secondary Plan.

On the north end, the main driveway to the Dixie Outlet mall is situated on the west side opposite Rometown Road. On the east side, an established residential neighbourhood is comprised of roughly four (4) blocks. On the west side, an 18-storey condominium is located 150m south. Sidewalks are located on both sides from Rometown Drive to the condominium, then, the sidewalk continues only on the east side. Approximately 100m north of the CN bridge, the sidewalk recommences on the west side. On the south end past the CN bridge, residential properties front both sides of the street.

Exhibit 2: Dixie Road from Rometown Drive to Lakeshore Road



(Land use map: Yellow indicates low density residential. Brown indicated higher density residential. Green indicates open space and parkland. Pink indicates commercial uses.)

Exhibit 3 is a summary of the existing conditions throughout the corridor. The corridor can generally be divided into three general areas with typical cross-sections (see Attachment B):

Existing D.1. Rometown Dr to Larchview Trail, South of the CN underpass to Lakeshore Rd: this section is 4 lanes (pavement is 13.3m-13.5m wide) with standard sidewalks on both sides (curbface on the west) and a hydro corridor on the west side

Existing D.2. Larchview Trail to CN underpass: this section is 4 lanes (pavement is 13.3m-13.4m wide) with narrow sidewalks on east side only, a hydro corridor and an asphalt strip on the west side

Existing D.3. at CN underpass: this section is 4 lanes with (pavement is 13.4m wide) with a wider boulevard and railing to separate elevated sidewalks

Exhibit 3: Existing Conditions on Dixie Road

Existing Conditions Summary	
Planning Characteristics	
Major Road Network[1]	No
Region Road Character[2]	Suburban Connector
City Functional Road Class[3]	Regional Major Collector (Scenic Route)
Regional Cycling Network[4]	Proposed Bike Lanes (Implementation Strategy: new construction (e.g. road widening))
City Cycling Network[5]	Proposed Primary On-Road Route (Proposed Secondary Route on Rometown Dr)
Physical Characteristics	
Right-of-Way width[6]	20m
Midblock pavement width[7]	13.3m to 13.5m 15.0m at the CN underpass
Number of Lanes	4 lanes
Operating Conditions	
Posted Speed	60 km/h from Rometown Dr to CN bridge 50 km/h from CN bridge to Lakeshore Rd
Operating Speed (85h percentile)	70 km/h (slightly higher speed SB than NB, 72 km/h vs. 68 km/h)
Existing Annual Average Daily Traffic[8]	12,500 vpd (ATR indicate higher volumes NB than SB, 6,900vpd vpd 5,600)
Forecasted Annual Average Daily Traffic[8]	15,100 vpd** (if volume characteristics remain the same, higher volumes are forecasted for NB than SB, 8,300 vph 6,800 vph)
Good Movement Strategy	Not identified in Truck Network (Primary Truck Network north of the QEW)
Truck Restrictions	No restrictions
Percent Trucks	5% (TMC data indicate slight higher percent of trucks traveling SB than NB, 7% vs. 3%)

References:

1. Schedule E: Major Road Network, Region of Peel Official Plan (2012)
2 Figure 5.0 Road Character Map, Region of Peel Road Characterization Study (2013)
3. Schedule 5: Long Term Road Network, City of Mississauga Official Plan (2010)
4. Map 10c Proposed Long-Term Regional Cycling Network, Region of Peel Active Transportation Study (2011)
5. Map 5-4 Proposed Mississauga Cycling Route Network (2010)
6. Schedule F: Regional Road Mid-Block Right-of-Way Requirements, Region of Peel Official Plan (2012)
   Schedule 8 Designated Right-of-Way Widths, City of Mississauga Official Plan (2010)
7. Measured on site
8. Existing volume based on automatic traffic recorder volumes in 2012, forecast assumes 1% growth per year** **growth rate assumptions to be confirmed by Peel Region**

Key constraints on the Dixie Road corridor (as identified in the annotated basemap) are:

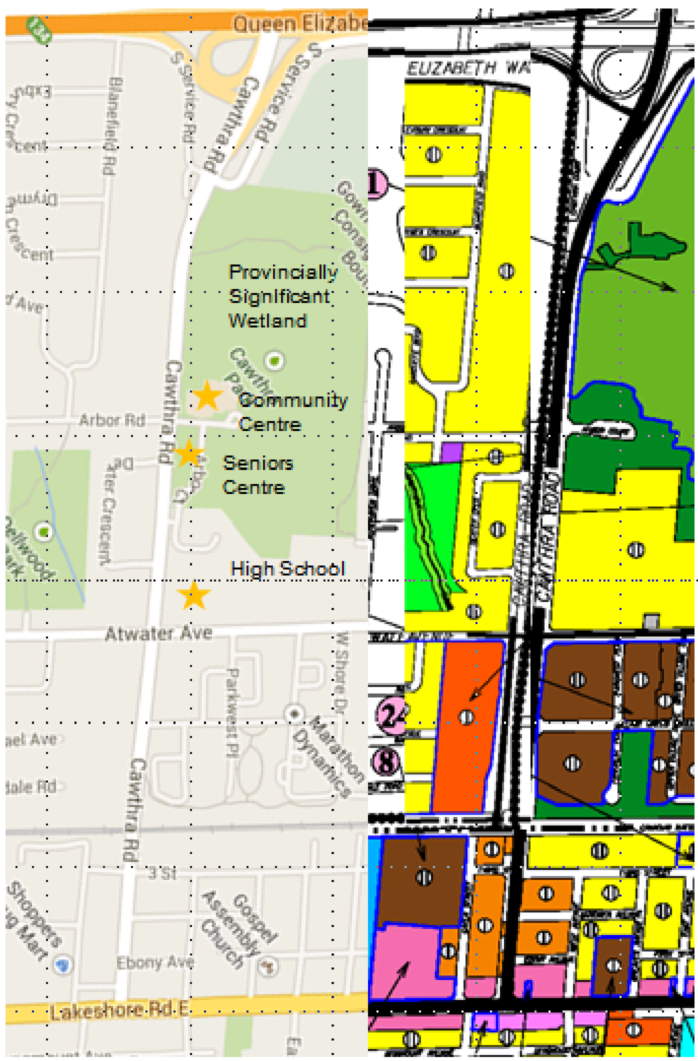
- Residential driveways on the west side from Rometown Dr to Larchview, and both side south of the CN underpass
- Hydro corridor on the west side throughout
- Scenic character by the presence of many trees within the right-of-way
- CN bridge underpass
- Need to accommodate a high volume of left-turns from Dixie Rd to Lakeshore Rd

Cawthra Road

Cawthra Road is a 5-lane road situated on the boundary between the Lakeview Community and the Mineola Community. Fronting the street are: multiple residential properties, a provincially significant wetland and multiple community destinations. **Exhibit 2** shows the designated land use in the Lakeview Area Secondary Plan.

On the north end, multiple residential driveways are located on the west side opposite Cawthra Park with a heritage building located on the grounds. From Arbor Rd to Atwater Ave, there is a community centre, a senior's centre and a high school. South of the CN underpass, residential properties front both sides of the street. Sidewalks are located on both sides throughout the corridor with varying widths in the boulevard with trees and a hydro trail on the west side.

Exhibit 4: Dixie Road from Rometown Drive to Lakeshore Road



(Land use map: Yellow indicates low-density residential. Orange indicates medium density. Brown indicated high density residential. Green indicates open space and parkland. Pink indicates commercial uses. Red indicates a mixed use area.)

Exhibit 5 is a summary of the existing conditions throughout the corridor.

Exhibit 5: Existing Conditions on Dixie Road

Existing Conditions Summary	
Planning Characteristics	
Major Road Network[1]	Yes
Region Road Character[2]	Suburban Connector
City Functional Road Class[3]	Regional Arterial
Regional Cycling Network[4]	Proposed Bike Lanes (Implementation Strategy: retrofit bike lanes (e.g. potential restriping)
City Cycling Network[5]	Proposed Primary On-Road Route (Proposed Secondary Route on South Service Rd, Arbor Rd, Atwater Ave and Existing multi-use trail on west side north of CN underpass)
Physical Characteristics	
Right-of-Way width[6]	36m
Midblock pavement width[7]	18.3m to 18.5m 20.9m at the CN underpass (including median)
Number of Lanes	5 lanes (4 general purpose lanes, 1 median lane)
Operating Conditions	
Posted Speed	50 km/h throughout
Operating Speed (85h percentile)	67 km/h
Existing Annual Average Daily Traffic[8]	22,500 vpd (TMC data indicate significant reduction in volumes from South Service Rd, to south of Atwater Rd and to Lakeshore Rd: 33,400 vph to 18,600 vpd and 8,200 vpd)
Forecasted Annual Average Daily Traffic[8]	27,200 vpd (if volume characteristics remain the same, lower volumes are forecasted south of Atwater Rd and at Lakeshore Rd: 22,500 vpd and 9,900)
Good Movement Strategy	Not identified in Truck Network (Primary Truck Network north of the QEW)
Truck Restrictions	No trucks from 7pm to 7am
Percent Trucks	4%

References:

1. Schedule E: Major Road Network, Region of Peel Official Plan (2012)
2 Figure 5.0 Road Character Map, Region of Peel Road Characterization Study (2013)
3. Schedule 5: Long Term Road Network, City of Mississauga Official Plan (2010)
4. Map 10c Proposed Long-Term Regional Cycling Network, Region of Peel Active Transportation Study (2011)
5. Map 5-4 Proposed Mississauga Cycling Route Network (2010)
7. Schedule F: Regional Road Mid-Block Right-of-Way Requirements, Region of Peel Official Plan (2012)
   Schedule 8 Designated Right-of-Way Widths, City of Mississauga Official Plan (2010)
7. Measured on site
8. Existing volume based on automatic traffic recorder volumes in 2012, forecast assumes 1% growth per year

The corridor can generally be divided into three general areas with typical cross-sections (see Attachment B):

Existing C.1. South Service Rd to CN underpass, South of the CN underpass to Lakeshore Rd: this section is 4 lanes plus a median TWLTL (pavement is 18.3m-18.5m wide) with standard sidewalks on both sides, varying boulevard widths and a hydro corridor on the west side

Existing C.2. at Atwater Ave: this section is 4 through lanes with a divided left-turn lane and a bus bay with rolled curb and standard sidewalks on both sides

Existing C.3. at CN underpass: this section is 4 lanes (pavement is 7.4m wide on each side) with a raised median (5.1m including curb and gutter) to provide space of structural support of the bridge, and a wider boulevard and railing to separate elevated sidewalks

Key constraints on the Cawthra Road corridor (as identified in the annotated basemap) are:

- Provincially significant wetland on the west side, from South Service Rd to Arbor St
- Residential driveways on the west side from South Service Rd to the CN underpass, and both sides south of the CN underpass
- Hydro corridor on the west side throughout
- Community centre, seniors' centre and high school located on north west block of Cawthra Rd and Atwater Ave (with a high volume of pedestrians and transit users)
- Observed sidewalk cycling on east sidewalk from South Service Rd to Atwater Ave
- Heavy volume of traffic north of Atwater Ave restricts opportunity to remove a travel lane
- Need to accommodate connectivity to proposed cycling facility north of the QEW as per Cawthra Road Pre-EA study
- Need to accommodate a high volume of left-turns from Cawthra Rd to Lakeshore Rd

Relevant plans and other studies

Below is a summary of other projects, studies and plans that are relevant to this study:

1. Cawthra Road Pre-EA study[1]: Peel Region is currently undergoing a study to assess the operational capacity and needs, on Cawthra Road from the QEW to Highway 403, for all modes of transportations. The purpose of the study is to identify technical feasible alternatives prior to an Environmental Assessment process, to improve the corridor under existing conditions and in the long-term for pedestrians, cyclists, transit users and motorists. Existing active transportation facilities have been identified as part of the study, including planned facilities as part of the Hanlan Feedermain Project. **Immediately north of the QEW, there are currently no existing cycling facilities. Preliminary recommendations include widening to six (6) lanes and a multi-use trail on the west side. As part of the bikeway feasibility studies, IBI Group will recommend a preferred strategy and Municipal Class EA Schedule. This strategy may consider a combined EA for Cawthra Road from Eastgate Pkwy to Lakeshore Rd.**
2. Hanlan Feedermain Project[2]: In 2011, Peel Region started construction of its largest and most extensive watermain project that connects from Lakeview Water Treatment Plant on Lake Ontario to the Hanlan Reservoir and Pumping Station on Tomken Rd and Britannia Rd. It is comprised of the installation of the Hanlan Feedermain along Dixie Rd (Eastgate Pkwy to Lakeshore Rd) and the Mississauga City Centre Subtransmission Watermain along Cawthra Road (Eastgate Pkwy to Burnhamthorpe Rd). Construction will be completed in

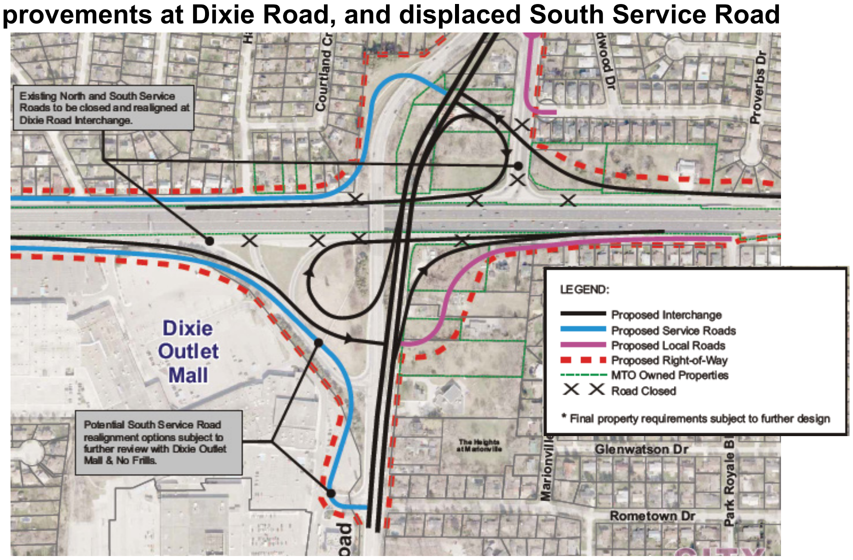
[1] Draft Multi-Modal Transportation Report for the Cawthra Road Pre-EA (QEW to Hwy 403 / Eastgate Parkway) prepared by IBI Group for the Region of Peel, dated January 20, 2014

[2] Hanlan Water Project website at <http://www.peelregion.ca/pw/water/hanlan-water/> Accessed on March 24, 2014.

2016. **As part of the project, multi-use trails will be built on the east side of Cawthra Rd, north of Burnhamthorpe Rd. On Dixie Rd, a multi-use trail will be built in the west side from Hickory Dr to Kendall Rd (or approximately one (1) block south of Eastgate Pkwy to four (4) blocks north of the QEW.)**

3. QEW Improvements from Evans Avenue to Cawthra Road[3]: In early 2012, MTO initiated a preliminary design and Class EA for this section of the expressway. Project completion is anticipated for the fall of this year. To date, the project has proposed a reconfiguration of the interchange at Dixie Road including relocation of both South Service Road and North Service Road. The technically preferred alternative (shown on **Exhibit 6**) is a Parclo A4 configuration south of the QEW and a Parclo A2 to the north. The existing South Service Road is proposed to be realigned to intersect with the south ramp terminal. **As per the study timeline, the study team is undergoing preliminary design with a schedule deadline in Spring 2014. As part of the bikeway feasibility studies, IBI Group will review the connectivity of the QEW ramp at Dixie Road and provide input to the MTO study.**

Exhibit 6: Technically Preferred Alternative for QEW Interchange Improvements at Dixie Road, and displaced South Service Road



4. Inspiration Lakeview[4]: In October 2010, the City of Mississauga initiated Inspiration Lakeview, an initiative between the City, the Province and Ontario Power Generation to develop a shared vision for Lakeview Waterfront. The lands are located south of Lakeshore Rd, between Cawthra Rd, Dixie Rd and the waterfront. In March 2014, the study team hosted a community workshop to help develop a framework for a Master Plan. Completion of the plan is anticipated for the end of June 2014. To date, the Vision for the plan is based on (8) core principles. **Among the principles of the plan are accessible public space, a**

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[3] Display panels for Public Information Centre #2 for the QEW Improvements from Evans Avenue to Cawthra Road, Preliminary Design and Class Environmental Assessment Study, on October 24, 2013 Available at: <http://qewdixieea.ca/wp-content/uploads/2013/10/3211155-PIC-2-Text-Displays-Oct-25.pdf>. Accessed on March 24, 2014.

[4] Inspiration Lakeview Community Update on November 27, 2013. Available at: < http://www5.mississauga.ca/marketing/websites/lakeview/downloads/2013-11-27-slides.pdf> . Accessed on March 24, 2014

sustainable community, and well-connected including options to walk, bike, take transit and drive.

5. Lakeview Local Area Plan[5]: The City of Mississauga is currently updating the Lakeview Local Area Plan (LAP) included in its Official Plan. The Draft LAP is anticipated to be completed in early 2014. **To date, the draft LAP proposes a Transportation Master Plan (TMP) for Lakeshore Rd throughout the City. The proposed TMP may also involve improvement to the road network and higher-order transit needs in the Lakeview Area, which is generally contained within Lakeshore Rd and the Queensway, from Cawthra Rd to the east boundary of the city.**

6. Lakeshore Road Transportation Review Study[6]: In 2010, the City of Mississauga completed this review study to provide a comprehensive and technical transportation review to identify how the Lakeshore Road can accommodate alternative modes of transportation. The review served as input for the development of the local area plans for Lakeview and Port Credit. **The review ultimately proposed bike lanes on Lakeshore Road throughout the City over the long-term that will impact on-street parking. Near Cawthra Road (from Broadview Ave to Greaves Ave), a wide curb lane with sharrow is proposed over the short-term given the narrow right-of-way. Near Dixie Rd, the proposed bike lane requires widening on both sides of the road.**

7. The Big Move: In 2008, Metrolinx released its Regional Transportation Plan for the Greater Toronto and Hamilton Area. In the Big Move, ten (10) strategies and nine (9) priority actions, also known as the "Big Moves". Among these recommendations are: build a comprehensive rapid transit network, build communities that are pedestrian, cycling and transit supportive; complete walking and cycling network with bike sharing programs. **Near the study area, rapid transit is proposed on a route titled "Waterfront West (27)", which connects Port Credit to Union Station. It is anticipated that Lakeshore Road will serve as this higher-order transit corridor from Hurontario St to the east boundary of the City.**

8. Strategic Goods Movement Network Study[7]: In 2013, Peel Region completed its Strategic Goods Movement Network Study. The objective of the study was to develop a systematic hierarchical truck route network throughout Peel. **The study recognizes that the efficient flow of goods on Regional Roads is important to the economies of both the Region and the Province. However both Cawthra Rd and Dixie Rd, south of the QEW are *not* identified as part of the truck route network.**

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[5] Reported by the Transportation and Work Department at the City of Mississauga, December 17, 2013

[6] Executive Summary of the Lakeshore Road Transportation Review Study (background report to the Draft Port Credit Local Area Plan), completed December 2010. Available at <http://www6.mississauga.ca/onlinemaps/planbldg/LakeviewPortCredit/DraftPCRLocalAreaPlanAppendix2LakeshoreRoadTransportationReview.pdf>. Accessed on March 24, 2014

[7] Final Technical Report for the Strategic Goods Movement Network Study, dated April 25, 2013. Available at <http://www.peelregion.ca/pw/transportation/goodsmovement/pdf/peel-final-technical-report.pdf>. Accessed on March 24, 2014

Proposed Design Criteria

Several references were considered during the development of the design criteria. These references included the existing conditions, the design guidelines listed below, and research of best practices throughout North America.

- Peel Road Characterisation Study (2012)
- Region of Peel Active Transportation Study: Chapter 8 Active Transportation Facilities Reference Guide
- Ontario Traffic Manual (OTM) Book 18: Bicycle Facilities (2013)
- Transportation Association of Canada (TAC) Geometric Design Guidelines for Canadian Roads (1999): Chapter 3.4 Bikeways
- American Association for State Highway and Transportation Officials (AASHTO) Guide

Separate design criteria are proposed for Dixie Road and Cawthra Road. The separation is required to address different road characteristics and the potential for different implementation strategies. **Exhibit 7** is the proposed design criteria for Dixie Road. **Exhibit 8** is the proposed design criteria for Cawthra Road.

Exhibit 7: Design Criteria for Dixie Road

DIXIE Road Characteristics			
Function	Minor Arterial, Scenic Route, Trucks permitted all-day		
Posted Speed	50 km/h south of the CN bridge 60 km/h north of the CN bridge		
Existing Volumes	8,000 to 12,500 vehicles per day		
Forecasted Volumes	10,000 to 15,000 vehicles per day		
% Trucks	3 to 8%		
Road Element	**Existing Width**	**Minimum Width**	**Desirable Width**
General purpose lane	3.1-3.7 m (excluding gutter)	3.35 m (excluding gutter)	3.5 m (excluding gutter)
Two-way left-turn lane	-	3.5m	3.5m
Auxiliary turn lane	3.0 m	3.0 m	3.25 m (divided) 3.3 m (undivided)
Bike lanes	-	1.5 m	1.8 m
Buffered bike lanes	-	1.5 m bike lane + 0.5 m painted buffer	1.5m bike lane + 1.0 m painted buffer

Exhibit 8: Design Criteria for Cawthra Road

CAWTHRA Road Characteristics			
Function	Minor Arterial, Bus Route (north of Atwater), Trucks restricted after 7pm to 7am		
Posted Speed	50 km/h		
Existing Volumes	18,500 to 33,500 vehicles per day north of Atwater 10,500 to 15,500 vehicles per day south of Atwater		
Forecasted Volumes	22,500 to 40,500 vehicles per day north of Atwater 12,500 to 18,500 vehicles per day south of Atwater		
% Trucks	3 to 5%		
Road Element	**Existing Width**	**Minimum Width**	**Desirable Width**
General purpose lane	3.45 - 3.6 m (excluding gutter)	3.3 m (inside lane) 3.35m (curb lane excluding gutter)	3.5 m (excluding gutter)
Two-way left-turn lane	3.0 - 3.65 m	3.5m	3.5m
Auxiliary turn lane	3.0 - 3.65 m	3.0 m	3.25 m (divided) 3.3 m (undivided) 3.5 m (dual left)
Bike lanes	-	1.5 m	1.8 m
Buffered bike lanes	-	1.5 m bike lane + 0.5 m painted buffer	1.5m bike lane + 1.0 m painted buffer
Segregated bike lanes	-	1.5 m bike lane + 0.5 m separator	2.0 m bike lane + 0.5 m separator
Multi-use trail	-	3.0 m	3.5 - 5.0 m
Sidewalk	-	1.5m 1.8m (curbface)	1.8m

Project Team Meeting No. 1

The first project team meeting was held on December 13, 2013. The purpose of the meeting was to introduce the study, review existing conditions and discuss design criteria and preliminary options. Participants represented several departments from both the Region and the City of Mississauga:

- Sustainable Transportation, Peel Transportation Division
- Traffic Operation, Peel Transportation Division
- Cycling Office, City of Mississauga
- Transportation and Works, City of Mississauga
- Infrastructure Planning and Design, Peel Transportation Division
- Pre-EA Study on Cawthra Road, Burnhamthorpe Road to North Service Road

The project team was presented with background information as discussed in the *Existing Conditions* and *Proposed Design Criteria* Sections. Based on this information, preliminary options were also discussed with the project team; however, the alternative strategies are presented in more details in the following section.

For Dixie Road, preliminary options include the reconfiguration of the road from 4 lanes to 3 lanes with bike lanes or buffered bike lanes. Representatives from the City expressed the need to recognize the heritage and scenic character of the corridor. Traffic Operations proposed the consideration of a roundabout design to accommodate.

For Cawthra Road, preliminary options include widening of the road to add bike lanes, buffered bike lanes or segregated bike lanes (i.e. cycle tracks). North of Atwater Road, another preliminary option was the replacement of the sidewalk on the east side with a multi-use trail, provided that an safe crossing treatment can be provided to transition cyclists to on-road facilities south of Atwater Road. Participants expressed a need to integrate the bikeway implementation strategies with cycling facilities proposed north of the QEW as per the Cawthra Road Pre-EA study.

For both corridors, participants discussed anticipated growth and development in south Mississauga, and its impact to the travel forecast assumptions. Staff from Infrastructure Planning and Design shared finding from a preliminary analysis of trip pattern in south Mississauga. Participants also raised the issue of snow storage, goods movement, minimum widths in the design criteria, and requirements as per the Municipal Class Environmental Assessment (EA) process.

Alternative Implementation Strategies

Attachment C provides cross-sections for the alternative implementation strategies listed below. Three types of cross-section are shown:

- Existing: shows existing widths measured on site
- Desirable: shows ideal widths based on proposed design criteria
- Recommended: shows recommended widths based on site context

Dixie Road

The recommended implementation strategy is to reconfigure the road from 4 lanes to 3 lanes, when the road is resurfaced, to accommodate bike lanes. Four (4) cross-sections are provided in Attachment C.

D.1. Midblock: bike lanes on both sides with two general purpose lanes and median travel lane

D.2. at CN underpass: buffered bike lanes on both sides with two general purpose lanes and a painted median

D.3. at Rometown Dr: narrow bike lanes if on-street facilities existing north of Rometown Rd OR bike lanes dropped as approaching intersection if no on-street facility exists north of Rometown Rd

D.4. at Lakeshore Rd: bike lanes with two general purpose lanes and auxiliary left-turn lanes for southbound traffic

Cawthra Road

No recommendations are provided yet for Cawthra Rd. Several site-specific constraints will impact the feasibility and advantages of the alternative strategies. Discussion with the project team is critical to assessing the constraints and alternatives. Six (6) cross-sections are provided in Attachment C.

C.1. Midblock (South Serve Rd to Atwater Ave): alternative strategies include widening for bike lanes, buffered bike lanes or segregated bike lanes; or replacing sidewalk on east side with multi-use trail

> Site specific constraint: feasibility of the multi-use trail option will depend on a transition from off-road to on-road facilities at Atwater Ave

C.2. Midblock (Atwater Ave to CN underpass): alternative strategies include widening or reconfiguring from 5 to 4 lanes to accommodate bike lanes, buffered bike lanes or segregated bike lanes

C.3. Midblock (CN underpass to Lakeshore Rd): alternative strategies include widening or reconfiguring from 5 to 4 lanes to accommodate bike lanes, buffered bike lanes or segregated bike lanes

C.4. at CN underpass: alternative strategies include allowing cycling on the sidewalk or reconfiguring from 4 to 2 lanes to accommodate bike lanes, buffered bike lanes or segregated bike lanes

> Site-specific constraint: bridge support structure located on 5.1m wide raised median; it is assumed that feasible strategies do not impact existing median

C.5. at Atwater Ave: alternative strategies include widenomg for bike lanes, buffered bike lanes or segregated bike lanes; or replacing sidewalk on east side with multi-use trail

Site-specific constraint: bus bay and transit shelter on east side must be appropriate relocated

C.6. at Lakeshore Rd: alternative strategies include widening or reconfiguring from 5 to 4 lanes (including an auxiliary left-turn lane) to accommodate bike lanes, buffered bike lanes or segregated bike lanes

Remaining Tasks and Next Steps

1. Confirm traffic growth assumptions for Dixie Road
2. Meet with the project team to solicit feedback and discuss advantages and impacts of each strategy (in a second project team meeting)
3. Confirm the recommended implementation strategy for both corridors
4. Confirm proposed design of the QEW ramp at Dixie Road and provide input to MTO regarding connectivity to the proposed cycling facilities across the Dixie Rd interchange
5. Confirm the municipal Class EA Schedule for the recommended strategy
6. If additional scope of work is approved, review the traffic operations analysis for Dixie Rd at Rometown Rd and Lakeshore Rd for the existing, future and road reconfiguration conditions
7. Recommend outstanding issues to be considered in subsequent studies or design assignments

Attachments

Attachment A: Annotated basemap of existing conditions

Attachment B: Typical cross-section of existing conditions

Attachment C: Alternative Implementation Strategies

C

Traffic Safety Report

Traffic Safety Report

IBI Group
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Memorandum

To/Attention	Allan Ortlieb	**Date**	December 10, 2013 *Revision 1*
From	Matt Colwill	**Project No**	35245
cc	IBI Group	**Steno**	ar
Subject	**Cawthra Road Pre-EA - Safety Review**		

Safety Review

This memorandum presents a review of traffic safety along the Cawthra Road corridor between Eastgate Parkway/Highway 403 and the QEW South Service Road. The Region of Peel provided historical collision data for the study area, summarizing the reported intersection and midblock collisions along the corridor for the five-year period from January 1, 2008 through December 31, 2012.

Along with the collision data, vehicle speed, counts and classification data were provided for consideration as part of the safety review. The speed, volume and classification data were collected on September 10, 11 and 12, 2012 at the following six locations:

i. 100 m north of Arbor Street;

ii. 100 m north of Tedwyn Drive;

iii. 200 m north of Queensway East;

iv. 500 m north of Silver Creek Boulevard;

v. 200 m north of Bloor Street; and

vi. 1000 m north of Burnhamthorpe Road.

Safety performance analysis was provided for an earlier study period spanning from 2005 to 2009. This information provided a benchmark upon which the observed collision history for the current analysis period could be compared.

Analysis and findings related to the collision and speed data are presented in the following sections.

Overall Collision Analysis

Over the five-year analysis period, a total of 1007 reported collisions[1] were reviewed. **Exhibit 1** illustrates the annual distribution of collisions over the analysis period, with a mean of 201 collisions per year.

[1] Out of a total of 1051 collision reports provided. Of these 1051 reports, 41 reports were discarded as they referred to incorrectly filed collisions occurring outside the Cawthra Road corridor, and 3 reports contained insufficient collision information for analysis purposes.

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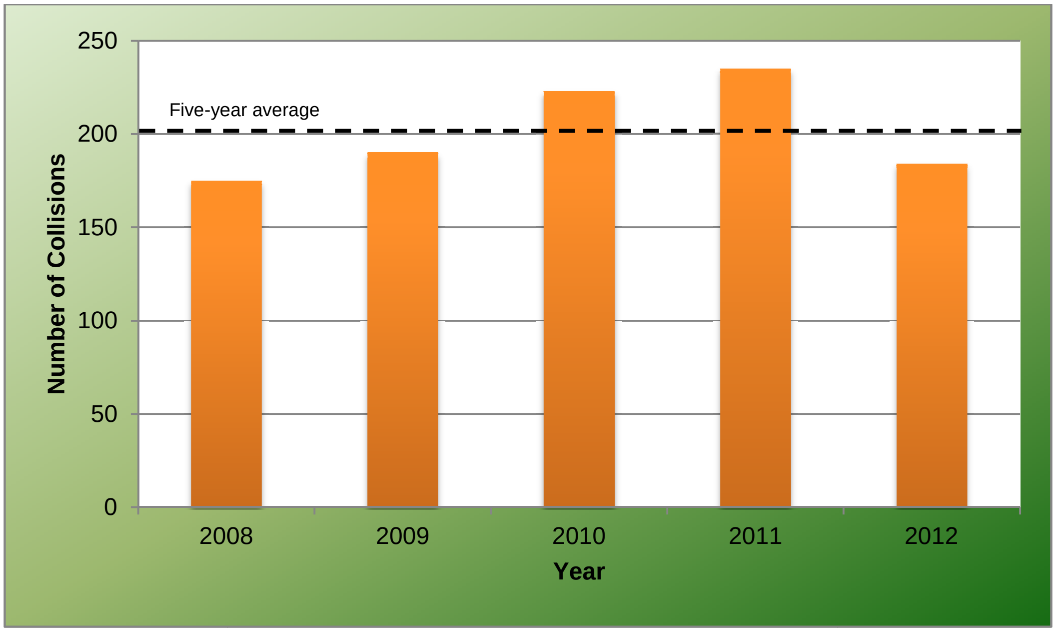
Exhibit 1: Five-year Collision Distribution

Year	2008	2009	2010	2011	2012	Total
Collisions	175	190	223	235	184	1007



Collision data obtained by IBI Group included all signalized intersections and midblock segments along Cawthra Road within the study area. There were no reported collisions the following intersections:

- Intersection of Schomberg Avenue and Cawthra Road;
- Midblock between Hyacinthe Boulevard and Schomberg Avenue;
- Midblock between Queensway East and Melton Drive; and
- Midblock between Melton Drive and Tedwyn Drive.

Exhibit 2 displays the distribution of collisions along Cawthra Road, divided into midblock and intersection collisions. It shows that most of the collisions (890 of 1007) occurred at or near intersections, particularly the intersections at Eastgate Parkway, Bloor Street, Queensway East, North Service Road and South Service Road. The remaining 117 collisions occurred between intersections. Two notable midblock locations were 3643 Cawthra Road, a plaza driveway immediately south of Burnhamthorpe Road East, where 16 collisions occurred, and 655 Queensway East (with access from Cawthra Road immediately north of Queensway East), a commercial driveway, with 35 collisions reported in the five-year study period.

Analysis of each notable intersection and midblock segment is provided later in this memorandum.

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Exhibit 2: Distribution of Collisions along Cawthra Road Corridor

Intersection	Collision Frequency	Midblock	Collision Frequency
Eastgate Parkway/Highway 403	128	Eastgate Parkway/Highway 403 and Meadows Blvd	2
Meadows Blvd	17	Meadows Blvd and Rathburn Road	9
Rathburn Road	37	Rathburn Road and Burnhamthorpe Road East	6
Burnhamthorpe Road East	169	Burnhamthorpe Road and Hassall Road	16
Hassall Road	2	Hassall Road and Runningbrook Drive	2
Runningbrook Drive	7	Runningbrook Drive and Breckenridge Road	1
Breckenridge Road	5	Breckenridge Road and Hyacinthe Blvd	1
Hyacinthe Blvd	1	Hyacinthe Blvd and Schomberg Avenue	0
Schomberg Avenue	0	Schomberg Avenue and Bloor Street	6
Bloor Street	84	Bloor Street and Santee Gate	2
Santee Gate	6	Santee Gate and Silver Creek Blvd	4
Silver Creek Blvd	36	Silver Creek Blvd and Dundas Street Ramp	3
Dundas Street Ramp	37	Dundas Street Ramp and Needham Lane	3
Needham Lane	8	Needham Lane and Orwell Street	7
Orwell Street	16	Orwell Street and Queensway East	45
Queensway East	123	Queensway East and Melton Drive	0
Melton Drive	9	Melton Drive and Tedwyn Drive	0
Tedwyn Drive	23	Tedwyn Drive and North Service Road	3
North Service Road	61	North Service Road and QEW Westbound Ramp	1
QEW Westbound Ramp	11	QEW Westbound Ramp and QEW Eastbound Ramp	3
QEW Eastbound Ramp	34	QEW Eastbound Ramp and South Service Road	3
South Service Road	76		

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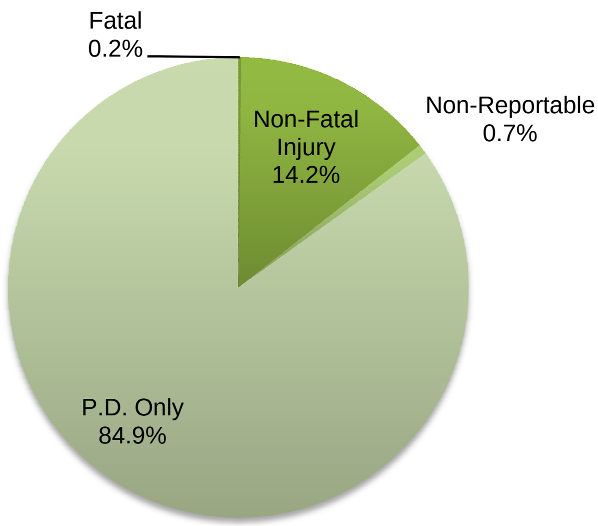
Collision Classification

Exhibit 3 presents a distribution of collisions based on severity. As regional collision distributions were not available for comparison, an analysis of collision over-representation could not be performed. However, as anticipated, the collisions were primarily classified as property damage only (P.D. Only). Non-fatal injury collisions (143) largely resulted from rear end (53) and turning movement (53) collisions. Two fatal collisions occurred along the corridor between 2008 and 2012, both of which were at intersections. These are discussed within the analysis for the intersections at Bloor Street and at the westbound QEW ramp.

Exhibit 3: Corridor Collision Distribution by Severity

Fatal	Non-Fatal Injury	Non-Reportable	P.D. Only
2	143	7	855



Initial Impact Type

Exhibit 4 shows the distribution of collisions by initial impact type. The dominant collision type along Cawthra Road, as anticipated of an urban commuter corridor, is rear-end collisions (45%); these are concentrated at the intersections (408 of 451 rear-end collisions), and generally occurred during periods of higher traffic demand. Rear-end collisions tended to be more common at intersections with significant queuing.

After rear-end collisions, the next most common impact type along the corridor was found to be turning movement collisions. This collision type is also concentrated at the corridor intersections, and is also likely to be influenced by traffic congestion. As gaps between vehicles become smaller and less frequent, and delays increase, drivers will tend to attempt more aggressive turning movements, and turning collisions subsequently tend to increase in frequency. Turning movement collisions represent approximately 33% of all collisions along the corridor, with a significant number reported at the intersections of Cawthra Road at Queensway East and Cawthra Road at Burnhamthorpe Road East, as discussed later within the intersection analysis.

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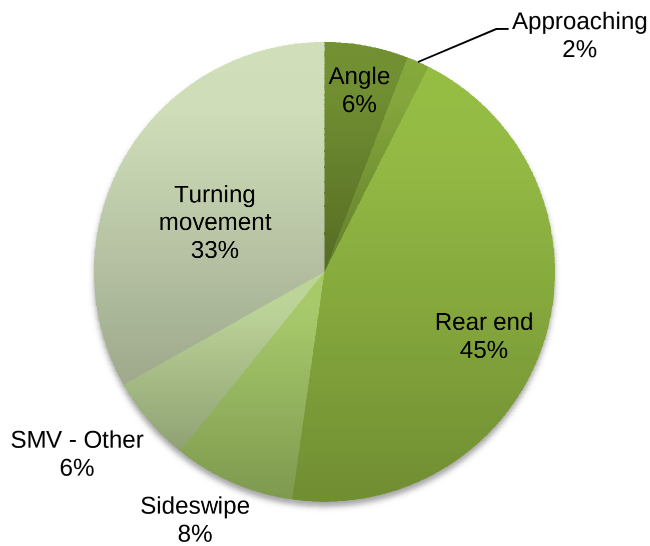
Exhibit 4: Corridor Collision Distribution by Initial Impact Type

Angle	Approaching	Rear end	Sideswipe	SMV Other	Turning
59	16	451	86	61	334



Time of Collision

Exhibit 5 shows the collision distribution for the corridor based on time-of-day. The data indicates that the vast majority of the collisions (775 of 1007) occurred between the hours of 7:00 AM and 7:00 PM. This information reinforces the observation that many of the collisions are a product of heavy congestion, as observed by the collision spikes associated with the AM (7:00 AM-10:00 AM) and PM (3:00 PM-7:00 PM) peak periods. The results further reinforce the connection between congestion and rear-end and turning vehicle collisions. These observations are most pronounced during the PM peak period, as approximately one third of all collisions occur between 3:00 PM and 7:00 PM.

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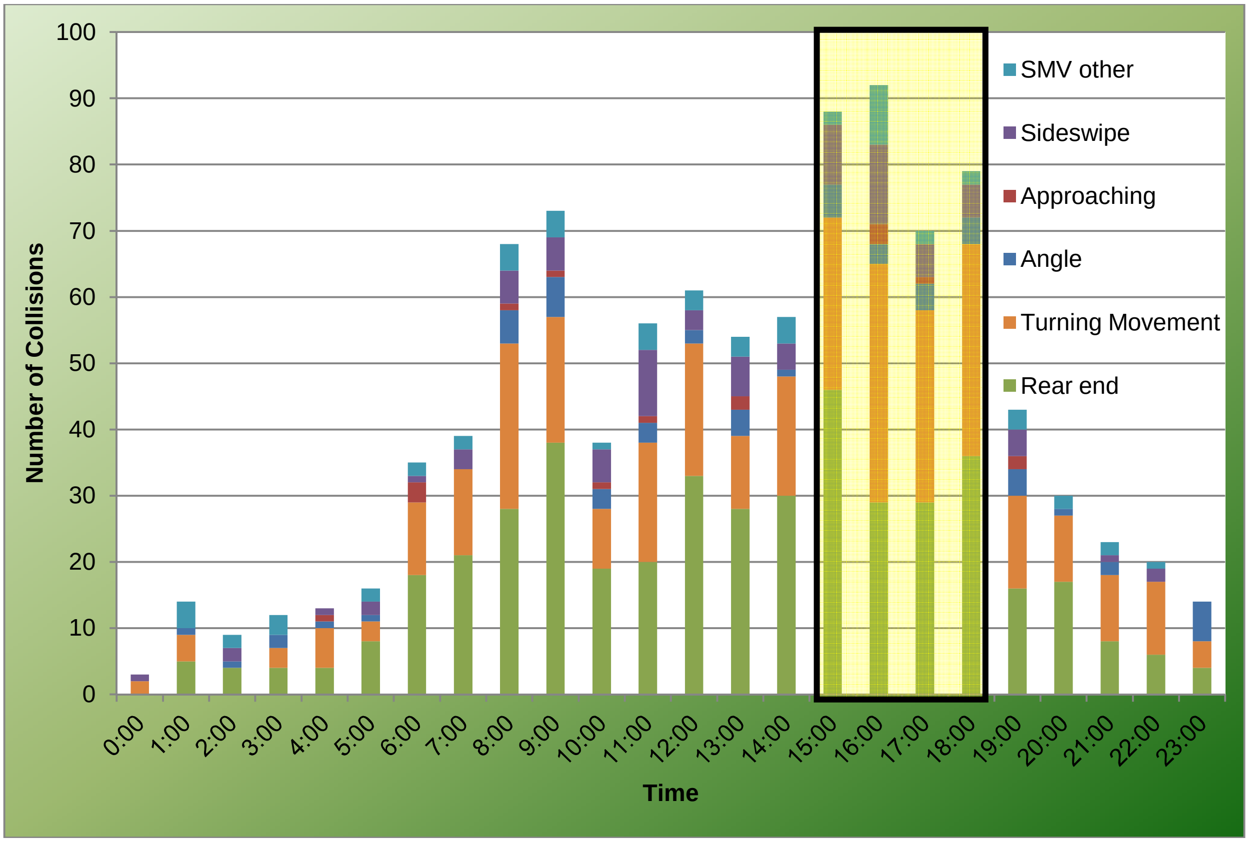
Exhibit 5: Hourly Collision Frequency by Type



Road and Weather Conditions

An analysis of road and weather conditions was conducted for all collisions, and the results suggest that weather, in addition to congestion, may be a contributing factor in the safety performance of the corridor. **Exhibit 6** shows the collision distribution under various road surface conditions, while **Exhibit 7** indicates the reported weather conditions at the time of collision.

It was found that approximately 30% of the reported collisions occurred under compromised (e.g., wet, icy, slushy, snow-covered, etc.) road surface conditions, and approximately 20% of collisions occurred during inclement weather. There was a higher representation of single vehicle collisions related to loss of control during periods of poor road and weather conditions. These trends were particularly pronounced at the North and South Service Roads of the QEW, where sharp curves and speeds on intersection approaches were found to be a factor in the collision history. Further analysis is provided for each of these intersections.

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Exhibit 6: Collision Frequency by Road Surface Condition

Dry	Loose Snow	Ice	Other	Packed Snow	Slush	Wet
719	22	10	11	4	13	228

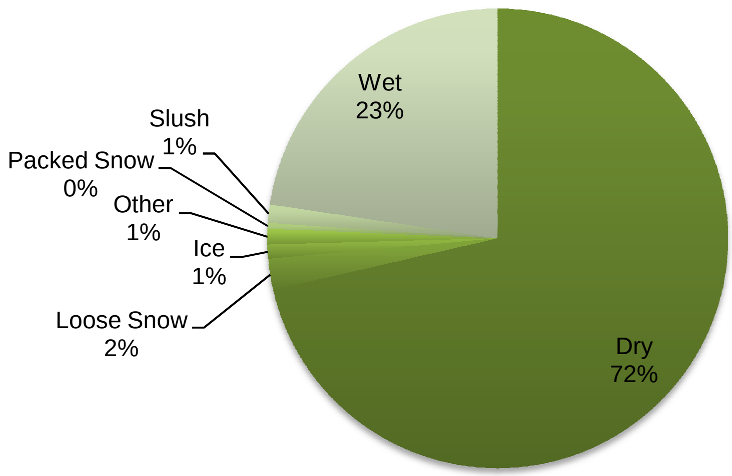
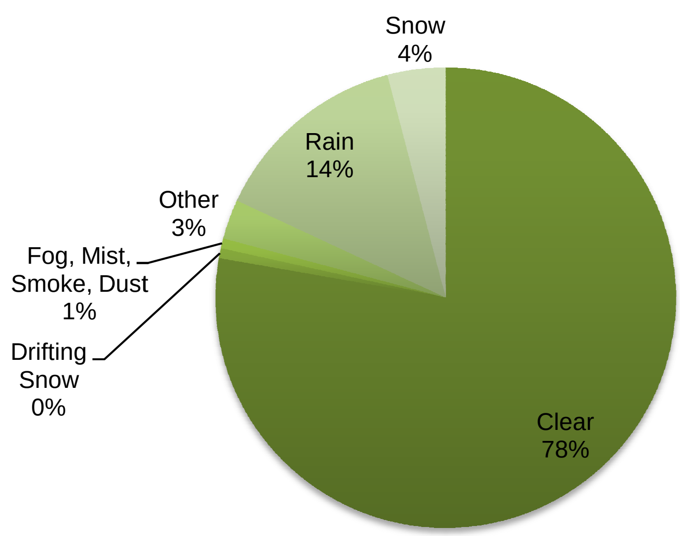


Exhibit 7: Collision Frequency by Weather Conditions

Clear	Drifting Snow	Fog, Mist, Smoke, Dust	Other	Rain	Snow
783	7	7	28	141	41



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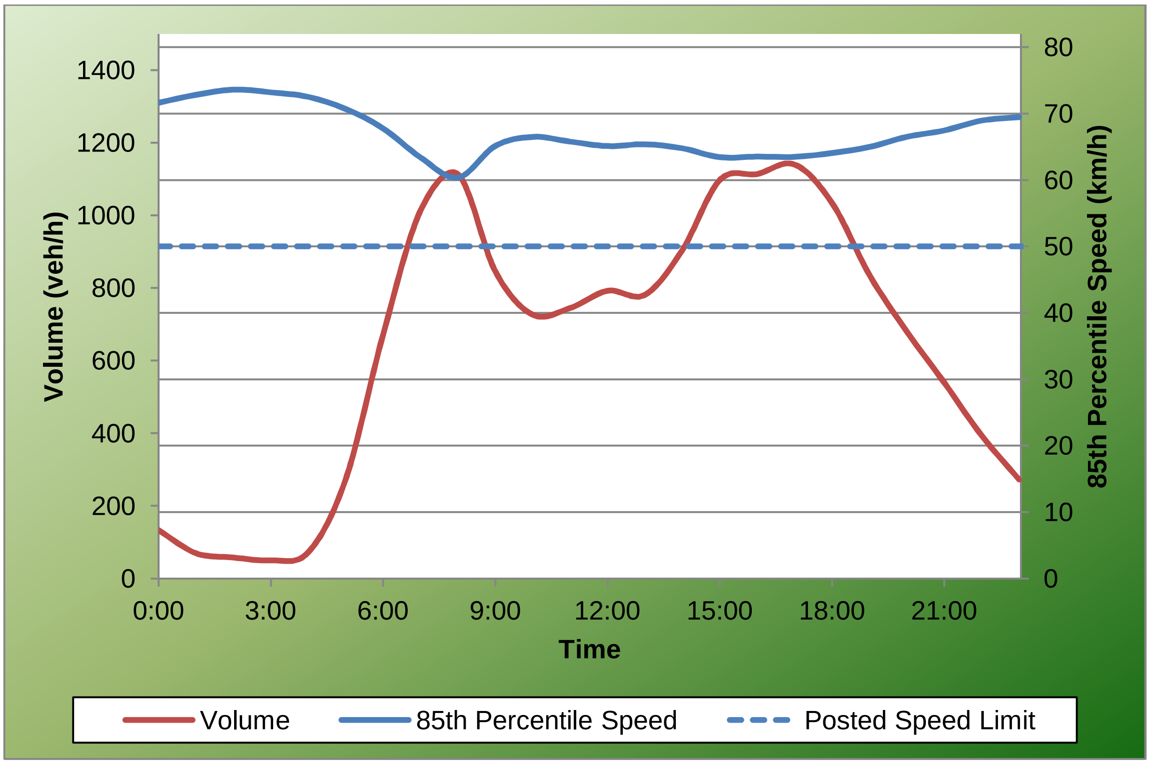
Traffic Volume and Operating Speed Analysis

Exhibit 8 provides a summary of the 24-hour speed and traffic volume observations from September 10-12, 2012, averaged throughout the corridor for northbound and southbound directions.

Exhibit 8: Hourly Corridor Traffic Volume and Speed



It can be seen that speeds well above the 50 km/h posted limit are maintained throughout the day, with the most excessive speeds in the overnight hours reaching well over 70 km/h.

Two clear bi-directional volume peaks in the AM and PM peak periods are observed between the hours of 7:00 AM and 9:00 AM, and between 3:00 PM and 7:00 PM. While a consistent decrease in AM peak period speed occurred around 8:00 AM, PM speeds generally remained consistent despite the peaking in traffic volumes. Complete speed and traffic volume data can be found in **Appendix B**.

Historical traffic volumes indicate a decline in demand on Cawthra Road over recent years, as shown in **Exhibit 9**. Specifically, annual average daily traffic (AADT) on the corridor has decreased from 2005 to 2012 by 24%. Traffic volume well below capacity is consistent with high speeds observed along the corridor, which may be a contributing factor in areas of safety underperformance.

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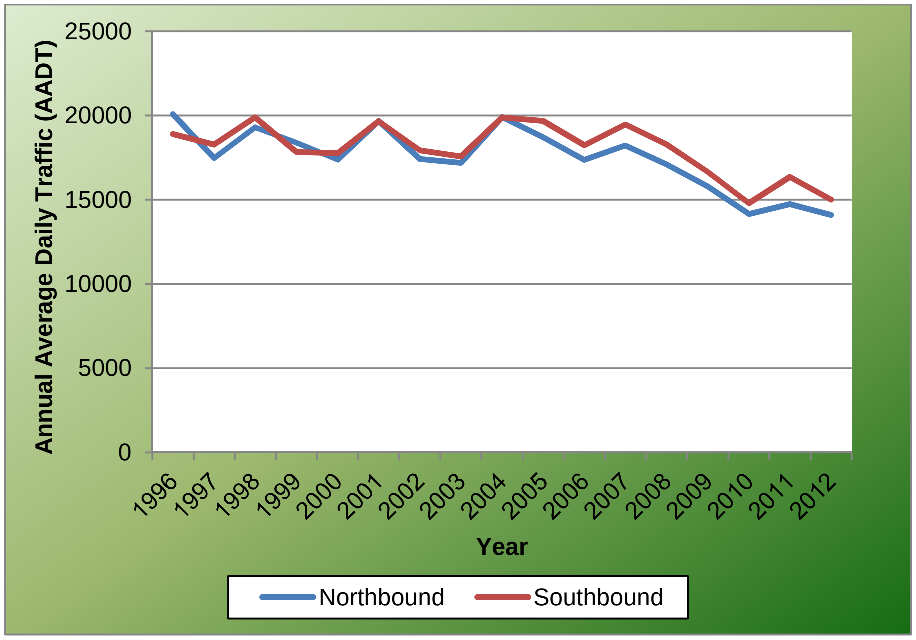
Exhibit 9: Cawthra Road AADT, 1996-2012



Historical Safety Performance

The Region of Peel provided a history of safety performance along the Cawthra Road corridor since 2005, categorized into two study periods: 2005-2009 and 2008-2012. During the period from 2005 to 2009, an annual collision frequency of 133 collisions per year was reported. In the 2008-2012 study period, the collision frequency increased to 168 collisions per year (26% increase), potentially indicative of worsening safety performance along the corridor. However, it should be noted that the study periods overlapped by two years (2008 and 2009), resulting in the increase being largely attributed to two above-average years of collisions in 2010 and 2011 (shown earlier in **Exhibit 1**).

Exhibit 10 presents a comparison of historical safety performance from 2005 to 2012, indicating that six (6) of the 15 major intersections and midblock segments had an increase in collision frequency from the 2005-2009 to the 2008-2012 study period. While potential for safety improvement (PSI) values could not be generated for the latter study period due to data constraints, it can be seen that six (6) intersections underperformed during the 2005-2009 study period with PSI values ranging from 8 to 36; these values represent the excess number of collisions observed over the study period as compared to predicted 5-year collision frequency for intersections of similar configuration.

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Exhibit 10: Summary of Intersection Collision Data

Intersection	Observed Collisions, 2005-2009 *Total (PDO, F+I)*	Potential for Safety Improvement (PSI), 2005-2009	Observed Collisions, 2008-2012 *Total (PDO, F+I)*	Collision Rate, 2008-2012[1]	Percent Change in Collision Frequency (2005-2009 vs. 2008-2012)
Eastgate Parkway / Highway 403	110 (100, 10)	0	128 (109, 19)	1.27	16%
Meadows Boulevard	14 (9, 5)	7.71	17 (12, 5)	0.28	21%
Rathburn Road East	38 (34, 4)	0	37 (32, 5)	0.42	-3%
Burnhamthorpe Road East	147 (130, 17)	0	169 (149, 20)	1.43	15%
3643 Cawthra Road	N/A	N/A	16 (13, 3)	N/A	N/A
Bloor Street	63 (52, 11)	0	84 (72, 12)	0.81	33%
Silver Creek Boulevard	37 (27, 10)	35.59	36 (33, 3)	0.46	-3%
Ramp to Dundas Street East	64 (62, 2)	35.16	77 (68, 9)	0.78	20%
655 Queensway East	N/A	N/A	35 (29, 6)	N/A	N/A
Queensway East	139 (121, 18)	14	123 (106, 17)	1.02	-12%
Tedwyn Drive	26 (21, 5)	11.87	23 (19, 4)	0.31	-12%
North Service Road	53 (44, 9)	0	61 (57, 4)	0.66	15%
QEW Westbound Ramp	8 (6, 2)	0	11 (8, 3)	0.16	38%
QEW Eastbound Ramp	35 (31, 4)	10.59	34 (28, 6)	0.47	-3%
South Service Road	46 (38, 8)	0	76 (64, 12)	0.77	65%

[1]Collisions per million intersecting vehicles.

The collision rates calculated for the Eastgate Parkway, Burnhamthorpe Road East and Queensway East intersections with Cawthra Road were significantly higher than the other intersections; potential reasons for these high collision rates are examined later within the intersection analysis.

For each of the intersections and midblock segments listed above, a review of safety operations is presented below.

Intersection Collision Analysis.

The following sections describe the analysis and findings related to collisions at each of the study area intersections and midblock segments previously identified. For locations with significant traffic volume and/or collision trends, a collision diagram is provided in **Appendix A**. The diagrams illustrate collision trends and concentrations along the corridor, and depict the vehicle movements and initial directions of travel of the involved vehicles for each reported collision.

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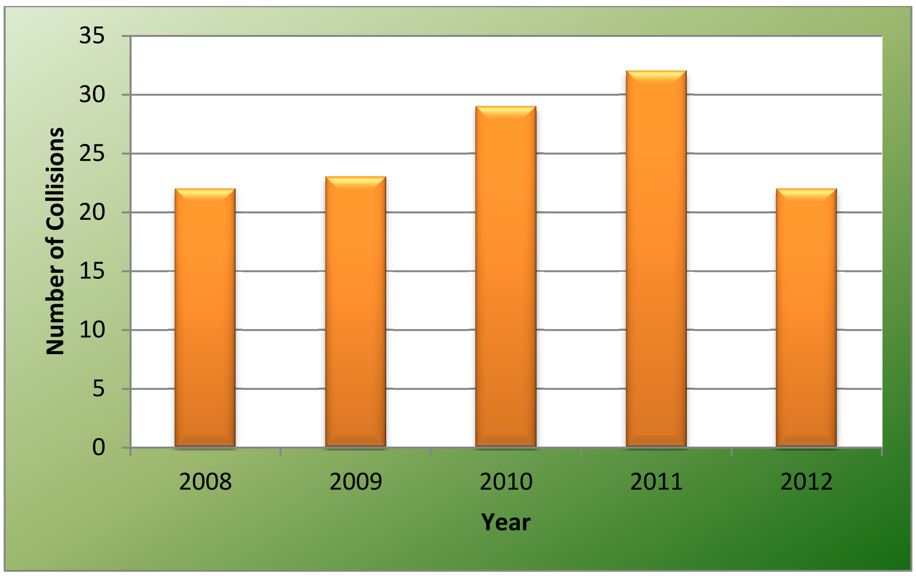
Eastgate Parkway / Highway 403

Cawthra Road reaches its northern terminus at the intersection of Eastgate Parkway and two ramps from Highway 403. As a major 4-way signalized intersection, heavy traffic volumes and potentially high speeds have contributed to the collision history as the road transitions between freeway and arterial character.

A total of 128 collisions were reported over the five-year period from 2008 to 2012, representing an increase of 16% from the previous study period of 2005 to 2009. **Exhibit 11** indicates the annual distribution of collisions over the analysis period. The intersection had the second highest collision frequency of all intersections along the corridor. The collision rate, normalized against traffic volume, was also second highest among all intersections studied (1.27 collisions per million intersecting vehicles), indicative of the relatively poor traffic safety performance at this intersection.

Exhibit 11: Eastgate Parkway/Highway 403 Annual Collision Frequency



An analysis of collision impact types reveals a prevalence of rear-end collisions (55%) followed by turning movement collisions (34%), with low occurrence of other collision types as illustrated in **Exhibit 12**.

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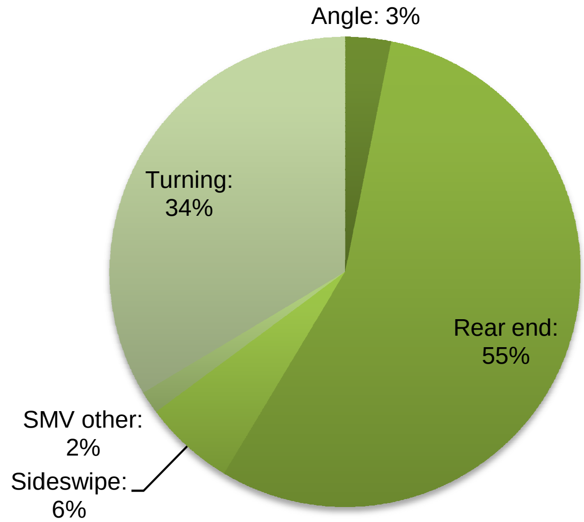
Exhibit 12: Eastgate Parkway/Highway 403 Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
4	0	71	8	2	43	0



The data show that 85% of the collisions resulted in property damage only, with the remaining 15% comprised of non-fatal injuries. The large number of rear-end collisions is consistent with the character of the intersection, with a 140 second traffic signal cycle length and long queues in all directions. Most of these rear-end collisions were relatively minor, resulting in property damage only. Of the 43 turning movement collisions reported, the clearest trends were observed in left-turn collisions, illustrated in the collision diagram in **Appendix A**. Left-turns from northbound Cawthra Road to westbound Highway 403 had the highest frequency of turning movement collisions, with the majority likely resulting from gap misjudgment by the left-turning vehicle. All four directions of left-turns are given protected and permitted signal phases.

It was found that five (5) left-turn collisions were the fault of the through traffic disobeying the traffic signal; all five of these were attributed to eastbound or southbound vehicles which originated from Highway 403. With no apparent sightline issues, it should be investigated whether the ramp traffic is given sufficient warning to slow from the highway speed limit of 100 km/h to the arterial speed limit of 50 km/h (Cawthra Road) or 70 km/h (Eastgate Parkway). Current signage advises a ramp speed of 90 km/h on the southbound approach, with a “50 km/h ahead” sign placed immediately upstream of the intersection.

Meadows Boulevard

The intersection of Cawthra Road and Meadows Boulevard is a signalized three-leg intersection 400 m south of Eastgate Parkway, south of which Cawthra Road is abutted on both sides by residential land uses. From 2008 to 2012, there were 17 reported collisions, five (5) of which resulted in non-fatal injuries (29%). The five-year distribution of collisions is illustrated in **Exhibit 13**, showing an absence of collisions in 2009.

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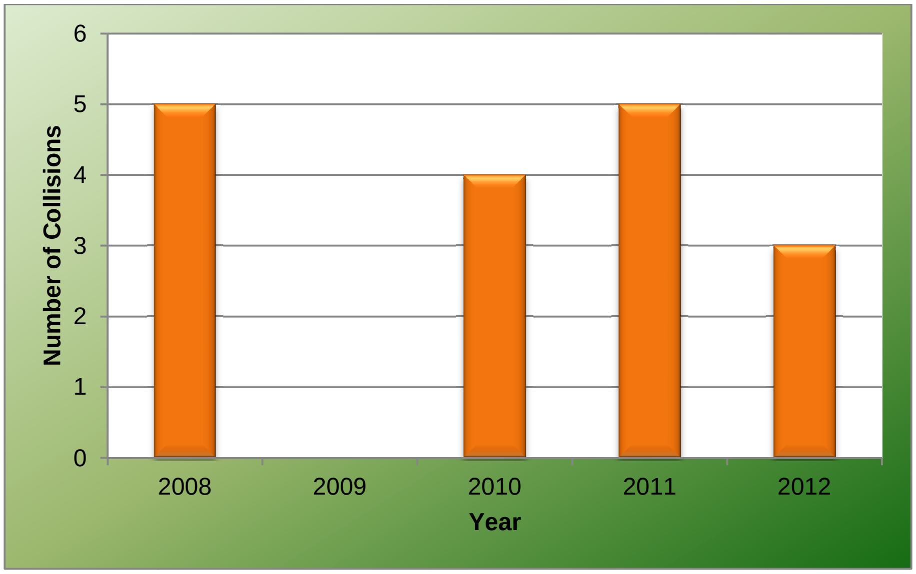
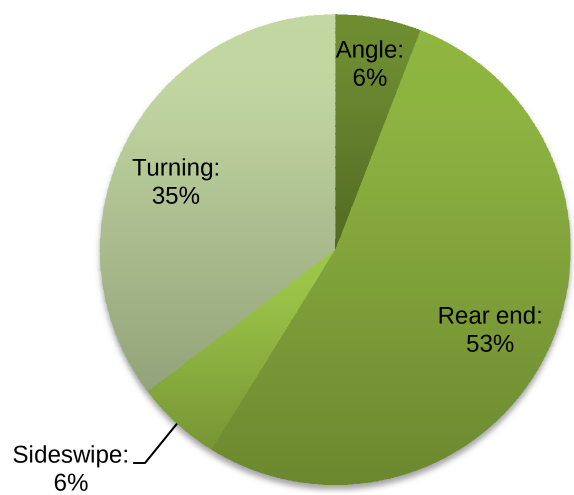
Exhibit 13: Meadows Boulevard Annual Collision Frequency



The most frequent collision type was rear-ends (53%), again followed by turning movement collisions (35%) as shown in **Exhibit 14**.

Exhibit 14: Meadows Boulevard Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
1	0	9	1	0	6	0



The collision frequency (3.4 per year) and collision rate (0.28 collisions per million intersecting vehicles) are among the lowest of signalized intersections within the Cawthra Road corridor, with a typical pattern of collisions observed.

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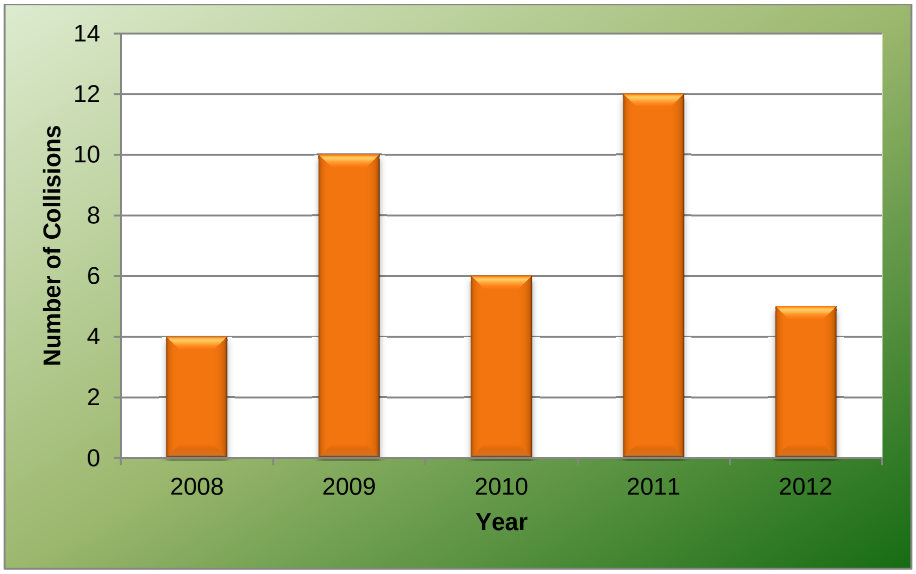
Rathburn Road East

Cawthra Road and Rathburn Road East intersect at a 4-leg signalized intersection in a predominantly residential area. There were 37 collisions reported in the five-year period ending in 2012, with an annual frequency illustrated in **Exhibit 15**. Since 2005, there was a 2.6% decrease in collision frequency. Five (5) out of the 37 collisions resulted in personal injury (14%).

Exhibit 15: Rathburn Road East Annual Collision Frequency



While rear-end collisions were the most frequently reported type of initial impact (43%), turning movement (22%), angle (16%), and sideswipe (14%) collisions also represented a relatively even proportion of collisions (**Exhibit 16**).

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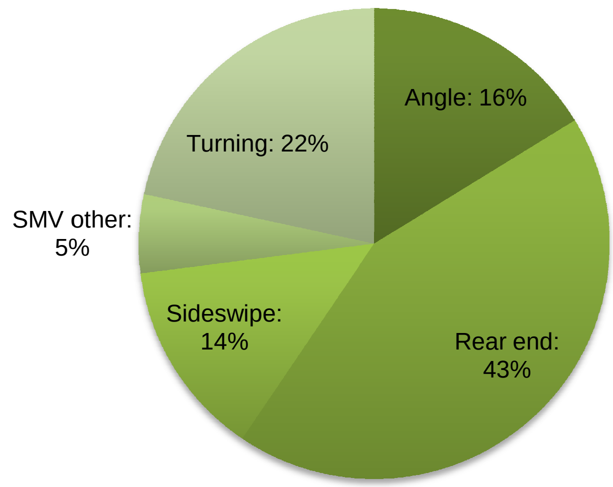
Exhibit 16: Rathburn Road East Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
6	0	16	5	2	8	0



Rear-end collisions were most prevalent on the southbound approach, followed by the northbound approach. Angle collisions were most frequent among the southbound and eastbound approaches, with an even split of at-fault drivers between these two approaches. Overall, the intersection performed significantly better than predicted by safety performance models, and had a collision rate of only 0.4 collisions per million intersecting vehicles.

Burnhamthorpe Road East

Cawthra Road and Burnhamthorpe Road East intersect at a 4-leg signalized intersection in a predominantly residential area. There were 169 collisions reported in the five-year period ending in 2012, with an annual frequency illustrated in **Exhibit 17**. Since 2005, there was a 15% increase in collision frequency. The intersection had the highest collision frequency of any intersection along the corridor. The collision rate, normalized against traffic volume, was also highest among all intersections studied (1.43 collisions per million intersecting vehicles), indicative of the relatively poor traffic safety performance at this intersection. Twenty (20) out of the 169 collisions resulted in personal injury (12%).

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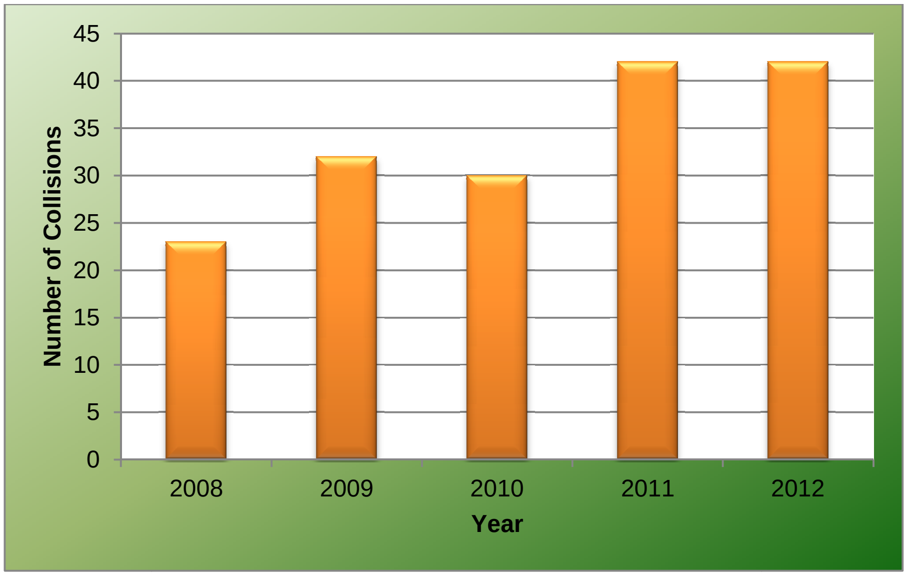
Exhibit 17: Burnhamthorpe Road East Annual Collision Frequency



While rear end collisions still comprised a significant proportion (30%) of collisions at the Burnhamthorpe Road East intersection, they did not represent the dominant collision type; which is unlike all other intersections along Cawthra Road. Turning movement collisions were the dominant collision type (52%). Seventy (70) of the 87 turning movement collisions were between southbound left turning vehicle and a northbound through vehicle indicating a significant problem. Sight lines were not observed to be problematic and there is a dedicated southbound left-turn phase; albeit only a 12 second phase (including amber). The short duration of the dedicated left-turn phase suggests that a significant portion of left turning vehicles are completing the turns during the permitted phase, which is likely contributing to the high collision frequency. Additionally, the intersection geometry is skewed leading to a larger-than-90-degree southbound left-turn, which is uncommon.

The intersection of Burnhamthorpe Road East and Cawthra Road has recently undergone geometric improvements. The channelized right-turn lanes have been replaced with dedicated right-turn lanes. Additionally, the intersection skew has been slightly corrected using the extra space provided by the removed channelized right-turns. These intersection geometric improvements could have partially addressed the factors contributing to the large number of southbound left turning movement collisions. Therefore, it may be several years before it is know whether or not the new intersection geometry has improved safety performance.

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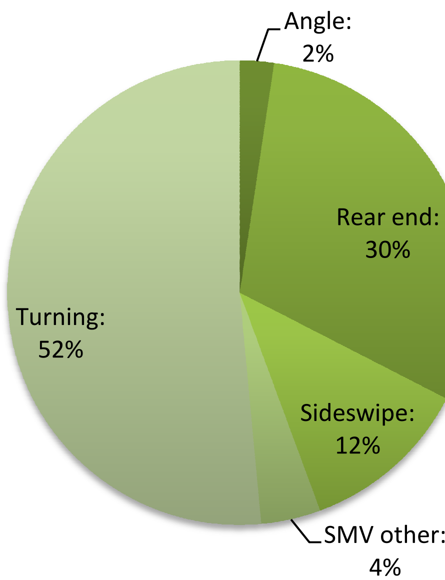
Exhibit 18: Burnhamthorpe Road East Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
4	0	51	20	7	87	0



3643 Cawthra Road (Plaza Driveway 120 metres south of Burnhamthorpe Road East)

The commercial plaza located at 3643 Cawthra Road was identified as having a higher than predicted collision frequency. The plaza is located on the east side of Cawthra Road 120 m south of Burnhamthorpe Road East. Left-turns into the plaza parking lot are facilitated by a centre two-way left-turn lane. Left-turns in and out of the plaza must cross 3 northbound lanes, consisting of two through lanes and one right-turn storage lane for Burnhamthorpe Road East, as well as the taper of a downstream left-turn lane.

A total of 16 collisions were reported in the vicinity of this driveway, including three (3) injury collisions (19%). The five-year history of collision frequency is shown in **Exhibit 19**.

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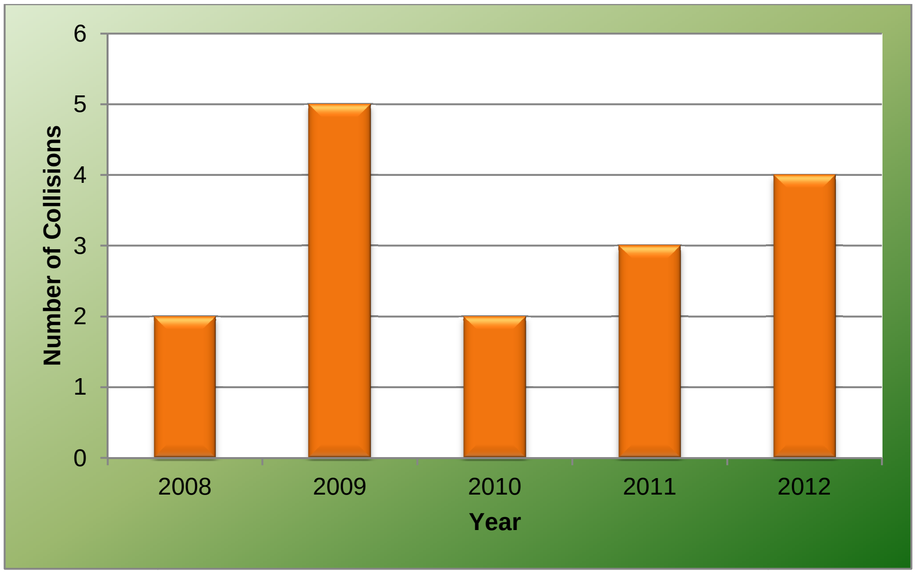
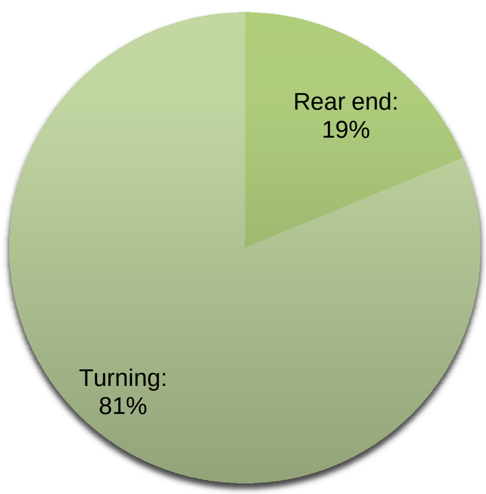
Exhibit 19: 3643 Cawthra Road Annual Collision Frequency



Most of the reported collisions were related to turning movements (81%), as shown in **Exhibit 20**.

Exhibit 20: 3643 Cawthra Road Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
0	0	3	0	0	13	0



With northbound queues for Burnhamthorpe Road East potentially stretching back to this midblock driveway, the rear-end collisions can likely be attributed to these queues.

Signage indicating “Left Turns: Centre Lane Only” is placed immediately upstream of the plaza in both directions, alluding to a possible history of safety concerns identified at this location. The collision diagram in **Appendix A** illustrates how the majority of turning movement collisions (7 out of 12) were caused by left-turns from southbound Cawthra Road into the plaza, while four (4)

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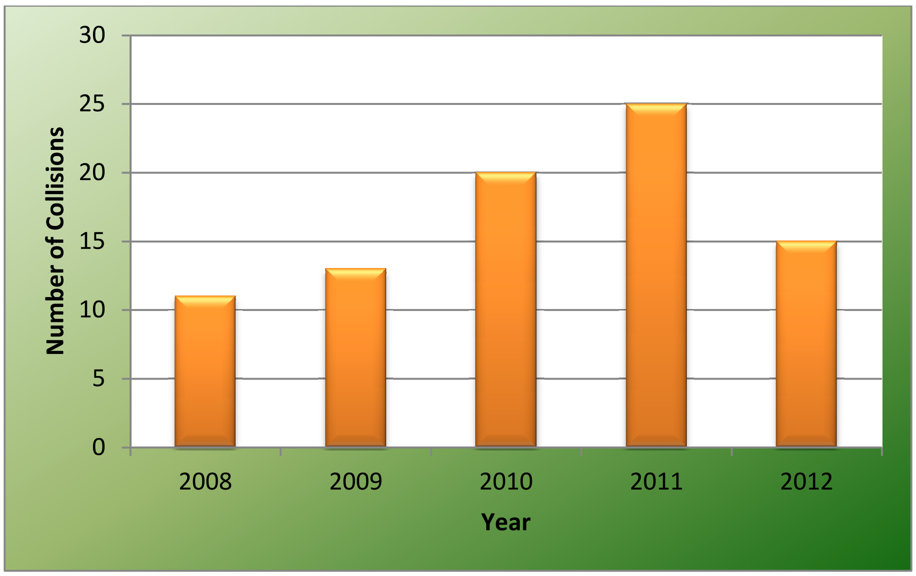
others were caused by left-turns exiting the plaza. The centre left-turn lane transitions to a raised concrete median approximately 30 m north of the driveway entrance, causing the centre left-turn lane to narrow and limit the left-turn storage length available. Potential treatments (e.g., banning certain left-turn movements) should be considered to mitigate the risk of collision at this location.

Bloor Street

The intersection of Cawthra Road at Bloor Street is a 4-leg signalized intersection located in a largely residential area. There were 84 collisions reported in the five-year period ending in 2012, with a gradually increasing yearly collision frequency as indicated in **Exhibit 21**.

Exhibit 21: Bloor Street Annual Collision Frequency



The distribution of collisions by initial impact type shows that the majority of collisions were rear-ends, as illustrated in **Exhibit 22**. This is followed by turning movement collisions, the majority of which were related to left-turning movements.

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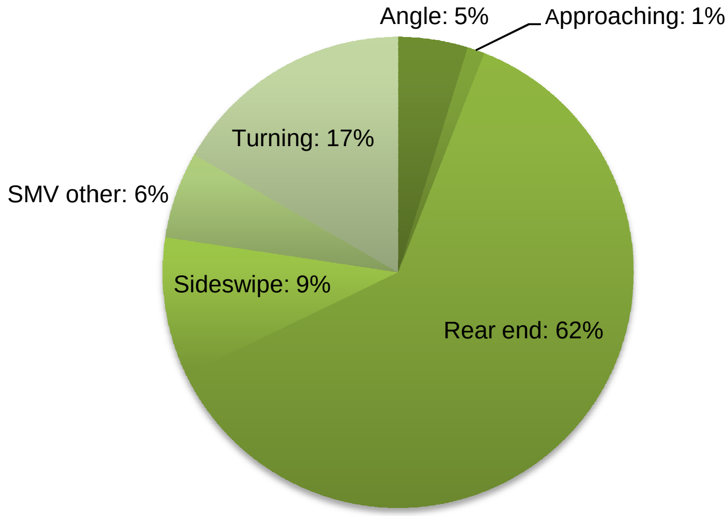
Exhibit 22: Bloor Street Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
4	1	52	8	5	14	0



The traffic operations analysis indicates the presence of long queues, most notably in the northbound direction. As indicated in the collision diagram in **Appendix A**, this is consistent with a pattern of northbound rear-end collisions (21 over five years). A distribution of traffic speeds indicates widespread non-compliance with the 50 km/h speed limit, with an 85^{th} percentile speed varying throughout the day from 64 km/h to 72 km/h northbound, and from 66 km/h to 79 km/h southbound. Excessive speeding was generally found to occur between the hours of 8:00 pm and 6:00 am.

The distribution of collisions by severity indicates that 85% of collisions resulted in property damage only (70 collisions), and 13% resulted in personal injury (11 collisions). A fatal collision occurred in 2009 when a northbound driver disobeyed the traffic signal, colliding with a westbound driver in an angle collision.

With a collision rate of 0.81 per million intersecting vehicles, the intersection was found to perform better than predicted by the safety performance model. Nevertheless, factors such as excessive speed and heavy turning volumes may have contributed to the high number of collisions at this intersection.

Silver Creek Boulevard

Cawthra Road at Silver Creek Boulevard is a signalized three-leg intersection where Cawthra Road begins to transition from residential towards commercial and industrial land uses. There were 36 collisions reported at this intersection between 2008 and 2012, with no clear increasing or decreasing trend, as shown in **Exhibit 23**.

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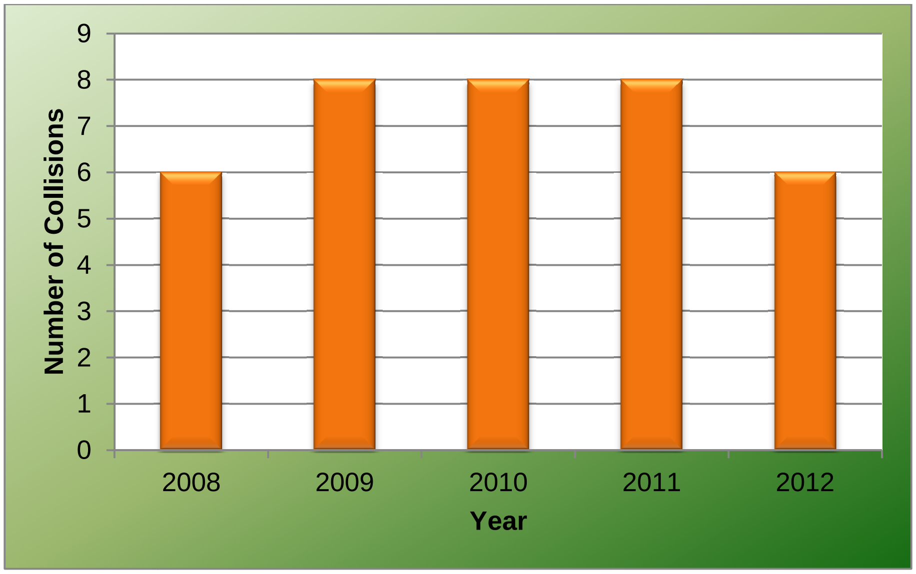
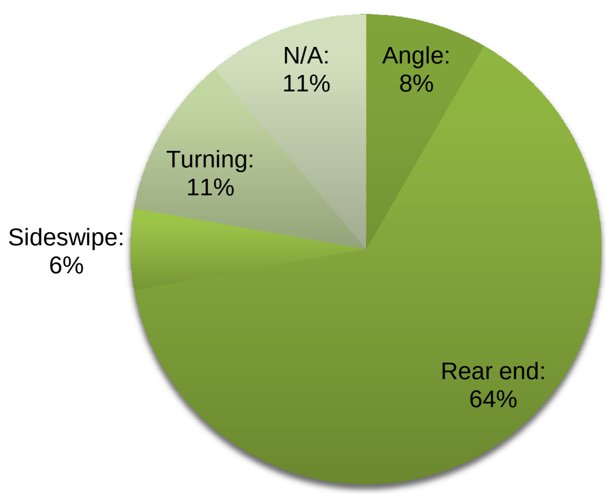
Exhibit 23: Silver Creek Boulevard Annual Collision Frequency



The intersection was found to have almost three times as many PDO (property damage only) collisions as was predicted over this five-year time span, with a particularly large incidence of southbound rear-end collisions. The complete distribution by initial impact type is shown in **Exhibit 24**.

Exhibit 24: Silver Creek Boulevard Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
3	0	23	2	0	4	4



The predominance of southbound rear-end collisions is consistent with the larger southbound volumes throughout the day, with AM and PM peak period volume of 1400 vehicles per hour, compared to the northbound AM and PM peak period volumes of 1100 vehicles per hour.

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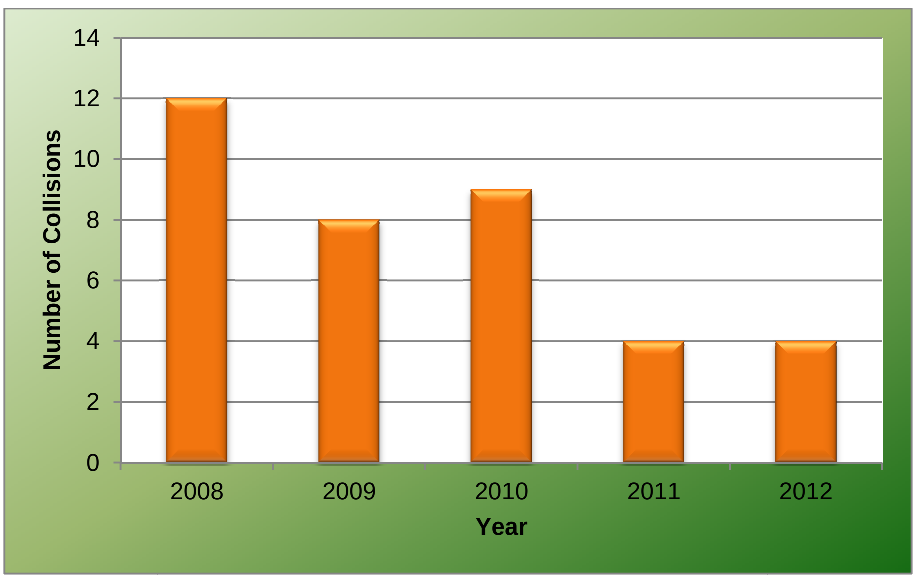
Furthermore, the intersection is closely spaced to the Dundas Street ramp intersection, located 170 m south of Silver Creek Boulevard. This short spacing may encourage drivers to accelerate through Silver Creek Boulevard to reach Dundas Street, and may be a factor in explaining the history of collisions at this intersection.

Ramp to Dundas Street East

Dundas Street East and Cawthra Road are grade separated, and are connected via a signalized ramp. The intersection of Cawthra Road and the ramp to Dundas Street is 4-way with a church driveway comprising the westbound approach. Right-turns to and from the ramp are channelized, and the character of the road is conducive to high speeds as similarly observed at Silver Creek Boulevard.

Through the assessment of the 87 collisions occurring at the Dundas Street and Cawthra Road ramp, 40 collisions were observed to occur at the Dundas Street ramp terminal intersection rather than the Cawthra Road ramp terminal intersection. As such, these collisions are outside the scope of this study and were not included within this assessment. There were 37 collisions reported between 2008 and 2012, and a year-to-year comparison indicates a drop in collision frequency over this period as shown in **Exhibit 25**, as well as a drop since the previous five-year study period.

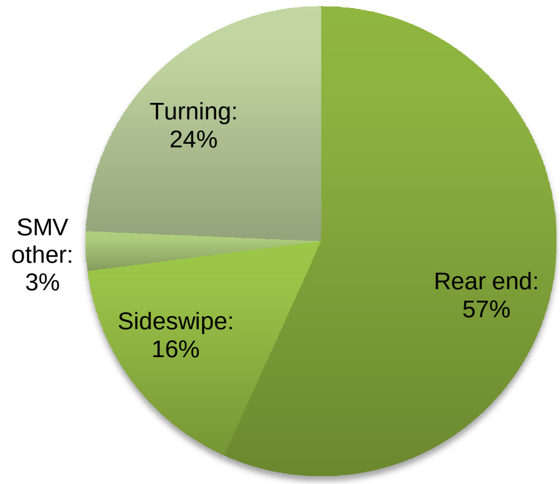
Exhibit 25: Dundas Street Ramp Annual Collision Frequency



Of these 37 collisions, 33 resulted in property damage only (89%), while the remainder involved non-fatal injuries. As illustrated in **Exhibit 26**, the majority of collisions (57%) were rear-end, while turning movement (24%) and sideswipe (16%) collisions made up the bulk of the other collision types.

Exhibit 26: Dundas Street Ramp Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
0	0	21	6	1	9	0



The collision diagram in **Appendix A** shows a clear trend of rear-end collisions immediately south of the intersection, where vehicles turning right from the Dundas Street ramp to southbound Cawthra Road must merge out of the channelized right-turn. Despite a yield sign warning drivers to wait for a gap, it is ambiguous to drivers whether a complete merge lane exists following the channel, or whether drivers must immediately enter the right lane of through traffic. No pavement markings exist to indicate the end of the right-turn channel, which is inconsistent with other nearby intersections that clearly indicate the presence of a right-turn merge lane.

The other clear pattern of collisions is northbound left-turns colliding with southbound through traffic. Analysis of collision reports indicates that all seven (7) of these collisions were the fault of improper turns by northbound traffic destined for Dundas Street. It should be noted that the character of southbound Cawthra Road is highly conducive to speeding, with a downhill section immediately downstream of the intersection towards the Dundas Street underpass, and an extended stretch of road with no accesses or signals. Therefore, while northbound left-turns may be at fault for these collisions, the issue of gap identification may be a contributing factor.

655 Queensway East (Gas Station Driveway on Cawthra Road 90 m north of Queensway East)

With the highest frequency of midblock collisions along the entire corridor, the driveway to 655 Queensway East was found to be significantly underperforming from a safety perspective. The driveway provides access to a gas station and plaza on the north-west corner of the intersection of Cawthra Road and Queensway East and, similar to the midblock access at 3643 Cawthra Road, left-turns from Cawthra Road are facilitated by a centre two-way left-turn lane.

There were 35 collisions reported in the vicinity of this driveway between 2008 and 2012. Annual collision frequency is illustrated in **Exhibit 27**, and it indicates high variability in collision frequency from year to year. Compared to the predicted collision frequency for this midblock segment, there were five times as many collisions observed as were predicted.

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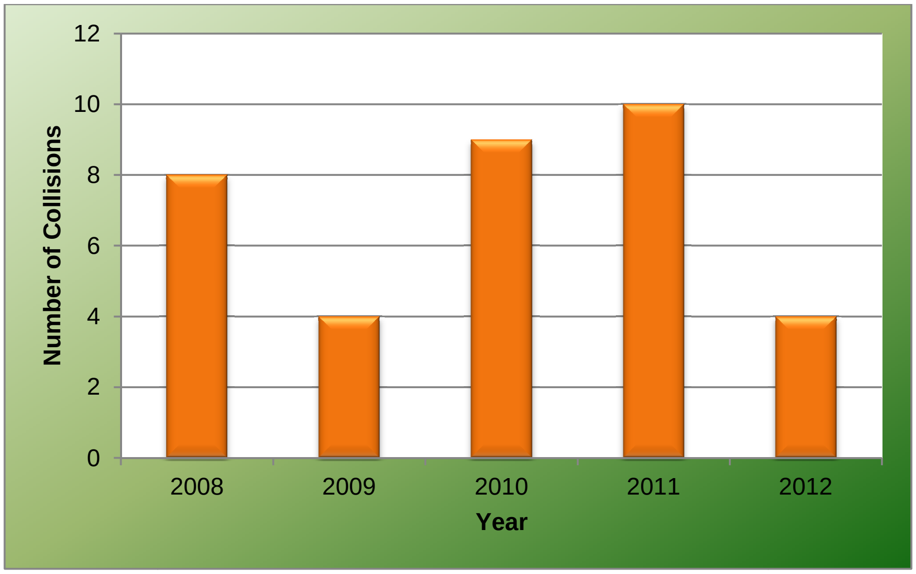
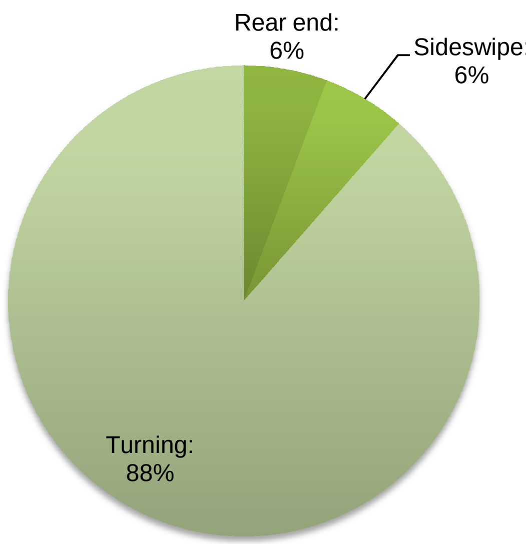
Exhibit 27: 655 Queensway East Annual Collision Frequency



The distribution of collisions by initial impact type, shown in **Exhibit 28**, clearly indicates that turning movements at this driveway are the predominant concern. The collision diagram in **Appendix A** shows that 18 of the 31 turning movement collisions were between northbound left-turns and southbound through traffic, and that improper turns and failure to yield right-of-way were the contributing driver actions in most of these collisions. The other significant trend was 12 other turning movement collisions, between eastbound left-turns exiting the driveway and southbound through traffic. Both turning movements must cross three southbound lanes, plus the taper of the dual left-turn lane for Queensway East.

Exhibit 28: 655 Queensway East Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
0	0	2	2	0	31	0



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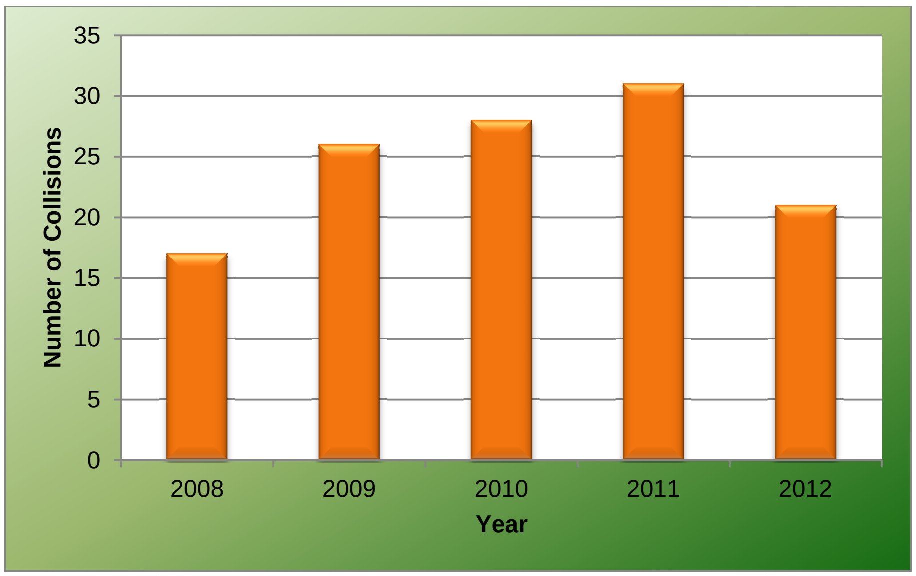
Considering the existing dual access to this plaza (from Cawthra Road and from Queensway East), it should be investigated whether certain left-turn restrictions can be applied to improve the safety performance of this currently underperforming segment.

Queensway East

The intersection of Cawthra Road and Queensway East was found to have among the highest five-year collision frequencies of any intersection along the corridor with 123 collisions reported between 2008 and 2012. As a major 4-way signalized intersection, it had the highest average daily traffic volume along the corridor. Despite the high volumes, the normalized collision rate was still among the highest within the corridor, with a rate of 1.02 collisions per million intersecting vehicles. The annual collision frequency from 2008 to 2012 is shown in **Exhibit 29**.

Exhibit 29: Queensway East Annual Collision Frequency



Of the 123 collisions, 106 resulted in property damage only (86%), while the remaining 17 involved personal injury. There were two clear trends in collision type, as illustrated in **Exhibit 30**, with rear-end and turning movement collisions comprising 86% of the collisions.

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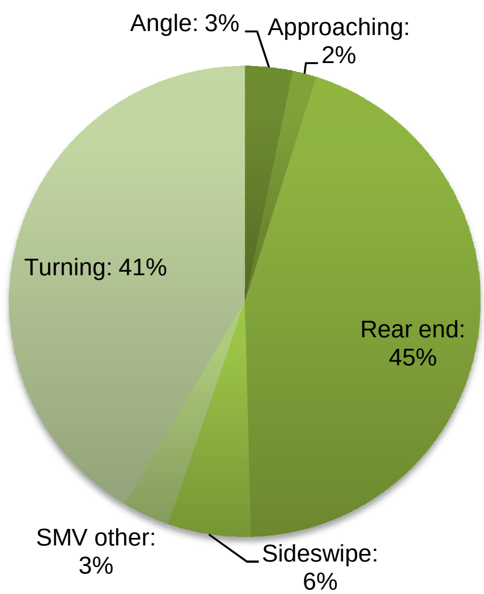
Exhibit 30: Queensway East Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
4	2	55	7	4	51	0



As shown in the collision diagram in **Appendix A**, rear-end collisions were most prevalent on the southbound approach (19), followed by the northbound approach (17). Despite the large number of rear-end collisions, only four (4) resulted in injury.

The other stark trend evident in the collision diagram is the turning movement collisions between eastbound left-turn and westbound through vehicles, and between northbound left-turn and southbound through vehicles. The northbound and eastbound left-turn movements are given protected and permissive phasings, with single left-turn lanes. This is in contrast to the westbound and southbound left-turn movements, which are given dual turn lanes and protected-only phasing.

Because of this asymmetry, there exists the potential for sightline issues during the permitted phase of the northbound and eastbound left-turns, which may have an obstructed view of the oncoming traffic adjacent to two left-turn lanes. Shadow lanes are used to mitigate the effects of this asymmetry, but the history of collisions indicates that this is not necessarily sufficient to ensure the safety of these turning movements. Of the 41 turning movement collisions related to these movements, almost all were determined to be the fault of the left-turning vehicle, indicating a systematic issue with the ability for drivers to judge gaps in oncoming traffic. Reconfiguration of the northbound and eastbound approaches to include dual left-turn lanes should be investigated as a potential treatment at this intersection.

Tedwyn Drive

South of Queensway East, Cawthra Road adjacent land uses are again predominantly residential. The intersection of Cawthra Road and Tedwyn Drive is located 350 m south of Queensway East, and is a three-way signalized intersection.

There were 23 collisions reported between 2008 and 2012, with decreasing frequency since 2005. Yearly collision frequency from 2008 to 2012 is shown in **Exhibit 31**.

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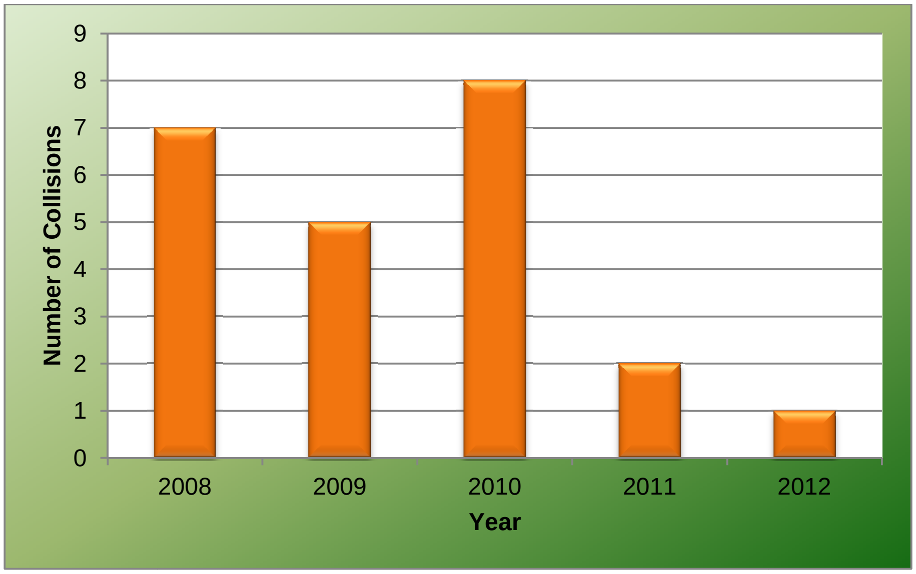
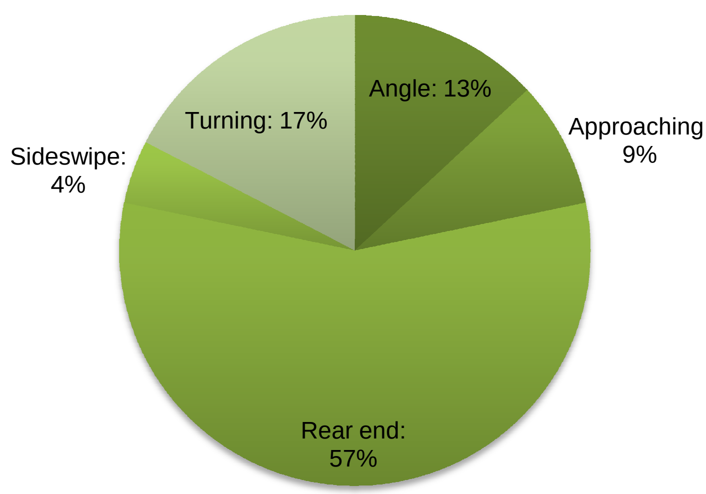
Exhibit 31: Tedwyn Drive Annual Collision Frequency



The majority of collisions were rear-ends, predominantly in the northbound direction. A complete distribution of collisions by initial impact type is shown in **Exhibit 32**.

Exhibit 32: Tedwyn Drive Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
3	2	13	1	0	4	0



It was found that four (4) collisions were the result of a driver disobeying the traffic signal; all four of these were southbound drivers at fault. Further review of right angle collisions and screening for the use of red-light cameras (based on current Region guidelines) as a means to reduce the frequency of such infractions should be considered. It should be noted that the cross-section of Cawthra Road is asymmetric between Queensway East and the QEW, with three southbound and two northbound lanes. The wide southbound cross-section on this stretch of flat, straight

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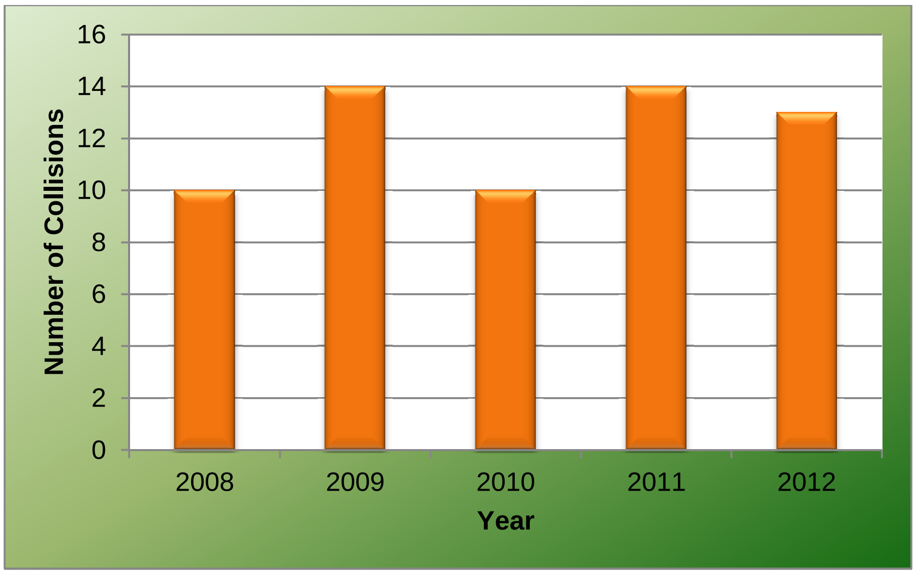
roadway is conducive to high speeds, as evidenced by 85th percentile speeds at or above 70 km/h for most of the day. Complete 24-hour speed data is shown in **Appendix B**.

North Service Road

North Service Road is a two-lane road that parallels the QEW and provides access to properties adjacent to the highway. It intersects Cawthra Road 150 m north of the westbound QEW off-ramp signalized intersection. A total of 61 collisions were reported at this intersection between 2008 and 2012. Yearly collision frequency from 2008 to 2012 is shown in **Exhibit 33**.

Exhibit 33: Tedwyn Drive Annual Collision Frequency



Analysis of collisions by initial impact type reveals a varied distribution in collision types, as shown in **Exhibit 34**. Rear-end collisions were the most common (33%), followed by turning movements (21%).

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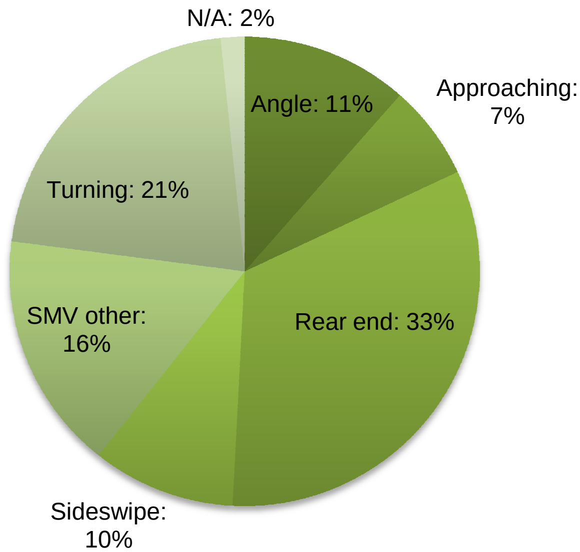
Exhibit 34: North Service Road Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
7	4	20	6	10	13	1



This intersection had the largest number of approaching (head-on) collisions along the corridor, all four (4) of which occurred in wet or snowy conditions and were due to speeding or loss of control by a vehicle on North Service Road at Cawthra Road. There was a similarly high incidence of single motor vehicle (SMV) collisions. The roadway alignment is such that both eastbound and westbound drivers must negotiate a sharp bend on the approach to the intersection. With a posted speed limit of 60 km/h on North Service Road, it is possible that speeding drivers may misjudge the tightness of the curve or have difficulty seeing the traffic signal heads. It is recommended that further investigation be done to explore the benefits of treatments such as improved signage or auxiliary signal heads for the eastbound and westbound approaches.

It was found that seven (7) collisions were the fault of a driver disobeying the traffic signal, most of which were northbound or southbound drivers (6 out of 7). As the intersection is immediately north of the QEW interchange, southbound drivers may be prone to disobeying the signal as it is the last signal before the westbound QEW on-ramp; similarly, northbound drivers originating from the QEW may be accustomed to high speed and more likely to disobey or misjudge the signal. Further review of right angle collisions and screening for the use of red-light cameras (based on current Region guidelines) as a means to reduce the frequency of such infractions should be considered.

QEW West Ramp

The westbound QEW exit ramp terminates at a signalized 3-leg intersection with Cawthra Road. Over the five-year period from 2008 to 2012, only 11 collisions were observed, representing fewer than half as many collisions as was predicted over this period. The annual breakdown of collision frequency is shown in **Exhibit 35**.

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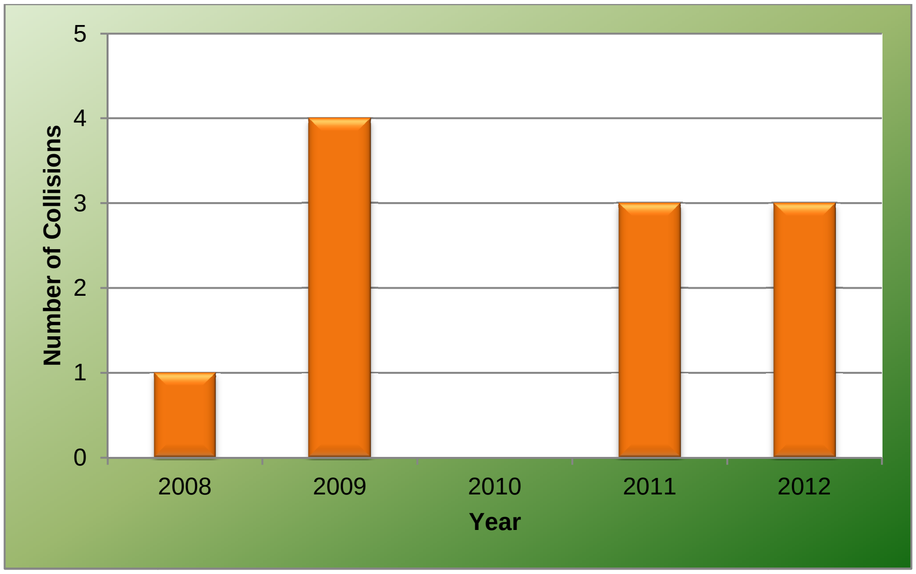
Exhibit 35: QEW West Ramp Annual Collision Frequency



A fatality occurred in 2011 as the result of an angle collision. A northbound drunk driver disobeyed the traffic signal and struck a westbound vehicle turning left from the QEW ramp.

The types of collisions reported at this intersection were predominantly rear-end and turning movement collisions, as shown in **Exhibit 36**. All four (4) rear-end collisions involved northbound vehicles, and two of these resulted in personal injury. There is a gentle left-hand bend in the northbound approach as Cawthra Road passes over the QEW, and this stretch of road is wide open and conducive to high speeds. Close spacing of the four intersections in this stretch of Cawthra Road (two ramp intersections and two service roads) may be contributing factors to the collision history in this area.

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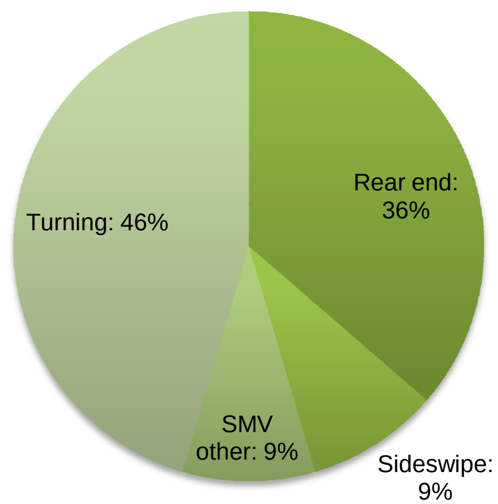
Exhibit 36: QEW West Ramp Collisions by Initial Impact Type

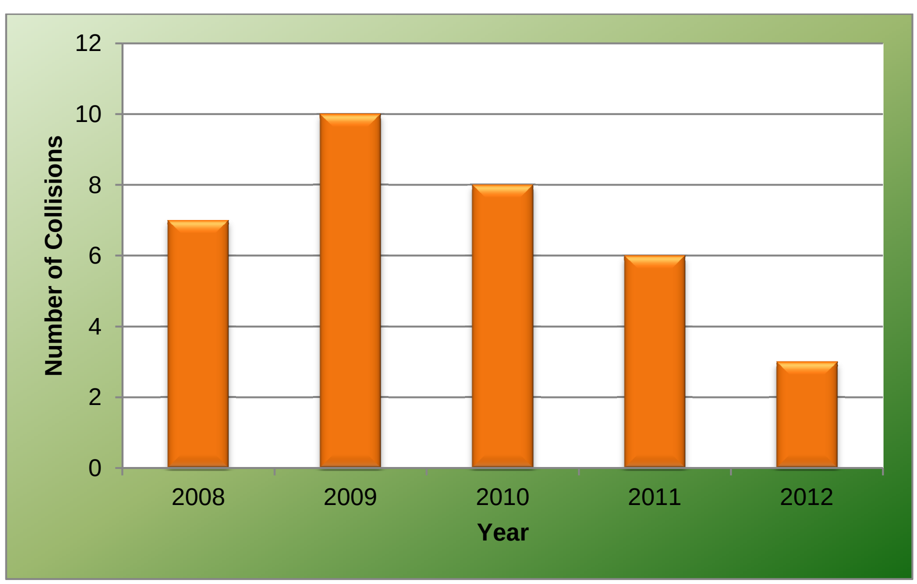
Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
0	0	4	1	1	5	0



QEW East Ramp

Similar to the geometry of the westbound QEW exit ramp, the eastbound QEW exit ramp terminates at a 3-leg intersection. Over the five-year period from 2008 to 2012, a total of 34 collisions were reported. The annual breakdown of collision frequency is shown in **Exhibit 37**. On average, the frequency has been mostly decreasing, with a slight decrease since the previous study period from 2005 to 2009.

Exhibit 37: QEW East Ramp Annual Collision Frequency



As illustrated in the collision diagram in **Appendix A**, the overwhelming majority of collisions at this intersection were rear-ends on the southbound approach. The complete distribution of

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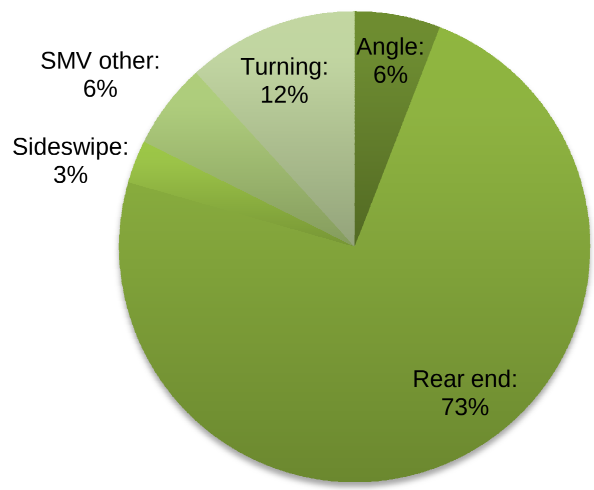
collisions by initial impact type is shown in **Exhibit 38**. The two-lane southbound approach is characterized by a slight downhill and gentle right-hand bend downstream of the QEW overpass. There is little signage to indicate a speed limit of 50 km/h in this area, especially considering drivers originating from the westbound QEW may not be accustomed to, or aware of, the slower speed limit. Similar to the westbound QEW exit ramp and North Service Road, the eastbound ramp intersection is closely adjacent to the South Service Road, with an intersection spacing of 160 metres.

Exhibit 38: QEW East Ramp Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
2	0	25	1	2	4	0



Furthermore, the right-most (third) southbound lane on Cawthra Road exits to the eastbound QEW immediately upstream of the traffic signal, resulting in this lane maintaining high speeds while the left two lanes serve as queue storage. The differential in speed across the three southbound lanes may be a contributing factor to the prevalence of rear-end collisions on the approach to this intersection.

It is recommended to consider the implementation of an auxiliary signal head for the southbound approach on the north side (near-side) of the intersection in order to address possible sightline issues given the downhill right-hand bend along the southbound approach.

South Service Road

The South Service Road parallels the QEW and provides access to properties adjacent to the highway. It intersects Cawthra Road 160 metres south of the eastbound QEW exit ramp at a 4-leg signalized intersection. This intersection marks the southern end of the study area.

Between 2008 and 2012, a total of 76 collisions were reported. This marks a significant increase (65%) since the 2005 to 2009 study period, and is worse than predicted by models. The yearly breakdown of collision frequency is shown in **Exhibit 39**.

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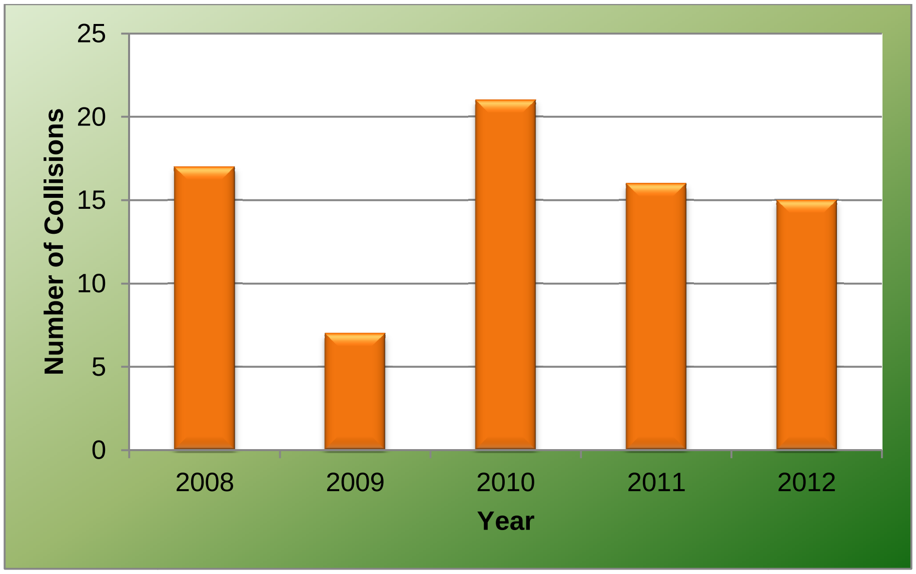
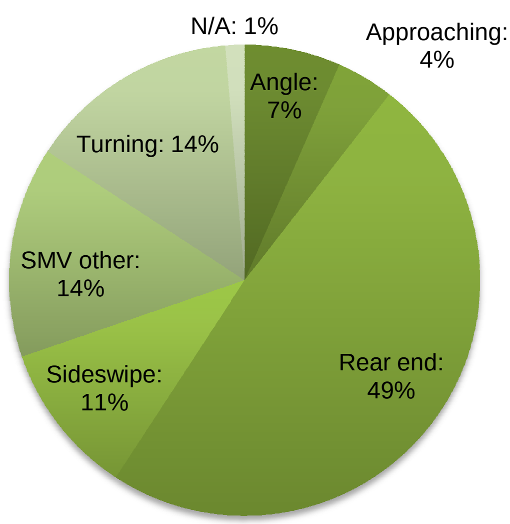
Exhibit 39: South Service Road Annual Collision Frequency



As illustrated in **Exhibit 40**, approximately half of the 76 collisions were rear-ends. Most of these occurred on the southbound approach, with similar character to the southbound approach at the westbound QEW exit ramp which also had a high incidence of southbound rear-end collisions.

Exhibit 40: South Service Road Collisions by Initial Impact Type

Angle	Approaching	Rear-end	Sideswipe	SMV other	Turning	N/A
5	3	37	8	11	11	1



There was also a relatively high prevalence of single motor vehicle (SMV) collisions caused by loss of control on the eastbound and westbound approaches to this intersection. Much like the North Service Road, these approaches have sharp bends as illustrated in the collision diagram in **Appendix A**. Given that almost all of the loss-of-control collisions at this intersection occurred in wet, snowy or otherwise inclement weather conditions, it should be investigated how the

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safety performance of these approaches can be improved (e.g., geometric improvements, warning signs and/or speed management). Improved signage and auxiliary (near-side) signal heads may offer safety benefits to drivers on South Service Road.

Of the 76 collisions, nine (9) were the fault of drivers disobeying the traffic signal. Most of these nine collisions were caused by southbound drivers failing to stop at the red light, and resulted in turning movement, angle, and sideswipe collisions. Further review of right angle collisions and screening for the use of red-light cameras (based on current Region guidelines) as a means to reduce the frequency of such infractions should be considered.

Conclusions and Recommendations

Based on the analysis presented above, the following conclusions were reached:

- There were a total of 1007 collisions reported for the corridor over the 5-year analysis period, and the majority (890) occurred at intersections;
- There were 143 non-fatal injury collisions, most of which were rear end (53) or turning movement (53), and 2 fatal collisions, both of which were angle collisions;
- The dominant collision impact type throughout the corridor was rear-end collisions (45%), followed by turning movement collisions (33%);
- Weather and compromised road surface conditions were also a factor in a significant number of collisions, at 20% and 30%, respectively; however, these distributions may not constitute statistical over-representations.
- In addition to the above, the following conclusions apply to individual intersections along the corridor:
  - The intersection of Cawthra Road at Eastgate Parkway/Highway 403 exhibited the second highest frequency and rate of collisions over the five-year study period, contributed by a transition from highway to arterial speeds in both the north-south and east-west directions;
  - Turning movement collisions was the dominant collision type at the intersection of Cawthra Road at Burnhamthorpe Road East, which differed from all other intersections. The southbound left turning vehicles colliding with northbound through vehicles comprised 70 and the 87 turning movement collisions at the intersection indicating a significant problem. Recent intersection geometry improvements could have partially addressed the southbound left problem; further study once several years of collision data are available is recommended to assess the new intersection geometry performance.
  - The midblock segment at 3643 Cawthra Road, 120 metres south of Burnhamthorpe Road East, was found to have a high frequency of collisions at a plaza entrance, with left-turns into the plaza using a centre left-turn lane. Further analysis of midblock operations may determine if changes are warranted at this location;
  - Excessive speeding, as observed along the entire corridor, was likely a factor contributing to the history of collisions at the intersection of Cawthra Road and Bloor Street, with 85th percentile speeds often reaching above 70 km/h;
  - Inconsistent lane markings at the intersection of Cawthra Road and the Dundas Street ramp have may be contributing to rear-end collisions caused by drivers misjudging the southbound merge from the right-turn channel.

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Clear merge lane markings would help alleviate the ambiguity of lane configuration and right-of-way;

- The midblock segment immediately north of Queensway East was found to have an exceptionally large number of left-turn collisions into the commercial driveway at 655 Queensway East. Similar to the other midblock segment noted above, there is a centre left-turn lane and an opposing lane configuration over 3 lanes wide;
- The intersection of Cawthra Road and Queensway East was found to have a large frequency and rate of collisions, with potential sightline issues related to the asymmetry of the left-turn lanes. Traffic operations should be further analyzed to determine if turning volumes may warrant a reconfiguration of the left-turn lanes to fully protected, dual left-turns;
- Both the North and South Service Roads were identified to have a high incidence of collisions related to drivers misjudging the sharpness of the eastbound and westbound approach curves. Improved signage and the use of auxiliary signal heads may help to better warn drivers of the signalized intersection ahead; and
- The downhill grade and right-hand bend on the southbound approach to the intersection of Cawthra Road and the eastbound QEW off-ramp may have contributed to the prevalence of southbound rear-end collisions at this location. Similar treatments as described for the Service Roads could be applied to mitigate the safety concerns at this intersection.

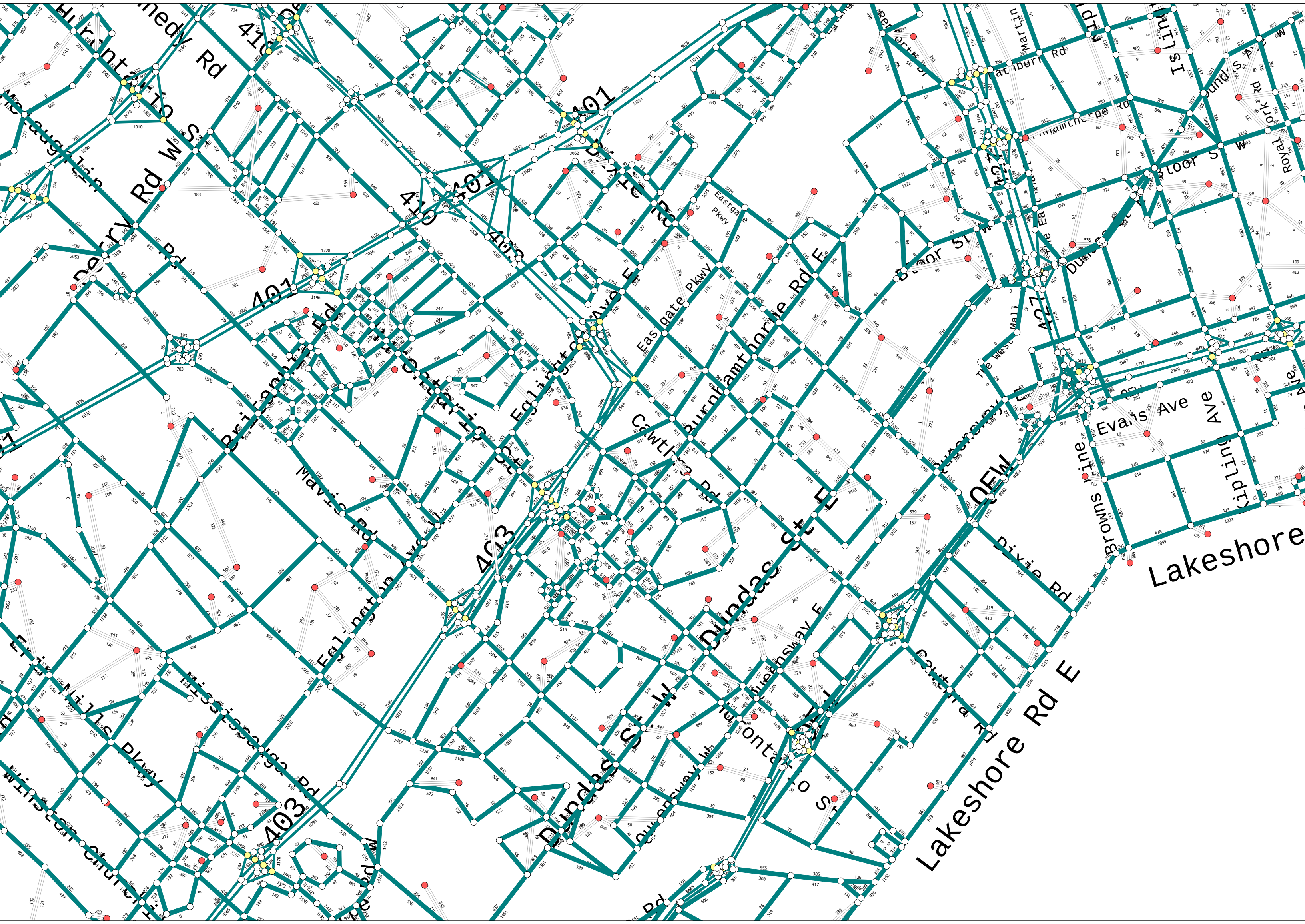
- Corridor speed and volume data suggest that overall, excessive speeding is a concern along Cawthra Road, with 85^{th} percentile speeds frequently reaching over 20 km/h above the posted speed limit. Recurring congestion was not found to be a crucial issue throughout the corridor. Therefore, caution should be exercised as to not create conditions that further encourage higher speeds in an effort to alleviate peak period congestion.

D

Traffic Volume Plots

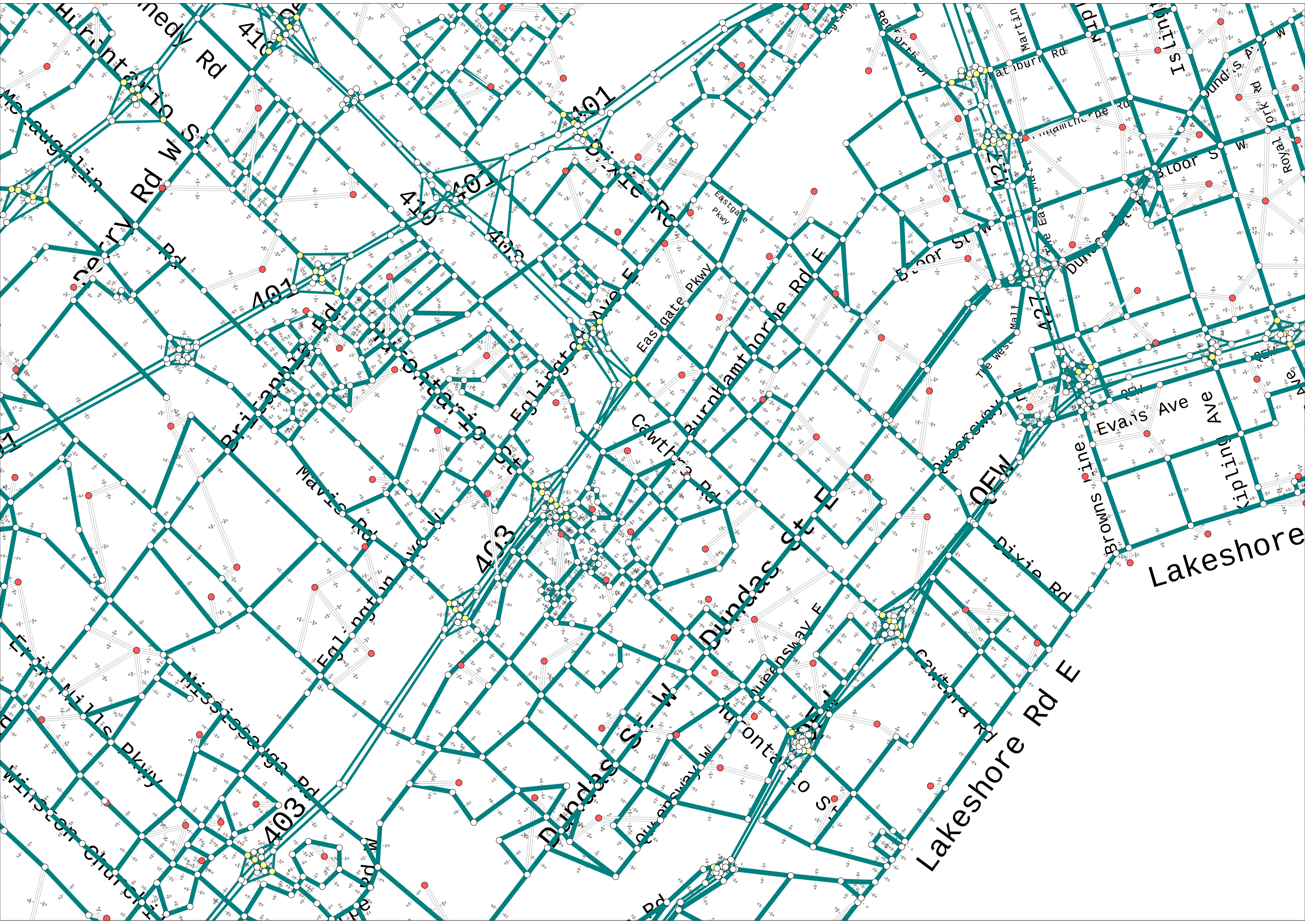
Traffic Volume Plots

2001



Kennedy Rd
410
401
403
Derry Rd W
Dixie Rd
Eastgate Pkwy
Eglinton Ave E
Burnhamthorpe Rd E
Cawthra Rd
Mavis Rd
Dundas St E
Dundas St W
Queensway E
Lakeshore Rd E
QEW
427
Bloor St W
The West Mall
Evans Ave
Browns Line
Kipling Ave
Lakeshore
Mississauga Rd
Erin Mills Pkwy

2001 (Lane, Cap, Speed)



REGION OF PEEL ROAD IMPROVEMENT PROGRAM

As per Proposed 2014 Capital Budget

Note: Distances shown are approximate and are based on conceptual plan.

LOCATION	PROPOSED IMPROVEMENT	EA	Design	Property	Utilities	CONSTRUCTION
Airport Road	2 to 5 lane widening from approximately 1km North of Mayfield Road to King St	Underway	2014	2014	2018	2019
Airport Road	2 to 5 lane widening from King Street to Olde Base Line Road	2015	2017	2019	2020	2021
Airport Road	4 to 6 lane widening from Braydon Boulevard to Countryside Drive	2022	2024		2026	2027
Bovaird Drive	2 to 4 lane widening from James Potter Road to Mississauga Road	Complete	2013	2014	2014	2015
Bovaird Drive	4 to 6 lane widening from Lake Louise Drive to Missisauga Road	Complete	2021		2022	2024
Bovaird Drive	2 to 4 lane widening from Mississauga Road to 1.45 km West of Heritage Road	Complete	2018	2020	2021	2023
Bovaird Drive	4 to 6 lane widening from Mississauga Road to North/South Freeway (1 km W of Miss. Rd.)	Complete	2027		2030	2031
Bolton Arterial By-Pass	2 Lane Road from King Street to Highway 50	Complete	on-going	on-going		2014/2015
Cawthra Road	4 to 6 lane widening from Queen Elizabeth Way to Dundas Street	On hold	2015	2017	2018	2020
Cawthra Road	4 to 6 lane widening from Burnhamthorpe Road to Eastgate Parkway	2022	2023	2026	2028	2030
Derry Road	4 to 6 lane widening from Hwy 407 to Danton Promenade	2025	2027	2029	2031	2032
Derry Road	4 to 6 lane widening from Millcreek Drive to West leg of Copenhagen Road	Complete	2023		2026	2028
Dixie Road	4 to 6 lane widening from Kendall Road to Blundell Road	Complete		on-going	on-going	2013
Dixie Road	4 to 6 lane widening from Steeles Avenue to Clark Boulevard	Complete	complete		on-going	2013/2014
Dixie Road	4 to 6 lane widening from Queen Street East to Bovaird Drive	Complete	2013	2014	2015	2016
Dixie Road	4 to 6 lane widening from Bovaird Drive to Countryside Drive	Complete	2014	2016		2017
Dixie Road	2 to 4 lane widening from Countryside Drive to Mayfield Road	Complete	2013	2014	2015	2016
Dixie Road	2 to 4 lane widening from Mayfield Road to approx. 2 km northerly	Complete	2013	2014	2015	2016
Highway 50	5 to 7 lane widening from Ebenezer Road to Castlemore Road					2013
Highway 50	5 to 7 lane widening from Castlemore Road to 600 m South of Countryside Drive	Complete	2013	2014	2016	2019
Highway 50	5 to 7 lane widening from 600 m South of Countryside Drive to Mayfield Road	Complete	2013	2015	2016	2019
Mavis Road	5 to 7 lane widening from Highway 407 to Steeles Avenue	Complete	on-going	on-going		2013
Mayfield Road	4 to 6 lane widening from Dixie Road to Bramalea Road	Complete	2017	2019	2021	2022
Mayfield Road	2 to 4 lane widening from Bramalea Road to Airport Road			2013	2014	2015
Mayfield Road	4 to 6 lane widening from Bramalea Road to Airport Road	Complete	2018	2020	2022	2023
Mayfield Road	2 to 4 lane widening from Airport Road to The Gore Road and The Gore from Beamish Court to Mayfield Road	Complete	2013	2014	2015	2018
Mayfield Road	2 to 4 lane widening from The Gore Road to Clarkway Drive	Complete	2013	2015	2017	2019
Mayfield Road	4 to 6 lane widening from Airport Road to Clarkway Drive	Complete	2024		2026	2028
Mayfield Road	2 to 4 lane widening from Clarkway Drive to Coleraine	Complete	2013	2015	2017	2019
Mayfield Road	2 to 4 lane widening from Coleraine to Hwy 50	Complete	2013	2015	2016	2019
Mayfield Road	2 to 4 lane widening from Hurontario Street to Chinguacousy Road	Underway	2013	2016	2017	2018
Mayfield Road	4 to 6 lane widening from Hurontario Street to Chinguacousy Road	Underway	2025	2027	2028	2029
Mayfield Road	2 to 4 lane widening from Chinguacousy Road to Mississauga Road	Underway	2015	2017	2018	2019
Mayfield Road	2 to 4 lane widening from Mississauga Road to Winston Churchill Boulevard	Underway	2017	2018	2020	2021
Mayfield Road	4 to 6 lane widening from Chinguacousy Road to 1.5 km west of Mississauga Road	Underway	2026	2028	2029	2031
Mayfield Road	4 to 6 lane widening from Heart Lake Road to Hurontario Street	Underway	2018	2019	2020	2021
Mississauga Road	4 to 6 lane widening from Financial Drive to Queen Street West	2015	2016		2020	2021
Mississauga Road	2 to 4 lane widening from Williams Parkway West to Bovaird Drive					2014/2015
Mississauga Road	4 to 6 lane widening from Queen Street West to Bovaird Drive	Complete	2018		2022	2023
Mississauga Road	2 to 4 lane widening from Bovaird Drive to Mayfield Road	Complete	2013	2014	2016	2017
Mississauga Road	4 to 6 lane widening from Bovaird Drive to Future Sandalwood Pkwy	Complete	2023		2025	2027
North/South Arterial Road	6 Lane Road from Future BramWest Pkwy to Bovaird Drive (Not confirmed to be Region Rd)	On hold	2022	2023		Bridge 2023 Road 2024
North/South Arterial Road	6 Lane Road from Bovaird Drive to Future Sandalwood Pkwy (Not confirmed to be Region Rd)	On hold	2022	2023		Bridge 2023 Road 2024
Old Church Road	2 to 4 lane widening from East leg of Marilyn Street to Innis Lake Road	Complete		2013	2013	2014
Queen Street West	2 to 4 lane widening from Chinguacousy Road to Mississauga Road					2014
Steeles Avenue West	4 to 6 lane widening from Chinguacousy Road to Mississauga Road	Underway	2014		2017	2018
Steeles Avenue West	4 to 6 lane widening from Mississauga Road to Winston Churchill Boulevard	Underway	2016		2020	2021
The Gore Road	2 to 4 lane widening from Eastbrook Way to Castlemore Road					On-going
The Gore Road	2 to 4 lane widening from Castlemore Road to Beamish Court	Complete	on-going	2013	2013	2014
The Gore Road	2 to 4 lane widening from Highway 50 to Queen Street East	Complete	on-going	2012	2013	2016
The Gore Road	4 to 6 lane widening from Queen Street to Cottrelle Boulevard	2013	2015	2017	2019	2020
The Gore Road	4 to 6 lane widening from Cottrelle Boulevard to Castlemore Road	2013	2016		2020	2021
The Gore Road	4 to 6 lane widening from Castlemore Road to Countryside Drive	2022	2026		2028	2030
Winston Churchill Boulevard	4 to 6 lane widening from Highway 401 to Steeles Avenue	2014	2015		2019	2021
Winston Churchill Boulevard	2 to 4 lane widening from 2.0km South of Embleton Road to By-Pass (1.3km N of Embleton)	2014	2015	2017	2019	2020
Winston Churchill Boulevard	5 to 7 lane widening from Steeles Avenue to 2 km South of Embleton Road	2023	2025		2029	2030
Winston Churchill Boulevard	4 to 6 lane widening from 2 km South of Embleton Road to Embleton Road	2023	2025		2029	2030
Winston Churchill Boulevard	4 to 6 lane widening from North Sheridan Way to Dundas Street	2023	2025	2027	2029	2030

2031 DO NOTHING
(Maintaining 4-Lanes)

2031 DO NOTHING (Lane, Cap, Speed)
(Maintaining 4-Lanes)

2031 BASE

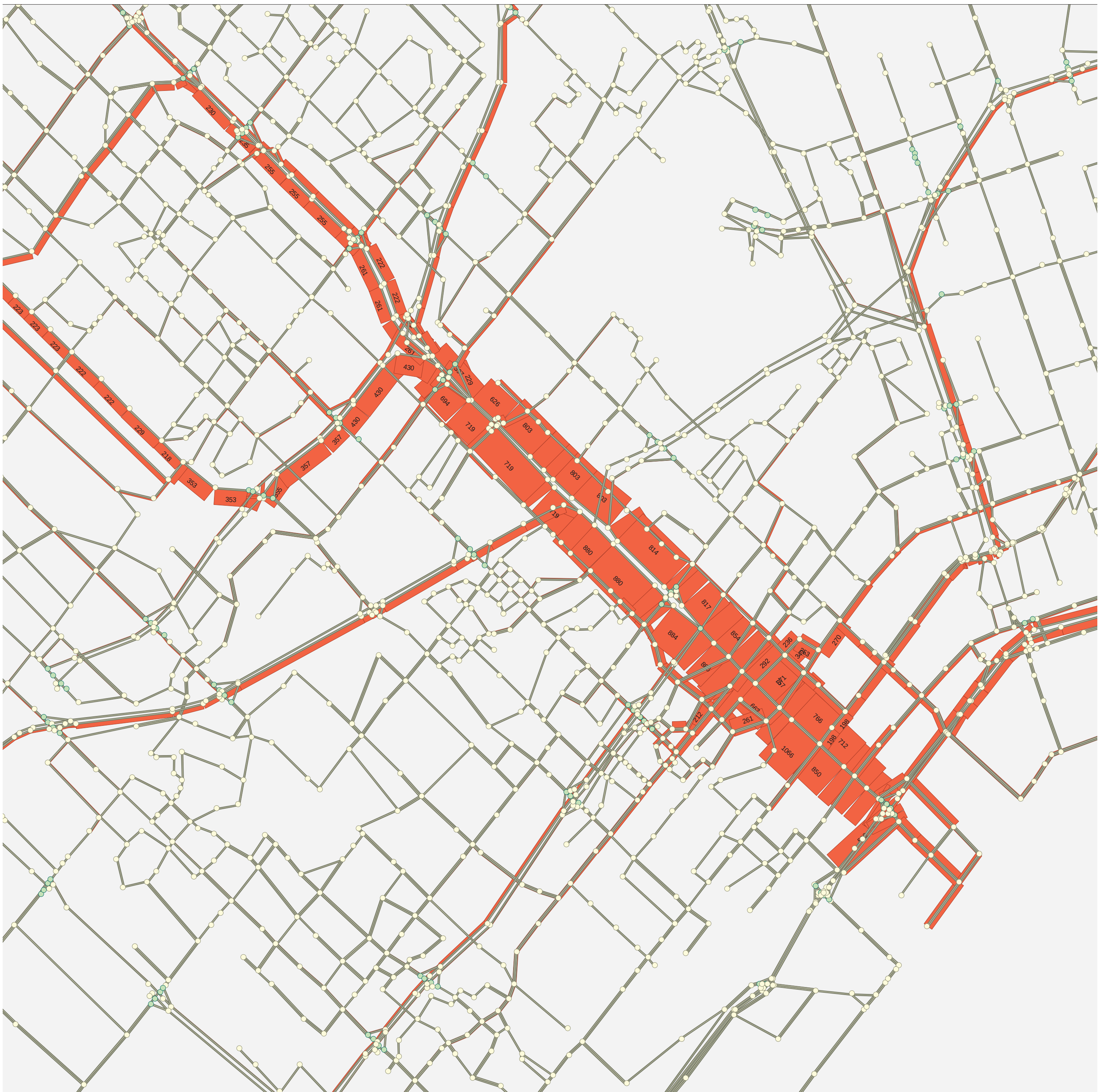
2031 BASE (Lane/Cap/Speed)

2031 SIX LANE

2031 SIX LANE (Lane, Cap, Speed)

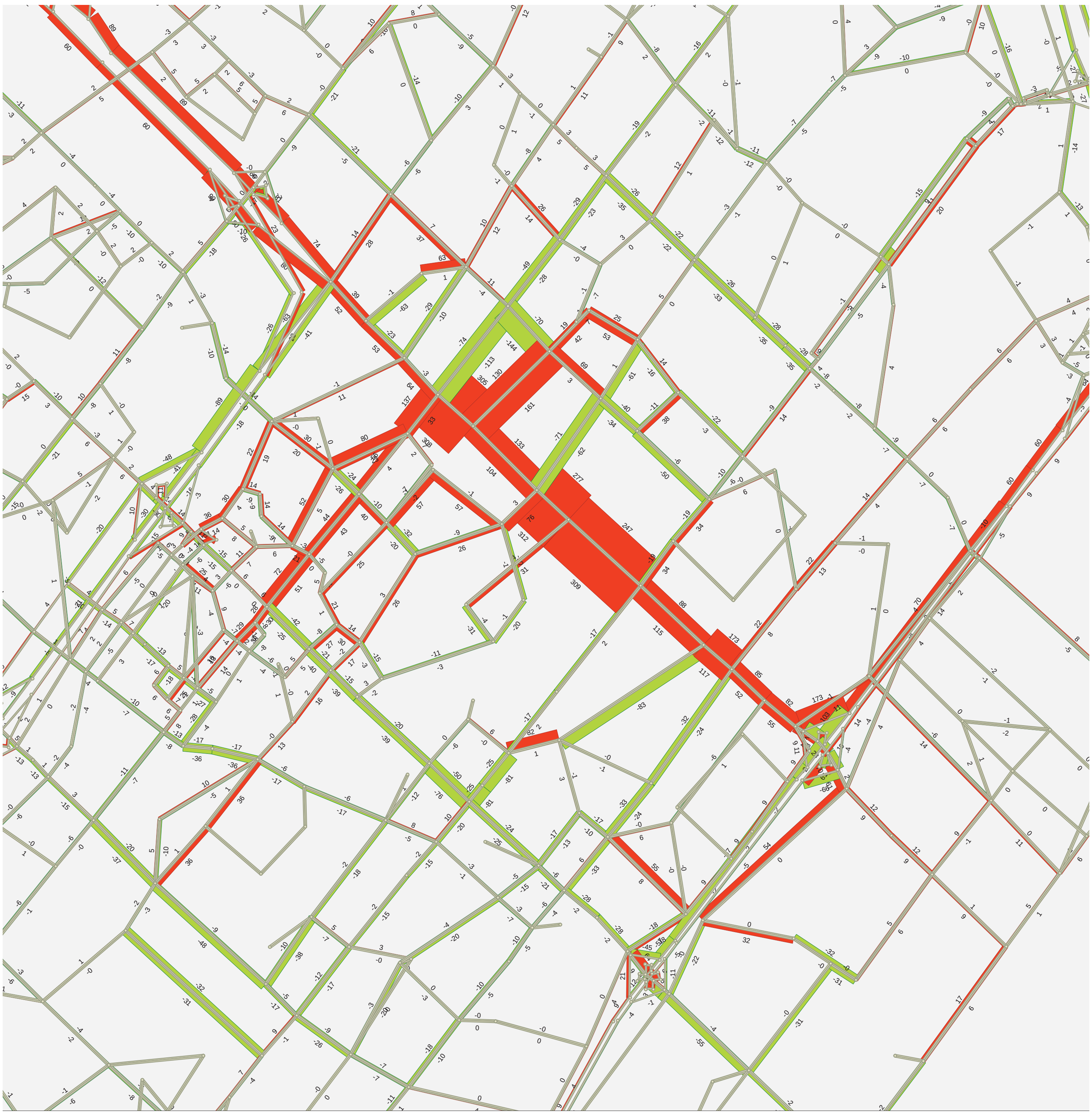
Base Case
Select Link Analysis

This plot shows the origin of traffic using Cawhra Road and suggests that Cawthra is an important north-south link in the region given the connection to Highways 403/410 and the QEW.



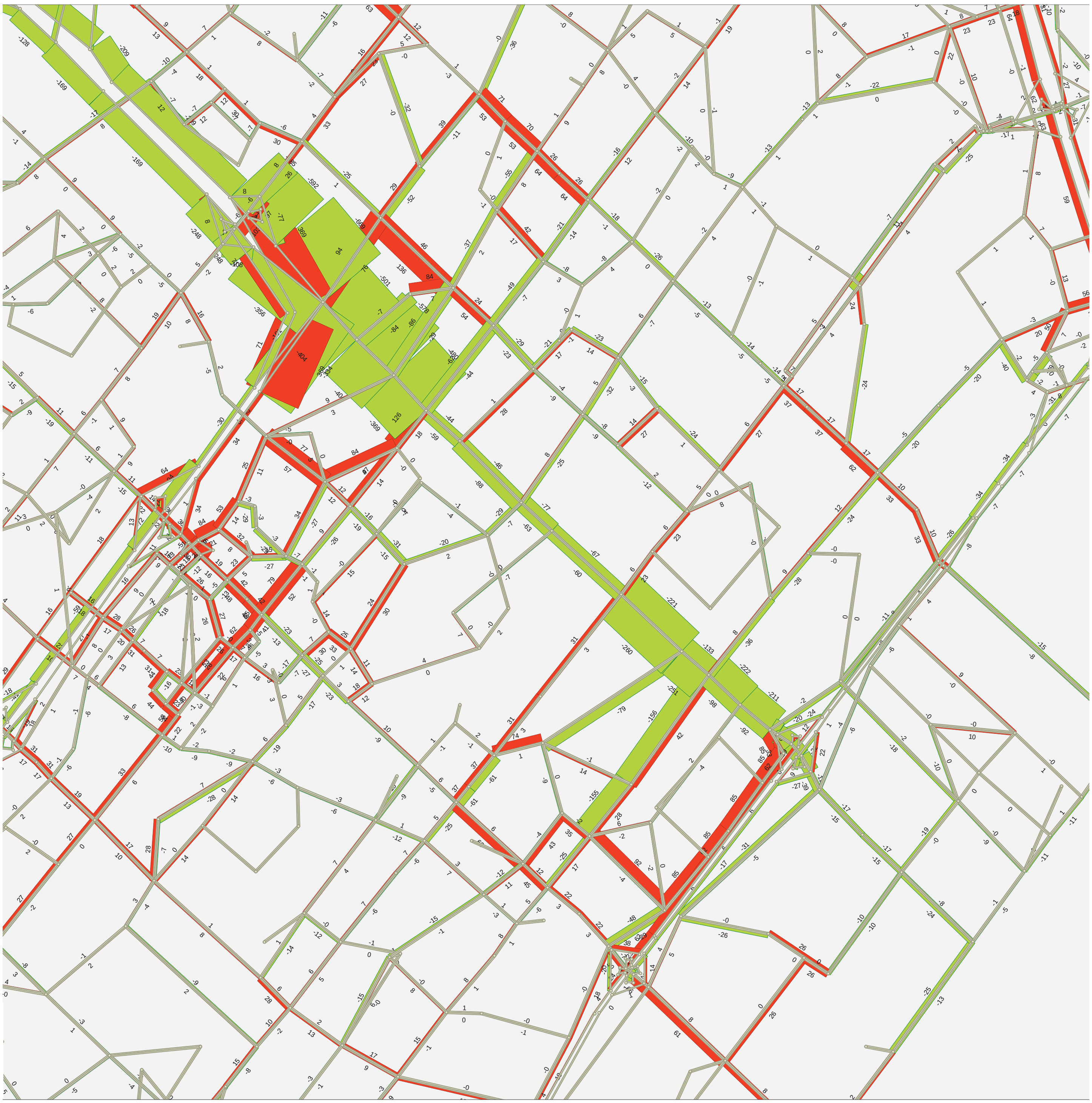
Base Case to Six Lane
Select Link Analysis

Red indicates an increase in traffic volume resulting in widening the middle section of Cawthra to six lanes as compared to the Base Case. This plot suggests that widening Cawthra to six lanes througout would draw sufficient demand to warrant the widneing.



Base Case to Do Nothing
Select Link Analysis

Green indicates the reduction in traffic resutling from not widening as compared to the Base Case. This plot suggests that a Do Nothing scenario will result in incrased traffic on various routes in the area that would otherwise be accommodated by Cawthra.



Future Traffic Growth

1. Cawthra Road Traffic Forecasts - Screenline Analysis

	2001			2031 Do Nothing			Growth/Year (Compounded)		
South of Eastgate	**Northbound**	**Southbound**	**Total**	**Northbound**	**Southbound**	**Total**	**Northbound**	**Southbound**	**Total**
McLaughlin/Confed Parkway	9	41	50	1,593	1,021	2,614	18.8%	11.3%	14.1%
Hurontario	2,835	3,276	6,111	3,578	2,903	6,481	0.8%	-0.4%	0.2%
Central Pkwy/Cliff	592	765	1,357	553	835	1,388	-0.2%	0.3%	0.1%
Highway 403/Cawthra	1,181	667	1,848	1,359	1,177	2,536	0.5%	1.9%	1.1%
Tomken/Haines/Stanfield	1,080	227	1,307	1,290	432	1,722	0.6%	n/a	0.9%
Dixie	2,830	563	3,393	3,379	74	3,453	0.6%	-6.5%	0.1%
Total	**12,283**	**8,729**	**21,012**	**15,898**	**10,744**	**26,642**	**0.9%**	**0.7%**	**0.8%**
South of Dundas									
McLaughlin/Confed Parkway	367	400	767	301	509	810	-0.7%	0.8%	0.2%
Hurontario	1,490	1,426	2,916	1,339	1,669	3,008	-0.4%	0.5%	0.1%
Central Pkwy/Cliff	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Highway 403/Cawthra	894	724	1,618	770	894	1,664	-0.5%	0.7%	0.1%
Tomken/Haines/Stanfield	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Dixie	1,005	1,430	2,435	1,736	1,736	3,472	1.8%	0.6%	1.2%
Total	**12,283**	**8,729**	**21,012**	**15,898**	**10,744**	**26,642**	**0.9%**	**0.7%**	**0.8%**

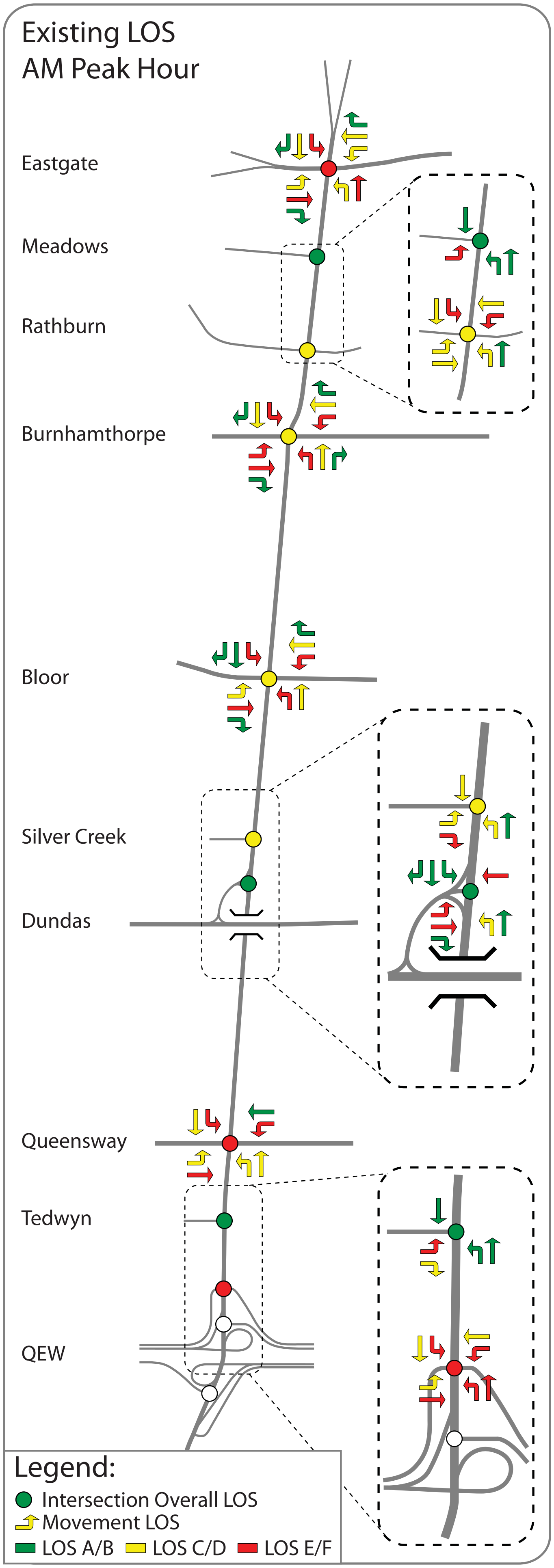
2. Cawthra Road Traffic Forecasts - Road Widening Scenario Analysis

		Cawthra Road (South of 403/Eastgate)	Cawthra Road (South of Dundas)
2031 Do Nothing	Northbound	1,359	770
	Southbound	1,177	894
	Total	2,536	1,664
2031 Base	Northbound	1,860	991
	Southbound	1,582	1,154
	Total	3,442	2,145
2031 Six Lane	Northbound	1,901	1,077
	Southbound	1,636	1,256
	Total	3,537	2,333
Absolute Growth 2031 Base	Northbound	**501**	**221**
	Southbound	**405**	**260**
	Total	**906**	**481**
Absolute Growth 2031 Six Lane	Northbound	**542**	**307**
	Southbound	**459**	**362**
	Total	**1,001**	**669**

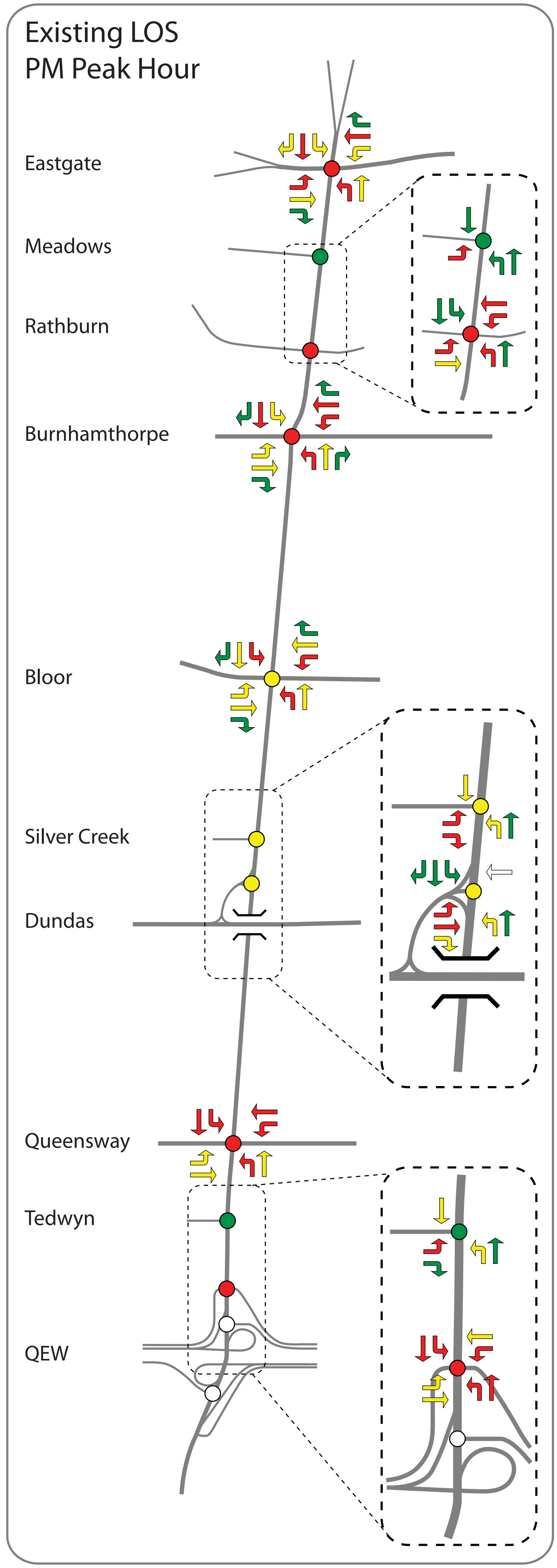
Notes:

1. *Number of Years=* 30
2. *GR/YR calculated shows compounded growth rate*

Synchro Results



Existing LOS
AM Peak Hour
Eastgate
Meadows
Rathburn
Burnhamthorpe
Bloor
Silver Creek
Dundas
Queensway
Tedwyn
QEW
Legend:
Intersection Overall LOS
Movement LOS
LOS A/B
LOS C/D
LOS E/F



Existing LOS
PM Peak Hour
Eastgate
Meadows
Rathburn
Burnhamthorpe
Bloor
Silver Creek
Dundas
Queensway
Tedwyn
QEW

Exhibit

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	81	154	311	195	87	34	177	1580	188	28	1866	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.6	6.6		4.0	6.6		3.0	6.3		6.3	6.3	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.91	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.90		1.00	0.96		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1688	1623		1700	1743		1700	3409		1608	4980	
Flt Permitted	0.67	1.00		0.12	1.00		0.07	1.00		0.07	1.00	
Satd. Flow (perm)	1195	1623		214	1743		126	3409		126	4980	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	167	338	212	95	37	192	1717	204	30	2028	34
RTOR Reduction (vph)	0	60	0	0	10	0	0	8	0	0	2	0
Lane Group Flow (vph)	88	445	0	212	122	0	192	1913	0	30	2060	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	11%	5%	5%
Turn Type	Perm	NA		pm+pt	NA		pm+pt	NA		Perm	NA	
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	29.4	29.4		41.4	41.4		65.7	65.7		53.7	53.7	
Effective Green, g (s)	29.4	29.4		41.4	41.4		65.7	65.7		53.7	53.7	
Actuated g/C Ratio	0.24	0.24		0.34	0.34		0.55	0.55		0.45	0.45	
Clearance Time (s)	6.6	6.6		4.0	6.6		3.0	6.3		6.3	6.3	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	292	397		172	601		187	1866		56	2228	
v/s Ratio Prot		0.27		c0.08	0.07		0.08	c0.56			0.41	
v/s Ratio Perm	0.07			c0.34			c0.48			0.24		
v/c Ratio	0.30	1.12		1.23	0.20		1.03	1.03		0.54	0.92	
Uniform Delay, d1	36.9	45.3		34.7	27.7		34.8	27.1		24.1	31.2	
Progression Factor	1.00	1.00		1.00	1.00		0.83	1.08		0.69	0.73	
Incremental Delay, d2	1.2	81.9		144.8	0.4		65.7	25.3		30.6	7.7	
Delay (s)	38.1	127.2		179.4	28.0		94.7	54.7		47.3	30.4	
Level of Service	D	F		F	C		F	D		D	C	
Approach Delay (s)		114.0			121.3			58.4			30.7	
Approach LOS		F			F			E			C	

Intersection Summary			
HCM 2000 Control Delay	57.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	19.9
Intersection Capacity Utilization	114.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	88	72	72	1518	1562	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.5	3.5	3.7	3.7	3.7
Total Lost time (s)	7.1	7.1	6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1560	1490	1698	3476	4988	
Flt Permitted	0.95	1.00	0.12	1.00	1.00	
Satd. Flow (perm)	1560	1490	209	3476	4988	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	96	78	78	1650	1698	13
RTOR Reduction (vph)	0	13	0	0	0	0
Lane Group Flow (vph)	96	65	78	1650	1711	0
Confl. Peds. (#/hr)	5	5	5			5
Heavy Vehicles (%)	17%	5%	5%	5%	5%	5%
Turn Type	NA	Perm	Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	14.7	14.7	91.9	91.9	91.9	
Effective Green, g (s)	14.7	14.7	91.9	91.9	91.9	
Actuated g/C Ratio	0.12	0.12	0.77	0.77	0.77	
Clearance Time (s)	7.1	7.1	6.3	6.3	6.3	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	191	182	160	2662	3819	
v/s Ratio Prot	c0.06			c0.47	0.34	
v/s Ratio Perm		0.04	0.37			
v/c Ratio	0.50	0.36	0.49	0.62	0.45	
Uniform Delay, d1	49.2	48.3	5.3	6.3	5.0	
Progression Factor	1.00	1.00	1.02	0.79	0.40	
Incremental Delay, d2	4.3	2.5	2.9	0.3	0.2	
Delay (s)	53.5	50.8	8.3	5.3	2.2	
Level of Service	D	D	A	A	A	
Approach Delay (s)	52.3			5.4	2.2	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	6.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.4
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	1149	278	188	257	90	188	1049	248	284	1147	64
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.9	6.9		5.0	6.9		3.0	7.5		5.0	7.5	
Lane Util. Factor	1.00	0.91		0.97	0.91		1.00	0.91		0.97	0.91	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1693	4832		3298	4707		1700	4834		3298	4950	
Flt Permitted	0.52	1.00		0.95	1.00		0.10	1.00		0.95	1.00	
Satd. Flow (perm)	926	4832		3298	4707		184	4834		3298	4950	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	196	1249	302	204	279	98	204	1140	270	309	1247	70
RTOR Reduction (vph)	0	34	0	0	53	0	0	33	0	0	5	0
Lane Group Flow (vph)	196	1517	0	204	324	0	204	1377	0	309	1312	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Heavy Vehicles (%)	5%	5%	5%	5%	5%	11%	5%	5%	5%	5%	5%	5%
Turn Type	Perm	NA		Prot	NA		pm+pt	NA		Prot	NA	
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4						2					
Actuated Green, G (s)	35.1	35.1		9.0	49.1		51.8	38.9		12.6	40.6	
Effective Green, g (s)	35.1	35.1		9.0	49.1		51.8	38.9		12.6	40.6	
Actuated g/C Ratio	0.29	0.29		0.08	0.41		0.43	0.32		0.10	0.34	
Clearance Time (s)	6.9	6.9		5.0	6.9		3.0	7.5		5.0	7.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	270	1413		247	1925		242	1567		346	1674	
v/s Ratio Prot		c0.31		c0.06	0.07		0.09	c0.28		c0.09	0.26	
v/s Ratio Perm	0.21						0.27					
v/c Ratio	0.73	1.07		0.83	0.17		0.84	0.88		0.89	0.78	
Uniform Delay, d1	38.1	42.5		54.7	22.5		28.0	38.3		53.0	35.7	
Progression Factor	1.00	1.00		1.00	1.00		0.83	1.00		1.00	1.00	
Incremental Delay, d2	11.3	46.4		21.8	0.2		21.1	6.2		25.3	3.7	
Delay (s)	49.5	88.8		76.5	22.7		44.2	44.7		78.3	39.5	
Level of Service	D	F		E	C		D	D		E	D	
Approach Delay (s)		84.4			41.6			44.6			46.9	
Approach LOS		F			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	57.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.4
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	234	1859	20	8	514	116	12	20	16	368	25	169
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5
Total Lost time (s)	3.0	6.8		6.8	6.8	6.8		7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.96		1.00	1.00	1.00	1.00	0.93
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1698	3469		1580	4995	1328		1792	1521	1651	1665	1407
Flt Permitted	0.38	1.00		0.09	1.00	1.00		0.28	1.00	0.95	0.96	1.00
Satd. Flow (perm)	678	3469		148	4995	1328		511	1521	1651	1665	1407
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	254	2021	22	9	559	126	13	22	17	400	27	184
RTOR Reduction (vph)	0	1	0	0	0	79	0	0	16	0	0	158
Lane Group Flow (vph)	254	2042	0	9	559	47	0	35	1	212	215	26
Confl. Peds. (#/hr)	5		5	5		5	5					30
Confl. Bikes (#/hr)						25						
Heavy Vehicles (%)	5%	5%	5%	13%	5%	16%	5%	5%	5%	5%	5%	5%
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm	Split	NA	Perm
Protected Phases	7	4			8			2		6	6	
Permitted Phases	4			8		8	2		2			6
Actuated Green, G (s)	72.5	72.5		44.8	44.8	44.8		9.8	9.8	16.9	16.9	16.9
Effective Green, g (s)	72.5	72.5		44.8	44.8	44.8		9.8	9.8	16.9	16.9	16.9
Actuated g/C Ratio	0.60	0.60		0.37	0.37	0.37		0.08	0.08	0.14	0.14	0.14
Clearance Time (s)	3.0	6.8		6.8	6.8	6.8		7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	619	2095		55	1864	495		41	124	232	234	198
v/s Ratio Prot	0.08	c0.59			0.11					0.13	c0.13	
v/s Ratio Perm	0.16			0.06		0.04		c0.07	0.00			0.02
v/c Ratio	0.41	0.97		0.16	0.30	0.10		0.85	0.01	0.91	0.92	0.13
Uniform Delay, d1	11.3	22.9		25.1	26.5	24.4		54.4	50.6	50.8	50.9	45.1
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	14.3		6.3	0.4	0.4		90.6	0.1	37.9	38.5	0.6
Delay (s)	12.2	37.1		31.4	26.9	24.8		145.0	50.7	88.7	89.4	45.8
Level of Service	B	D		C	C	C		F	D	F	F	D
Approach Delay (s)		34.4			26.6			114.2			76.0	
Approach LOS		C			C			F			E	

Intersection Summary			
HCM 2000 Control Delay	41.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.8
Intersection Capacity Utilization	93.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	379	3	104	4	2	1	70	1512	2	3	1624	488
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.7	3.7	3.7	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.4	6.4	6.4		6.4		3.0	6.4		6.4	6.4	6.4
Lane Util. Factor	0.95	0.95	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.93		1.00		1.00	1.00		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.98		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00		0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1651	1657	1439		1745		1638	3475		1700	3476	1479
Flt Permitted	0.95	0.95	1.00		0.97		0.05	1.00		0.10	1.00	1.00
Satd. Flow (perm)	1651	1657	1439		1745		82	3475		185	3476	1479
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	412	3	113	4	2	1	76	1643	2	3	1765	530
RTOR Reduction (vph)	0	0	92	0	1	0	0	0	0	0	0	101
Lane Group Flow (vph)	206	209	21	0	6	0	76	1645	0	3	1765	429
Confl. Peds. (#/hr)			35	16					7			19
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	9%	5%	5%	5%	5%	5%
Turn Type	Split	NA	Perm	Split	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases			4				2			6		6
Actuated Green, G (s)	25.9	25.9	25.9		1.8		93.1	93.1		81.1	81.1	81.1
Effective Green, g (s)	25.9	25.9	25.9		1.8		93.1	93.1		81.1	81.1	81.1
Actuated g/C Ratio	0.18	0.18	0.18		0.01		0.66	0.66		0.58	0.58	0.58
Clearance Time (s)	6.4	6.4	6.4		6.4		3.0	6.4		6.4	6.4	6.4
Vehicle Extension (s)	5.0	5.0	5.0		5.0		5.0	5.0		5.0	5.0	5.0
Lane Grp Cap (vph)	305	306	266		22		154	2310		107	2013	856
v/s Ratio Prot	0.12	c0.13			c0.00		0.03	c0.47			c0.51	
v/s Ratio Perm			0.01				0.30			0.02		0.29
v/c Ratio	0.68	0.68	0.08		0.27		0.49	0.71		0.03	0.88	0.50
Uniform Delay, d1	53.1	53.2	47.2		68.5		25.6	14.9		12.6	25.2	17.5
Progression Factor	1.00	1.00	1.00		1.00		1.00	1.00		0.83	0.49	0.42
Incremental Delay, d2	7.5	7.9	0.3		13.6		5.1	1.9		0.3	3.5	1.2
Delay (s)	60.7	61.1	47.4		82.0		30.7	16.8		10.7	15.9	8.6
Level of Service	E	E	D		F		C	B		B	B	A
Approach Delay (s)		58.0			82.0			17.4			14.2	
Approach LOS		E			F			B			B	

Intersection Summary			
HCM 2000 Control Delay	20.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	22.2
Intersection Capacity Utilization	86.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	95	0	366	0	0	0	122	1280	0	0	1608	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.7	3.7	3.7	3.5	3.7	3.7	3.7	3.7	3.7
Total Lost time (s)		6.0	6.0				3.0	6.0			6.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.98				1.00	1.00			1.00	
Flpb, ped/bikes		0.99	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			1.00	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1728	1519				1700	3476			3461	
Flt Permitted		0.76	1.00				0.05	1.00			1.00	
Satd. Flow (perm)		1377	1519				92	3476			3461	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	0	398	0	0	0	133	1391	0	0	1748	32
RTOR Reduction (vph)	0	0	115	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	103	283	0	0	0	133	1391	0	0	1779	0
Confl. Peds. (#/hr)	3		6	6		3	7					7
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	10%
Turn Type	Perm	NA	Perm	Perm			pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		27.4	27.4				100.6	100.6			87.0	
Effective Green, g (s)		27.4	27.4				100.6	100.6			87.0	
Actuated g/C Ratio		0.20	0.20				0.72	0.72			0.62	
Clearance Time (s)		6.0	6.0				3.0	6.0			6.0	
Vehicle Extension (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		269	297				187	2497			2150	
v/s Ratio Prot							c0.05	0.40			c0.51	
v/s Ratio Perm		0.07	c0.19				0.46					
v/c Ratio		0.38	0.95				0.71	0.56			0.83	
Uniform Delay, d1		48.9	55.7				35.8	9.2			20.7	
Progression Factor		1.00	1.00				1.38	0.79			1.34	
Incremental Delay, d2		1.9	40.2				11.2	0.7			2.7	
Delay (s)		50.8	95.9				60.5	7.9			30.3	
Level of Service		D	F				E	A			C	
Approach Delay (s)		86.6			0.0			12.5			30.3	
Approach LOS		F			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	30.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	176	669	238	196	266	142	88	1161	152	155	1334	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.7	3.7	3.7	3.7	3.7	3.5
Total Lost time (s)	3.0	6.9	4.0	3.0	6.9	4.0	7.0	7.0		3.0	7.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1680	3476	1501	1700	3476	1496	1738	3416		1738	3476	1501
Flt Permitted	0.57	1.00	1.00	0.14	1.00	1.00	0.11	1.00		0.06	1.00	1.00
Satd. Flow (perm)	1016	3476	1501	258	3476	1496	194	3416		106	3476	1501
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	191	727	259	213	289	154	96	1262	165	168	1450	50
RTOR Reduction (vph)	0	0	0	0	0	0	0	7	0	0	0	0
Lane Group Flow (vph)	191	727	259	213	289	154	96	1420	0	168	1450	50
Confl. Peds. (#/hr)	16		5			16	5					5
Turn Type	pm+pt	NA	Free	pm+pt	NA	Free	Perm	NA		pm+pt	NA	Free
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4		Free	8		Free	2			6		Free
Actuated Green, G (s)	42.9	36.1	140.0	48.5	38.9	140.0	65.8	65.8		77.4	77.4	140.0
Effective Green, g (s)	42.9	36.1	140.0	48.5	38.9	140.0	65.8	65.8		77.4	77.4	140.0
Actuated g/C Ratio	0.31	0.26	1.00	0.35	0.28	1.00	0.47	0.47		0.55	0.55	1.00
Clearance Time (s)	3.0	6.9		3.0	6.9		7.0	7.0		3.0	7.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	343	896	1501	188	965	1496	91	1605		158	1921	1501
v/s Ratio Prot	0.03	0.21		c0.08	0.08			0.42		c0.06	0.42	
v/s Ratio Perm	0.14		0.17	c0.31		0.10	0.49			c0.52		0.03
v/c Ratio	0.56	0.81	0.17	1.13	0.30	0.10	1.05	0.88		1.06	0.75	0.03
Uniform Delay, d1	38.7	48.8	0.0	40.1	39.8	0.0	37.1	33.7		40.3	24.0	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.84	0.84		1.88	0.43	1.00
Incremental Delay, d2	3.3	6.4	0.2	105.9	0.4	0.1	103.1	6.6		81.9	2.3	0.0
Delay (s)	42.0	55.1	0.2	146.0	40.2	0.1	134.4	34.9		157.6	12.6	0.0
Level of Service	D	E	A	F	D	A	F	C		F	B	A
Approach Delay (s)		40.9			65.1			41.1			26.9	
Approach LOS		D			E			D			C	

Intersection Summary			
HCM 2000 Control Delay	39.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	19.9
Intersection Capacity Utilization	93.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	163	1113	194	128	568	37	183	1201	137	131	1081	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	7.5	7.5	4.0	3.0	7.5	4.0	3.0	8.0	8.0	3.0	8.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1688	3476	1502	1700	3476	1496	1700	3476	1534	1700	3476	1501
Flt Permitted	0.41	1.00	1.00	0.08	1.00	1.00	0.09	1.00	1.00	0.07	1.00	1.00
Satd. Flow (perm)	733	3476	1502	139	3476	1496	158	3476	1534	127	3476	1501
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	177	1210	211	139	617	40	199	1305	149	142	1175	63
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	62	0	0	0
Lane Group Flow (vph)	177	1210	211	139	617	40	199	1305	87	142	1175	63
Confl. Peds. (#/hr)	14		1	1		14	11		1	1		5
Turn Type	Perm	NA	Free	pm+pt	NA	Free	pm+pt	NA	Perm	pm+pt	NA	Free
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4		Free	8		Free	2		2	6		Free
Actuated Green, G (s)	48.5	48.5	140.0	58.3	58.3	140.0	63.2	56.4	56.4	63.2	56.4	140.0
Effective Green, g (s)	48.5	48.5	140.0	58.3	58.3	140.0	63.2	56.4	56.4	63.2	56.4	140.0
Actuated g/C Ratio	0.35	0.35	1.00	0.42	0.42	1.00	0.45	0.40	0.40	0.45	0.40	1.00
Clearance Time (s)	7.5	7.5		3.0	7.5		3.0	8.0	8.0	3.0	8.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	253	1204	1502	133	1447	1496	146	1400	617	133	1400	1501
v/s Ratio Prot		0.35		c0.05	0.18		c0.07	0.38		0.05	0.34	
v/s Ratio Perm	0.24		0.14	c0.38		0.03	c0.55		0.06	0.43		0.04
v/c Ratio	0.70	1.00	0.14	1.05	0.43	0.03	1.36	0.93	0.14	1.07	0.84	0.04
Uniform Delay, d1	39.5	45.8	0.0	34.8	29.0	0.0	31.7	40.0	26.5	33.3	37.7	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.94	0.62	0.29	1.92	0.52	1.00
Incremental Delay, d2	10.3	27.1	0.2	90.6	0.4	0.0	195.6	10.9	0.4	88.8	5.0	0.0
Delay (s)	49.8	72.9	0.2	125.4	29.4	0.0	257.1	35.7	8.0	152.7	24.8	0.0
Level of Service	D	E	A	F	C	A	F	D	A	F	C	A
Approach Delay (s)		60.7			44.7			59.8			36.8	
Approach LOS		E			D			E			D	

Intersection Summary			
HCM 2000 Control Delay	52.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	97.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	568	135	103	436	112	130	1330	176	93	1024	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.7	3.7	3.7
Total Lost time (s)	6.4	6.4		6.4	6.4		6.5	6.5		6.5	6.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.98	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.97		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1674	3359		1694	3331		1696	3408		1738	3456	
Flt Permitted	0.30	1.00		0.19	1.00		0.18	1.00		0.06	1.00	
Satd. Flow (perm)	525	3359		347	3331		322	3408		118	3456	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	617	147	112	474	122	141	1446	191	101	1113	28
RTOR Reduction (vph)	0	15	0	0	17	0	0	7	0	0	1	0
Lane Group Flow (vph)	70	749	0	112	579	0	141	1630	0	101	1140	0
Confl. Peds. (#/hr)	36		12	12		36	12		6	6		12
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	12%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	45.2	45.2		45.2	45.2		81.9	81.9		81.9	81.9	
Effective Green, g (s)	45.2	45.2		45.2	45.2		81.9	81.9		81.9	81.9	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.59	0.59		0.59	0.59	
Clearance Time (s)	6.4	6.4		6.4	6.4		6.5	6.5		6.5	6.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	169	1084		112	1075		188	1993		69	2021	
v/s Ratio Prot		0.22			0.17			0.48			0.33	
v/s Ratio Perm	0.13			c0.32			0.44			c0.86		
v/c Ratio	0.41	0.69		1.00	0.54		0.75	0.82		1.46	0.56	
Uniform Delay, d1	37.1	41.3		47.4	38.9		21.5	23.1		29.0	18.0	
Progression Factor	1.00	1.00		1.00	1.00		0.68	0.60		1.23	1.07	
Incremental Delay, d2	3.4	2.4		85.0	1.0		16.0	2.5		266.4	1.0	
Delay (s)	40.5	43.8		132.4	39.8		30.6	16.5		302.0	20.2	
Level of Service	D	D		F	D		C	B		F	C	
Approach Delay (s)		43.5			54.5			17.6			43.1	
Approach LOS		D			D			B			D	

Intersection Summary			
HCM 2000 Control Delay	35.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.9
Intersection Capacity Utilization	102.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	121	25	21	1302	1121	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2		6.0	6.0	6.0	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frpb, ped/bikes	1.00		1.00	1.00	1.00	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.98		1.00	1.00	0.99	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1716		1737	3476	3451	
Flt Permitted	0.96		0.19	1.00	1.00	
Satd. Flow (perm)	1716		353	3476	3451	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	132	27	23	1415	1218	52
RTOR Reduction (vph)	5	0	0	0	2	0
Lane Group Flow (vph)	154	0	23	1415	1268	0
Confl. Peds. (#/hr)			2			2
Turn Type	NA		Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	19.6		108.2	108.2	108.2	
Effective Green, g (s)	19.6		108.2	108.2	108.2	
Actuated g/C Ratio	0.14		0.77	0.77	0.77	
Clearance Time (s)	6.2		6.0	6.0	6.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	240		272	2686	2667	
v/s Ratio Prot	c0.09			c0.41	0.37	
v/s Ratio Perm			0.07			
v/c Ratio	0.64		0.08	0.53	0.48	
Uniform Delay, d1	56.9		3.9	6.1	5.7	
Progression Factor	1.00		0.84	1.10	0.71	
Incremental Delay, d2	7.8		0.4	0.4	0.5	
Delay (s)	64.6		3.6	7.1	4.6	
Level of Service	E		A	A	A	
Approach Delay (s)	64.6			7.1	4.6	
Approach LOS	E			A	A	

Intersection Summary			
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	368	1423	333	55	509	234	193	992	120	180	643	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4		3.0	8.4	8.4
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1700	3476	1521	1580	3476	1521	1700	3420		1700	3476	1268
Flt Permitted	0.33	1.00	1.00	0.09	1.00	1.00	0.21	1.00		0.10	1.00	1.00
Satd. Flow (perm)	583	3476	1521	144	3476	1521	379	3420		179	3476	1268
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	400	1547	362	60	553	254	210	1078	130	196	699	136
RTOR Reduction (vph)	0	0	128	0	0	122	0	6	0	0	0	97
Lane Group Flow (vph)	400	1547	234	60	553	132	210	1202	0	196	699	39
Confl. Peds. (#/hr)												
Heavy Vehicles (%)	5%	5%	5%	13%	5%	5%	5%	5%	5%	5%	5%	26%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	71.1	62.7	62.7	51.6	46.2	46.2	51.0	41.4		48.2	40.0	40.0
Effective Green, g (s)	71.1	62.7	62.7	51.6	46.2	46.2	51.0	41.4		48.2	40.0	40.0
Actuated g/C Ratio	0.51	0.45	0.45	0.37	0.33	0.33	0.36	0.30		0.34	0.29	0.29
Clearance Time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4		3.0	8.4	8.4
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Grp Cap (vph)	470	1556	681	108	1147	501	228	1011		150	993	362
v/s Ratio Prot	c0.13	c0.45		0.02	0.16		c0.06	0.35		c0.08	0.20	
v/s Ratio Perm	0.30		0.15	0.18		0.09	0.27			c0.37		0.03
v/c Ratio	0.85	0.99	0.34	0.56	0.48	0.26	0.92	1.19		1.31	0.70	0.11
Uniform Delay, d1	23.4	38.5	25.2	34.9	37.4	34.4	38.5	49.3		40.0	44.7	36.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.87	0.69		1.00	1.00	1.00
Incremental Delay, d2	15.0	21.4	0.6	10.1	0.7	0.6	36.2	93.6		177.7	4.2	0.6
Delay (s)	38.4	59.8	25.9	45.0	38.0	35.0	69.7	127.5		217.8	48.9	37.4
Level of Service	D	E	C	D	D	D	E	F		F	D	D
Approach Delay (s)		50.8			37.6			118.9			79.5	
Approach LOS		D			D			F			E	

Intersection Summary			
HCM 2000 Control Delay	71.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	22.3
Intersection Capacity Utilization	105.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	84	145	498	185	91	161	1285	188	58	2202	69
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.6	6.6		3.0	6.6		3.0	6.3		6.3	6.3	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.91	
Frt	1.00	0.90		1.00	0.95		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1700	1655		1700	1739		1700	3410		1700	4972	
Flt Permitted	0.58	1.00		0.40	1.00		0.09	1.00		0.10	1.00	
Satd. Flow (perm)	1033	1655		716	1739		160	3410		172	4972	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	42	91	158	541	201	99	175	1397	204	63	2393	75
RTOR Reduction (vph)	0	52	0	0	8	0	0	10	0	0	3	0
Lane Group Flow (vph)	42	197	0	541	292	0	175	1591	0	63	2465	0
Turn Type	Perm	NA		pm+pt	NA		pm+pt	NA		Perm	NA	
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	29.4	29.4		54.6	54.6		52.5	52.5		41.7	41.7	
Effective Green, g (s)	29.4	29.4		54.6	54.6		52.5	52.5		41.7	41.7	
Actuated g/C Ratio	0.24	0.24		0.46	0.46		0.44	0.44		0.35	0.35	
Clearance Time (s)	6.6	6.6		3.0	6.6		3.0	6.3		6.3	6.3	
Lane Grp Cap (vph)	253	405		507	791		170	1491		59	1727	
v/s Ratio Prot		0.12		c0.20	0.17		0.07	c0.47			c0.50	
v/s Ratio Perm	0.04			c0.29			0.38			0.37		
v/c Ratio	0.17	0.49		1.07	0.37		1.03	1.07		1.07	1.43	
Uniform Delay, d1	35.7	38.8		28.9	21.4		30.3	33.8		39.1	39.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		0.54	0.57	
Incremental Delay, d2	1.4	4.1		59.0	1.3		77.0	43.6		133.4	195.6	
Delay (s)	37.1	43.0		88.0	22.8		107.3	77.4		154.5	218.0	
Level of Service	D	D		F	C		F	E		F	F	
Approach Delay (s)		42.1			64.7			80.3			216.4	
Approach LOS		D			E			F			F	

Intersection Summary			
HCM 2000 Control Delay	139.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	18.9
Intersection Capacity Utilization	111.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	37	59	99	1267	1719	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.5	3.5	3.7	3.7	3.7
Total Lost time (s)	7.1	7.1	3.0	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1738	1494	1700	3476	4977	
Flt Permitted	0.95	1.00	0.08	1.00	1.00	
Satd. Flow (perm)	1738	1494	148	3476	4977	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	40	64	108	1377	1868	37
RTOR Reduction (vph)	0	59	0	0	1	0
Lane Group Flow (vph)	40	5	108	1377	1904	0
Confl. Peds. (#/hr)	5	5	5			5
Turn Type	NA	Perm	pm+pt	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	8.7	8.7	97.9	97.9	85.1	
Effective Green, g (s)	8.7	8.7	97.9	97.9	85.1	
Actuated g/C Ratio	0.07	0.07	0.82	0.82	0.71	
Clearance Time (s)	7.1	7.1	3.0	6.3	6.3	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	126	108	247	2835	3529	
v/s Ratio Prot	c0.02		0.04	c0.40	c0.38	
v/s Ratio Perm		0.00	0.32			
v/c Ratio	0.32	0.04	0.44	0.49	0.54	
Uniform Delay, d1	52.8	51.8	5.6	3.4	8.2	
Progression Factor	1.00	1.00	4.07	0.17	2.67	
Incremental Delay, d2	3.0	0.3	0.6	0.1	0.2	
Delay (s)	55.9	52.1	23.5	0.7	22.1	
Level of Service	E	D	C	A	C	
Approach Delay (s)	53.6			2.4	22.1	
Approach LOS	D			A	C	

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.4
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	98	489	162	542	1293	237	230	712	195	188	1366	129
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	3.0	6.9		5.0	6.9		3.0	7.5		5.0	7.5	
Lane Util. Factor	1.00	0.91		0.97	0.91		1.00	0.91		0.97	0.91	
Frt	1.00	0.96		1.00	0.98		1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1700	4809		3298	4879		1700	4834		3298	4930	
Flt Permitted	0.15	1.00		0.95	1.00		0.11	1.00		0.95	1.00	
Satd. Flow (perm)	268	4809		3298	4879		198	4834		3298	4930	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	107	532	176	589	1405	258	250	774	212	204	1485	140
RTOR Reduction (vph)	0	50	0	0	22	0	0	41	0	0	9	0
Lane Group Flow (vph)	107	658	0	589	1641	0	250	945	0	204	1616	0
Turn Type	pm+pt	NA		Prot	NA		pm+pt	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4						2					
Actuated Green, G (s)	35.7	26.7		20.2	39.9		46.3	36.1		12.6	40.5	
Effective Green, g (s)	35.7	26.7		20.2	39.9		46.3	36.1		12.6	40.5	
Actuated g/C Ratio	0.30	0.22		0.17	0.33		0.39	0.30		0.10	0.34	
Clearance Time (s)	3.0	6.9		5.0	6.9		3.0	7.5		5.0	7.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	187	1070		555	1622		204	1454		346	1663	
v/s Ratio Prot	0.04	0.14		c0.18	c0.34		c0.10	0.20		0.06	c0.33	
v/s Ratio Perm	0.13						c0.37					
v/c Ratio	0.57	0.62		1.06	1.01		1.23	0.65		0.59	0.97	
Uniform Delay, d1	33.6	42.0		49.9	40.0		30.6	36.5		51.2	39.2	
Progression Factor	1.00	1.00		1.00	1.00		1.96	0.56		1.00	1.00	
Incremental Delay, d2	6.6	1.5		55.5	25.3		134.4	2.1		4.0	16.3	
Delay (s)	40.2	43.5		105.4	65.3		194.2	22.5		55.2	55.5	
Level of Service	D	D		F	E		F	C		E	E	
Approach Delay (s)		43.1			75.8			57.2			55.4	
Approach LOS		D			E			E			E	

Intersection Summary			
HCM 2000 Control Delay	61.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.4
Intersection Capacity Utilization	96.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	295	961	10	23	1463	450	19	30	8	257	22	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5
Total Lost time (s)	3.0	6.8		6.8	6.8	6.8		7.0	7.0	7.0	7.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.91	1.00		1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1700	3471		1700	4995	1521		1795	1521	1651	1668	1521
Flt Permitted	0.08	1.00		0.27	1.00	1.00		0.80	1.00	0.95	0.96	1.00
Satd. Flow (perm)	152	3471		485	4995	1521		1470	1521	1651	1668	1521
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	321	1045	11	25	1590	489	21	33	9	279	24	223
RTOR Reduction (vph)	0	0	0	0	0	241	0	0	8	0	0	0
Lane Group Flow (vph)	321	1056	0	25	1590	248	0	54	1	151	152	223
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm	Split	NA	Free
Protected Phases	5	2			6			8		4	4	
Permitted Phases	2			6		6	8		8			Free
Actuated Green, G (s)	73.8	73.8		58.0	58.0	58.0		9.7	9.7	15.7	15.7	120.0
Effective Green, g (s)	73.8	73.8		58.0	58.0	58.0		9.7	9.7	15.7	15.7	120.0
Actuated g/C Ratio	0.61	0.61		0.48	0.48	0.48		0.08	0.08	0.13	0.13	1.00
Clearance Time (s)	3.0	6.8		6.8	6.8	6.8		7.0	7.0	7.0	7.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	258	2134		234	2414	735		118	122	216	218	1521
v/s Ratio Prot	c0.13	0.30			0.32					c0.09	0.09	
v/s Ratio Perm	c0.63			0.05		0.16		c0.04	0.00			0.15
v/c Ratio	1.24	0.49		0.11	0.66	0.34		0.46	0.01	0.70	0.70	0.15
Uniform Delay, d1	32.6	12.8		16.9	23.5	19.1		52.6	50.7	49.9	49.9	0.0
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	138.2	0.8		0.9	1.4	1.2		5.8	0.0	11.9	11.7	0.2
Delay (s)	170.7	13.6		17.8	24.9	20.4		58.4	50.8	61.8	61.6	0.2
Level of Service	F	B		B	C	C		E	D	E	E	A
Approach Delay (s)		50.2			23.8			57.3			35.6	
Approach LOS		D			C			E			D	

Intersection Summary			
HCM 2000 Control Delay	34.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	23.8
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	691	3	165	0	0	0	122	1673	5	2	1590	543
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.7	3.7	3.7	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.4	6.4	6.4				3.0	6.4		6.4	6.4	6.4
Lane Util. Factor	0.95	0.95	1.00				1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.97				1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00				1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85				1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00				0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1651	1656	1508				1700	3475		1700	3476	1555
Flt Permitted	0.95	0.95	1.00				0.05	1.00		0.09	1.00	1.00
Satd. Flow (perm)	1651	1656	1508				87	3475		157	3476	1555
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	751	3	179	0	0	0	133	1818	5	2	1728	590
RTOR Reduction (vph)	0	0	90	0	0	0	0	0	0	0	0	104
Lane Group Flow (vph)	375	379	89	0	0	0	133	1823	0	2	1728	486
Confl. Peds. (#/hr)			13	13		2						
Turn Type	Split	NA	Perm	Split			pm+pt	NA		Perm	NA	Perm
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases			4				2			6		6
Actuated Green, G (s)	29.6	29.6	29.6				97.6	97.6		79.1	79.1	79.1
Effective Green, g (s)	29.6	29.6	29.6				97.6	97.6		79.1	79.1	79.1
Actuated g/C Ratio	0.21	0.21	0.21				0.70	0.70		0.56	0.56	0.56
Clearance Time (s)	6.4	6.4	6.4				3.0	6.4		6.4	6.4	6.4
Vehicle Extension (s)	5.0	5.0	5.0				5.0	5.0		5.0	5.0	5.0
Lane Grp Cap (vph)	349	350	318				239	2422		88	1963	878
v/s Ratio Prot	0.23	c0.23					0.06	c0.52			c0.50	
v/s Ratio Perm			0.06				0.33			0.01		0.31
v/c Ratio	1.07	1.08	0.28				0.56	0.75		0.02	0.88	0.55
Uniform Delay, d1	55.2	55.2	46.3				36.1	13.5		13.4	26.4	19.3
Progression Factor	1.00	1.00	1.00				1.00	1.00		0.68	0.38	0.25
Incremental Delay, d2	69.4	72.1	1.0				4.7	2.2		0.3	4.0	1.6
Delay (s)	124.6	127.3	47.3				40.8	15.7		9.4	13.9	6.3
Level of Service	F	F	D				D	B		A	B	A
Approach Delay (s)		110.9			0.0			17.4			12.0	
Approach LOS		F			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.8
Intersection Capacity Utilization	95.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	71	0	211	0	0	0	349	1323	0	0	1552	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.7	3.7	3.7	3.5	3.7	3.7	3.7	3.7	3.7
Total Lost time (s)		6.0	6.0				3.0	6.0			6.0	
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	
Frpb, ped/bikes		1.00	0.97				1.00	1.00			1.00	
Flpb, ped/bikes		1.00	1.00				1.00	1.00			1.00	
Frt		1.00	0.85				1.00	1.00			0.99	
Flt Protected		0.95	1.00				0.95	1.00			1.00	
Satd. Flow (prot)		1735	1516				1700	3476			3438	
Flt Permitted		0.76	1.00				0.05	1.00			1.00	
Satd. Flow (perm)		1383	1516				92	3476			3438	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	77	0	229	0	0	0	379	1438	0	0	1687	111
RTOR Reduction (vph)	0	0	204	0	0	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	77	25	0	0	0	379	1438	0	0	1795	0
Confl. Peds. (#/hr)	1		7	7		1	3					3
Turn Type	Perm	NA	Perm	Perm			pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8			2			6		
Actuated Green, G (s)		15.5	15.5				112.5	112.5			75.2	
Effective Green, g (s)		15.5	15.5				112.5	112.5			75.2	
Actuated g/C Ratio		0.11	0.11				0.80	0.80			0.54	
Clearance Time (s)		6.0	6.0				3.0	6.0			6.0	
Vehicle Extension (s)		5.0	5.0				5.0	5.0			5.0	
Lane Grp Cap (vph)		153	167				467	2793			1846	
v/s Ratio Prot							c0.20	0.41			c0.52	
v/s Ratio Perm		c0.06	0.02				0.45					
v/c Ratio		0.50	0.15				0.81	0.51			0.97	
Uniform Delay, d1		58.6	56.3				43.3	4.6			31.4	
Progression Factor		1.00	1.00				1.13	0.67			0.62	
Incremental Delay, d2		5.4	0.9				6.1	0.3			9.1	
Delay (s)		64.0	57.2				55.0	3.4			28.5	
Level of Service		E	E				E	A			C	
Approach Delay (s)		58.9			0.0			14.2			28.5	
Approach LOS		E			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	24.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	88.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	69	377	145	342	874	183	194	1044	168	104	1247	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.7	3.7	3.7	3.7	3.7	3.5
Total Lost time (s)	3.0	6.9	4.0	3.0	6.9	4.0	3.0	7.0		3.0	7.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1700	3476	1502	1699	3476	1498	1738	3404		1738	3476	1502
Flt Permitted	0.10	1.00	1.00	0.44	1.00	1.00	0.06	1.00		0.07	1.00	1.00
Satd. Flow (perm)	174	3476	1502	788	3476	1498	119	3404		126	3476	1502
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	75	410	158	372	950	199	211	1135	183	113	1355	107
RTOR Reduction (vph)	0	0	0	0	0	0	0	9	0	0	0	0
Lane Group Flow (vph)	75	410	158	372	950	199	211	1309	0	113	1355	107
Confl. Peds. (#/hr)	10		1	1		10	2					2
Turn Type	pm+pt	NA	Free	pm+pt	NA	Free	pm+pt	NA		pm+pt	NA	Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8		Free	2			6		Free
Actuated Green, G (s)	51.0	44.2	140.0	51.0	44.2	140.0	71.9	61.6		66.3	58.8	140.0
Effective Green, g (s)	51.0	44.2	140.0	51.0	44.2	140.0	71.9	61.6		66.3	58.8	140.0
Actuated g/C Ratio	0.36	0.32	1.00	0.36	0.32	1.00	0.51	0.44		0.47	0.42	1.00
Clearance Time (s)	3.0	6.9		3.0	6.9		3.0	7.0		3.0	7.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	137	1097	1502	331	1097	1498	180	1497		146	1459	1502
v/s Ratio Prot	0.03	0.12		c0.05	0.27		c0.09	0.38		0.04	0.39	
v/s Ratio Perm	0.17		0.11	c0.35		0.13	c0.52			0.32		0.07
v/c Ratio	0.55	0.37	0.11	1.12	0.87	0.13	1.17	0.87		0.77	0.93	0.07
Uniform Delay, d1	33.3	37.2	0.0	43.8	45.1	0.0	41.8	35.7		28.6	38.6	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.90	1.35		1.83	0.45	1.00
Incremental Delay, d2	7.7	0.4	0.1	87.3	8.0	0.2	118.0	6.8		15.8	7.5	0.1
Delay (s)	41.0	37.6	0.1	131.1	53.1	0.2	155.6	55.0		68.2	24.7	0.1
Level of Service	D	D	A	F	D	A	F	D		E	C	A
Approach Delay (s)		28.8			65.2			68.9			26.2	
Approach LOS		C			E			E			C	

Intersection Summary			
HCM 2000 Control Delay	50.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	19.9
Intersection Capacity Utilization	93.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	786	238	217	1335	78	307	940	98	96	1096	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	3.0	7.5	4.0	3.0	7.5	4.0	3.0	7.5	7.5	3.0	7.5	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1700	3476	1521	1700	3476	1493	1700	3476	1513	1700	3476	1498
Flt Permitted	0.08	1.00	1.00	0.17	1.00	1.00	0.09	1.00	1.00	0.14	1.00	1.00
Satd. Flow (perm)	143	3476	1521	307	3476	1493	161	3476	1513	254	3476	1498
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	854	259	236	1451	85	334	1022	107	104	1191	183
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	67	0	0	0
Lane Group Flow (vph)	87	854	259	236	1451	85	334	1022	40	104	1191	183
Confl. Peds. (#/hr)	22					22	11		11	11		11
Turn Type	pm+pt	NA	Free	pm+pt	NA	Free	pm+pt	NA	Perm	pm+pt	NA	Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8		Free	2		2	6		Free
Actuated Green, G (s)	56.7	49.9	140.0	63.9	54.1	140.0	61.1	51.3	51.3	48.3	41.5	140.0
Effective Green, g (s)	56.7	49.9	140.0	63.9	54.1	140.0	61.1	51.3	51.3	48.3	41.5	140.0
Actuated g/C Ratio	0.41	0.36	1.00	0.46	0.39	1.00	0.44	0.37	0.37	0.34	0.30	1.00
Clearance Time (s)	3.0	7.5		3.0	7.5		3.0	7.5	7.5	3.0	7.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	133	1238	1521	249	1343	1493	252	1273	554	157	1030	1498
v/s Ratio Prot	0.03	0.25		c0.07	c0.42		c0.16	0.29		0.03	0.34	
v/s Ratio Perm	0.23		0.17	0.36		0.06	c0.42		0.03	0.20		0.12
v/c Ratio	0.65	0.69	0.17	0.95	1.08	0.06	1.33	0.80	0.07	0.66	1.16	0.12
Uniform Delay, d1	34.0	38.4	0.0	30.4	42.9	0.0	43.6	39.8	28.9	33.9	49.2	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.60	0.55	0.39	0.87	0.69	1.00
Incremental Delay, d2	14.5	2.1	0.2	43.4	49.4	0.1	167.1	4.4	0.2	9.6	78.7	0.1
Delay (s)	48.5	40.5	0.2	73.7	92.3	0.1	236.9	26.4	11.4	39.2	112.7	0.1
Level of Service	D	D	A	E	F	A	F	C	B	D	F	A
Approach Delay (s)		32.4			85.4			73.4			93.6	
Approach LOS		C			F			E			F	

Intersection Summary			
HCM 2000 Control Delay	73.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	107.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	360	64	151	1010	49	271	768	81	105	1108	69
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.7	3.7	3.7
Total Lost time (s)	6.4	6.4		6.4	6.4		3.0	6.5		6.5	6.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.99		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1700	3397		1700	3452		1700	3427		1738	3446	
Flt Permitted	0.09	1.00		0.39	1.00		0.11	1.00		0.30	1.00	
Satd. Flow (perm)	168	3397		692	3452		203	3427		544	3446	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	391	70	164	1098	53	295	835	88	114	1204	75
RTOR Reduction (vph)	0	10	0	0	3	0	0	6	0	0	3	0
Lane Group Flow (vph)	36	451	0	164	1148	0	295	917	0	114	1276	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	42.6	42.6		42.6	42.6		84.5	84.5		73.3	73.3	
Effective Green, g (s)	42.6	42.6		42.6	42.6		84.5	84.5		73.3	73.3	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.60	0.60		0.52	0.52	
Clearance Time (s)	6.4	6.4		6.4	6.4		3.0	6.5		6.5	6.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	51	1033		210	1050		210	2068		284	1804	
v/s Ratio Prot		0.13			c0.33		c0.08	0.27			0.37	
v/s Ratio Perm	0.21			0.24			c0.76			0.21		
v/c Ratio	0.71	0.44		0.78	1.09		1.40	0.44		0.40	0.71	
Uniform Delay, d1	43.1	39.1		44.4	48.7		23.9	15.0		20.1	25.2	
Progression Factor	1.00	1.00		1.00	1.00		3.69	1.18		0.40	0.43	
Incremental Delay, d2	43.4	0.6		19.4	56.9		200.4	0.5		3.8	2.1	
Delay (s)	86.5	39.7		63.8	105.6		288.8	18.1		11.8	13.0	
Level of Service	F	D		E	F		F	B		B	B	
Approach Delay (s)		43.1			100.4			83.7			12.9	
Approach LOS		D			F			F			B	

Intersection Summary			
HCM 2000 Control Delay	61.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.9
Intersection Capacity Utilization	103.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	50	26	16	998	1193	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0	6.0	6.0	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.95		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1690		1738	3476	3432	
Flt Permitted	0.97		0.17	1.00	1.00	
Satd. Flow (perm)	1690		310	3476	3432	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	28	17	1085	1297	121
RTOR Reduction (vph)	15	0	0	0	3	0
Lane Group Flow (vph)	67	0	17	1085	1415	0
Turn Type	NA		Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	12.7		115.3	115.3	115.3	
Effective Green, g (s)	12.7		115.3	115.3	115.3	
Actuated g/C Ratio	0.09		0.82	0.82	0.82	
Clearance Time (s)	6.0		6.0	6.0	6.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	153		255	2862	2826	
v/s Ratio Prot	c0.04			0.31	c0.41	
v/s Ratio Perm			0.05			
v/c Ratio	0.43		0.07	0.38	0.50	
Uniform Delay, d1	60.3		2.3	3.2	3.7	
Progression Factor	1.00		2.09	2.71	0.12	
Incremental Delay, d2	4.1		0.5	0.4	0.2	
Delay (s)	64.4		5.3	8.9	0.7	
Level of Service	E		A	A	A	
Approach Delay (s)	64.4			8.9	0.7	
Approach LOS	E			A	A	

Intersection Summary			
HCM 2000 Control Delay	6.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	506	282	146	1016	84	148	509	56	255	1375	371
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4		3.0	8.4	8.4
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1700	3476	1521	1700	3476	1521	1700	3424		1700	3476	1487
Flt Permitted	0.10	1.00	1.00	0.31	1.00	1.00	0.08	1.00		0.31	1.00	1.00
Satd. Flow (perm)	174	3476	1521	547	3476	1521	138	3424		561	3476	1487
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	123	550	307	159	1104	91	161	553	61	277	1495	403
RTOR Reduction (vph)	0	0	146	0	0	62	0	6	0	0	0	97
Lane Group Flow (vph)	123	550	161	159	1104	29	161	608	0	277	1495	306
Confl. Peds. (#/hr)							8					8
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	47.9	41.1	41.1	53.5	43.9	43.9	62.9	51.9		70.0	56.0	56.0
Effective Green, g (s)	47.9	41.1	41.1	53.5	43.9	43.9	62.9	51.9		70.0	56.0	56.0
Actuated g/C Ratio	0.34	0.29	0.29	0.38	0.31	0.31	0.45	0.37		0.50	0.40	0.40
Clearance Time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4		3.0	8.4	8.4
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Grp Cap (vph)	133	1020	446	288	1089	476	184	1269		403	1390	594
v/s Ratio Prot	c0.04	0.16		c0.04	c0.32		c0.07	0.18		c0.07	c0.43	
v/s Ratio Perm	0.27		0.11	0.17		0.02	0.32			0.27		0.21
v/c Ratio	0.92	0.54	0.36	0.55	1.01	0.06	0.88	0.48		0.69	1.08	0.51
Uniform Delay, d1	38.9	41.5	39.1	30.3	48.1	33.6	37.0	33.7		22.0	42.0	31.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.38	1.32		1.00	1.00	1.00
Incremental Delay, d2	57.0	1.0	1.0	3.9	30.7	0.1	34.6	1.2		6.2	47.3	3.2
Delay (s)	96.0	42.5	40.1	34.2	78.8	33.7	85.7	45.7		28.2	89.3	34.9
Level of Service	F	D	D	C	E	C	F	D		C	F	C
Approach Delay (s)		48.5			70.5			54.0			71.4	
Approach LOS		D			E			D			E	

Intersection Summary			
HCM 2000 Control Delay	64.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	22.3
Intersection Capacity Utilization	100.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	94	179	362	227	101	40	206	1838	219	33	2171	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.6	6.6	6.6	4.0	6.6		3.0	6.3		6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.95		1.00	0.91	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.96		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1686	1830	1521	3298	1742		1700	3408		1608	4980	
Flt Permitted	0.66	1.00	1.00	0.95	1.00		0.05	1.00		0.06	1.00	
Satd. Flow (perm)	1171	1830	1521	3298	1742		98	3408		97	4980	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	102	195	393	247	110	43	224	1998	238	36	2360	39
RTOR Reduction (vph)	0	0	143	0	10	0	0	7	0	0	1	0
Lane Group Flow (vph)	102	195	250	247	143	0	224	2229	0	36	2398	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	11%	5%	5%
Turn Type	Perm		Perm	Prot			pm+pt			Perm		
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4				2			6		
Actuated Green, G (s)	23.6	23.6	23.6	11.5	39.1		88.0	88.0		70.0	70.0	
Effective Green, g (s)	23.6	23.6	23.6	11.5	39.1		88.0	88.0		70.0	70.0	
Actuated g/C Ratio	0.17	0.17	0.17	0.08	0.28		0.63	0.63		0.50	0.50	
Clearance Time (s)	6.6	6.6	6.6	4.0	6.6		3.0	6.3		6.3	6.3	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	197	308	256	271	487		233	2142		49	2490	
v/s Ratio Prot		0.11		c0.07	0.08		0.10	c0.65			0.48	
v/s Ratio Perm	0.09		c0.16				0.50			0.37		
v/c Ratio	0.52	0.63	0.98	0.91	0.29		0.96	1.04		0.73	0.96	
Uniform Delay, d1	53.0	54.2	57.9	63.7	39.6		47.5	26.0		27.7	33.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		0.86	0.80	
Incremental Delay, d2	4.5	5.8	49.7	33.7	0.7		48.6	31.0		61.8	10.6	
Delay (s)	57.5	60.0	107.6	97.4	40.3		96.2	57.0		85.5	37.5	
Level of Service	E	E	F	F	D		F	E		F	D	
Approach Delay (s)		86.8			75.6			60.6			38.2	
Approach LOS		F			E			E			D	

Intersection Summary			
HCM Average Control Delay	55.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.9
Intersection Capacity Utilization	102.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	102	84	84	1766	1817	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.5	3.5	3.7	3.7	3.7
Total Lost time (s)	7.1	7.1	6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1560	1488	1699	3476	4988	
Flt Permitted	0.95	1.00	0.08	1.00	1.00	
Satd. Flow (perm)	1560	1488	149	3476	4988	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	111	91	91	1920	1975	15
RTOR Reduction (vph)	0	27	0	0	0	0
Lane Group Flow (vph)	111	64	91	1920	1990	0
Confl. Peds. (#/hr)	5	5	5			5
Heavy Vehicles (%)	17%	5%	5%	5%	5%	5%
Turn Type		Perm	Perm			
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	16.7	16.7	109.9	109.9	109.9	
Effective Green, g (s)	16.7	16.7	109.9	109.9	109.9	
Actuated g/C Ratio	0.12	0.12	0.79	0.79	0.79	
Clearance Time (s)	7.1	7.1	6.3	6.3	6.3	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	186	177	117	2729	3916	
v/s Ratio Prot	c0.07			0.55	0.40	
v/s Ratio Perm		0.04	c0.61			
v/c Ratio	0.60	0.36	0.78	0.70	0.51	
Uniform Delay, d1	58.5	56.7	8.3	7.2	5.4	
Progression Factor	1.00	1.00	0.42	0.15	0.38	
Incremental Delay, d2	7.6	2.6	4.6	0.1	0.2	
Delay (s)	66.0	59.3	8.1	1.2	2.3	
Level of Service	E	E	A	A	A	
Approach Delay (s)	63.0			1.5	2.3	
Approach LOS	E			A	A	

Intersection Summary			
HCM Average Control Delay	4.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.4
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	209	1337	323	219	299	105	219	1220	289	330	1334	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.9	6.9		5.0	6.9		3.0	7.5		5.0	7.5	
Lane Util. Factor	1.00	0.91		0.97	0.91		0.97	0.91		0.97	0.91	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1693	4831		3298	4706		3298	4833		3298	4951	
Flt Permitted	0.49	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	870	4831		3298	4706		3298	4833		3298	4951	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	227	1453	351	238	325	114	238	1326	314	359	1450	80
RTOR Reduction (vph)	0	29	0	0	45	0	0	28	0	0	5	0
Lane Group Flow (vph)	227	1775	0	238	394	0	238	1612	0	359	1525	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Heavy Vehicles (%)	5%	5%	5%	5%	5%	11%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Prot			Prot			Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4											
Actuated Green, G (s)	47.1	47.1		10.0	62.1		12.0	43.3		15.2	48.5	
Effective Green, g (s)	47.1	47.1		10.0	62.1		12.0	43.3		15.2	48.5	
Actuated g/C Ratio	0.34	0.34		0.07	0.44		0.09	0.31		0.11	0.35	
Clearance Time (s)	6.9	6.9		5.0	6.9		3.0	7.5		5.0	7.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	293	1625		236	2087		283	1495		358	1715	
v/s Ratio Prot		c0.37		c0.07	0.08		0.07	c0.33		c0.11	0.31	
v/s Ratio Perm	0.26											
v/c Ratio	0.77	1.09		1.01	0.19		0.84	1.08		1.00	0.89	
Uniform Delay, d1	41.7	46.5		65.0	23.7		63.1	48.4		62.4	43.2	
Progression Factor	1.00	1.00		1.00	1.00		0.95	1.22		1.30	0.90	
Incremental Delay, d2	13.9	52.0		60.8	0.2		16.8	44.8		38.8	4.9	
Delay (s)	55.6	98.4		125.8	23.9		76.7	103.8		119.8	44.0	
Level of Service	E	F		F	C		E	F		F	D	
Approach Delay (s)		93.6			59.7			100.4			58.4	
Approach LOS		F			E			F			E	

Intersection Summary			
HCM Average Control Delay	81.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	24.4
Intersection Capacity Utilization	99.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	441	3	121	5	2	1	81	1759	2	3	1889	568
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.7	3.7	3.7	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.4	6.4	6.4		6.4		3.0	6.4		6.4	6.4	6.4
Lane Util. Factor	0.95	0.95	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.93		1.00		1.00	1.00		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85		0.98		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00		0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1651	1656	1439		1744		1638	3476		1700	3476	1479
Flt Permitted	0.95	0.95	1.00		0.97		0.05	1.00		0.06	1.00	1.00
Satd. Flow (perm)	1651	1656	1439		1744		80	3476		114	3476	1479
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	479	3	132	5	2	1	88	1912	2	3	2053	617
RTOR Reduction (vph)	0	0	104	0	1	0	0	0	0	0	0	116
Lane Group Flow (vph)	239	243	28	0	7	0	88	1914	0	3	2053	501
Confl. Peds. (#/hr)			35	16					7			19
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	9%	5%	5%	5%	5%	5%
Turn Type	Split		Perm	Split			pm+pt			Perm		Perm
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases			4				2			6		6
Actuated Green, G (s)	23.0	23.0	23.0		1.6		96.2	96.2		83.6	83.6	83.6
Effective Green, g (s)	23.0	23.0	23.0		1.6		96.2	96.2		83.6	83.6	83.6
Actuated g/C Ratio	0.16	0.16	0.16		0.01		0.69	0.69		0.60	0.60	0.60
Clearance Time (s)	6.4	6.4	6.4		6.4		3.0	6.4		6.4	6.4	6.4
Vehicle Extension (s)	5.0	5.0	5.0		5.0		5.0	5.0		5.0	5.0	5.0
Lane Grp Cap (vph)	271	272	236		20		162	2389		68	2076	883
v/s Ratio Prot	0.14	c0.15			c0.00		0.04	c0.55			c0.59	
v/s Ratio Perm			0.02				0.34			0.03		0.34
v/c Ratio	0.88	0.89	0.12		0.35		0.54	0.80		0.04	0.99	0.57
Uniform Delay, d1	57.2	57.3	49.9		68.7		35.3	15.2		11.7	27.7	17.2
Progression Factor	1.00	1.00	1.00		1.00		2.04	0.68		0.65	0.45	0.28
Incremental Delay, d2	28.3	30.2	0.5		20.9		4.3	2.0		0.4	9.0	0.9
Delay (s)	85.5	87.5	50.4		89.5		76.2	12.3		8.0	21.4	5.6
Level of Service	F	F	D		F		E	B		A	C	A
Approach Delay (s)		78.7			89.5			15.1			17.7	
Approach LOS		E			F			B			B	

Intersection Summary			
HCM Average Control Delay	23.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	25.6
Intersection Capacity Utilization	94.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	111	426	142	1489	1871	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.7	3.7	3.7
Total Lost time (s)	6.0	6.0	3.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1690	1519	1700	3476	3462	
Flt Permitted	0.95	1.00	0.05	1.00	1.00	
Satd. Flow (perm)	1690	1519	83	3476	3462	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	121	463	154	1618	2034	37
RTOR Reduction (vph)	0	88	0	0	1	0
Lane Group Flow (vph)	121	375	154	1618	2070	0
Confl. Peds. (#/hr)	3	6	7			7
Heavy Vehicles (%)	5%	5%	5%	5%	5%	10%
Turn Type		custom	pm+pt			
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	33.0	33.0	95.0	95.0	83.0	
Effective Green, g (s)	33.0	33.0	95.0	95.0	83.0	
Actuated g/C Ratio	0.24	0.24	0.68	0.68	0.59	
Clearance Time (s)	6.0	6.0	3.0	6.0	6.0	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	398	358	160	2359	2052	
v/s Ratio Prot			c0.06	0.47	c0.60	
v/s Ratio Perm	0.07	c0.25	0.59			
v/c Ratio	0.30	1.05	0.96	0.69	1.01	
Uniform Delay, d1	44.0	53.5	48.2	13.5	28.5	
Progression Factor	1.00	1.00	1.08	0.92	0.39	
Incremental Delay, d2	0.9	60.6	44.9	1.0	13.9	
Delay (s)	45.0	114.1	97.1	13.4	25.1	
Level of Service	D	F	F	B	C	
Approach Delay (s)	99.8			20.7	25.1	
Approach LOS	F			C	C	

Intersection Summary			
HCM Average Control Delay	33.2	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	778	277	228	309	165	102	1351	177	180	1552	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.7	3.7	3.7	3.7	3.7	3.5
Total Lost time (s)	3.0	6.9	4.0	3.0	6.9	4.0	3.0	7.0	7.0	3.0	7.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1690	3476	1501	1700	3476	1496	1738	3476	1555	1738	3476	1501
Flt Permitted	0.41	1.00	1.00	0.14	1.00	1.00	0.06	1.00	1.00	0.06	1.00	1.00
Satd. Flow (perm)	722	3476	1501	250	3476	1496	114	3476	1555	113	3476	1501
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	846	301	248	336	179	111	1468	192	196	1687	59
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	70	0	0	0
Lane Group Flow (vph)	223	846	301	248	336	179	111	1468	122	196	1687	59
Confl. Peds. (#/hr)	16		5			16	5					5
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt		Perm	pm+pt		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8		Free	2		2	6		Free
Actuated Green, G (s)	48.1	32.1	140.0	41.6	28.6	140.0	74.5	64.0	64.0	75.5	64.5	140.0
Effective Green, g (s)	48.1	32.1	140.0	41.6	28.6	140.0	74.5	64.0	64.0	75.5	64.5	140.0
Actuated g/C Ratio	0.34	0.23	1.00	0.30	0.20	1.00	0.53	0.46	0.46	0.54	0.46	1.00
Clearance Time (s)	3.0	6.9		3.0	6.9		3.0	7.0	7.0	3.0	7.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	362	797	1501	209	710	1496	182	1589	711	189	1601	1501
v/s Ratio Prot	c0.07	0.24		c0.11	0.10		0.05	0.42		c0.08	c0.49	
v/s Ratio Perm	0.14		c0.20	c0.24		0.12	0.28		0.08	0.48		0.04
v/c Ratio	0.62	1.06	0.20	1.19	0.47	0.12	0.61	0.92	0.17	1.04	1.05	0.04
Uniform Delay, d1	35.1	54.0	0.0	43.0	49.1	0.0	30.1	35.7	22.4	43.2	37.8	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.97	1.43	1.00	1.00	1.00
Incremental Delay, d2	4.4	49.5	0.3	121.7	1.0	0.2	6.4	8.5	0.4	75.5	38.1	0.0
Delay (s)	39.5	103.4	0.3	164.7	50.1	0.2	32.1	43.1	32.5	118.7	75.9	0.0
Level of Service	D	F	A	F	D	A	C	D	C	F	E	A
Approach Delay (s)		70.4			75.7			41.2			77.9	
Approach LOS		E			E			D			E	

Intersection Summary			
HCM Average Control Delay	64.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	102.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	190	1295	226	149	661	43	213	1397	159	152	1258	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	6.0	7.5	4.0	3.0	7.5	4.0	3.0	8.0	8.0	3.0	8.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1699	3476	1502	1700	3476	1496	3298	3476	1534	3298	3476	1501
Flt Permitted	0.17	1.00	1.00	0.09	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	299	3476	1502	163	3476	1496	3298	3476	1534	3298	3476	1501
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	207	1408	246	162	718	47	232	1518	173	165	1367	73
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	74	0	0	0
Lane Group Flow (vph)	207	1408	246	162	718	47	232	1518	99	165	1367	73
Confl. Peds. (#/hr)	14		1	1		14	11		1	1		5
Turn Type	pm+pt		Free	pm+pt		Free	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8		Free			2			Free
Actuated Green, G (s)	65.5	55.5	154.0	50.8	43.8	154.0	9.0	64.0	64.0	6.0	61.0	154.0
Effective Green, g (s)	65.5	55.5	154.0	50.8	43.8	154.0	9.0	64.0	64.0	6.0	61.0	154.0
Actuated g/C Ratio	0.43	0.36	1.00	0.33	0.28	1.00	0.06	0.42	0.42	0.04	0.40	1.00
Clearance Time (s)	6.0	7.5		3.0	7.5		3.0	8.0	8.0	3.0	8.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	270	1253	1502	124	989	1496	193	1445	638	128	1377	1501
v/s Ratio Prot	0.08	c0.41		c0.06	0.21		c0.07	c0.44		0.05	0.39	
v/s Ratio Perm	0.25		0.16	c0.37		0.03			0.06			0.05
v/c Ratio	0.77	1.12	0.16	1.31	0.73	0.03	1.20	1.05	0.16	1.29	0.99	0.05
Uniform Delay, d1	32.6	49.2	0.0	46.8	49.7	0.0	72.5	45.0	28.1	74.0	46.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.3	66.6	0.2	184.2	3.3	0.0	129.8	38.2	0.5	176.3	22.6	0.1
Delay (s)	46.8	115.8	0.2	231.0	53.0	0.0	202.3	83.2	28.6	250.3	68.9	0.1
Level of Service	D	F	A	F	D	A	F	F	C	F	E	A
Approach Delay (s)		92.9			81.4			92.6			84.4	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	89.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	154.0	Sum of lost time (s)	24.5
Intersection Capacity Utilization	106.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	74	661	157	120	507	130	151	1547	205	108	1191	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.7	3.7	3.7
Total Lost time (s)	6.4	6.4		6.4	6.4		6.0	6.5	6.5	6.0	6.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.97		1.00	0.97		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1678	3359		1695	3332		1700	3476	1525	1738	3455	
Flt Permitted	0.27	1.00		0.17	1.00		0.07	1.00	1.00	0.07	1.00	
Satd. Flow (perm)	480	3359		307	3332		118	3476	1525	125	3455	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	80	718	171	130	551	141	164	1682	223	117	1295	33
RTOR Reduction (vph)	0	15	0	0	16	0	0	0	50	0	1	0
Lane Group Flow (vph)	80	874	0	130	676	0	164	1682	173	117	1327	0
Confl. Peds. (#/hr)	36		12	12		36	12		6	6		12
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	12%
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	52.6	52.6		52.6	52.6		70.5	60.5	60.5	66.5	58.5	
Effective Green, g (s)	52.6	52.6		52.6	52.6		70.5	60.5	60.5	66.5	58.5	
Actuated g/C Ratio	0.38	0.38		0.38	0.38		0.50	0.43	0.43	0.48	0.42	
Clearance Time (s)	6.4	6.4		6.4	6.4		6.0	6.5	6.5	6.0	6.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	180	1262		115	1252		172	1502	659	152	1444	
v/s Ratio Prot		0.26			0.20		c0.07	c0.48		0.04	0.38	
v/s Ratio Perm	0.17			c0.42			0.41		0.11	0.32		
v/c Ratio	0.44	0.69		1.13	0.54		0.95	1.12	0.26	0.77	0.92	
Uniform Delay, d1	32.8	36.9		43.7	34.2		39.5	39.8	25.5	32.0	38.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.45	1.47	
Incremental Delay, d2	3.6	2.1		123.3	0.8		55.7	63.4	1.0	20.4	9.4	
Delay (s)	36.4	39.0		167.0	35.0		95.1	103.2	26.4	66.8	66.1	
Level of Service	D	D		F	D		F	F	C	E	E	
Approach Delay (s)		38.8			55.9			94.3			66.1	
Approach LOS		D			E			F			E	

Intersection Summary			
HCM Average Control Delay	70.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.4
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	141	29	24	1515	1304	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2		6.0	6.0	6.0	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frpb, ped/bikes	1.00		1.00	1.00	1.00	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.98		1.00	1.00	0.99	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1716		1738	3476	3451	
Flt Permitted	0.96		0.14	1.00	1.00	
Satd. Flow (perm)	1716		264	3476	3451	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	153	32	26	1647	1417	61
RTOR Reduction (vph)	6	0	0	0	2	0
Lane Group Flow (vph)	179	0	26	1647	1476	0
Confl. Peds. (#/hr)			2			2
Turn Type			Perm			
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	21.6		106.2	106.2	106.2	
Effective Green, g (s)	21.6		106.2	106.2	106.2	
Actuated g/C Ratio	0.15		0.76	0.76	0.76	
Clearance Time (s)	6.2		6.0	6.0	6.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	265		200	2637	2618	
v/s Ratio Prot	c0.10			c0.47	0.43	
v/s Ratio Perm			0.10			
v/c Ratio	0.68		0.13	0.62	0.56	
Uniform Delay, d1	55.9		4.5	7.8	7.1	
Progression Factor	1.00		2.06	2.18	1.24	
Incremental Delay, d2	8.6		0.1	0.1	0.7	
Delay (s)	64.5		9.4	17.0	9.5	
Level of Service	E		A	B	A	
Approach Delay (s)	64.5			16.9	9.5	
Approach LOS	E			B	A	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	428	1656	387	64	592	272	225	1154	140	209	748	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4	8.4	3.0	8.4	8.4
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1700	3476	1521	1580	3476	1521	3298	3476	1555	3298	3476	1268
Flt Permitted	0.19	1.00	1.00	0.12	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	344	3476	1521	195	3476	1521	3298	3476	1555	3298	3476	1268
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	465	1800	421	70	643	296	245	1254	152	227	813	158
RTOR Reduction (vph)	0	0	124	0	0	108	0	0	55	0	0	112
Lane Group Flow (vph)	465	1800	297	70	643	188	245	1254	97	227	813	46
Confl. Peds. (#/hr)												
Heavy Vehicles (%)	5%	5%	5%	13%	5%	5%	5%	5%	5%	5%	5%	26%
Turn Type	pm+pt		Perm	pm+pt		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)	68.1	60.1	60.1	39.1	34.1	34.1	12.0	45.6	45.6	7.0	40.6	40.6
Effective Green, g (s)	68.1	60.1	60.1	39.1	34.1	34.1	12.0	45.6	45.6	7.0	40.6	40.6
Actuated g/C Ratio	0.49	0.43	0.43	0.28	0.24	0.24	0.09	0.33	0.33	0.05	0.29	0.29
Clearance Time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4	8.4	3.0	8.4	8.4
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	468	1492	653	104	847	370	283	1132	506	165	1008	368
v/s Ratio Prot	c0.22	c0.52		0.02	0.18		c0.07	c0.36		c0.07	0.23	
v/s Ratio Perm	0.26		0.20	0.16		0.12			0.06			0.04
v/c Ratio	0.99	1.21	0.46	0.67	0.76	0.51	0.87	1.11	0.19	1.38	0.81	0.12
Uniform Delay, d1	35.6	40.0	28.3	41.4	49.1	45.7	63.2	47.2	33.9	66.5	46.1	36.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.03	1.11	1.00	1.00	1.00
Incremental Delay, d2	39.8	99.5	1.1	20.2	4.7	2.3	20.6	59.1	0.7	202.5	6.9	0.7
Delay (s)	75.4	139.4	29.4	61.6	53.8	48.0	82.3	107.6	38.5	269.0	53.0	37.3
Level of Service	E	F	C	E	D	D	F	F	D	F	D	D
Approach Delay (s)		111.1			52.7			97.5			91.8	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	95.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.9
Intersection Capacity Utilization	108.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	98	169	579	215	106	187	1495	219	67	2562	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.6	6.6	6.6	4.0	6.6		3.0	6.3		6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.95		1.00	0.91	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.95		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1689	1830	1521	3298	1727		1700	3394		1608	4967	
Flt Permitted	0.55	1.00	1.00	0.95	1.00		0.05	1.00		0.06	1.00	
Satd. Flow (perm)	981	1830	1521	3298	1727		95	3394		94	4967	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	107	184	629	234	115	203	1625	238	73	2785	87
RTOR Reduction (vph)	0	0	79	0	13	0	0	7	0	0	2	0
Lane Group Flow (vph)	49	107	105	629	336	0	203	1856	0	73	2870	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	11%	5%	5%
Turn Type	Perm		Perm	Prot			pm+pt			Perm		
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4				2			6		
Actuated Green, G (s)	16.4	16.4	16.4	19.0	39.4		87.7	87.7		72.1	72.1	
Effective Green, g (s)	16.4	16.4	16.4	19.0	39.4		87.7	87.7		72.1	72.1	
Actuated g/C Ratio	0.12	0.12	0.12	0.14	0.28		0.63	0.63		0.51	0.51	
Clearance Time (s)	6.6	6.6	6.6	4.0	6.6		3.0	6.3		6.3	6.3	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	115	214	178	448	486		204	2126		48	2558	
v/s Ratio Prot		0.06		c0.19	c0.19		c0.09	0.55			0.58	
v/s Ratio Perm	0.05		0.07				0.53			c0.78		
v/c Ratio	0.43	0.50	0.59	1.40	0.69		1.00	0.87		1.52	1.12	
Uniform Delay, d1	57.4	58.0	58.6	60.5	44.9		48.4	21.6		34.0	34.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		0.89	0.90	
Incremental Delay, d2	5.2	3.8	7.8	194.8	5.3		61.4	5.3		311.0	60.3	
Delay (s)	62.7	61.8	66.4	255.3	50.2		109.9	26.9		341.2	91.0	
Level of Service	E	E	E	F	D		F	C		F	F	
Approach Delay (s)		64.4			182.1			35.0			97.2	
Approach LOS		E			F			D			F	

Intersection Summary			
HCM Average Control Delay	88.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.3
Intersection Capacity Utilization	105.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	43	69	115	1474	2000	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.5	3.5	3.7	3.7	3.7
Total Lost time (s)	7.1	7.1	6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1560	1488	1699	3476	4977	
Flt Permitted	0.95	1.00	0.06	1.00	1.00	
Satd. Flow (perm)	1560	1488	116	3476	4977	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	75	125	1602	2174	43
RTOR Reduction (vph)	0	19	0	0	1	0
Lane Group Flow (vph)	47	56	125	1602	2216	0
Confl. Peds. (#/hr)	5	5	5			5
Heavy Vehicles (%)	17%	5%	5%	5%	5%	5%
Turn Type		Perm	Perm			
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	12.6	12.6	114.0	114.0	114.0	
Effective Green, g (s)	12.6	12.6	114.0	114.0	114.0	
Actuated g/C Ratio	0.09	0.09	0.81	0.81	0.81	
Clearance Time (s)	7.1	7.1	6.3	6.3	6.3	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	140	134	94	2830	4053	
v/s Ratio Prot	0.03			0.46	0.45	
v/s Ratio Perm		c0.04	c1.08			
v/c Ratio	0.34	0.42	1.33	0.57	0.55	
Uniform Delay, d1	59.8	60.2	13.0	4.5	4.4	
Progression Factor	1.00	1.00	0.93	0.22	1.00	
Incremental Delay, d2	3.0	4.3	180.7	0.4	0.5	
Delay (s)	62.7	64.6	192.9	1.4	4.9	
Level of Service	E	E	F	A	A	
Approach Delay (s)	63.9			15.3	4.9	
Approach LOS	E			B	A	

Intersection Summary			
HCM Average Control Delay	11.1	HCM Level of Service	B
HCM Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.4
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	114	569	188	631	1504	276	268	828	227	219	1589	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.9	6.9		5.0	6.9		3.0	7.5		3.0	7.5	
Lane Util. Factor	1.00	0.91		0.97	0.91		0.97	0.91		0.97	0.91	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1699	4787		3298	4822		3298	4814		3298	4922	
Flt Permitted	0.10	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	170	4787		3298	4822		3298	4814		3298	4922	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	124	618	204	686	1635	300	291	900	247	238	1727	163
RTOR Reduction (vph)	0	50	0	0	22	0	0	41	0	0	8	0
Lane Group Flow (vph)	124	772	0	686	1913	0	291	1106	0	238	1882	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Heavy Vehicles (%)	5%	5%	5%	5%	5%	11%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Prot			Prot			Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4											
Actuated Green, G (s)	42.1	42.1		13.0	60.1		7.0	29.3		13.2	35.5	
Effective Green, g (s)	42.1	42.1		13.0	60.1		7.0	29.3		13.2	35.5	
Actuated g/C Ratio	0.35	0.35		0.11	0.50		0.06	0.24		0.11	0.30	
Clearance Time (s)	6.9	6.9		5.0	6.9		3.0	7.5		3.0	7.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	60	1679		357	2415		192	1175		363	1456	
v/s Ratio Prot		0.16		c0.21	0.40		c0.09	0.23		0.07	c0.38	
v/s Ratio Perm	c0.73											
v/c Ratio	2.07	0.46		1.92	0.79		1.52	0.94		0.66	1.29	
Uniform Delay, d1	39.0	30.1		53.5	24.8		56.5	44.5		51.2	42.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	532.4	0.4		425.0	2.8		256.9	15.5		5.6	137.0	
Delay (s)	571.4	30.6		478.5	27.5		313.4	60.0		56.9	179.2	
Level of Service	F	C		F	C		F	E		E	F	
Approach Delay (s)		101.5			145.6			111.3			165.6	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	138.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	104.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	804	3	192	0	0	0	142	1946	6	2	1850	632
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.7	3.7	3.7	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.4	6.4	6.4				3.0	6.4		6.4	6.4	6.4
Lane Util. Factor	0.95	0.95	1.00				1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.93				1.00	1.00		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00				1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85				1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	0.95	1.00				0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1651	1656	1439				1638	3474		1700	3476	1479
Flt Permitted	0.95	0.95	1.00				0.05	1.00		0.06	1.00	1.00
Satd. Flow (perm)	1651	1656	1439				92	3474		99	3476	1479
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	874	3	209	0	0	0	154	2115	7	2	2011	687
RTOR Reduction (vph)	0	0	91	0	0	0	0	0	0	0	0	136
Lane Group Flow (vph)	437	440	118	0	0	0	154	2122	0	2	2011	551
Confl. Peds. (#/hr)			35	16					7			19
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	9%	5%	5%	5%	5%	5%
Turn Type	Split		Perm	Split			pm+pt			Perm		Perm
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases			4				2			6		6
Actuated Green, G (s)	32.6	32.6	32.6				94.6	94.6		72.2	72.2	72.2
Effective Green, g (s)	32.6	32.6	32.6				94.6	94.6		72.2	72.2	72.2
Actuated g/C Ratio	0.23	0.23	0.23				0.68	0.68		0.52	0.52	0.52
Clearance Time (s)	6.4	6.4	6.4				3.0	6.4		6.4	6.4	6.4
Vehicle Extension (s)	5.0	5.0	5.0				5.0	5.0		5.0	5.0	5.0
Lane Grp Cap (vph)	384	386	335				276	2347		51	1793	763
v/s Ratio Prot	0.26	c0.27					0.08	c0.61			c0.58	
v/s Ratio Perm			0.08				0.30			0.02		0.37
v/c Ratio	1.14	1.14	0.35				0.56	0.90		0.04	1.12	0.72
Uniform Delay, d1	53.7	53.7	44.9				38.9	18.9		16.8	33.9	26.2
Progression Factor	1.00	1.00	1.00				1.00	1.00		0.32	0.37	0.05
Incremental Delay, d2	89.1	89.6	1.3				4.1	6.3		0.7	58.7	2.8
Delay (s)	142.8	143.3	46.2				43.0	25.2		6.0	71.2	4.1
Level of Service	F	F	D				D	C		A	E	A
Approach Delay (s)		124.4			0.0			26.4			54.1	
Approach LOS		F			A			C			D	

Intersection Summary			
HCM Average Control Delay	56.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	83	245	406	1539	1806	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.7	3.7	3.7
Total Lost time (s)	6.0	6.0	3.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1690	1519	1700	3476	3425	
Flt Permitted	0.95	1.00	0.05	1.00	1.00	
Satd. Flow (perm)	1690	1519	91	3476	3425	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	266	441	1673	1963	129
RTOR Reduction (vph)	0	238	0	0	3	0
Lane Group Flow (vph)	90	28	441	1673	2089	0
Confl. Peds. (#/hr)	3	6	7			7
Heavy Vehicles (%)	5%	5%	5%	5%	5%	10%
Turn Type		custom	pm+pt			
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	14.9	14.9	113.1	113.1	76.0	
Effective Green, g (s)	14.9	14.9	113.1	113.1	76.0	
Actuated g/C Ratio	0.11	0.11	0.81	0.81	0.54	
Clearance Time (s)	6.0	6.0	3.0	6.0	6.0	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	180	162	465	2808	1859	
v/s Ratio Prot			c0.23	0.48	c0.61	
v/s Ratio Perm	c0.05	0.02	0.54			
v/c Ratio	0.50	0.17	0.95	0.60	1.12	
Uniform Delay, d1	59.0	57.0	46.8	5.0	32.0	
Progression Factor	1.00	1.00	0.98	0.78	0.59	
Incremental Delay, d2	4.5	1.1	12.2	0.3	57.7	
Delay (s)	63.5	58.0	58.1	4.1	76.6	
Level of Service	E	E	E	A	E	
Approach Delay (s)	59.4			15.4	76.6	
Approach LOS	E			B	E	

Intersection Summary			
HCM Average Control Delay	46.9	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	98.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	439	169	398	1017	213	226	1215	195	121	1451	114
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.7	3.7	3.7	3.7	3.7	3.5
Total Lost time (s)	3.0	6.9	4.0	3.0	6.9	4.0	3.0	7.0	7.0	3.0	7.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1699	3476	1501	1700	3476	1496	1738	3476	1555	1738	3476	1501
Flt Permitted	0.19	1.00	1.00	0.18	1.00	1.00	0.06	1.00	1.00	0.08	1.00	1.00
Satd. Flow (perm)	333	3476	1501	322	3476	1496	117	3476	1555	154	3476	1501
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	477	184	433	1105	232	246	1321	212	132	1577	124
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	86	0	0	0
Lane Group Flow (vph)	87	477	184	433	1105	232	246	1321	126	132	1577	124
Confl. Peds. (#/hr)	16		5			16	5					5
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt		Perm	pm+pt		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8		Free	2		2	6		Free
Actuated Green, G (s)	26.5	21.5	140.0	50.5	42.5	140.0	75.6	64.6	64.6	67.6	59.6	140.0
Effective Green, g (s)	26.5	21.5	140.0	50.5	42.5	140.0	75.6	64.6	64.6	67.6	59.6	140.0
Actuated g/C Ratio	0.19	0.15	1.00	0.36	0.30	1.00	0.54	0.46	0.46	0.48	0.43	1.00
Clearance Time (s)	3.0	6.9		3.0	6.9		3.0	7.0	7.0	3.0	7.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	112	534	1501	372	1055	1496	214	1604	718	165	1480	1501
v/s Ratio Prot	0.03	0.14		c0.22	0.32		c0.11	0.38		0.05	0.45	
v/s Ratio Perm	0.12		0.12	c0.20		0.16	c0.52		0.08	0.34		0.08
v/c Ratio	0.78	0.89	0.12	1.16	1.05	0.16	1.15	0.82	0.18	0.80	1.07	0.08
Uniform Delay, d1	52.4	58.1	0.0	40.8	48.8	0.0	45.7	32.7	22.1	27.1	40.2	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.25	1.90	0.72	1.06	1.00
Incremental Delay, d2	31.8	18.2	0.2	99.3	41.0	0.2	103.6	4.3	0.5	13.2	36.6	0.0
Delay (s)	84.2	76.3	0.2	140.1	89.7	0.2	146.3	45.2	42.3	32.7	79.1	0.0
Level of Service	F	E	A	F	F	A	F	D	D	C	E	A
Approach Delay (s)		58.5			90.3			58.8			70.4	
Approach LOS		E			F			E			E	

Intersection Summary			
HCM Average Control Delay	71.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	105.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	93	914	277	252	1553	91	357	1094	114	112	1275	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	6.0	7.5	4.0	3.0	7.5	4.0	3.0	8.0	8.0	3.0	8.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1700	3476	1502	1700	3476	1496	3298	3476	1534	3298	3476	1501
Flt Permitted	0.08	1.00	1.00	0.10	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	151	3476	1502	175	3476	1496	3298	3476	1534	3298	3476	1501
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	993	301	274	1688	99	388	1189	124	122	1386	212
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	78	0	0	0
Lane Group Flow (vph)	101	993	301	274	1688	99	388	1189	46	122	1386	212
Confl. Peds. (#/hr)	14		1	1		14	11		1	1		5
Turn Type	pm+pt		Free	pm+pt		Free	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8		Free			2			Free
Actuated Green, G (s)	55.5	47.5	140.0	66.5	52.5	140.0	11.0	49.0	49.0	6.0	44.0	140.0
Effective Green, g (s)	55.5	47.5	140.0	66.5	52.5	140.0	11.0	49.0	49.0	6.0	44.0	140.0
Actuated g/C Ratio	0.40	0.34	1.00	0.48	0.38	1.00	0.08	0.35	0.35	0.04	0.31	1.00
Clearance Time (s)	6.0	7.5		3.0	7.5		3.0	8.0	8.0	3.0	8.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	148	1179	1502	257	1304	1496	259	1217	537	141	1092	1501
v/s Ratio Prot	0.04	0.29		c0.12	c0.49		c0.12	0.34		0.04	c0.40	
v/s Ratio Perm	0.23		0.20	0.38		0.07			0.03			0.14
v/c Ratio	0.68	0.84	0.20	1.07	1.29	0.07	1.50	0.98	0.09	0.87	1.27	0.14
Uniform Delay, d1	34.3	42.8	0.0	39.8	43.8	0.0	64.5	44.9	30.5	66.6	48.0	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.93	1.56	4.03	1.01	1.30	1.00
Incremental Delay, d2	15.5	6.2	0.3	74.7	138.3	0.1	240.2	18.6	0.3	5.7	121.8	0.0
Delay (s)	49.7	49.0	0.3	114.5	182.1	0.1	300.2	88.7	123.0	72.9	184.1	0.0
Level of Service	D	D	A	F	F	A	F	F	F	E	F	A
Approach Delay (s)		38.5			164.4			139.5			153.6	
Approach LOS		D			F			F			F	

Intersection Summary			
HCM Average Control Delay	130.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	116.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	38	419	74	176	1175	57	315	894	94	122	1289	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.7	3.7	3.7
Total Lost time (s)	6.4	6.4		6.4	6.4		6.0	6.5	6.5	6.0	6.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		0.99	1.00		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1700	3385		1690	3443		1700	3476	1525	1738	3427	
Flt Permitted	0.08	1.00		0.35	1.00		0.07	1.00	1.00	0.21	1.00	
Satd. Flow (perm)	150	3385		624	3443		120	3476	1525	381	3427	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	455	80	191	1277	62	342	972	102	133	1401	87
RTOR Reduction (vph)	0	10	0	0	3	0	0	0	48	0	3	0
Lane Group Flow (vph)	41	525	0	191	1336	0	342	972	54	133	1485	0
Confl. Peds. (#/hr)	36		12	12		36	12		6	6		12
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	12%
Turn Type	Perm			Perm			pm+pt		Perm	pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	47.6	47.6		47.6	47.6		79.5	62.2	62.2	64.8	53.5	
Effective Green, g (s)	47.6	47.6		47.6	47.6		79.5	62.2	62.2	64.8	53.5	
Actuated g/C Ratio	0.34	0.34		0.34	0.34		0.57	0.44	0.44	0.46	0.38	
Clearance Time (s)	6.4	6.4		6.4	6.4		6.0	6.5	6.5	6.0	6.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	51	1151		212	1171		294	1544	678	286	1310	
v/s Ratio Prot		0.16			c0.39		c0.17	0.28		0.04	0.43	
v/s Ratio Perm	0.27			0.31			c0.49		0.04	0.18		
v/c Ratio	0.80	0.46		0.90	1.14		1.16	0.63	0.08	0.47	1.13	
Uniform Delay, d1	42.0	36.1		44.0	46.2		47.4	30.0	22.4	23.0	43.2	
Progression Factor	1.00	1.00		1.00	1.00		1.55	0.87	1.48	1.22	0.93	
Incremental Delay, d2	65.0	0.6		37.7	74.2		89.9	0.9	0.1	2.1	68.6	
Delay (s)	107.0	36.7		81.6	120.4		163.2	27.0	33.3	30.2	108.9	
Level of Service	F	D		F	F		F	C	C	C	F	
Approach Delay (s)		41.7			115.5			60.3			102.4	
Approach LOS		D			F			E			F	

Intersection Summary			
HCM Average Control Delay	87.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.4
Intersection Capacity Utilization	117.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	58	30	19	1161	1388	129
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2		6.0	6.0	6.0	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frpb, ped/bikes	1.00		1.00	1.00	1.00	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.95		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1689		1738	3476	3424	
Flt Permitted	0.97		0.13	1.00	1.00	
Satd. Flow (perm)	1689		229	3476	3424	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	63	33	21	1262	1509	140
RTOR Reduction (vph)	15	0	0	0	3	0
Lane Group Flow (vph)	81	0	21	1262	1646	0
Confl. Peds. (#/hr)			2			2
Turn Type			Perm			
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	13.9		113.9	113.9	113.9	
Effective Green, g (s)	13.9		113.9	113.9	113.9	
Actuated g/C Ratio	0.10		0.81	0.81	0.81	
Clearance Time (s)	6.2		6.0	6.0	6.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	168		186	2828	2786	
v/s Ratio Prot	c0.05			0.36	c0.48	
v/s Ratio Perm			0.09			
v/c Ratio	0.48		0.11	0.45	0.59	
Uniform Delay, d1	59.6		2.7	3.8	4.7	
Progression Factor	1.00		0.34	0.32	0.59	
Incremental Delay, d2	4.5		1.0	0.4	0.1	
Delay (s)	64.1		1.9	1.6	2.9	
Level of Service	E		A	A	A	
Approach Delay (s)	64.1			1.6	2.9	
Approach LOS	E			A	A	

Intersection Summary			
HCM Average Control Delay	4.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	131	589	328	170	1182	98	172	592	65	297	1600	432
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4	8.4	3.0	8.4	8.4
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1700	3476	1521	1580	3476	1521	3298	3476	1555	3298	3476	1268
Flt Permitted	0.10	1.00	1.00	0.23	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	183	3476	1521	384	3476	1521	3298	3476	1555	3298	3476	1268
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	142	640	357	185	1285	107	187	643	71	323	1739	470
RTOR Reduction (vph)	0	0	84	0	0	62	0	0	47	0	0	59
Lane Group Flow (vph)	142	640	273	185	1285	45	187	643	24	323	1739	411
Confl. Peds. (#/hr)												
Heavy Vehicles (%)	5%	5%	5%	13%	5%	5%	5%	5%	5%	5%	5%	26%
Turn Type	pm+pt		Perm	pm+pt		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)	44.1	39.1	39.1	53.1	45.1	45.1	6.0	48.1	48.1	19.5	61.6	61.6
Effective Green, g (s)	44.1	39.1	39.1	53.1	45.1	45.1	6.0	48.1	48.1	19.5	61.6	61.6
Actuated g/C Ratio	0.32	0.28	0.28	0.38	0.32	0.32	0.04	0.34	0.34	0.14	0.44	0.44
Clearance Time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4	8.4	3.0	8.4	8.4
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	112	971	425	240	1120	490	141	1194	534	459	1529	558
v/s Ratio Prot	c0.05	0.18		c0.06	0.37		c0.06	0.18		0.10	c0.50	
v/s Ratio Perm	c0.35		0.18	0.23		0.03			0.02			0.32
v/c Ratio	1.27	0.66	0.64	0.77	1.15	0.09	1.33	0.54	0.05	0.70	1.14	0.74
Uniform Delay, d1	46.5	44.6	44.3	32.9	47.5	33.1	67.0	37.0	30.6	57.5	39.2	32.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.13	2.11	1.00	1.00	1.00
Incremental Delay, d2	173.4	2.2	4.5	16.3	77.1	0.2	184.6	1.6	0.1	6.1	70.4	8.4
Delay (s)	219.9	46.8	48.8	49.3	124.5	33.3	245.6	43.4	64.7	63.6	109.6	40.9
Level of Service	F	D	D	D	F	C	F	D	E	E	F	D
Approach Delay (s)		69.0			109.5			87.1			90.9	
Approach LOS		E			F			F			F	

Intersection Summary			
HCM Average Control Delay	91.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.4
Intersection Capacity Utilization	109.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	94	179	362	227	101	40	206	2088	219	33	2371	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.6	6.6	6.6	4.0	6.6		3.0	6.3		6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.91		1.00	0.91	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.96		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1688	1830	1523	3298	1742		1700	4908		1608	4981	
Flt Permitted	0.66	1.00	1.00	0.95	1.00		0.06	1.00		0.07	1.00	
Satd. Flow (perm)	1172	1830	1523	3298	1742		114	4908		113	4981	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	102	195	393	247	110	43	224	2270	238	36	2577	39
RTOR Reduction (vph)	0	0	126	0	5	0	0	10	0	0	2	0
Lane Group Flow (vph)	102	195	267	247	148	0	224	2498	0	36	2614	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	11%	5%	5%
Turn Type	Perm		Perm	Prot			pm+pt			Perm		
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4				2			6		
Actuated Green, G (s)	19.8	19.8	19.8	9.4	33.2		73.9	73.9		59.9	59.9	
Effective Green, g (s)	19.8	19.8	19.8	9.4	33.2		73.9	73.9		59.9	59.9	
Actuated g/C Ratio	0.17	0.17	0.17	0.08	0.28		0.62	0.62		0.50	0.50	
Clearance Time (s)	6.6	6.6	6.6	4.0	6.6		3.0	6.3		6.3	6.3	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	193	302	251	258	482		216	3023		56	2486	
v/s Ratio Prot		0.11		c0.07	0.08		c0.10	0.51			0.52	
v/s Ratio Perm	0.09		c0.18				c0.55			0.32		
v/c Ratio	0.53	0.65	1.06	0.96	0.31		1.04	0.83		0.64	1.05	
Uniform Delay, d1	45.8	46.8	50.1	55.1	34.3		39.7	18.0		22.2	30.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.96		0.77	0.82	
Incremental Delay, d2	4.9	6.4	74.6	44.7	0.8		53.7	1.4		40.7	32.6	
Delay (s)	50.7	53.2	124.7	99.8	35.1		93.2	18.8		57.9	57.2	
Level of Service	D	D	F	F	D		F	B		E	E	
Approach Delay (s)		93.5			75.0			24.9			57.2	
Approach LOS		F			E			C			E	

Intersection Summary			
HCM Average Control Delay	48.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.6
Intersection Capacity Utilization	93.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	102	84	84	2016	2017	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.5	3.5	3.7	3.7	3.7
Total Lost time (s)	7.1	7.1	6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1560	1490	1699	4995	4989	
Flt Permitted	0.95	1.00	0.06	1.00	1.00	
Satd. Flow (perm)	1560	1490	109	4995	4989	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	111	91	91	2191	2192	15
RTOR Reduction (vph)	0	14	0	0	0	0
Lane Group Flow (vph)	111	77	91	2191	2207	0
Confl. Peds. (#/hr)	5	5	5			5
Heavy Vehicles (%)	17%	5%	5%	5%	5%	5%
Turn Type		Perm	Perm			
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	15.6	15.6	91.0	91.0	91.0	
Effective Green, g (s)	15.6	15.6	91.0	91.0	91.0	
Actuated g/C Ratio	0.13	0.13	0.76	0.76	0.76	
Clearance Time (s)	7.1	7.1	6.3	6.3	6.3	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	203	194	83	3788	3783	
v/s Ratio Prot	c0.07			0.44	0.44	
v/s Ratio Perm		0.05	c0.83			
v/c Ratio	0.55	0.40	1.10	0.58	0.58	
Uniform Delay, d1	48.9	47.9	14.5	6.2	6.3	
Progression Factor	1.00	1.00	0.75	0.09	1.00	
Incremental Delay, d2	5.2	2.8	102.4	0.4	0.7	
Delay (s)	54.1	50.7	113.3	0.9	6.9	
Level of Service	D	D	F	A	A	
Approach Delay (s)	52.6			5.4	6.9	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	8.2	HCM Level of Service	A
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.4
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	209	1337	323	219	299	105	219	1470	289	330	1534	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.0	6.9		5.0	6.9		3.0	7.5		5.0	7.5	
Lane Util. Factor	0.97	0.91		0.97	0.91		0.97	0.91		0.97	0.91	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3298	4831		3298	4706		3298	4856		3298	4956	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3298	4831		3298	4706		3298	4856		3298	4956	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	227	1453	351	238	325	114	238	1598	314	359	1667	80
RTOR Reduction (vph)	0	29	0	0	45	0	0	21	0	0	4	0
Lane Group Flow (vph)	227	1775	0	238	394	0	238	1891	0	359	1743	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Heavy Vehicles (%)	5%	5%	5%	5%	5%	11%	5%	5%	5%	5%	5%	5%
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	15.2	43.1		9.0	35.9		11.0	49.5		14.0	54.5	
Effective Green, g (s)	15.2	43.1		9.0	35.9		11.0	49.5		14.0	54.5	
Actuated g/C Ratio	0.11	0.31		0.06	0.26		0.08	0.35		0.10	0.39	
Clearance Time (s)	6.0	6.9		5.0	6.9		3.0	7.5		5.0	7.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	358	1487		212	1207		259	1717		330	1929	
v/s Ratio Prot	0.07	c0.37		c0.07	0.08		0.07	c0.39		c0.11	c0.35	
v/s Ratio Perm												
v/c Ratio	0.63	1.19		1.12	0.33		0.92	1.10		1.09	0.90	
Uniform Delay, d1	59.7	48.4		65.5	42.2		64.1	45.2		63.0	40.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.30	0.80	
Incremental Delay, d2	5.0	94.0		98.7	0.7		36.1	55.1		62.8	4.3	
Delay (s)	64.8	142.5		164.2	43.0		100.1	100.4		144.7	36.5	
Level of Service	E	F		F	D		F	F		F	D	
Approach Delay (s)		133.8			85.6			100.3			55.0	
Approach LOS		F			F			F			D	

Intersection Summary			
HCM Average Control Delay	94.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.21		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	31.9
Intersection Capacity Utilization	104.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	441	3	121	5	2	1	81	2059	2	3	2239	568
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.7	3.7	3.7	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.4	6.4	6.4		6.4		3.0	6.4		6.4	6.4	
Lane Util. Factor	0.95	0.95	1.00		1.00		1.00	0.91		1.00	0.91	
Frpb, ped/bikes	1.00	1.00	0.93		1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00		1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85		0.98		1.00	1.00		1.00	0.97	
Flt Protected	0.95	0.95	1.00		0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1651	1656	1439		1744		1638	4994		1700	4795	
Flt Permitted	0.95	0.95	1.00		0.97		0.05	1.00		0.06	1.00	
Satd. Flow (perm)	1651	1656	1439		1744		80	4994		103	4795	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	479	3	132	5	2	1	88	2238	2	3	2434	617
RTOR Reduction (vph)	0	0	104	0	1	0	0	0	0	0	30	0
Lane Group Flow (vph)	239	243	28	0	7	0	88	2240	0	3	3021	0
Confl. Peds. (#/hr)			35	16					7			19
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	9%	5%	5%	5%	5%	5%
Turn Type	Split		Perm	Split			pm+pt			Perm		
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases			4				2			6		
Actuated Green, G (s)	23.1	23.1	23.1		1.6		96.1	96.1		83.5	83.5	
Effective Green, g (s)	23.1	23.1	23.1		1.6		96.1	96.1		83.5	83.5	
Actuated g/C Ratio	0.17	0.17	0.17		0.01		0.69	0.69		0.60	0.60	
Clearance Time (s)	6.4	6.4	6.4		6.4		3.0	6.4		6.4	6.4	
Vehicle Extension (s)	5.0	5.0	5.0		5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	272	273	237		20		162	3428		61	2860	
v/s Ratio Prot	0.14	c0.15			c0.00		0.04	c0.45			c0.63	
v/s Ratio Perm			0.02				0.34			0.03		
v/c Ratio	0.88	0.89	0.12		0.35		0.54	0.65		0.05	1.06	
Uniform Delay, d1	57.1	57.2	49.8		68.7		35.6	12.5		11.7	28.2	
Progression Factor	1.00	1.00	1.00		1.00		2.08	0.50		1.14	1.63	
Incremental Delay, d2	27.5	29.6	0.5		20.9		4.1	0.6		0.8	30.5	
Delay (s)	84.6	86.9	50.2		89.5		78.3	6.9		14.2	76.4	
Level of Service	F	F	D		F		E	A		B	E	
Approach Delay (s)		78.1			89.5			9.6			76.3	
Approach LOS		E			F			A			E	

Intersection Summary			
HCM Average Control Delay	50.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	25.6
Intersection Capacity Utilization	95.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	111	426	142	1789	2221	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.7	3.7	3.7
Total Lost time (s)	6.0	6.0	3.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1690	1519	1700	4995	4977	
Flt Permitted	0.95	1.00	0.05	1.00	1.00	
Satd. Flow (perm)	1690	1519	89	4995	4977	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	121	463	154	1945	2414	37
RTOR Reduction (vph)	0	124	0	0	1	0
Lane Group Flow (vph)	121	339	154	1945	2450	0
Confl. Peds. (#/hr)	3	6	7			7
Heavy Vehicles (%)	5%	5%	5%	5%	5%	10%
Turn Type		custom	pm+pt			
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	35.2	35.2	92.8	92.8	77.6	
Effective Green, g (s)	35.2	35.2	92.8	92.8	77.6	
Actuated g/C Ratio	0.25	0.25	0.66	0.66	0.55	
Clearance Time (s)	6.0	6.0	3.0	6.0	6.0	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	425	382	199	3311	2759	
v/s Ratio Prot			c0.07	0.39	c0.49	
v/s Ratio Perm	0.07	c0.22	0.45			
v/c Ratio	0.28	0.89	0.77	0.59	0.89	
Uniform Delay, d1	42.2	50.5	41.4	13.0	27.4	
Progression Factor	1.00	1.00	0.70	1.11	1.32	
Incremental Delay, d2	0.8	22.4	15.0	0.6	0.5	
Delay (s)	43.0	72.9	43.9	15.0	36.5	
Level of Service	D	E	D	B	D	
Approach Delay (s)	66.7			17.1	36.5	
Approach LOS	E			B	D	

Intersection Summary			
HCM Average Control Delay	32.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	778	277	228	309	165	102	1651	177	180	1902	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.7	3.7	3.7	3.7	3.7	3.5
Total Lost time (s)	3.0	6.9	4.0	3.0	6.9	4.0	6.0	7.0	7.0	3.0	7.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1690	3476	1501	1700	3476	1496	1738	3476	1555	1738	3476	1501
Flt Permitted	0.41	1.00	1.00	0.14	1.00	1.00	0.06	1.00	1.00	0.06	1.00	1.00
Satd. Flow (perm)	722	3476	1501	259	3476	1496	116	3476	1555	113	3476	1501
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	846	301	248	336	179	111	1795	192	196	2067	59
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	57	0	0	0
Lane Group Flow (vph)	223	846	301	248	336	179	111	1795	135	196	2067	59
Confl. Peds. (#/hr)	16		5			16	5					5
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt		Perm	pm+pt		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8		Free	2		2	6		Free
Actuated Green, G (s)	46.6	30.1	140.0	41.6	27.6	140.0	71.0	63.0	63.0	78.0	65.0	140.0
Effective Green, g (s)	46.6	30.1	140.0	41.6	27.6	140.0	71.0	63.0	63.0	78.0	65.0	140.0
Actuated g/C Ratio	0.33	0.22	1.00	0.30	0.20	1.00	0.51	0.45	0.45	0.56	0.46	1.00
Clearance Time (s)	3.0	6.9		3.0	6.9		6.0	7.0	7.0	3.0	7.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	354	747	1501	221	685	1496	152	1564	700	214	1614	1501
v/s Ratio Prot	c0.07	c0.24		c0.11	0.10		0.04	0.52		c0.09	c0.59	
v/s Ratio Perm	0.14		0.20	0.22		0.12	0.33		0.09	0.43		0.04
v/c Ratio	0.63	1.13	0.20	1.12	0.49	0.12	0.73	1.15	0.19	0.92	1.28	0.04
Uniform Delay, d1	36.2	54.9	0.0	42.9	50.0	0.0	31.4	38.5	23.2	44.2	37.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.61	0.85	1.28	0.75	1.53	1.00
Incremental Delay, d2	4.9	75.8	0.3	97.3	1.2	0.2	16.8	73.3	0.5	26.1	128.9	0.0
Delay (s)	41.1	130.8	0.3	140.2	51.1	0.2	67.3	106.1	30.1	59.2	186.1	0.0
Level of Service	D	F	A	F	D	A	E	F	C	E	F	A
Approach Delay (s)		87.5			68.1			97.1			170.7	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM Average Control Delay	117.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	113.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	190	1295	226	149	661	43	213	1797	159	152	1758	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	4.0	7.5	7.5	3.0	7.5	7.5	3.0	8.0		3.0	8.0	8.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.97	1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1699	3476	1501	1700	3476	1478	1700	4929		1700	4995	1492
Flt Permitted	0.18	1.00	1.00	0.10	1.00	1.00	0.07	1.00		0.08	1.00	1.00
Satd. Flow (perm)	329	3476	1501	176	3476	1478	128	4929		135	4995	1492
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	207	1408	246	162	718	47	232	1953	173	165	1911	73
RTOR Reduction (vph)	0	0	77	0	0	31	0	7	0	0	0	45
Lane Group Flow (vph)	207	1408	169	162	718	16	232	2119	0	165	1911	28
Confl. Peds. (#/hr)	14		1	1		14	11		1	1		5
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	58.5	50.5	50.5	45.6	40.6	40.6	66.0	57.0		59.0	53.0	53.0
Effective Green, g (s)	58.5	50.5	50.5	45.6	40.6	40.6	66.0	57.0		59.0	53.0	53.0
Actuated g/C Ratio	0.42	0.36	0.36	0.33	0.29	0.29	0.47	0.41		0.42	0.38	0.38
Clearance Time (s)	4.0	7.5	7.5	3.0	7.5	7.5	3.0	8.0		3.0	8.0	8.0
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Grp Cap (vph)	273	1254	541	112	1008	429	173	2007		124	1891	565
v/s Ratio Prot	0.08	c0.41		c0.05	0.21		c0.10	0.43		0.06	0.38	
v/s Ratio Perm	0.24		0.11	c0.42		0.01	c0.54			0.50		0.02
v/c Ratio	0.76	1.12	0.31	1.45	0.71	0.04	1.34	1.06		1.33	1.01	0.05
Uniform Delay, d1	29.7	44.8	32.2	45.7	44.5	35.7	40.8	41.5		36.3	43.5	27.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.82	1.18		2.20	1.01	2.36
Incremental Delay, d2	13.4	66.2	0.7	243.8	3.0	0.1	176.5	33.4		171.9	16.6	0.1
Delay (s)	43.2	111.0	32.9	289.5	47.5	35.8	209.8	82.3		251.6	60.8	65.2
Level of Service	D	F	C	F	D	D	F	F		F	E	E
Approach Delay (s)		93.1			89.2			94.9			75.6	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM Average Control Delay	88.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	110.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	74	661	157	120	507	130	151	1947	205	108	1691	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.7	3.7	3.7
Total Lost time (s)	6.4	6.4		4.0	6.4		4.0	6.5		4.0	6.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.91		1.00	0.91	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	0.98	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.97		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1672	3359		1700	3332		1700	4914		1738	4973	
Flt Permitted	0.36	1.00		0.10	1.00		0.06	1.00		0.07	1.00	
Satd. Flow (perm)	635	3359		181	3332		113	4914		122	4973	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	80	718	171	130	551	141	164	2116	223	117	1838	33
RTOR Reduction (vph)	0	15	0	0	16	0	0	9	0	0	1	0
Lane Group Flow (vph)	80	874	0	130	676	0	164	2330	0	117	1870	0
Confl. Peds. (#/hr)	36		12	12		36	12		6	6		12
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	12%
Turn Type	Perm			pm+pt			pm+pt			pm+pt		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	35.6	35.6		49.6	49.6		77.0	63.6		70.0	60.1	
Effective Green, g (s)	35.6	35.6		49.6	49.6		77.0	63.6		70.0	60.1	
Actuated g/C Ratio	0.25	0.25		0.35	0.35		0.55	0.45		0.50	0.43	
Clearance Time (s)	6.4	6.4		4.0	6.4		4.0	6.5		4.0	6.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	161	854		173	1180		214	2232		175	2135	
v/s Ratio Prot		c0.26		c0.05	0.20		c0.07	c0.47		0.05	0.38	
v/s Ratio Perm	0.13			0.21			0.35			0.29		
v/c Ratio	0.50	1.02		0.75	0.57		0.77	1.04		0.67	0.88	
Uniform Delay, d1	44.6	52.2		36.2	36.6		37.5	38.2		30.8	36.5	
Progression Factor	1.00	1.00		1.00	1.00		1.65	0.81		1.40	1.50	
Incremental Delay, d2	5.0	36.9		19.5	1.1		8.3	26.1		10.5	4.7	
Delay (s)	49.5	89.1		55.8	37.7		70.1	57.0		53.4	59.6	
Level of Service	D	F		E	D		E	E		D	E	
Approach Delay (s)		85.8			40.6			57.8			59.3	
Approach LOS		F			D			E			E	

Intersection Summary			
HCM Average Control Delay	60.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.4
Intersection Capacity Utilization	100.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	141	29	24	1915	1804	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2		6.0	6.0	6.0	
Lane Util. Factor	1.00		1.00	0.91	0.91	
Frpb, ped/bikes	1.00		1.00	1.00	1.00	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.98		1.00	1.00	1.00	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1716		1738	4995	4968	
Flt Permitted	0.96		0.08	1.00	1.00	
Satd. Flow (perm)	1716		141	4995	4968	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	153	32	26	2082	1961	61
RTOR Reduction (vph)	6	0	0	0	2	0
Lane Group Flow (vph)	179	0	26	2082	2020	0
Confl. Peds. (#/hr)			2			2
Turn Type			Perm			
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	21.6		106.2	106.2	106.2	
Effective Green, g (s)	21.6		106.2	106.2	106.2	
Actuated g/C Ratio	0.15		0.76	0.76	0.76	
Clearance Time (s)	6.2		6.0	6.0	6.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	265		107	3789	3769	
v/s Ratio Prot	c0.10			c0.42	0.41	
v/s Ratio Perm			0.18			
v/c Ratio	0.68		0.24	0.55	0.54	
Uniform Delay, d1	55.9		5.0	7.0	6.9	
Progression Factor	1.00		2.01	2.13	1.82	
Incremental Delay, d2	8.6		1.3	0.1	0.3	
Delay (s)	64.5		11.3	15.0	12.9	
Level of Service	E		B	B	B	
Approach Delay (s)	64.5			15.0	12.9	
Approach LOS	E			B	B	

Intersection Summary			
HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	428	1656	387	64	592	272	225	1554	140	209	1248	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4	8.4	3.0	8.4	8.4
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1700	3476	1521	1580	3476	1521	1700	4995	1555	1700	4995	1268
Flt Permitted	0.19	1.00	1.00	0.12	1.00	1.00	0.10	1.00	1.00	0.10	1.00	1.00
Satd. Flow (perm)	331	3476	1521	200	3476	1521	172	4995	1555	185	4995	1268
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	465	1800	421	70	643	296	245	1689	152	227	1357	158
RTOR Reduction (vph)	0	0	126	0	0	123	0	0	57	0	0	101
Lane Group Flow (vph)	465	1800	295	70	643	173	245	1689	95	227	1357	57
Confl. Peds. (#/hr)												
Heavy Vehicles (%)	5%	5%	5%	13%	5%	5%	5%	5%	5%	5%	5%	26%
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	69.1	61.1	61.1	38.3	33.3	33.3	54.6	43.6	43.6	46.6	38.6	38.6
Effective Green, g (s)	69.1	61.1	61.1	38.3	33.3	33.3	54.6	43.6	43.6	46.6	38.6	38.6
Actuated g/C Ratio	0.49	0.44	0.44	0.27	0.24	0.24	0.39	0.31	0.31	0.33	0.28	0.28
Clearance Time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4	8.4	3.0	8.4	8.4
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	484	1517	664	104	827	362	209	1556	484	148	1377	350
v/s Ratio Prot	c0.23	c0.52		0.02	0.18		c0.11	0.34		c0.09	0.27	
v/s Ratio Perm	0.25		0.19	0.16		0.11	0.35		0.06	c0.42		0.04
v/c Ratio	0.96	1.19	0.44	0.67	0.78	0.48	1.17	1.09	0.20	1.53	0.99	0.16
Uniform Delay, d1	35.3	39.5	27.6	41.9	49.9	45.9	40.0	48.2	35.3	41.3	50.4	38.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.05	1.17	1.00	1.00	1.00
Incremental Delay, d2	31.4	90.9	1.0	20.2	5.4	2.1	111.9	48.4	0.8	271.2	21.0	1.0
Delay (s)	66.7	130.4	28.6	62.0	55.3	48.0	153.8	98.9	42.0	312.5	71.5	39.4
Level of Service	E	F	C	E	E	D	F	F	D	F	E	D
Approach Delay (s)		103.4			53.6			101.2			100.0	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	95.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.9
Intersection Capacity Utilization	111.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	98	169	579	215	106	187	1745	219	67	2762	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.6	6.6	6.6	3.0	6.6		3.0	6.3		6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.91		1.00	0.91	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.95		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1694	1830	1507	3298	1729		1700	4894		1607	4969	
Flt Permitted	0.55	1.00	1.00	0.95	1.00		0.05	1.00		0.06	1.00	
Satd. Flow (perm)	984	1830	1507	3298	1729		86	4894		106	4969	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	107	184	629	234	115	203	1897	238	73	3002	87
RTOR Reduction (vph)	0	0	83	0	13	0	0	11	0	0	2	0
Lane Group Flow (vph)	49	107	101	629	336	0	203	2124	0	73	3087	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	11%	5%	5%
Turn Type	Perm		Perm	Prot			pm+pt			Perm		
Protected Phases		4		3	8		5	2			6	
Permitted Phases	4		4				2			6		
Actuated Green, G (s)	11.0	11.0	11.0	21.0	35.0		92.1	92.1		80.1	80.1	
Effective Green, g (s)	11.0	11.0	11.0	21.0	35.0		92.1	92.1		80.1	80.1	
Actuated g/C Ratio	0.08	0.08	0.08	0.15	0.25		0.66	0.66		0.57	0.57	
Clearance Time (s)	6.6	6.6	6.6	3.0	6.6		3.0	6.3		6.3	6.3	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	77	144	118	495	432		160	3220		61	2843	
v/s Ratio Prot		0.06		c0.19	c0.19		c0.08	0.43			0.62	
v/s Ratio Perm	0.05		0.07				c0.75			0.69		
v/c Ratio	0.64	0.74	0.86	1.27	0.78		1.27	0.66		1.20	1.09	
Uniform Delay, d1	62.6	63.1	63.7	59.5	48.9		48.1	14.5		30.0	30.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		0.83	0.82	
Incremental Delay, d2	33.9	28.9	50.9	137.0	13.0		160.9	1.1		171.9	44.8	
Delay (s)	96.5	92.0	114.6	196.5	61.8		209.0	15.5		196.8	69.4	
Level of Service	F	F	F	F	E		F	B		F	E	
Approach Delay (s)		104.9			148.4			32.3			72.4	
Approach LOS		F			F			C			E	

Intersection Summary			
HCM Average Control Delay	71.2	HCM Level of Service	E
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	117.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	43	69	115	1724	2200	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.5	3.5	3.7	3.7	3.7
Total Lost time (s)	7.1	7.1	6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1560	1492	1700	4995	4978	
Flt Permitted	0.95	1.00	0.05	1.00	1.00	
Satd. Flow (perm)	1560	1492	87	4995	4978	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	75	125	1874	2391	43
RTOR Reduction (vph)	0	9	0	0	1	0
Lane Group Flow (vph)	47	66	125	1874	2433	0
Confl. Peds. (#/hr)	5	5	5			5
Heavy Vehicles (%)	17%	5%	5%	5%	5%	5%
Turn Type		Perm	Perm			
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	13.4	13.4	113.2	113.2	113.2	
Effective Green, g (s)	13.4	13.4	113.2	113.2	113.2	
Actuated g/C Ratio	0.10	0.10	0.81	0.81	0.81	
Clearance Time (s)	7.1	7.1	6.3	6.3	6.3	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	149	143	70	4039	4025	
v/s Ratio Prot	0.03			0.38	0.49	
v/s Ratio Perm		c0.04	c1.44			
v/c Ratio	0.32	0.46	1.79	0.46	0.60	
Uniform Delay, d1	59.0	59.9	13.4	4.1	5.0	
Progression Factor	1.00	1.00	1.31	0.24	0.47	
Incremental Delay, d2	2.5	4.9	392.4	0.3	0.1	
Delay (s)	61.6	64.7	409.9	1.3	2.4	
Level of Service	E	E	F	A	A	
Approach Delay (s)	63.5			26.8	2.4	
Approach LOS	E			C	A	

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	1.64		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.4
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	114	569	188	631	1504	276	268	1078	227	219	1789	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.0	6.9		5.0	6.9		3.0	7.5		5.0	7.5	
Lane Util. Factor	0.97	0.91		0.97	0.91		0.97	0.91		0.97	0.91	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.98		1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	3298	4786		3298	4821		3298	4848		3298	4929	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	3298	4786		3298	4821		3298	4848		3298	4929	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	124	618	204	686	1635	300	291	1172	247	238	1945	163
RTOR Reduction (vph)	0	42	0	0	19	0	0	24	0	0	7	0
Lane Group Flow (vph)	124	780	0	686	1916	0	291	1395	0	238	2101	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Heavy Vehicles (%)	5%	5%	5%	5%	5%	11%	5%	5%	5%	5%	5%	5%
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	8.0	30.1		25.0	46.1		10.0	48.5		12.0	52.5	
Effective Green, g (s)	8.0	30.1		25.0	46.1		10.0	48.5		12.0	52.5	
Actuated g/C Ratio	0.06	0.22		0.18	0.33		0.07	0.35		0.09	0.38	
Clearance Time (s)	6.0	6.9		5.0	6.9		3.0	7.5		5.0	7.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	188	1029		589	1587		236	1679		283	1848	
v/s Ratio Prot	0.04	0.16		c0.21	c0.40		c0.09	0.29		0.07	c0.43	
v/s Ratio Perm												
v/c Ratio	0.66	0.76		1.16	1.21		1.23	0.83		0.84	1.14	
Uniform Delay, d1	64.7	51.5		57.5	47.0		65.0	42.0		63.1	43.8	
Progression Factor	1.00	1.00		1.00	1.00		0.99	1.21		1.29	0.65	
Incremental Delay, d2	10.7	3.9		91.6	99.5		133.7	4.5		8.2	64.2	
Delay (s)	75.4	55.4		149.1	146.5		197.8	55.4		89.6	92.8	
Level of Service	E	E		F	F		F	E		F	F	
Approach Delay (s)		58.0			147.2			79.6			92.5	
Approach LOS		E			F			E			F	

Intersection Summary			
HCM Average Control Delay	104.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	22.4
Intersection Capacity Utilization	107.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	804	3	192	0	0	0	142	2246	6	2	2200	632
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.7	3.7	3.7	3.7	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7
Total Lost time (s)	6.4	6.4	6.4				3.0	6.4		6.4	6.4	
Lane Util. Factor	0.95	0.95	1.00				1.00	0.91		1.00	0.91	
Frpb, ped/bikes	1.00	1.00	0.94				1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00				1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85				1.00	1.00		1.00	0.97	
Flt Protected	0.95	0.95	1.00				0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1651	1656	1463				1638	4992		1700	4775	
Flt Permitted	0.95	0.95	1.00				0.05	1.00		0.05	1.00	
Satd. Flow (perm)	1651	1656	1463				89	4992		96	4775	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	874	3	209	0	0	0	154	2441	7	2	2391	687
RTOR Reduction (vph)	0	0	91	0	0	0	0	0	0	0	37	0
Lane Group Flow (vph)	437	440	118	0	0	0	154	2448	0	2	3041	0
Confl. Peds. (#/hr)			35	16					7			19
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	9%	5%	5%	5%	5%	5%
Turn Type	Split		Perm	Split			pm+pt			Perm		
Protected Phases	4	4		8	8		5	2			6	
Permitted Phases			4				2			6		
Actuated Green, G (s)	30.6	30.6	30.6				96.6	96.6		74.6	74.6	
Effective Green, g (s)	30.6	30.6	30.6				96.6	96.6		74.6	74.6	
Actuated g/C Ratio	0.22	0.22	0.22				0.69	0.69		0.53	0.53	
Clearance Time (s)	6.4	6.4	6.4				3.0	6.4		6.4	6.4	
Vehicle Extension (s)	5.0	5.0	5.0				5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	361	362	320				272	3444		51	2544	
v/s Ratio Prot	0.26	c0.27					0.08	c0.49			c0.64	
v/s Ratio Perm			0.08				0.31			0.02		
v/c Ratio	1.21	1.22	0.37				0.57	0.71		0.04	1.20	
Uniform Delay, d1	54.7	54.7	46.5				39.9	13.2		15.6	32.7	
Progression Factor	1.00	1.00	1.00				1.10	0.76		0.26	0.48	
Incremental Delay, d2	117.8	119.7	1.5				3.8	1.1		0.9	90.5	
Delay (s)	172.5	174.4	48.0				47.6	11.2		4.9	106.1	
Level of Service	F	F	D				D	B		A	F	
Approach Delay (s)		149.3			0.0			13.3			106.1	
Approach LOS		F			A			B			F	

Intersection Summary			
HCM Average Control Delay	77.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	19.2
Intersection Capacity Utilization	101.2%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	83	245	406	1839	2156	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.7	3.7	3.7
Total Lost time (s)	6.0	6.0	3.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	
Frpb, ped/bikes	1.00	0.98	1.00	1.00	1.00	
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1690	1519	1700	4995	4933	
Flt Permitted	0.95	1.00	0.05	1.00	1.00	
Satd. Flow (perm)	1690	1519	94	4995	4933	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	266	441	1999	2343	129
RTOR Reduction (vph)	0	238	0	0	4	0
Lane Group Flow (vph)	90	28	441	1999	2468	0
Confl. Peds. (#/hr)	3	6	7			7
Heavy Vehicles (%)	5%	5%	5%	5%	5%	10%
Turn Type		custom	pm+pt			
Protected Phases			5	2	6	
Permitted Phases	4	4	2			
Actuated Green, G (s)	14.9	14.9	113.1	113.1	72.9	
Effective Green, g (s)	14.9	14.9	113.1	113.1	72.9	
Actuated g/C Ratio	0.11	0.11	0.81	0.81	0.52	
Clearance Time (s)	6.0	6.0	3.0	6.0	6.0	
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	180	162	503	4035	2569	
v/s Ratio Prot			c0.23	0.40	c0.50	
v/s Ratio Perm	c0.05	0.02	0.47			
v/c Ratio	0.50	0.17	0.88	0.50	0.96	
Uniform Delay, d1	59.0	57.0	43.4	4.3	32.2	
Progression Factor	1.00	1.00	0.99	1.38	0.53	
Incremental Delay, d2	4.5	1.1	9.5	0.2	1.4	
Delay (s)	63.5	58.0	52.3	6.2	18.5	
Level of Service	E	E	D	A	B	
Approach Delay (s)	59.4			14.5	18.5	
Approach LOS	E			B	B	

Intersection Summary			
HCM Average Control Delay	19.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	89.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	439	169	398	1017	213	226	1515	195	121	1801	114
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.7	3.7	3.7	3.7	3.7	3.5
Total Lost time (s)	3.0	6.9	4.0	3.0	6.9	4.0	3.0	7.0	7.0	3.0	7.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1700	3476	1501	1700	3476	1496	1738	3476	1555	1738	3476	1501
Flt Permitted	0.17	1.00	1.00	0.20	1.00	1.00	0.06	1.00	1.00	0.06	1.00	1.00
Satd. Flow (perm)	310	3476	1501	363	3476	1496	105	3476	1555	109	3476	1501
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	477	184	433	1105	232	246	1647	212	132	1958	124
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	69	0	0	0
Lane Group Flow (vph)	87	477	184	433	1105	232	246	1647	143	132	1958	124
Confl. Peds. (#/hr)	16		5			16	5					5
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt		Perm	pm+pt		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		Free	8		Free	2		2	6		Free
Actuated Green, G (s)	28.1	23.1	140.0	46.1	38.1	140.0	80.0	71.0	71.0	73.0	67.0	140.0
Effective Green, g (s)	28.1	23.1	140.0	46.1	38.1	140.0	80.0	71.0	71.0	73.0	67.0	140.0
Actuated g/C Ratio	0.20	0.17	1.00	0.33	0.27	1.00	0.57	0.51	0.51	0.52	0.48	1.00
Clearance Time (s)	3.0	6.9		3.0	6.9		3.0	7.0	7.0	3.0	7.0	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	112	574	1501	311	946	1496	177	1763	789	127	1664	1501
v/s Ratio Prot	0.03	0.14		c0.20	0.32		c0.10	0.47		0.04	0.56	
v/s Ratio Perm	0.13		0.12	c0.26		0.16	c0.70		0.09	0.50		0.08
v/c Ratio	0.78	0.83	0.12	1.39	1.17	0.16	1.39	0.93	0.18	1.04	1.18	0.08
Uniform Delay, d1	51.3	56.6	0.0	40.6	51.0	0.0	45.2	32.3	18.7	35.3	36.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.41	2.47	1.88	0.44	1.00
Incremental Delay, d2	31.8	11.0	0.2	195.1	87.1	0.2	203.8	9.9	0.5	55.0	81.7	0.0
Delay (s)	83.1	67.6	0.2	235.7	138.1	0.2	244.8	55.3	46.7	121.5	97.6	0.0
Level of Service	F	E	A	F	F	A	F	E	D	F	F	A
Approach Delay (s)		52.8			143.9			76.6			93.6	
Approach LOS		D			F			E			F	

Intersection Summary			
HCM Average Control Delay	96.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	115.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	93	914	277	252	1553	91	357	1494	114	112	1775	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	3.0	7.5	7.5	3.0	7.5	7.5	3.0	7.5		3.0	7.5	7.5
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.91		1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.97	1.00	1.00		1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1700	3476	1501	1700	3476	1478	1700	4937		1700	4995	1492
Flt Permitted	0.09	1.00	1.00	0.09	1.00	1.00	0.08	1.00		0.09	1.00	1.00
Satd. Flow (perm)	168	3476	1501	157	3476	1478	151	4937		161	4995	1492
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	993	301	274	1688	99	388	1624	124	122	1929	212
RTOR Reduction (vph)	0	0	150	0	0	27	0	6	0	0	0	59
Lane Group Flow (vph)	101	993	151	274	1688	72	388	1742	0	122	1929	153
Confl. Peds. (#/hr)	14		1	1		14	11		1	1		5
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	47.5	42.5	42.5	61.5	53.5	53.5	63.5	53.5		51.5	44.5	44.5
Effective Green, g (s)	47.5	42.5	42.5	61.5	53.5	53.5	63.5	53.5		51.5	44.5	44.5
Actuated g/C Ratio	0.34	0.30	0.30	0.44	0.38	0.38	0.45	0.38		0.37	0.32	0.32
Clearance Time (s)	3.0	7.5	7.5	3.0	7.5	7.5	3.0	7.5		3.0	7.5	7.5
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Lane Grp Cap (vph)	112	1055	456	245	1328	565	246	1887		136	1588	474
v/s Ratio Prot	0.03	0.29		c0.13	c0.49		c0.18	0.35		0.04	0.39	
v/s Ratio Perm	0.27		0.10	0.36		0.05	c0.54			0.29		0.10
v/c Ratio	0.90	0.94	0.33	1.12	1.27	0.13	1.58	0.92		0.90	1.21	0.32
Uniform Delay, d1	42.0	47.5	37.7	42.9	43.2	28.1	44.0	41.3		34.6	47.8	36.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.49	0.72		1.38	0.60	0.40
Incremental Delay, d2	57.6	16.0	0.9	93.0	128.0	0.2	274.1	7.2		7.9	97.2	0.2
Delay (s)	99.6	63.5	38.6	135.9	171.3	28.3	339.9	36.8		55.8	126.0	14.7
Level of Service	F	E	D	F	F	C	F	D		E	F	B
Approach Delay (s)		60.8			159.7			91.8			111.7	
Approach LOS		E			F			F			F	

Intersection Summary			
HCM Average Control Delay	109.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	121.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	38	419	74	176	1175	57	315	1294	94	122	1789	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.7	3.5	3.7	3.7	3.5	3.7	3.7	3.7	3.7	3.7
Total Lost time (s)	6.4	6.4		6.0	6.4		3.0	6.5		6.0	6.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.91		1.00	0.91	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1700	3385		1698	3443		1700	4938		1738	4943	
Flt Permitted	0.11	1.00		0.25	1.00		0.07	1.00		0.09	1.00	
Satd. Flow (perm)	195	3385		455	3443		129	4938		157	4943	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	455	80	191	1277	62	342	1407	102	133	1945	87
RTOR Reduction (vph)	0	10	0	0	3	0	0	6	0	0	3	0
Lane Group Flow (vph)	41	525	0	191	1336	0	342	1503	0	133	2029	0
Confl. Peds. (#/hr)	36		12	12		36	12		6	6		12
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	12%
Turn Type	Perm			pm+pt			pm+pt			pm+pt		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	36.8	36.8		50.8	50.8		76.3	57.8		64.8	52.3	
Effective Green, g (s)	36.8	36.8		50.8	50.8		76.3	57.8		64.8	52.3	
Actuated g/C Ratio	0.26	0.26		0.36	0.36		0.54	0.41		0.46	0.37	
Clearance Time (s)	6.4	6.4		6.0	6.4		3.0	6.5		6.0	6.5	
Vehicle Extension (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	51	890		236	1249		306	2039		214	1847	
v/s Ratio Prot		0.16		0.05	c0.39		c0.17	0.30		0.06	0.41	
v/s Ratio Perm	0.21			0.25			c0.44			0.23		
v/c Ratio	0.80	0.59		0.81	1.07		1.12	0.74		0.62	1.10	
Uniform Delay, d1	48.2	45.0		38.7	44.6		46.8	34.7		25.8	43.9	
Progression Factor	1.00	1.00		1.00	1.00		0.68	1.49		1.50	1.08	
Incremental Delay, d2	65.0	1.6		20.4	46.4		72.2	1.2		6.7	52.3	
Delay (s)	113.2	46.6		59.1	91.0		104.2	52.9		45.5	99.8	
Level of Service	F	D		E	F		F	D		D	F	
Approach Delay (s)		51.3			87.1			62.3			96.5	
Approach LOS		D			F			E			F	

Intersection Summary			
HCM Average Control Delay	79.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	9.4
Intersection Capacity Utilization	114.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	58	30	19	1561	1888	129
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0	6.0	6.0	
Lane Util. Factor	1.00		1.00	0.91	0.91	
Frpb, ped/bikes	1.00		1.00	1.00	1.00	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.95		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1689		1738	4995	4939	
Flt Permitted	0.97		0.07	1.00	1.00	
Satd. Flow (perm)	1689		122	4995	4939	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	63	33	21	1697	2052	140
RTOR Reduction (vph)	14	0	0	0	4	0
Lane Group Flow (vph)	82	0	21	1697	2188	0
Confl. Peds. (#/hr)			2			2
Turn Type			Perm			
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	13.9		114.1	114.1	114.1	
Effective Green, g (s)	13.9		114.1	114.1	114.1	
Actuated g/C Ratio	0.10		0.81	0.81	0.81	
Clearance Time (s)	6.0		6.0	6.0	6.0	
Vehicle Extension (s)	5.0		5.0	5.0	5.0	
Lane Grp Cap (vph)	168		99	4071	4025	
v/s Ratio Prot	c0.05			0.34	c0.44	
v/s Ratio Perm			0.17			
v/c Ratio	0.49		0.21	0.42	0.54	
Uniform Delay, d1	59.7		2.9	3.6	4.3	
Progression Factor	1.00		0.23	0.24	0.17	
Incremental Delay, d2	4.6		3.6	0.2	0.0	
Delay (s)	64.2		4.3	1.1	0.8	
Level of Service	E		A	A	A	
Approach Delay (s)	64.2			1.1	0.8	
Approach LOS	E			A	A	

Intersection Summary			
HCM Average Control Delay	2.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	131	589	328	170	1182	98	172	992	65	297	2100	432
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.7	3.5	3.5	3.7	3.5	3.5	3.7	3.7	3.5	3.7	3.5
Total Lost time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4	8.4	3.0	8.4	8.4
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.91	1.00	1.00	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1700	3476	1521	1580	3476	1521	1700	4995	1555	1700	4995	1268
Flt Permitted	0.11	1.00	1.00	0.22	1.00	1.00	0.10	1.00	1.00	0.12	1.00	1.00
Satd. Flow (perm)	195	3476	1521	358	3476	1521	177	4995	1555	217	4995	1268
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	142	640	357	185	1285	107	187	1078	71	323	2283	470
RTOR Reduction (vph)	0	0	119	0	0	62	0	0	51	0	0	74
Lane Group Flow (vph)	142	640	238	185	1285	45	187	1078	20	323	2283	396
Confl. Peds. (#/hr)												
Heavy Vehicles (%)	5%	5%	5%	13%	5%	5%	5%	5%	5%	5%	5%	26%
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	42.8	36.8	36.8	55.1	46.1	46.1	48.4	40.4	40.4	68.6	57.6	57.6
Effective Green, g (s)	42.8	36.8	36.8	55.1	46.1	46.1	48.4	40.4	40.4	68.6	57.6	57.6
Actuated g/C Ratio	0.31	0.26	0.26	0.39	0.33	0.33	0.35	0.29	0.29	0.49	0.41	0.41
Clearance Time (s)	3.0	7.9	7.9	3.0	7.9	7.9	3.0	8.4	8.4	3.0	8.4	8.4
Vehicle Extension (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	124	914	400	274	1145	501	148	1441	449	373	2055	522
v/s Ratio Prot	c0.05	0.18		0.07	c0.37		c0.07	0.22		0.16	c0.46	
v/s Ratio Perm	0.30		0.16	0.19		0.03	c0.36		0.01	0.27		0.31
v/c Ratio	1.15	0.70	0.60	0.68	1.12	0.09	1.26	0.75	0.05	0.87	1.11	0.76
Uniform Delay, d1	45.8	46.6	45.1	30.9	47.0	32.4	40.2	45.2	35.9	36.2	41.2	35.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.08	1.27	3.14	1.00	1.00	1.00
Incremental Delay, d2	125.1	3.1	3.6	8.3	66.9	0.2	158.9	3.3	0.2	20.0	57.5	9.9
Delay (s)	170.9	49.7	48.7	39.2	113.8	32.6	202.4	60.7	112.9	56.1	98.7	45.2
Level of Service	F	D	D	D	F	C	F	E	F	E	F	D
Approach Delay (s)		64.5			99.6			83.3			86.1	
Approach LOS		E			F			F			F	

Intersection Summary			
HCM Average Control Delay	85.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	25.3
Intersection Capacity Utilization	110.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Signal Warrant Analysis

Input Data Sheet

Analysis Sheet | Results Sheet | Proposed Collision

GO TO Justification:

What are the intersecting roadways? NEEDHAM LANE (4-Lane) - 2031

What is the direction of the Main Road street? North-South

When was the data collected? 2031

Justification 1 - 4: Volume Warrants

a.- Number of lanes on the Main Road? 2 or more

b.- Number of lanes on the Minor Road? 1

c.- How many approaches? 4

d.- What is the operating environment? Urban   **Population >= 10,000   AND   Speed < 70 km/hr**

e.- What is the eight hour vehicle volume at the intersection? (Please fill in table below)

Hour Ending	Main Northbound Approach			Minor Eastbound Approach			Main Southbound Approach			Minor Westbound Approach			Pedestrians Crossing Main Road
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
7:00	16	1182	0	12	0	44	23	1312	51	0	0	0	
8:00	27	1514	2	19	0	60	19	1390	66	0	0	1	
9:00	30	834	12	12	0	51	16	880	34	7	1	15	
10:00	38	907	24	30	1	45	28	913	52	23	5	26	
15:00	1	35	1	2	0	1	0	41	2	0	0	1	
16:00	24	1307	17	23	2	67	26	1253	35	21	1	26	
17:00	36	1153	14	33	5	67	10	1564	34	3	5	19	
18:00	31	1202	12	33	5	72	21	1618	28	13	0	29	
Total	**205**	**8,134**	**83**	**163**	**13**	**410**	**143**	**8,971**	**302**	**67**	**12**	**116**	**0**

Justification 5: Collision Experience

Preceding Months	Number of Collisions*
1-12	0
13-24	0
25-36	0

***** Include only collisions that are susceptable to correction through the installation of traffic signal control

Justification 6: Pedestrian Volume

a.- Please fill in table below summarizing total pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	0	0	0	0	0	0	0	0	
Factored 8 hour pedestrian volume	0		0		0		0		
% Assigned to crossing rate	100%		50%		0%		0%		
Net 8 Hour Pedestrian Volume at Crossing									0
Net 8 Hour Vehicular Volume on Street Being Crossed									6,411

b.- Please fill in table below summarizing delay to pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	0	0	0	0	0	0	0	0	
Total 8 hour pedestrians delayed greater than 10 seconds	0	0	0	0	0	0	0	0	
Factored volume of total pedestrians	0		0		0		0		
Factored volume of delayed pedestrians	0		0		0		0		
% Assigned to Crossing Rate	100%		50%		0%		0%		
Net 8 Hour Volume of Total Pedestrians									0
Net 8 Hour Volume of Delayed Pedestrians									0

Results Sheet

Input Sheet | Analysis Sheet | Proposed Collision

GO TO Justification:

Intersection: NEEDHAM LANE (4-Lane) - 2031 Count Date: 2031

Summary Results

Justification			Compliance		Signal Justified? YES	Signal Justified? NO
1. Minimum Vehicular Volume	A	Total Volume	89	%	☐	☑
	B	Crossing Volume	57	%		
2. Delay to Cross Traffic	A	Main Road	89	%	☐	☑
	B	Crossing Road	41	%		
3. Combination	A	Justificaton 1	57	%	☐	☑
	B	Justification 2	41	%		
4. 4-Hr Volume			84	%	☐	☑
5. Collision Experience			0	%	☐	☑
6. Pedestrians	A	Volume	Justification not met		☐	☑
	B	Delay	Justification not met			

Input Data Sheet

Analysis Sheet | Results Sheet | Proposed Collision

GO TO Justification:

What are the intersecting roadways? ORWELL AVE (4-Lane) - 2031

What is the direction of the Main Road street? North-South

When was the data collected? 2031

Justification 1 - 4: Volume Warrants

a.- Number of lanes on the Main Road? 2 or more

b.- Number of lanes on the Minor Road? 1

c.- How many approaches? 4

d.- What is the operating environment? Urban — **Population >= 10,000** **AND** **Speed < 70 km/hr**

e.- What is the eight hour vehicle volume at the intersection? (Please fill in table below)

Hour Ending	Main Northbound Approach			Minor Eastbound Approach			Main Southbound Approach			Minor Westbound Approach			Pedestrians Crossing Main Road
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
7:00	16	1182	0	12	0	44	23	1312	51	0	0	0	
8:00	27	1514	2	19	0	60	19	1390	66	0	0	1	
9:00	30	834	12	12	0	51	16	880	34	7	1	15	
10:00	38	907	24	30	1	45	28	913	52	23	5	26	
15:00	1	35	1	2	0	1	0	41	2	0	0	1	
16:00	24	1307	17	23	2	67	26	1253	35	21	1	26	
17:00	36	1153	14	33	5	67	10	1564	34	3	5	19	
18:00	31	1202	12	33	5	72	21	1618	28	13	0	29	
Total	**205**	**8,134**	**83**	**163**	**13**	**410**	**143**	**8,971**	**302**	**67**	**12**	**116**	**0**

Justification 5: Collision Experience

Preceding Months	Number of Collisions*
1-12	0
13-24	0
25-36	0

***** Include only collisions that are susceptable to correction through the installation of traffic signal control

Justification 6: Pedestrian Volume

a.- Please fill in table below summarizing total pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	0	0	0	0	0	0	0	0	
Factored 8 hour pedestrian volume	0		0		0		0		
% Assigned to crossing rate	100%		50%		0%		0%		
Net 8 Hour Pedestrian Volume at Crossing									0
Net 8 Hour Vehicular Volume on Street Being Crossed									6,411

b.- Please fill in table below summarizing delay to pedestrians crossing major roadway at the intersection or in proximity to the intersection (zones). Please reference Section 4.8 of the Manual for further explanation and graphical representation.

	Zone 1		Zone 2		Zone 3 (if needed)		Zone 4 (if needed)		Total
	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	Assisted	Unassisted	
Total 8 hour pedestrian volume	0	0	0	0	0	0	0	0	
Total 8 hour pedestrians delayed greater than 10 seconds	0	0	0	0	0	0	0	0	
Factored volume of total pedestrians	0		0		0		0		
Factored volume of delayed pedestrians	0		0		0		0		
% Assigned to Crossing Rate	100%		50%		0%		0%		
Net 8 Hour Volume of Total Pedestrians									0
Net 8 Hour Volume of Delayed Pedestrians									0

Results Sheet

Input Sheet | Analysis Sheet | Proposed Collision

GO TO Justification:

Intersection: ORWELL AVE (4-Lane) - 2031

Count Date: 2031

Summary Results

Justification			Compliance		Signal Justified? YES	Signal Justified? NO
1. Minimum Vehicular Volume	A	Total Volume	89	%	☐	☑
	B	Crossing Volume	57	%		
2. Delay to Cross Traffic	A	Main Road	89	%	☐	☑
	B	Crossing Road	41	%		
3. Combination	A	Justificaton 1	57	%	☐	☑
	B	Justification 2	41	%		
4. 4-Hr Volume			84	%	☐	☑

5. Collision Experience			0	%	☐	☑

6. Pedestrians	A	Volume	Justification not met	☐	☑
	B	Delay	Justification not met		

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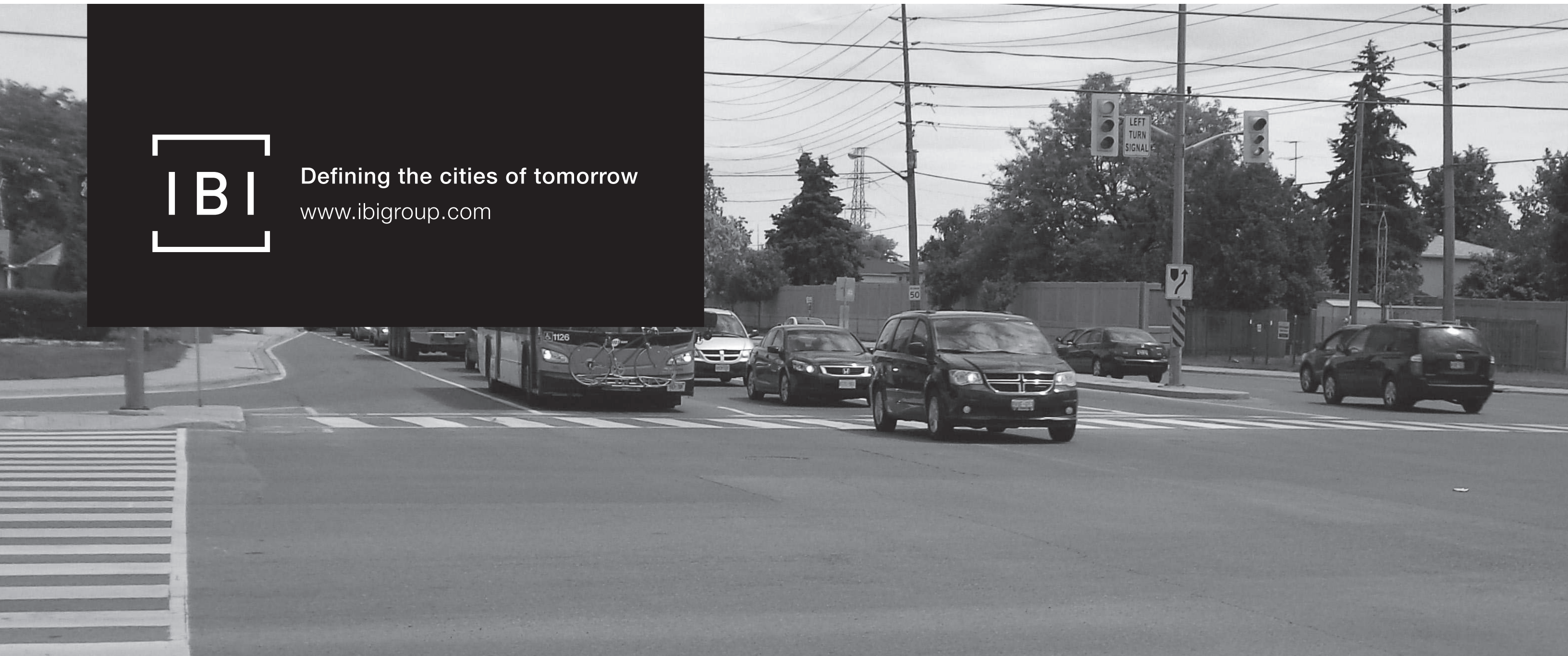

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