APPENDIX A

TRAFFIC & SAFETY ASSESSMENT

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Prepared for:

Halton Region

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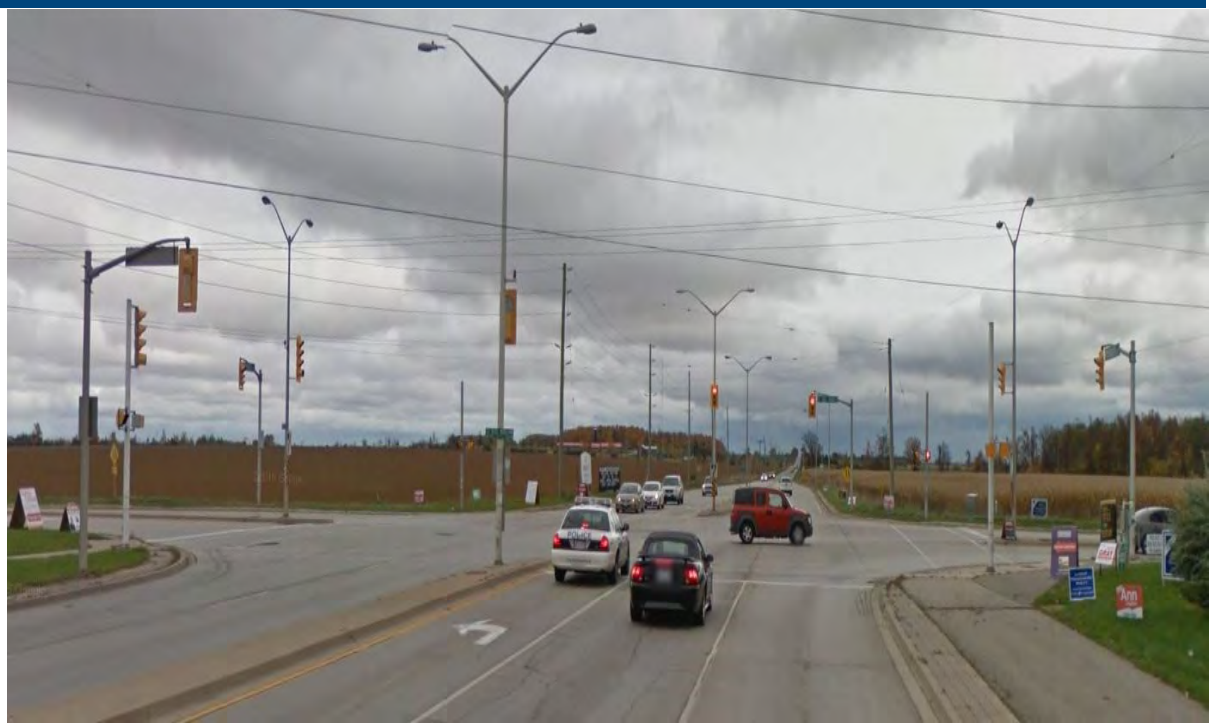
Ninth Line Transportation Corridor Improvements
Traffic and Safety Assessment



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1.0 PURPOSE OF CLASS EA AND TRAFFIC & SAFETY ASSESSMENT

Halton Region has undertaken a Schedule 'C' Class Environmental Assessment (EA) Study to identify transportation corridor improvements to satisfy future travel demands on Ninth Line (Regional Road 13), from 10 Side Road (Regional Road 10) to Highway 407, in the Town of Halton Hills pursuant to the Municipal Class EA process (MEA October 2000, as amended in 2007 and 2011). The Municipal Class EA is an approved planning process under the Ontario Environmental Assessment Act (EAA). The Ninth Line (Regional Road 13), from 10 Side Road (Regional Road 10) to Highway 407, in the Town of Halton Hills Class EA Study took into consideration the future transportation needs within the corridor while balancing the potential impacts on the natural, socio-economic and cultural environments.

The Halton Region Transportation Master Plans, the Region in Motion (2004) and Halton Transportation Master Plan – The Road to Change (2011), herein referred to the TMPS, both concluded that the existing capacity of the Ninth Line transportation corridor would be insufficient to accommodate expected growth within the planning time horizons of the TMPs. Both TMPs recommended that Ninth Line be widened from two lanes to four lanes.

The purpose of this Ninth Line Transportation Improvements Class Environmental Assessment Study is to review, evaluate, and recommend improvements to Ninth Line within the project limits, including widening of the roadway to four-lanes as recommended in the 2004 TMP and confirmed in the Regional TMP (2011). This traffic and safety assessment report provides an overview of the existing conditions along the Ninth Line corridor within the project limits and documents the traffic forecasting that was completed to obtain the 2031 travel demands at the study intersections.

2.0 BACKGROUND

Halton Region completed its Transportation Master Plan (2031) – The Road to Change, in September 2011. This Regional TMP (the TMP) provides strategic direction to Regional transportation policy, programming, and infrastructure priorities to 2031. The TMP was conducted in accordance with Phase 1 and Phase 2 of the Municipal Class Environmental Assessment (June 2000 as amended in 2007 and 2011). All roadway improvement projects recommended as part of the TMP are Schedule 'C' projects requiring completion of Phases 3 and 4 of the Municipal Class EA process.

The TMP conducted numerous analyses to define the need for north/south capacity improvements in the general area of Ninth Line taking into account the Halton-Peel Boundary Area Transportation study (HPBATS), the GTA-West Transportation Corridor (MTO), and proposed improvements to Winston Churchill Blvd. Transportation system deficiencies were identifiable by analyzing the travel demand to 2031. The current transportation systems were unable to maintain the current level of service even with planned system improvements. Output from the Region's Demand Forecasting model for Screenline Level Deficiency Analysis under 2016 PM traffic condition shows that SL 58 (5 roadways) would have a volume to capacity ratio (V/C) of 0.87 and Ninth Line south of 10 Side Road requires an additional lane. Regional Screenline analyses within the study area along with proposed transportation solutions are presented in **Table 2-1.**

Table 2-1: Screenline Level Deficiency Analysis under 2016 PM traffic condition

Halton Hills Screenlines	Deficiency	Proposed Transportation Solution
58 – South of Georgetown	9th Line operating over capacity (0.87)	Add 1 lane in each direction

3.0 STUDY AREA

The Ninth Line Transportation Corridor (Ninth Line) is an important corridor connecting Georgetown to the north, with Milton, Oakville, Mississauga and Highways 401/407/QEW to the south. The study area includes Ninth Line from Highway 407 as the south limit to 10 Side Road as a north limit, as well as a section of Steeles Avenue, a length of approximately 7.2 kilometres. The boundaries of the study area are shown in **Figure 3-1**.

Within the project limits, Ninth Line intersects with three roadways – 10 Side Road, 5 Side Road, and Steeles Avenue (as shown in **Figure 3-1**). In addition, residential driveways and agricultural equipment access routes connect to Ninth Line on both sides throughout the corridor. Ninth Line, within the study area, is designated as part of the Regional Road Network and is functionally classified as a Major Arterial in the November 2014 Regional Official Plan and also recognized in the Town of Halton Hills Official Plan (2008).

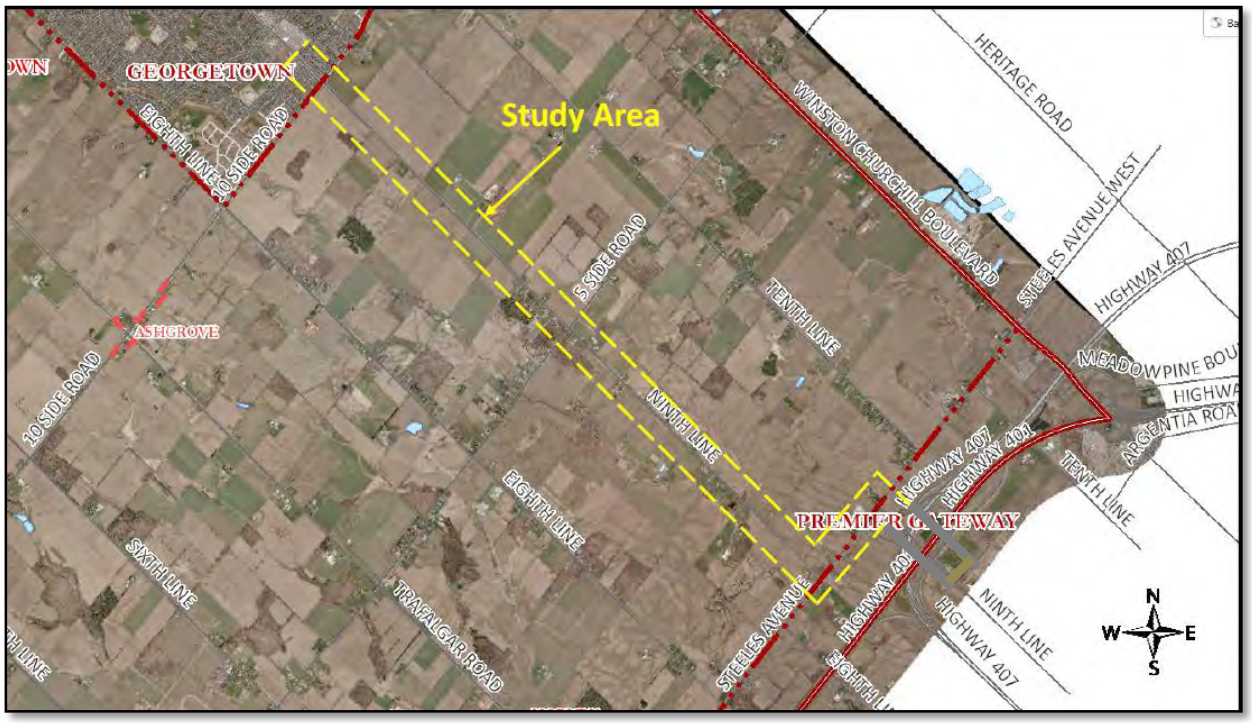


Figure 3-1: Study area with respect to surrounding road network

4.0 EXISTING TRANSPORTATION NETWORK

Ninth Line is a currently a rural north-south two-lane arterial road beginning at Upper Middle Road in the Town of Oakville extending north to 10 Side Road in the Town of Halton Hills. Located near the eastern limits of Halton Region, Ninth Line traverses through urban area in the Town of Oakville in the south and then to rural residential in the Town of Halton Hills providing Regional connection.

Ninth Line (RR 13), within the study area, is designated as part of the regional road network and is functionally classified as a Major Arterial in the Regional Official Plan and also recognized in the Town of Halton Hills Official Plan (2008). **Figure 4.1** and **Figure 4.2** present regional road network and the

functional classification of the road network within the study area, as detailed per the summary in **Table 4.1**.

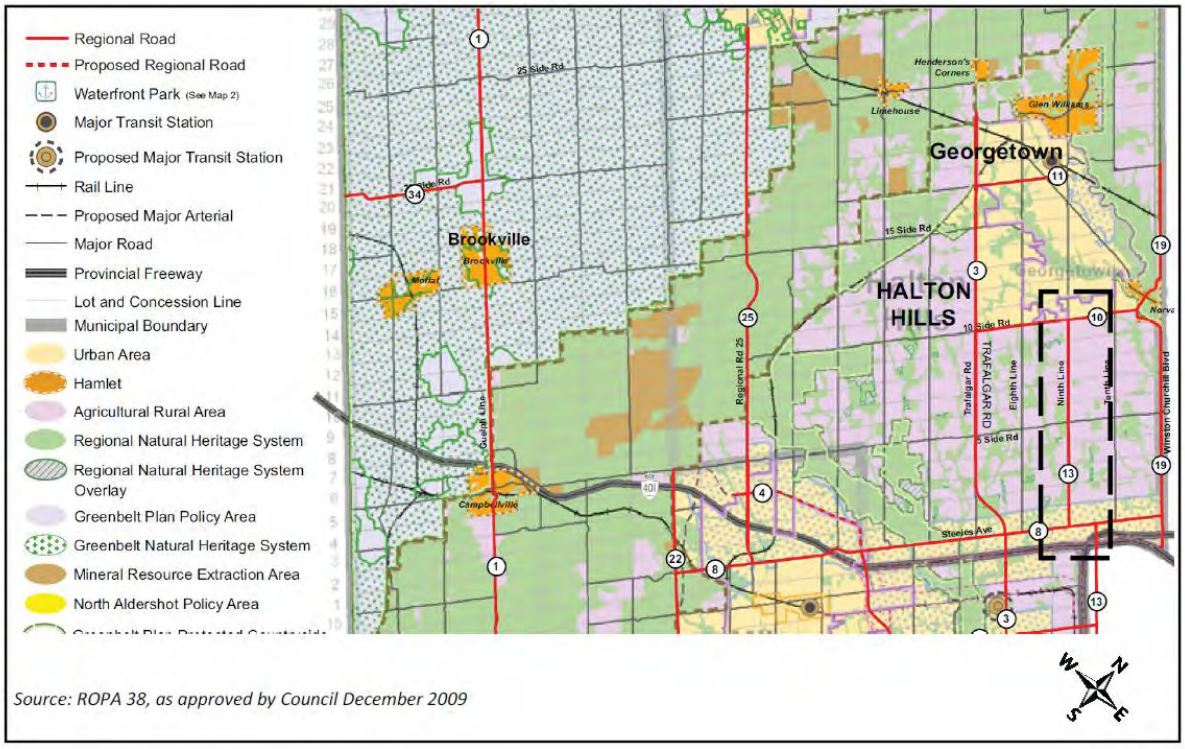


Figure 4-1: Regional Structure of Road Network within Study Area

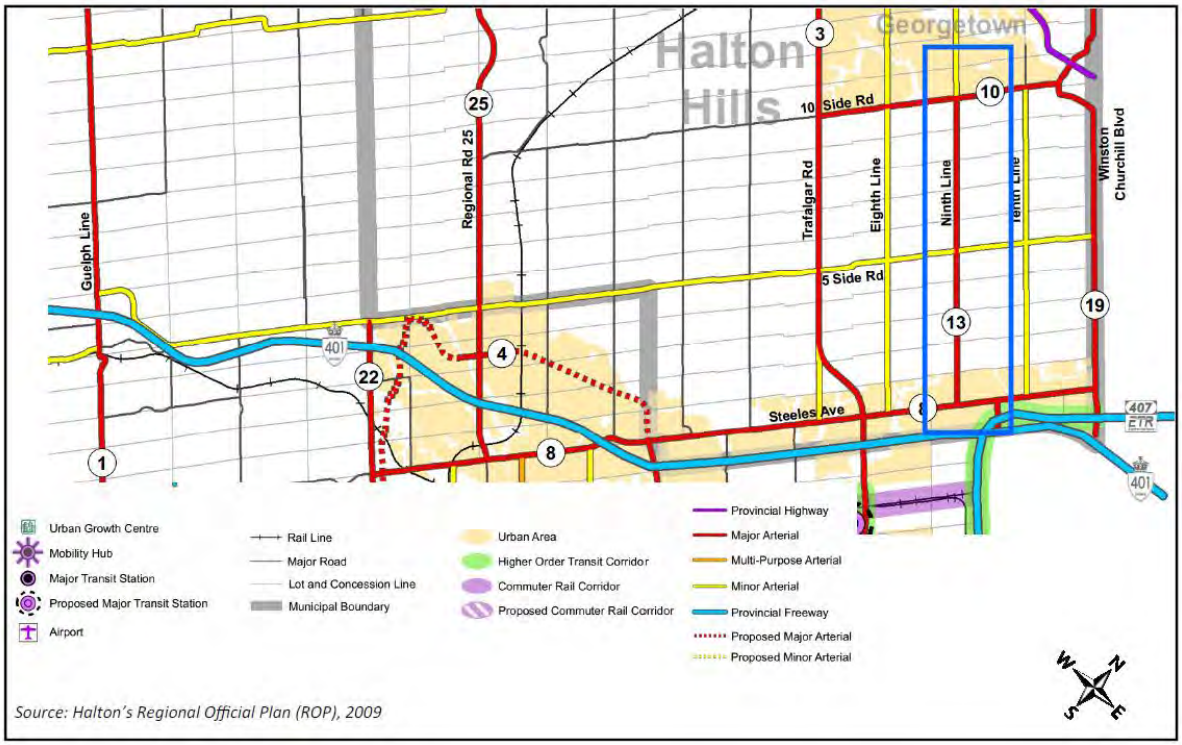


Figure 4-2: Functional Classification of Road Network within Study Area

Table 4-1: Roadway Functional Classification

Road Section	Regional Structure	Functional Classification
Ninth Line between 10 Side Road and 5 Side Road	RR 13	Major Arterial
5 Side Road	n/a	Minor Arterial
Ninth Line between 5 Side Road and Steeles Avenue	RR 13	Major Arterial
Steeles Avenue	RR 8	Major Arterial
Ninth Line south of Steeles Avenue and within study area limit	RR 13	Major Arterial

4.1 ROADWAY CHARACTERISTICS

Ninth Line (RR 13), within the study area, is a two-lane roadway with a rural cross-section and changes to a 4-lane roadway with an urban cross-section to the north of its intersection with 10 Side Road. The posted speed limit on Ninth Line within the study area is shown in **Table 4.2**.

Table 4-2: Posted Speed Limit within Study Area

Ninth Line Section	NB	SB
North of 10 Side Road within the study area limit	60 km/h	60 km/h
Between 10 Side Road and 5 Side Road	80 km/h	60 km/h
Between Steeles Avenue Side and 5 Side Road	80 km/h	80 km/h
South of Steeles Avenue and within the study area limit	--- km/h	--- km/h

Ninth Line, within the study area boundaries, has relatively narrow shoulders and ditches on either side. Predominantly farm lands are located on both sides of Ninth Line between the section of Steeles Avenue and 10 Side Road along with some residential pockets within the study area. Passing is mostly permitted for both northbound and southbound traffic but is prohibited in sections throughout the corridor (i.e. near the driveway locations). There is no sidewalk on either side of the roadway within study limits. Narrow gravel shoulders are currently provided on both sides of the roadway.

Within the project limits, Ninth Line intersects with three roadways – 10 Side Road, 5 Side Road, and Steeles Avenue (two locations).

10 Side Road (RR 10) has an east-west alignment and extends from Regional Road 25 in the west to Winston Churchill Blvd in the east. It is a two-lane roadway without a median and has a rural cross section within the study area and changes to a two-lane cross section with raised median and an exclusive LT lane for WB traffic at the intersection with Ninth Line. It has gravel shoulders on both sides of the roadway. Curb starts on the north and south side of east and west approach closer to the intersection with Ninth Line. Posted speed for eastbound and westbound traffic is 80 km/h within the study area limit. 10 Side Road from Ninth Line to Tenth Line is scheduled for reconstruction, from Fall 2014 – Fall 2015, from a two lane rural cross section to a two lane semi-urban cross section.

5 Side Road is a two-lane roadway without a median and has a rural cross section within the study area limit. It has gravel shoulders on both sides of the roadway. Posted speed for eastbound and westbound traffic is 80 km/h within the study area.

Steeles Avenue (RR 8) was under construction during the development of this Class EA study. As of the writing of this Transportation Report, Steeles Avenue is being widened from two lanes to four lanes. The two intersections with Ninth Line are being upgraded as part of the Steeles Avenue construction and are controlled by traffic signals.

The existing cross section of the road network within the study area is summarized in **Table 4.3**. The study area roadway network depicting road configurations and intersection traffic control as presented in **Figure 4.3**.

Table 4-3: Road Cross-Sections

Road Section	Road Cross Section
Ninth Line north of 10 Side Road within study area limit	Four-lane roadway with raised median and urban cross section
10 Side Road	Four-lane roadway with rural cross section and a raised median and urban cross section closer to the intersection with Ninth Line
Ninth Line between 10 Side Road and 5 Side Road	Two-lane roadway without median and rural cross section
5 Side Road	Two-lane roadway without median and rural cross section
Ninth Line between 5 Side Road and Steeles Avenue	Two-lane roadway without median and rural cross section
Steeles Avenue	Currently under construction for upgrading from two-lanes to four-lanes
Ninth Line south of Steeles Avenue and within study area limit	Two-lane roadway without median and rural cross section

4.2 RIGHT-OF-WAY

The right-of-way (ROW) classification of the road network within the study area is presented in **Table 4.4** and is shown in **Figure 4.4**.

Table 4-4: Roadway Right-of-Way

Road Section	ROW
Ninth Line north of 10 Side Road within study area limit	35m
10 Side Road	35 m
Ninth Line between 10 Side Road and 5 Side Road	35m
5 Side Road	30 m
Ninth Line between 5 Side Road and Steeles Avenue	35m
Steeles Avenue	35 m
Ninth Line south of Steeles Avenue and within study area limit	35m

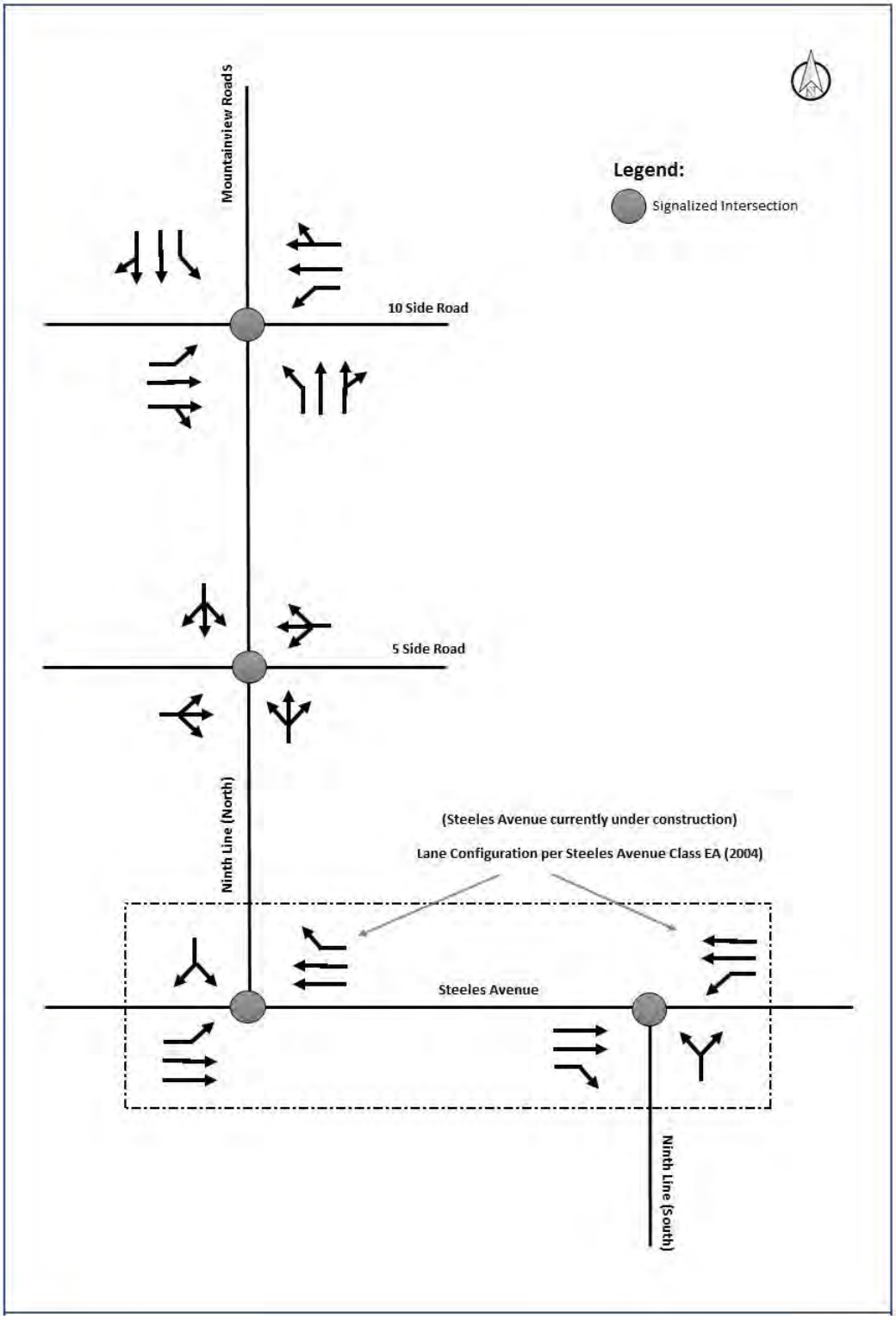


Figure 4-3: Existing 2014 Lane Configuration and Traffic Signal Control

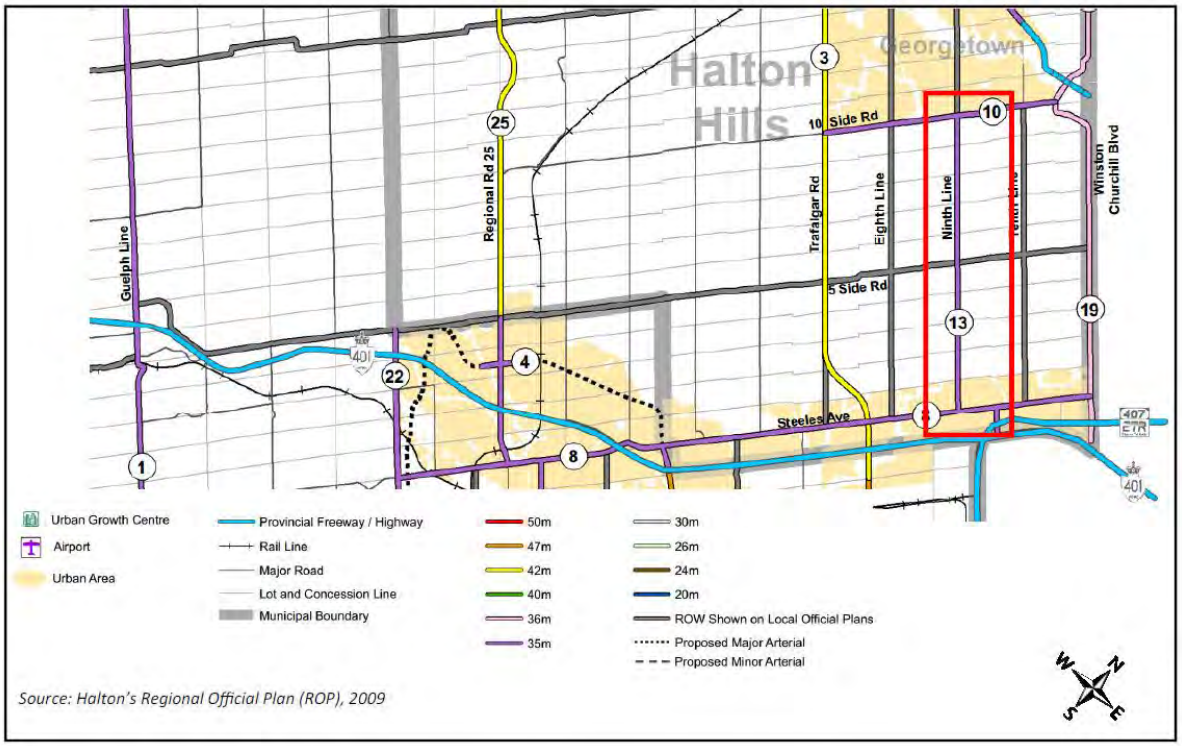


Figure 4-4: Right-of-Way (ROW) Classification of Road Network within Study Area

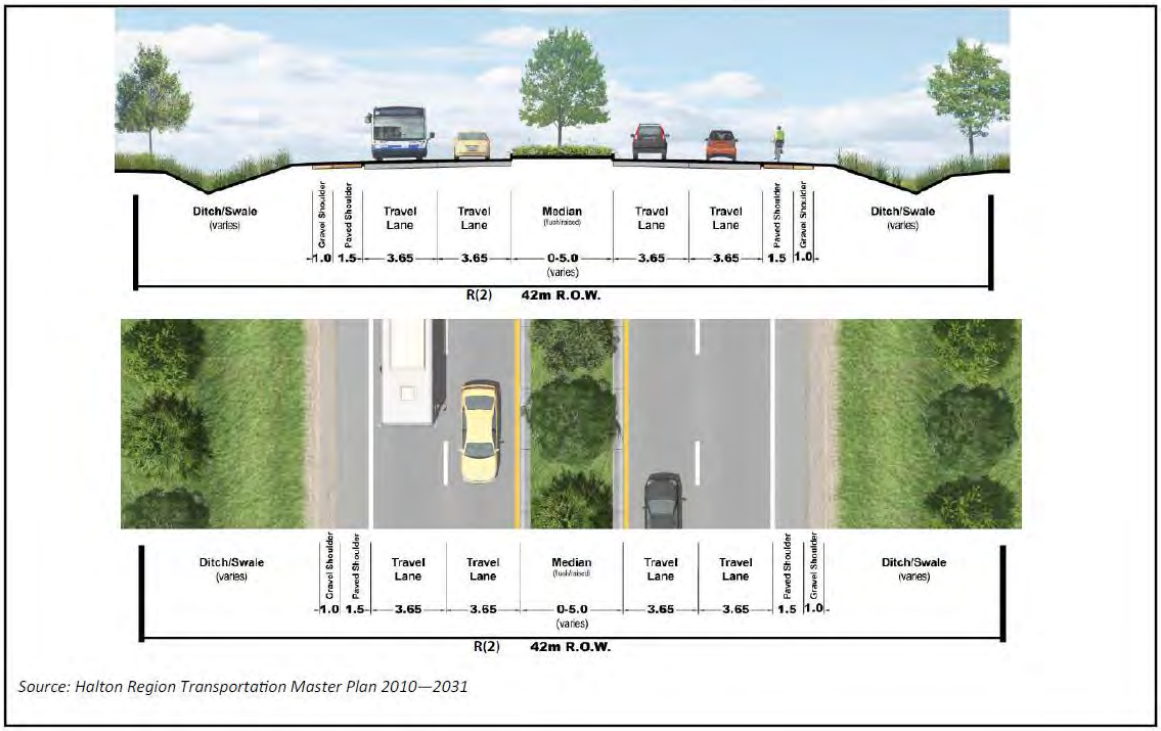
As per the TMP, Ninth Line is planned for a 42m ROW between 10 Side Road and Steeles Avenue. The planned 2031 ROW and road cross sections of Regional Roads within the study area are presented in **Table 4.5**.

Table 4-5: ROW (Ultimate)

Road Section	Category	Proposed ROW	Number of Shared Travel Lanes	Number of Priority Lanes
10 Side Road within study area limit	Corridor (1)	42m	4	n/a
Ninth Line between 10 Side Road and 5 Side Road	Rural (2)	42m	4	n/a
Ninth Line between 5 Side Road and Steeles Avenue	Rural (2)	42m	4	n/a
Steeles Avenue within study area	Corridor (4)	47m	4	HOV/RBL (2)
Ninth Line south of Steeles Avenue and within study area limit	Rural (2)	42m	4	n/a

Source: Regional Transportation Master Plan 2031 – The Road to Change

The cross-section of Rural (2) category as identified in the TMP is shown in **Figure 4.5**.



Source: Halton Region Transportation Master Plan 2010—2031

Figure 4-5: Cross-Section of Rural (2) Category as identified in the TMP

4.3 INTERSECTION CONTROL AND ACCESS

Even though Ninth Line intersects with only three roadways, there are four intersections within the study area due to the offset alignment of the Ninth Line (North) and Ninth Line (South) roadways at Steeles Avenue. All are signalized intersections.

Within the study area, access from adjacent land uses to Ninth Line primarily consists of residential and farm entrances.

4.4 ACTIVE TRANSPORTATION INFRASTRUCTURE

Currently, Ninth Line does not accommodate active transportation within the study limits.

4.4.1 HALTON ACTIVE TRANSPORTATION MASTER PLAN (ATMP)

The TMP had recommended the development of a Region-wide Active Transportation Plan. Halton Region undertook an Active Transportation Master Plan (ATMP) study to the year 2031 to develop strategies, assess infrastructure requirements, and support initiatives and programs to promote active transportation throughout the Region. The ATMP was finalized in May 2015.

The preferred (high level) strategy alternative identified to achieve the vision for Active Transportation included developing a Regional Walking and Cycling Network in combination with other initiatives and updates to policies and guidelines. The preferred network alternative for Regional Walking and Cycling Network included providing active transportation facilities along all Regional roads and some routes of regional significance along the local municipal corridors.

The ATMP proposes the Regional Cycling Network as shown in **Figure 4.6** and the Regional Walking Network as shown in **Figure 4.7** respectively.

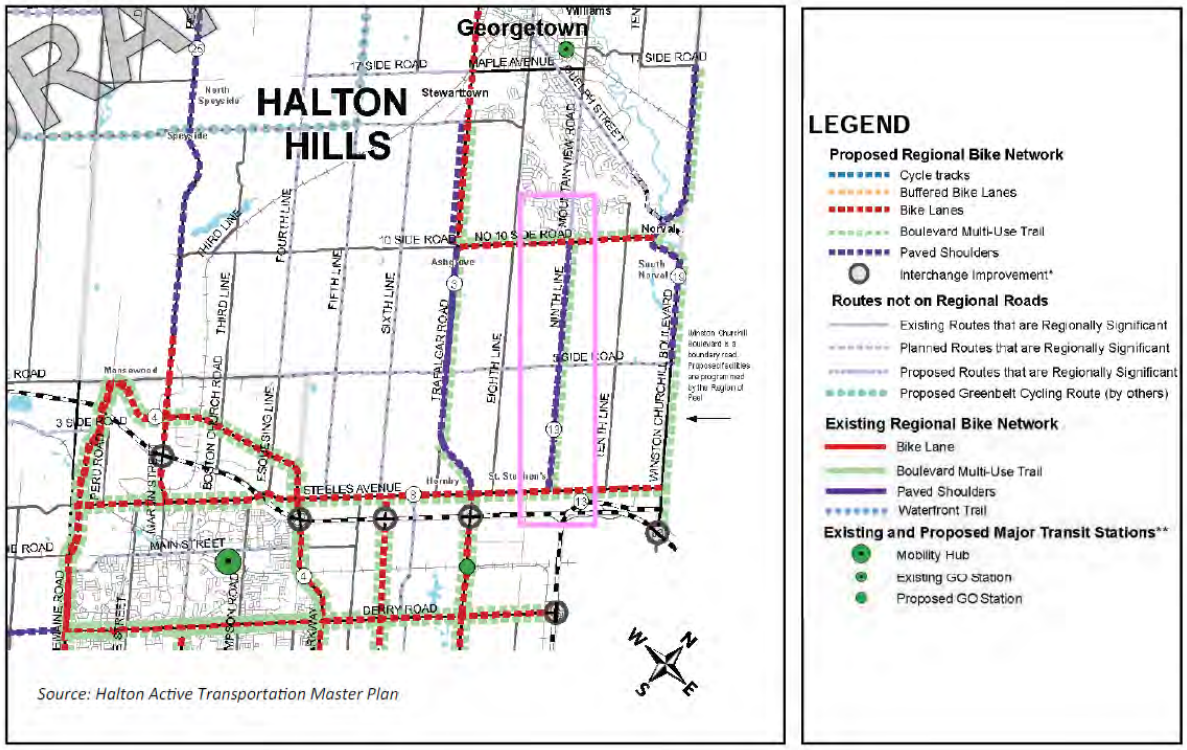


Figure 4-6: Proposed Regional Cycling Network as per Halton Active Transportation Master Plan

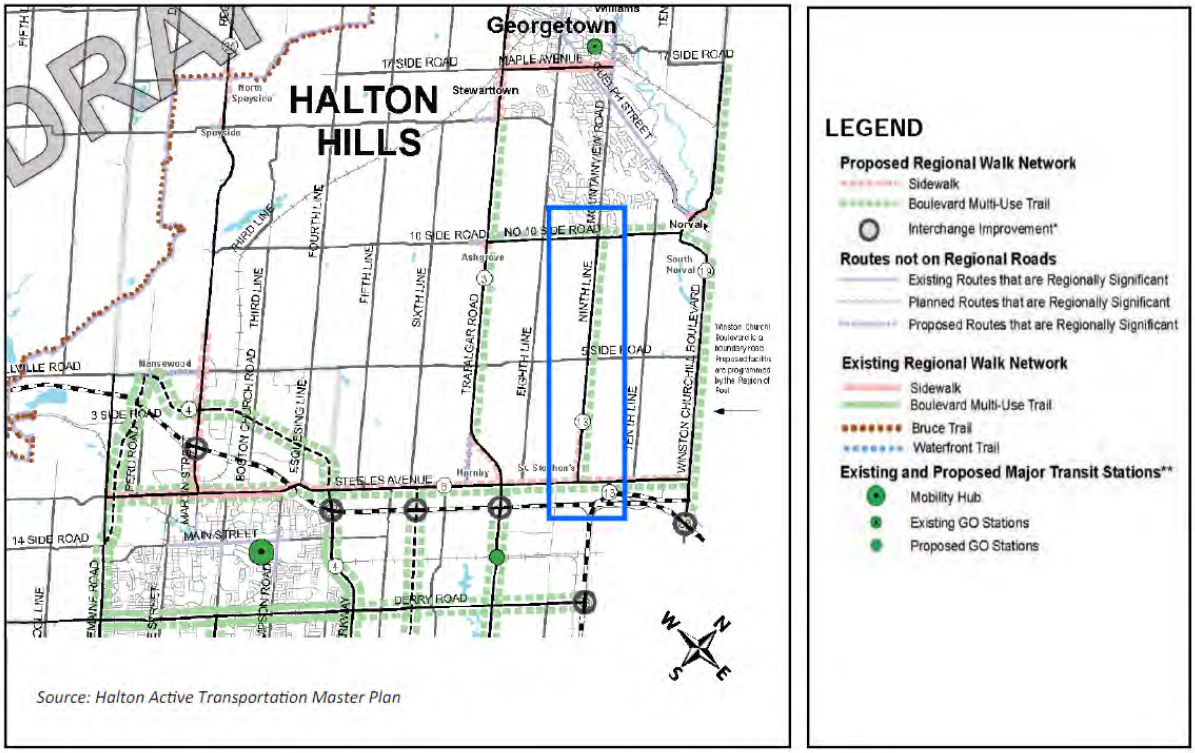


Figure 4-7: Proposed Regional Walking Network as per Halton Active Transportation Master Plan

4.4.2 HALTON HILLS ACTIVE TRANSPORTATION MASTER PLAN (2010)

Existing cycling facility, recommended facility type and implementation schedule as per Halton Hills Cycling Master Plan (2010) is shown in **Figure 4.8, Figure 4.9** and **Figure 4.10** respectively and the details are summarized in **Table 4.6**.

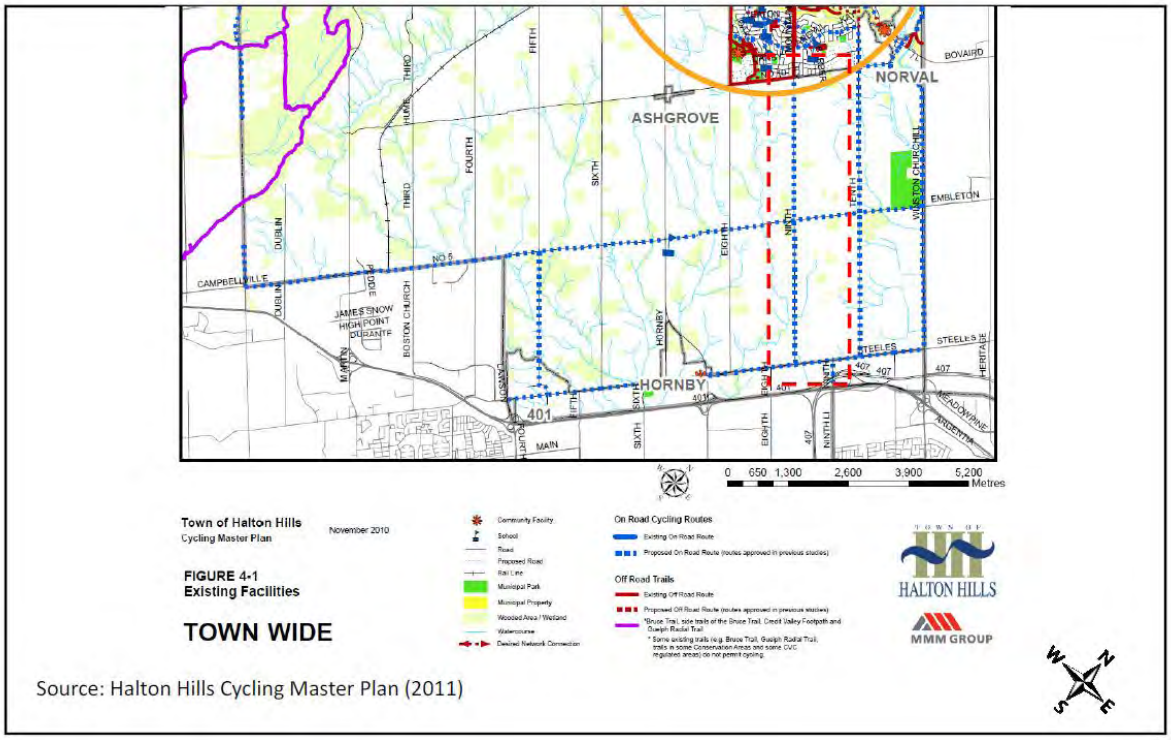


Figure 4-8: Existing Cycling Facility as proposed in Halton Hills Cycling Master Plan (2011)

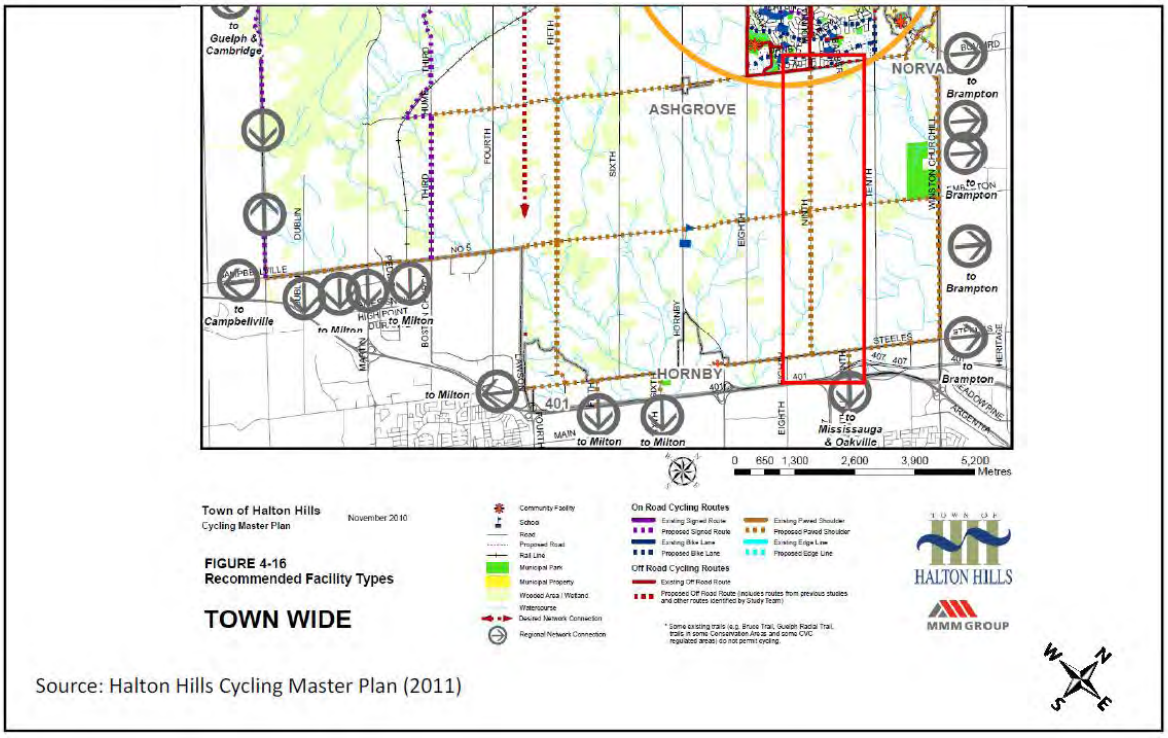


Figure 4-9: Recommended Cycling Facility as proposed in Halton Hills Cycling Master Plan (2011)

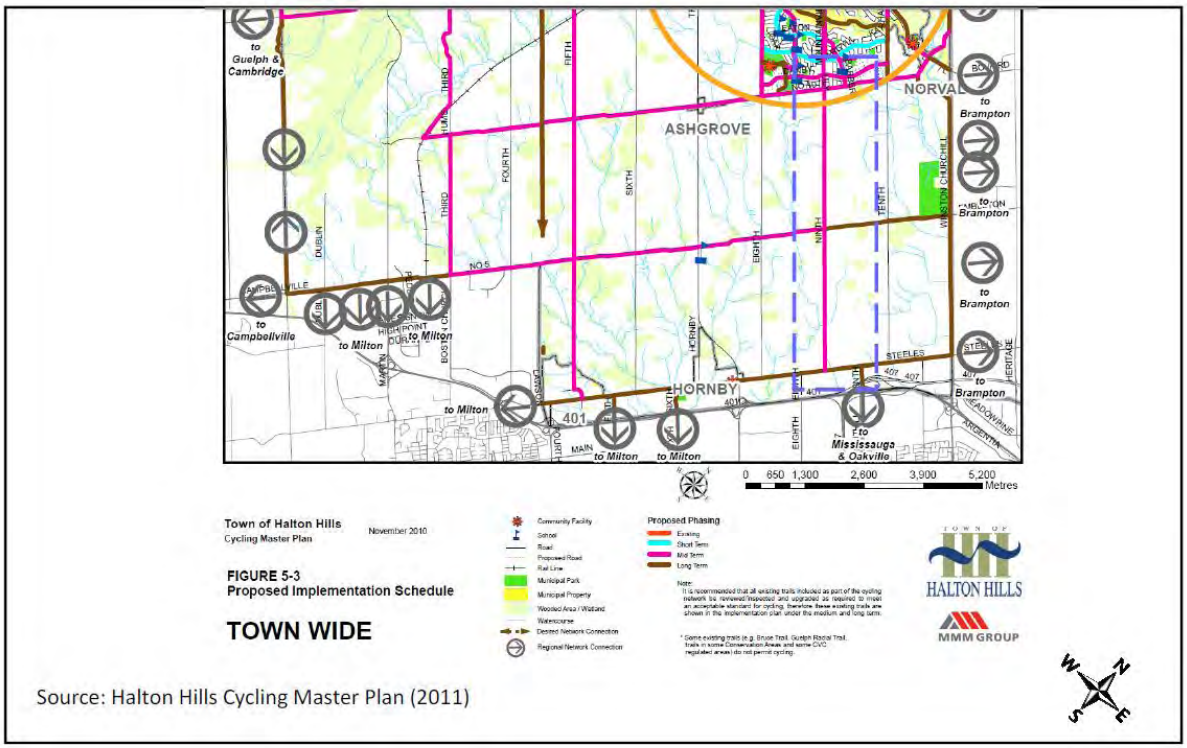


Figure 4-10: Implementation Schedule of Cycling Facility as proposed in Halton Hills Cycling Master Plan (2011)

Table 4-6: Recommended Cycling Facility Type and Implementation Schedule

Road Section	Recommended Facility Type	Implementation Schedule
Ninth Line north of 10 Side Road within study area limit	Existing Off-Road Route	n/a
10 Side Road	Existing Off-Road Route on West approach but proposed Off-Road Route on East approach at a minimum width of 3.0m	East of Ninth Line: Mid-term (2 to 10 years)
Ninth Line between 10 Side Road and 5 Side Road	Proposed paved shoulder at a minimum width of 1.5m	Mid-term (2 to 10 years)
5 Side Road	Proposed paved shoulder at a minimum width of 1.5m	West of Ninth Line: Mid-term (2 to 10 years) East of Ninth Line: Long-term (11+ years)
Ninth Line between 5 Side Road and Steeles Avenue	Proposed paved shoulder at a minimum width of 1.5m	Mid-term (2 to 10 years)
Steeles Avenue	Proposed paved shoulder at a minimum width of 1.5m	Long-term (11+ years)
Ninth Line south of Steeles Avenue and within study area limit	Proposed paved shoulder at a minimum width of 1.5m	Long-term (11+ years)

4.5 TRANSIT

Currently there is no local transit service within the limits of the study area.

Halton Hills ActiVan Accessible Transit service provides public transportation for seniors aged 65 or older, and for persons with physical, medical or cognitive disabilities within the municipal boundaries of Halton Hills. This on-demand paid service is provided for registered users from Monday to Friday 8:00 am to 4:30 pm and on evenings and weekends by advance booking.

The Red Cross, which is funded by the Ministry of Health and Long Term Care, also provides transportation services for medical appointments and day programs to seniors (over 60 years) and to persons with disabilities during weekends.

5.0 NETWORK ANALYSIS

5.1 ANALYSIS PERIOD AND DESIGN HOUR

2031 was considered as the horizon year and traffic conditions during a typical weekday PM peak hours were considered for the traffic operations analysis.

As Steeles Avenue is currently under construction, the intersection of Steeles Avenue with Ninth Line was not considered for analysis under current conditions. Only the intersections of Ninth Line with 10 Side Road, and Ninth Line with 5 Side Road were considered for operations analysis of roadways within the study area.

5.2 DATA SOURCE

Turning Movement Count (TMC) data provided by Halton Region was used to carry out this analysis. TMC data for the intersection of Ninth Line and 10 Side Road was dated April 2, 2014; and for the intersection of Ninth Line and 5 Side Road was dated May 16, 2013. **Appendix A** provides the TMC data that was used in this analysis. In addition to this, signal timing and Automatic Traffic Recorder (ATR) data was also provided by Halton Region.

5.3 EXISTING TRAFFIC CHARACTERISTICS

5.3.1 TRAFFIC VOLUME

Table 5.1 provides a summary of the peak hour at the study intersections and the Peak Hour Factor (PHF) considered for analysis as obtained from the TMC data.

Table 5-1: Weekday PM peak hour at the study intersections and the PHF factor

Criteria	Ninth Line @ 10 Side Road	Ninth Line @ 5 Side Road
	PM Peak Hour	PM Peak Hour
Data date	April 2, 2014	May 16, 2013
Peak Hour	4:00 – 5:00	4:45 – 5:45
Peak Hour Factor	0.99	0.97

Details of the location of the ATR station, the Average Annual Daily Traffic (AADT) count and the time of maximum traffic volumes as summarized from the ATR information is shown in **Table 5.2**.

Table 5-2: AADT count and Maximum Traffic Volume

HI-STAR ID	Data Date	Street	Location	Direction	AADT	Maximum Volume & Time
1FF5E	12 Sep. 2013 to 13 Sep. 2013	REG. RD. #13	Between Steeles Av & 5 Side Rd	NB	5233	128 @ 5:45 PM
10852D		REG. RD. #13	Between Steeles Av & 5 Side Rd	SB	5045	129 @ 3:45 PM
10FDC8	17 Sep. 2013 to 18 Sep. 2013	REG. RD. #13	Between 5 Side Rd & 10 Side Rd	NB	5713	180 @ 6:00 PM
10FDCB		REG. RD. #13	Between 5 Side Rd & 10 Side Rd	SB	6098	222 @ 7:30 AM

Based on 2013 ATR data, Ninth Line carries approximately 5,000 vehicles on a daily basis between Steeles Avenue and 5 Side Road; and approximately 6,000 vehicles on a daily basis between 5 Side Road and 10 Side Road. The maximum traffic volume was observed during the PM period for both the northbound and southbound directions; whereas, the maximum traffic volume between the 5 Side Road and 10 Side Road northbound direction was observed during the PM peak period and for the southbound direction was observed during the AM peak period. Two-way traffic volumes on Ninth Line are approximately 1,200 vehicles per hour during the weekday (PM) peak hour, and are expected to increase to approximately 2,600 vehicles per hour by 2031 for the same period (which exceeds the capacity of a two lane road).

A summary of the 2014 turning movement counts along the study corridor is presented in **Figure 5.1**.

It is important to note these traffic volumes were obtained prior to the commencement of the Steeles Avenue construction. The traffic patterns indicate avoidance of the Steeles Avenue and Ninth Line intersection in the morning period due to poor service levels. The improvements under construction will address this issue.

5.3.2 OPERATING SPEED

Observations from the ATR data regarding operating speeds on the roadways within the study area are summarized in **Table 5.3**:

Table 5-3: Percentage of vehicle travelling above posted speed limit

Street	Location	Direction	Posted Speed	Observed Range	Percentage
REG. RD. #13	Between Steeles Av & 5 Side Rd	NB	80	80 - 89	33.68%
REG. RD. #13	Between Steeles Av & 5 Side Rd	SB	80	80 – 89	41.91%
REG. RD. #13	Between 5 Side Rd & 10 Side Rd	NB	80	90 - 99	31.54%
REG. RD. #13	Between 5 Side Rd & 10 Side Rd	SB	80	80 - 89	38.03%

A review of vehicle operating speeds indicates that vehicles are generally travelling above the posted speed limit in the range of about 10 km/h except for the northbound section between 5 Side Road and 10 Side Road where the vehicle operating speed exceeds the posted speed limit by a range of 20 km/h.

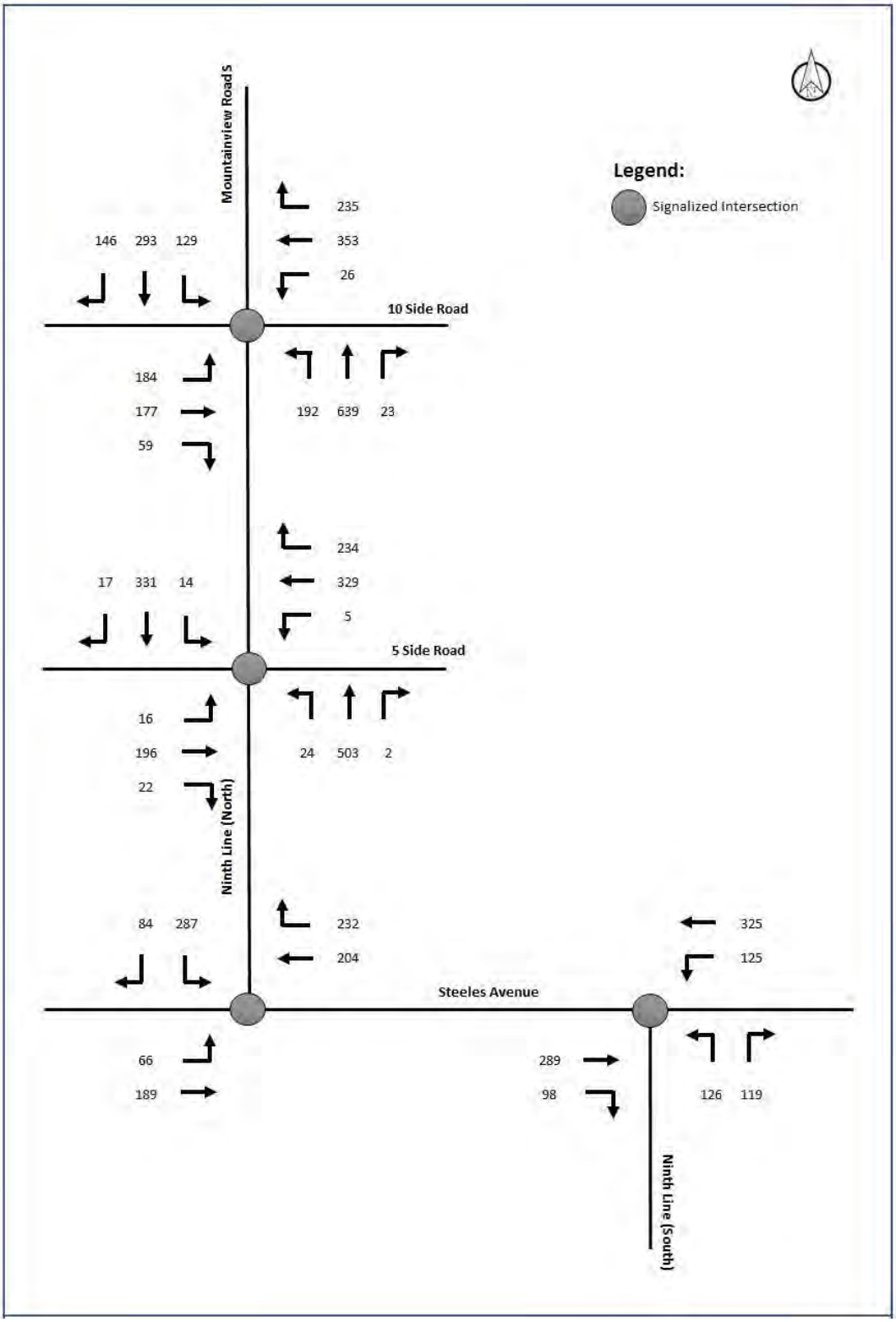


Figure 5-1: Existing 2014 Weekday PM Peak Hour Traffic Volume

Figure 5.2 shows the northbound and southbound speed profile for the Ninth Line roadway section between 10 Side Road and 5 Side Road during a typical weekday; and **Figure 5.3** shows the same between the section of 5 Side Road and Steeles Avenue.

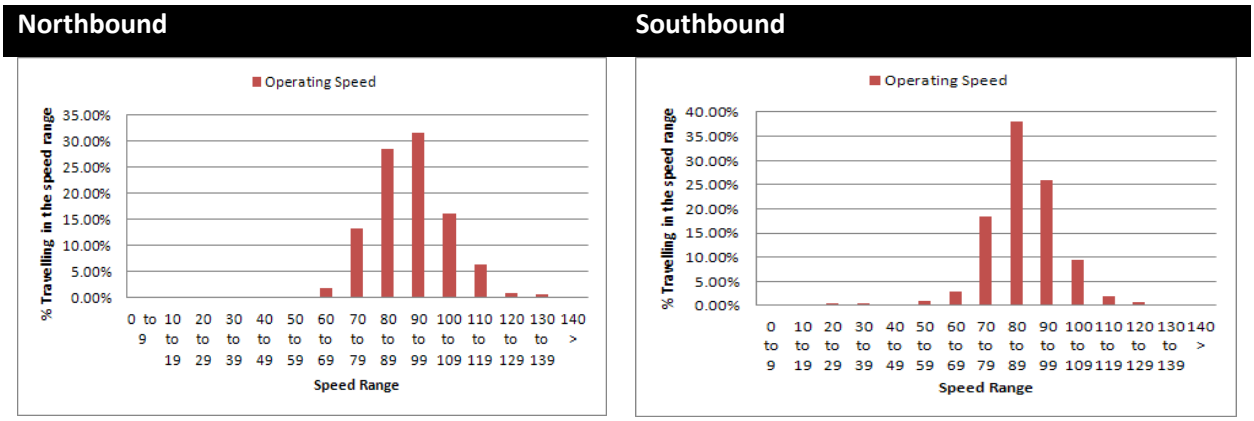


Figure 5-2: Speed profile for the northbound and southbound Ninth Line between the section of 10 Side Road and 5 Side Road

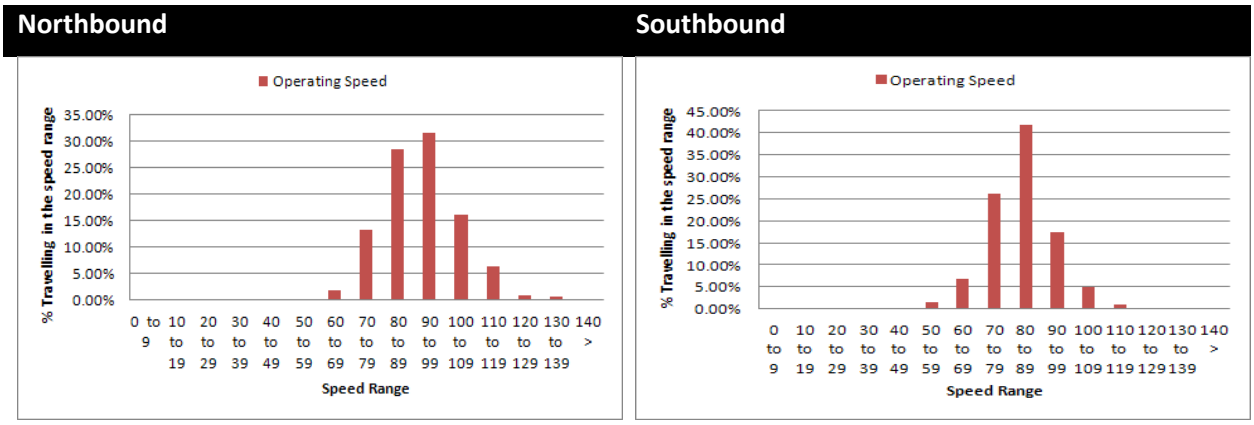


Figure 5-3: Speed profile for the northbound and southbound Ninth Line between the section of 5 Side Road and Steeles Avenue

5.4 EXISTING TRAFFIC OPERATIONS

The concept of capacity and Level of Service (LOS) are central to the operational analysis of intersections. Capacity analysis is a process that is used to describe how well an intersection will perform under various traffic conditions and the results can assist in evaluating the need for improvements. At signalized intersections, capacity is normally evaluated using the volume-to-capacity (v/c) ratio, which describes the extent of available capacity used by vehicles either within the intersection as a whole or for specific lanes or movements. The overall intersection sufficiency is measured using a composite v/c ratio for the sum of the critical lanes or movements within the intersection. The v/c ratio is measured by a fractional value between zero and one. A v/c ratio near one suggests fully utilized capacity. Additionally, the movements or lane groups with a v/c ratio in excess of established thresholds were identified as “critical” movements. The thresholds correspond to:

- a v/c ratio of 0.85 for individual through movement and for shared through movements; and
- a v/c of 0.95 for exclusive turning movements.

LOS is a qualitative concept used to define the quality of service of traffic condition at an intersection and/or road section. Six measures of LOS are defined with LOS A representing the best operating condition and LOS F the worst.

Figure 4.3 shows the existing lane configurations and traffic signal control within the study area boundaries, and the existing traffic volumes for the weekday PM peak hour are shown in **Figure 5.1**. As the study intersection is a signalized intersection, capacity analysis involved measuring the overall intersection sufficiency using a composite volume-to-capacity (v/c) ratio; and, LOS was determined by assessing the average control delay per vehicle for various movements within the intersection.

Therefore, the overall operational performance of the study intersection was measured by the intersection overall v/c ratio. **Table 5.4** summarizes the overall intersection control delay, the overall intersection v/c ratio and the intersection overall LOS obtained from operational analysis of the weekday PM peak hour traffic volume using Synchro/SimTraffic operational analysis software which uses Highway Capacity Manual methodology. The detailed Synchro operational analysis reports for the existing condition are given in **Appendix B**.

Table 5-4: Existing (2014) Weekday PM Peak Hour Operational Performance

Ninth Line @	Movement	Weekday PM Peak Hour		
		Control Delay (seconds)	v/c Ratio	LOS
10 Side Road		*No critical movement*		
	Overall	***21.9***	***0.62***	***C***
5 Side Road		*No critical movement*		
	Overall	***23.7***	***0.73***	***C***

5.5 COLLISION HISTORY

A preliminary review of collision history from 2010 to 2015 was undertaken for each intersection on Ninth Line as well as the mid-block sections within the corridor. Collision reports were analyzed to determine the type and pattern of collision within the study area and the observations are summarized below:

Ninth Line between Steeles Avenue and 5 Side Road

1. Read End type and Single Motor Vehicle (SMV) type collisions were predominant along this session of the roadway.
2. 35% of the total collisions were Rear End type collisions. The major factors contributing to Rear End type collisions were speeding and following too closely.
3. The major cause of the 39% of the SMV type collisions were due to losing control with the contributing factors being wet/snow conditions resulting in skidding/sliding.
4. 8% of the total collisions which contributed to Sideswipe type collision could also justify the lack of opportunity to overtake.

Ninth Line and 5 Side Road (Intersection)

1. Angle type, Rear End type, and SMV type collisions were mostly observed at this intersection.

2. Analysis of Angle Type collisions showed that majority of accidents involved pick-up trucks/large vehicles moving in the south direction while colliding with automobiles moving in the east or west direction.
3. Rear End type collisions mostly occurred due to vehicles following too closely.

Ninth Line between 5 Side Road and 10 Side Road

1. SMV type collision dominated this session of the roadway (around 74% of the collisions).
2. Major contributing factors for SMV type collisions were – skidding/sliding in wet/snow conditions, speeding and running off the road.

Ninth Line and 10 Side Road (Intersection)

1. No particular type of collision pattern was observed at this intersection.
2. Through and Angle type collisions contributed to 66% of the collision type, the absoulute number of collisions in a year was low.

5.6 COLLISION SUMMARY

Analysis of the collision observations is summarized below:

- The operating speed characteristics during the weekday PM peak hour may suggest aggressive driver behavior and may be contributing to the Rear End type collisions. Another reason for this could be lack of opportunity to overtake.
- The predominant SMV type collision and sideswipe type collision observed in the sections on this roadway may be alleviated by increasing the through lane capacity.

The collision experience along the Ninth Line corridor is typical of a commuter route that is more heavily travelled during the weekdays, experiencing highest traffic volumes during the weekday morning and afternoon peak periods. The predominant collision patterns suggest that some of the collisions may be avoided in the future through road improvements, such as widening (more capacity, provision of auxiliary lanes) and design improvements for visibility.

5.7 TRAFFIC FORECASTS (2031)

Traffic forecasting is an integral part of the transportation planning process. It serves as an analysis tool for transportation planners and aids decision-makers in the evaluation of transportation network. In addition to the analysis undertaken as part of the transportation master planning process, traffic projections for the study area were derived from existing traffic volumes and considered link volumes and growth factors for Ninth Line. Crossing roadways within the project limit were also forecasted based on data from the Halton Region Transportation Demand Forecasting Model.

The future traffic estimates for the study corridor were developed from the Regional Travel Demand Forecasting Model for the years 2021 and 2031. The land use reflected in the forecasts for each year includes the planned future developments within the Town of Halton Hills and generalized growth across Halton Region by 2031, as per the approved Best Planning Estimates. The Region's model forecast also reflect the approved roadway Capital Program as identified in the Halton Transportation Master Plan (2031) – The Road to Change.

The Region's model provides directional travel demands for weekday PM peak hour on modelled road sections ('links').

The land use reflected in the forecasts for each year includes the planned future developments within the Town of Halton Hills and generalized growth across Halton Region by 2031, as per the approved Best Planning Estimates.

The Region's model provides directional travel demands for weekday PM peak hour on modelled road sections (links). The following Screenlines relevant to the study area, presented in Table 5.5, were considered in the analysis.

Table 5-5: Descriptions of Screenlines used in the Regional Travel Demand Forecasting Model

Screenline Identification No.	Screenline Name	Location	Direction
20	West Georgetown	Between Trafalgar Rd and Eighth Line	EB-WB
74	West of Winston Churchill	North of Tenth Line	EB-WB
15	West of Ninth Line	South of Ninth Line (between Eighth and Ninth Line)	EB-WB
59	Central Georgetown south of 17th Side Rd	North of 10 Side Rd	NB-SB
58	Georgetown South	Between 10 Side Rd and 5 Side Rd	NB-SB
56	East Halton Hills North of Steeles Avenue	Between Steeles Av and 5 Side Rd	NB-SB

The travel demand model output and corresponding corridor and Screenline growth rates are summarized in Table 5.6.

Table 5-6: Overview of Screenline Growth Rates

Standardized Screenline Growth Rates

Eastbound / Westbound

Tag	Screenline Name	Direction	Model Forecasts						Annual Growth Rates						
			2006	2011	2016	2021	2026	2031	2006-2011	2011-2016	2016-2021	2021-2026	2026-2031	2011-2031	2016-2031
15	West of Ninth Line	EB	5212	6356	7144	9208	10318	11397	4.0%	2.4%	5.2%	2.3%	2.0%	3.0%	3.2%
		WB	7394	8409	8305	12169	12544	11689	2.6%	-0.2%	7.9%	0.6%	-1.4%	1.7%	2.3%
20	West Georgetown	EB	1177	1465	1694	1908	2094	2231	4.5%	2.9%	2.4%	1.9%	1.3%	2.1%	1.9%
		WB	1358	1531	1586	1552	1891	2599	2.4%	0.7%	-0.4%	4.0%	6.6%	2.7%	3.3%
74	West of Winston Churchill	EB	1236	1532	2104	1946	2285	1981	4.4%	6.6%	-1.5%	3.3%	-2.8%	1.3%	-0.4%
		WB	2082	2281	2898	2388	2157	1865	1.8%	4.9%	-3.8%	-2.0%	-2.9%	-1.0%	-2.9%

Northbound / Southbound

Tag	Screenline Name	Direction	Model Forecasts						Annual Growth Rates						
			2006	2011	2016	2021	2026	2031	2006-2011	2011-2016	2016-2021	2021-2026	2026-2031	2011-2031	2016-2031
56	East Halton Hills North of Steeles Avenue	NB	1675	2089	2708	2685	2956	8097	4.5%	5.3%	-0.2%	1.9%	22.3%	7.0%	7.6%
		SB	716	855	993	1053	1275	4976	3.6%	3.0%	1.2%	3.9%	31.3%	9.2%	11.3%
58	Georgetown South	NB	2875	3472	4242	4930	5718	11007	3.8%	4.1%	3.1%	3.0%	14.0%	5.9%	6.6%
		SB	951	1163	1383	1831	1952	4305	4.1%	3.5%	5.8%	1.3%	17.1%	6.8%	7.9%
59	Central Georgetown south of 17th Side Rd	NB	1578	3064	3400	3823	4213	4329	14.2%	2.1%	2.4%	2.0%	0.5%	1.7%	1.6%
		SB	1156	2243	2453	2481	3022	3124	14.2%	1.8%	0.2%	4.0%	0.7%	1.7%	1.6%

Output from the Region's Demand Forecasting model for Screenline Level Deficiency Analysis under 2016 PM traffic condition shows that Ninth Line will be exceeding the minimum capacity threshold and therefore would require improvements.

Figure 5.4 identifies predicted auto volume growth between 2016 and 2031.

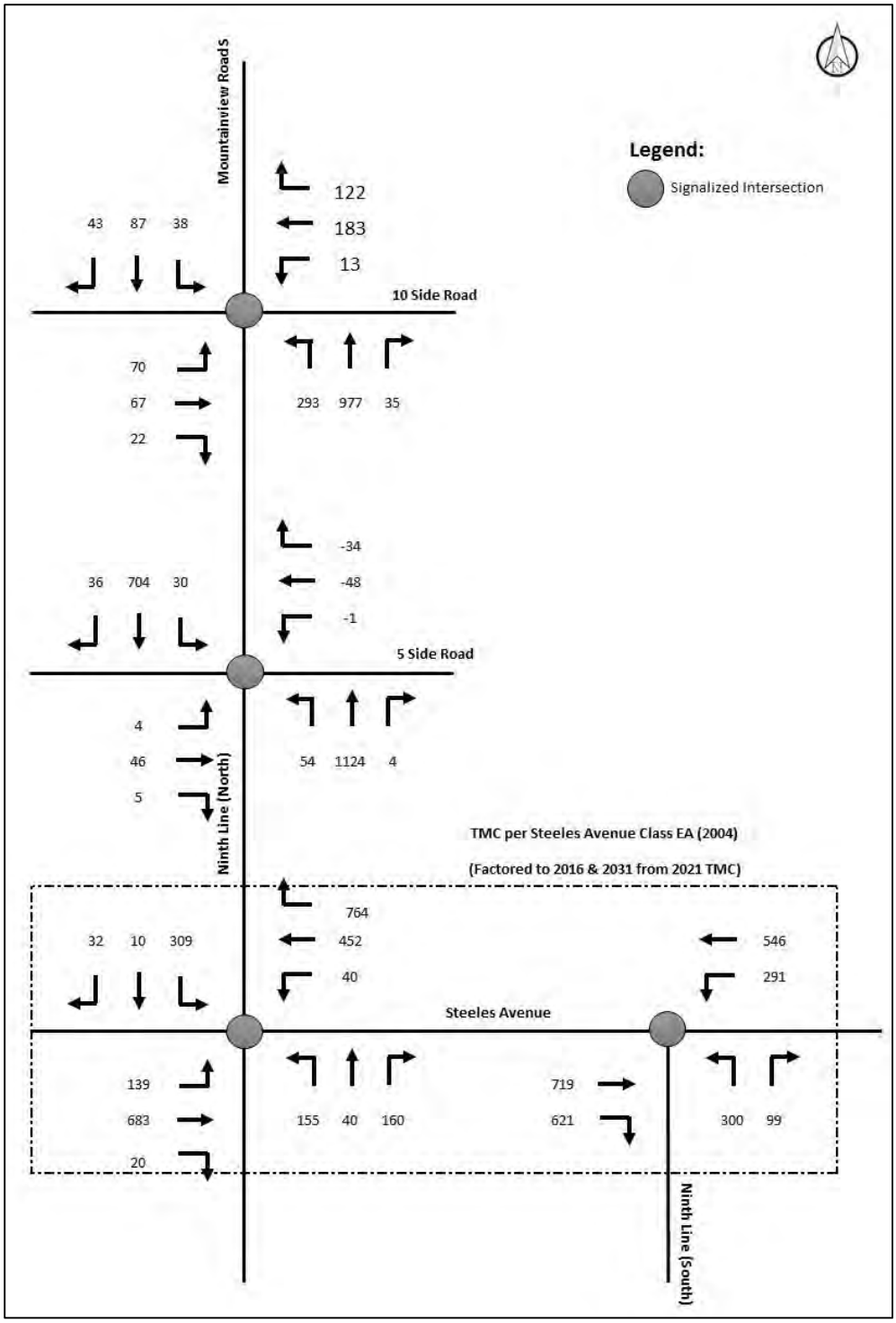


Figure 5-4: Predicted Auto Volume Growth between 2016 and 2031

The future volume, and planning and operational capacity of Ninth Line under 2016 and 2031 traffic condition is summarized in **Table 5.7**.

Table 5-7: Summary of Traffic Characteristics Under 2016 and 2031 Traffic Condition Scenarios

Roadway Section	Existing 2014 Volume	Planning Capacity	Operational Capacity	V/C Ratio (Planning)	V/C Ratio (Operation)
Ninth Line between 10 Side Rd and 5 Side Rd	830	950	1472	0.87	0.56
Ninth Line between 5 Side Rd and Steeles Av	530	950	767	0.56	0.69
Ninth Line south of Steeles Av	421	950		0.44	
Roadway Section	**Future 2031 Volume**	**Planning Capacity**	**Operational Capacity**	**V/C Ratio (Planning)**	**V/C Ratio (Operation)**
Ninth Line between 10 Side Rd and 5 Side Rd	2265	950	1473	2.38	1.54
Ninth Line between 5 Side Rd and Steeles Av	1785	950	611	1.87	2.92
Ninth Line south of Steeles Av	820	950		0.86	

The lane capacity of a major arterial as identified in the TMP (2011) is approximately 850 vehicles per hour. For long-range roadway planning in the Region, a roadway's level of service is defined as the ratio of volume-to-capacity (V/C). A road with a V/C of 1.0 is completely saturated and cannot theoretically accommodate more vehicles. This condition results in congestion and delays. The Region uses a critical volume to capacity ratio of 0.9 in its transportation master planning analyses to identify road segments in the Regional Road network, which may require improvement.

Based on traffic forecasts discussed above, traffic volumes on Ninth Line between Steeles Avenue to 10 Side Road will approach or exceed the critical capacity levels for a two-lane roadway in the peak direction in the 2021. This clearly indicates that improvements are required to provide acceptable level of service conditions in the future. Therefore, widening to 4 lanes is required in order to meet projected 2031 travel demand.

The development of the 2031 forecasts at the intersection level was developed from the existing TMC and the year 2031 approach and departure volumes as forecasted in the Region's transportation model. **Figure 5.5** presents the traffic volumes derived for the future conditions (2031) at the intersections along the Ninth Line corridor.

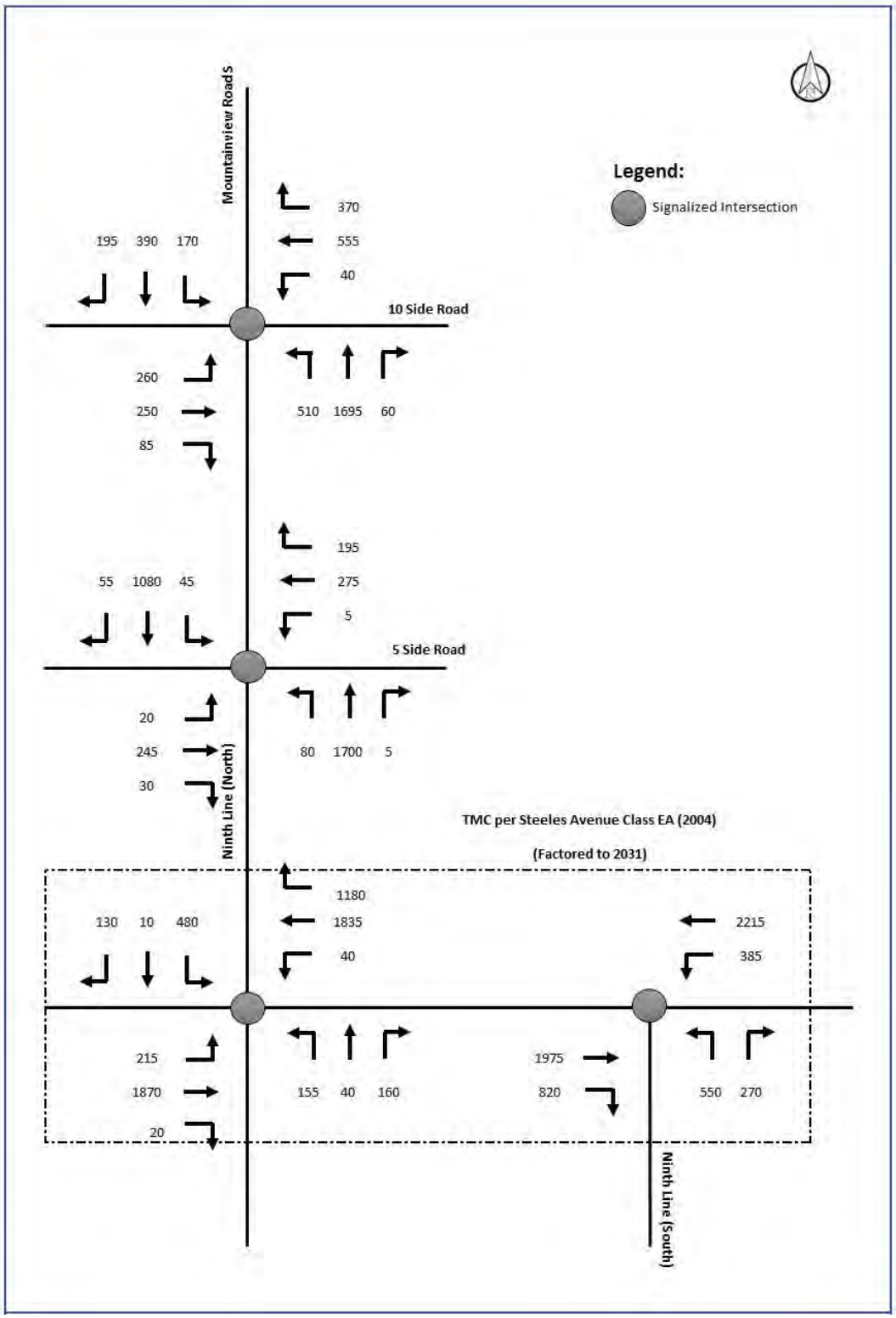


Figure 5-5: Future Total 2031 PM Peak Hour Traffic Volume

5.8 FUTURE TRAFFIC CONDITIONS (2031)

The operational performance of Ninth Line within the project limits was evaluated for the 2031 horizon year for the 'Do Nothing' scenario. **Table 5.8** summarizes the information about the control delay, V/C ratio and LOS for the critical movements and also for the overall intersection obtained from operational analysis of the weekday PM peak hour traffic volume using Synchro/SimTraffic operational analysis software. The detailed Synchro operational analysis reports for the future traffic condition without any improvements are presented in **Appendix C**.

Table 5-8: Future (2031) Weekday PM Peak Hour Operational Performance under Do Nothing Scenario

Ninth Line @	Movement	Weekday PM Peak Hour		
		Control Delay (seconds)	v/c Ratio	LOS
10 Side Road	Eastbound LT	441.3	1.87	F
	Northbound LT	355.3	1.71	F
	Northbound TH-RT	116.9	1.18	F
	Southbound LT	675.5	2.36	F
	Overall	***143.1***	***2.12***	***F***
5 Side Road	Northbound LT-TH-RT	935.0	3.01	F
	Southbound LT-TH-RT	545.8	2.15	F
	Overall	***623.9***	***1.85***	***F***

6.0 CONCLUSION

The operational analysis of the roadway network within the study area, taking into consideration the existing geometrics and no operational improvement, shows that the existing roadway capacity is insufficient to accommodate the projected 2031 future traffic. Additional capacity in the form of geometric improvement and traffic operations improvement are required to maintain the current level of service for the future conditions.

The conclusion of the 2004 TMP to widen the Ninth Line transportation corridor was reaffirmed during the development of the 2011 TMP.

APPENDIX A

TMC Data Used in the Analysis

10 Side Rd @ Ninth Line

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 7:15:00
To: 8:15:00

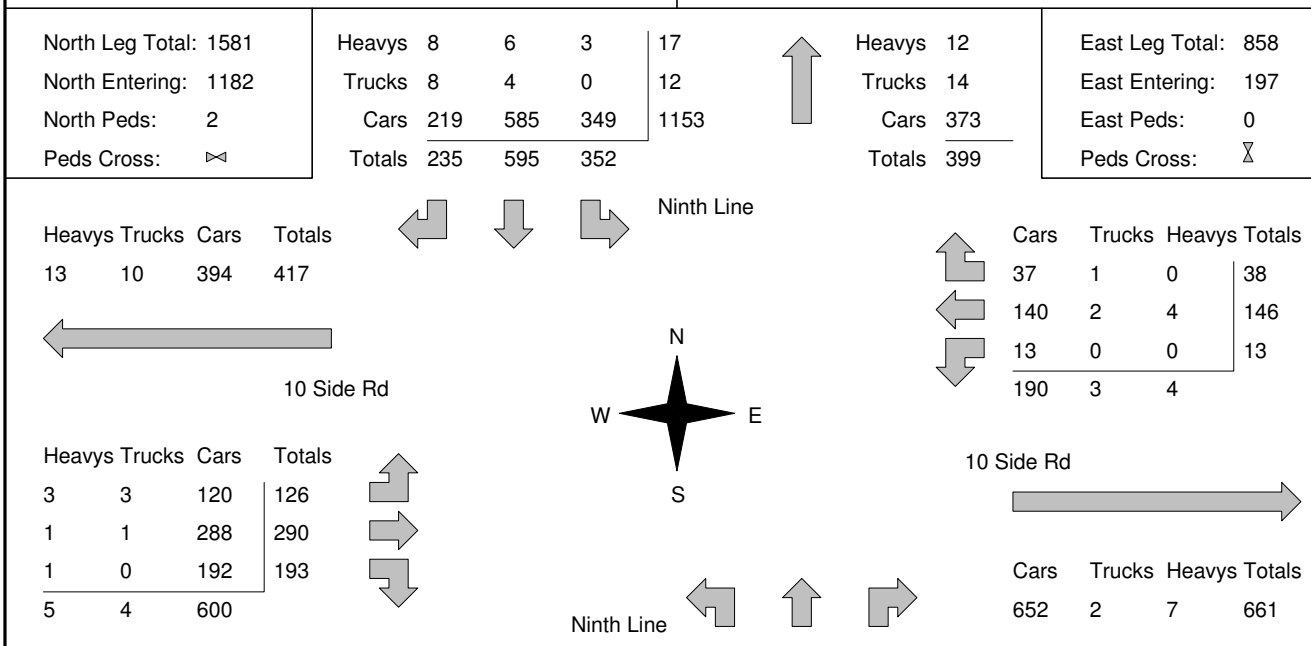
Municipality: Halton Region
Site #: 0000002077
Intersection: Ninth Line & 10 Side Rd
TFR File #: 4
Count date: 2-Apr-2014

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Margaret

**** Signalized Intersection ****

Major Road: Ninth Line runs N/S



Comments

10 Side Rd @ Ninth Line

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 14:00:00

One Hour Peak
From: 13:00:00
To: 14:00:00

Municipality: Halton Region
Site #: 0000002077
Intersection: Ninth Line & 10 Side Rd
TFR File #: 4
Count date: 2-Apr-2014

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Margaret

**** Signalized Intersection ****

Major Road: Ninth Line runs N/S

North Leg Total:	865			
North Entering:	431			
North Peds:	1			
Peds Cross:	⋈			
Heavys	1	13	0	14
Trucks	3	13	0	16
Cars	97	253	51	401
Totals	101	279	51	
Heavys	34			
Trucks	20			
Cars	380			
Totals	434			
East Leg Total:	317			
East Entering:	169			
East Peds:	0			
Peds Cross:	⧖			

Ninth Line

Heavys	Trucks	Cars	Totals
8	10	190	208

10 Side Rd

Cars	Trucks	Heavys	Totals
84	1	0	85
56	5	5	66
14	2	2	18
154	8	7	

N
W E
S

Heavys	Trucks	Cars	Totals
13	5	86	104
5	3	74	82
5	4	37	46
23	12	197	

10 Side Rd

Cars	Trucks	Heavys	Totals
139	4	5	148

Ninth Line

Peds Cross:	⧖			
West Peds:	0			
West Entering:	232			
West Leg Total:	440			
Cars	304			
Trucks	19			
Heavys	20			
Totals	343			
Cars	37	210	14	261
Trucks	2	14	1	17
Heavys	2	21	0	23
Totals	41	245	15	
Peds Cross:	⋈			
South Peds:	0			
South Entering:	301			
South Leg Total:	644			

Comments

10 Side Rd @ Ninth Line

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:00:00
To: 17:00:00

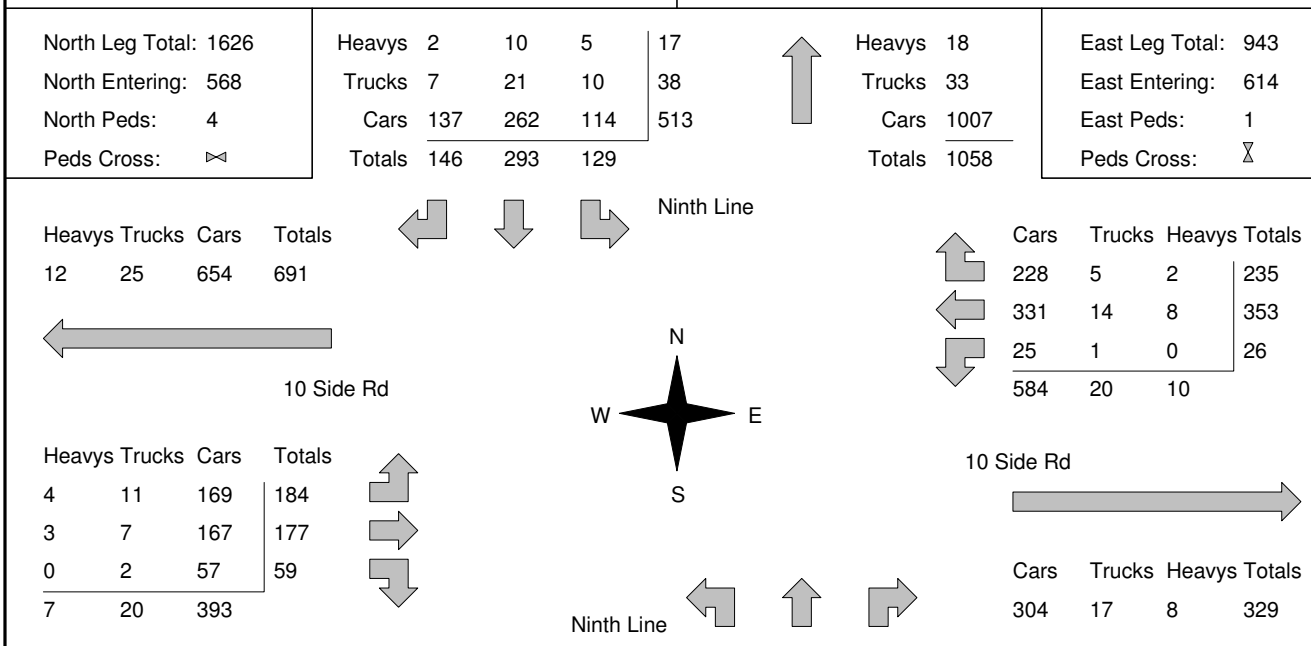
Municipality: Halton Region
Site #: 0000002077
Intersection: Ninth Line & 10 Side Rd
TFR File #: 4
Count date: 2-Apr-2014

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Margaret

**** Signalized Intersection ****

Major Road: Ninth Line runs N/S



Comments

10 Side Rd @ Ninth Line

Total Count Diagram

Municipality: Halton Region
Site #: 0000002077
Intersection: Ninth Line & 10 Side Rd
TFR File #: 4
Count date: 2-Apr-2014

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Margaret

**** Signalized Intersection ****

Major Road: Ninth Line runs N/S

North Leg Total:	9772			
North Entering:	4966			
North Peds:	28			
Peds Cross:	⋈			
Heavys	26	71	15	112
Trucks	39	89	25	153
Cars	1049	2559	1093	4701
Totals	1114	2719	1133	
Heavys	158			
Trucks	169			
Cars	4479			
Totals	4806			
East Leg Total:	4886			
East Entering:	2395			
East Peds:	1			
Peds Cross:	⧖			

Ninth Line

Heavys	Trucks	Cars	Totals
63	90	2962	3115

10 Side Rd

Cars	Trucks	Heavys	Totals
877	26	7	910
1272	39	31	1342
128	10	5	143
2277	75	43	

N
W E
S

Heavys	Trucks	Cars	Totals
44	48	958	1050
28	41	1158	1227
9	13	613	635
81	102	2729	

10 Side Rd

Cars	Trucks	Heavys	Totals
2372	70	49	2491

Ninth Line

Peds Cross:	⧖			
West Peds:	0			
West Entering:	2912			
West Leg Total:	6027			
Cars	3300			
Trucks	112			
Heavys	85			
Totals	3497			
Cars	641	2644	121	3406
Trucks	12	95	4	111
Heavys	6	107	6	119
Totals	659	2846	131	
Peds Cross:	⋈			
South Peds:	3			
South Entering:	3636			
South Leg Total:	7133			

Comments

Ninth Line @ No 5 Side Road

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 7:15:00
To: 8:15:00

Municipality: Halton Region
Site #: 1032970100
Intersection: Ninth Line & No 5 Side Rd
TFR File #: 5
Count date: 16-May-2013

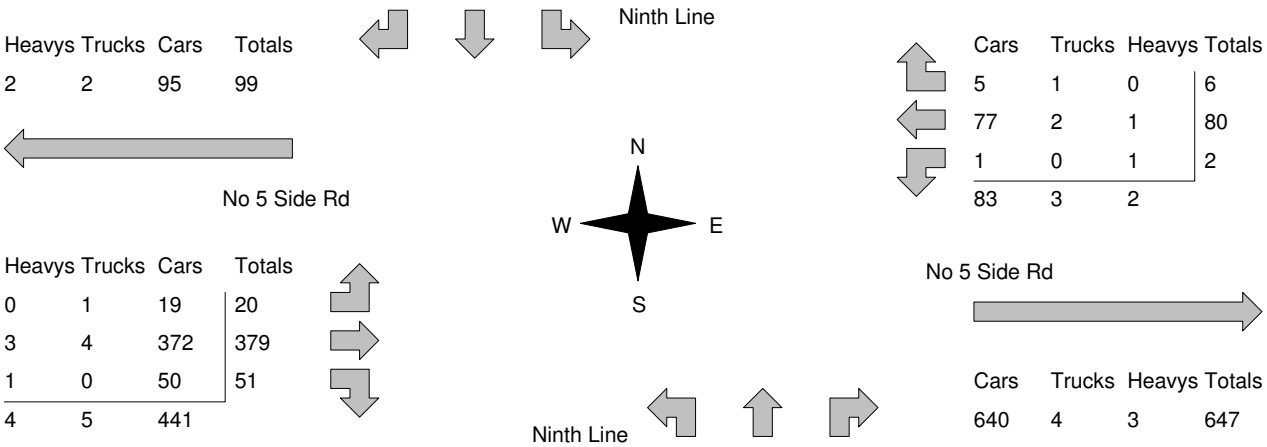
Weather conditions:
Clear/Dry

Person(s) who counted:
Leszek

**** Signalized Intersection ****

Major Road: Ninth Line runs N/S

North Leg Total:	1011			
North Entering:	720			
North Peds:	0			
Peds Cross:	⋈			
Heavys	1	9	0	10
Trucks	0	11	0	11
Cars	11	448	240	699
Totals	12	468	240	
Heavys	9			
Trucks	14			
Cars	268			
Totals	291			
East Leg Total:	735			
East Entering:	88			
East Peds:	0			
Peds Cross:	⧖			



Peds Cross:	⧖			
West Peds:	1			
West Entering:	450			
West Leg Total:	549			
Cars	499			
Trucks	11			
Heavys	11			
Totals	521			
Cars	7	244	28	279
Trucks	0	12	0	12
Heavys	0	9	0	9
Totals	7	265	28	
Peds Cross:	⋈			
South Peds:	0			
South Entering:	300			
South Leg Total:	821			

Comments

Ninth Line @ No 5 Side Road

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 14:00:00

One Hour Peak
From: 12:00:00
To: 13:00:00

Municipality: Halton Region
Site #: 1032970100
Intersection: Ninth Line & No 5 Side Rd
TFR File #: 5
Count date: 16-May-2013

Weather conditions:
Clear/Dry

Person(s) who counted:
Leszek

**** Signalized Intersection ****

Major Road: Ninth Line runs N/S

North Leg Total: 574
North Entering: 267
North Peds: 1
Peds Cross: ⋈

Heavys	0	20	0	20
Trucks	0	7	1	8
Cars	16	206	17	239
Totals	16	233	18	

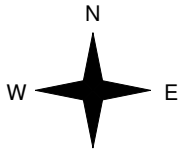
Heavys	23
Trucks	9
Cars	275
Totals	307

East Leg Total: 159
East Entering: 91
East Peds: 1
Peds Cross: ⧖

Heavys	Trucks	Cars	Totals
1	0	82	83

No 5 Side Rd

Heavys	Trucks	Cars	Totals
0	1	14	15
0	0	46	46
0	0	11	11
0	1	71	



Cars	Trucks	Heavys	Totals
28	1	0	29
56	0	1	57
5	0	0	5
89	1	1	

No 5 Side Rd

Cars	Trucks	Heavys	Totals
67	1	0	68

Ninth Line

Peds Cross: ⧖
West Peds: 1
West Entering: 72
West Leg Total: 155

Cars	222
Trucks	7
Heavys	20
Totals	249

Cars	10	233	4	247
Trucks	0	7	0	7
Heavys	0	23	0	23
Totals	10	263	4	

Peds Cross: ⋈
South Peds: 1
South Entering: 277
South Leg Total: 526

Comments

Ninth Line @ No 5 Side Road

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:45:00
To: 17:45:00

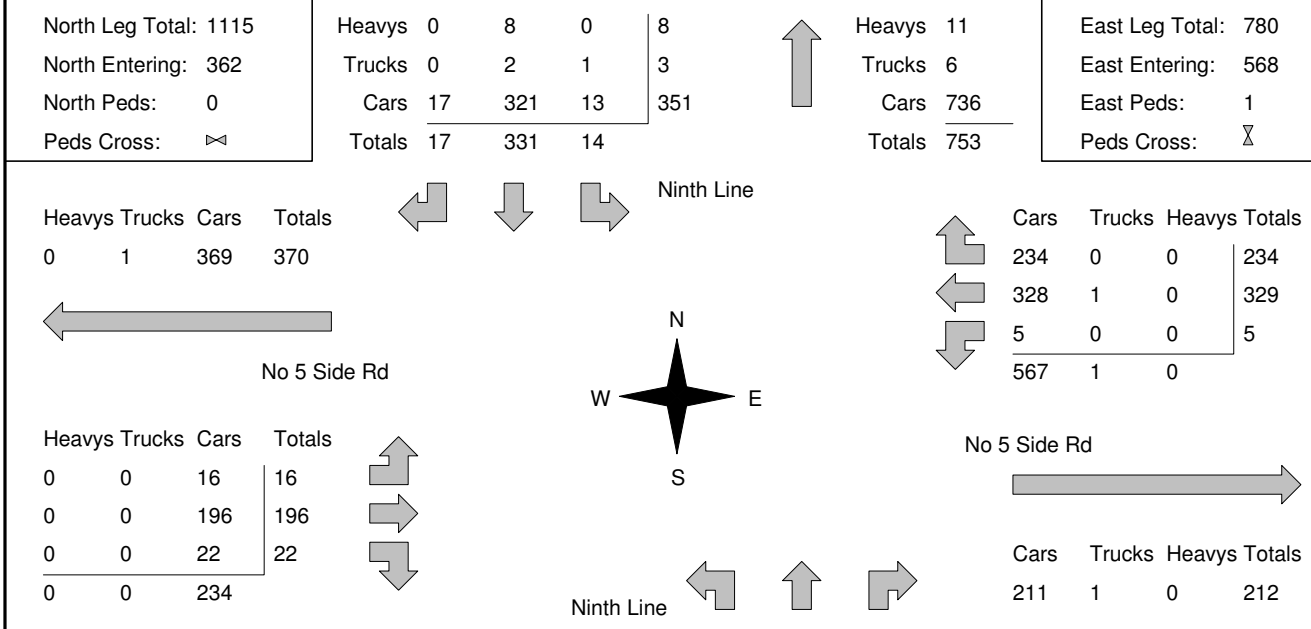
Municipality: Halton Region
Site #: 1032970100
Intersection: Ninth Line & No 5 Side Rd
TFR File #: 5
Count date: 16-May-2013

Weather conditions:
Clear/Dry

Person(s) who counted:
Leszek

**** Signalized Intersection ****

Major Road: Ninth Line runs N/S



Comments

Ninth Line @ No 5 Side Road

Total Count Diagram

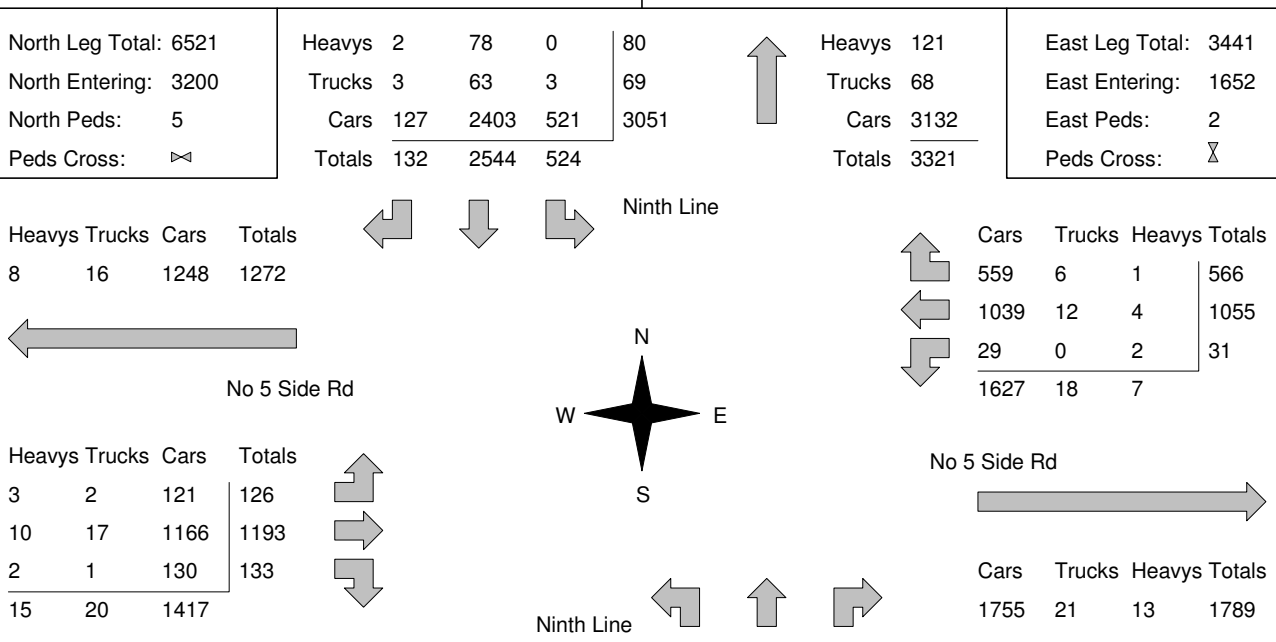
Municipality: Halton Region
Site #: 1032970100
Intersection: Ninth Line & No 5 Side Rd
TFR File #: 5
Count date: 16-May-2013

Weather conditions:
Clear/Dry

Person(s) who counted:
Leszek

**** Signalized Intersection ****

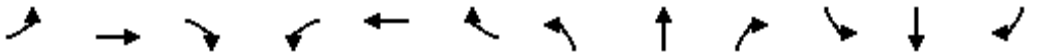
Major Road: Ninth Line runs N/S



Comments

APPENDIX B

Existing (2014) Weekday PM Peak Operations

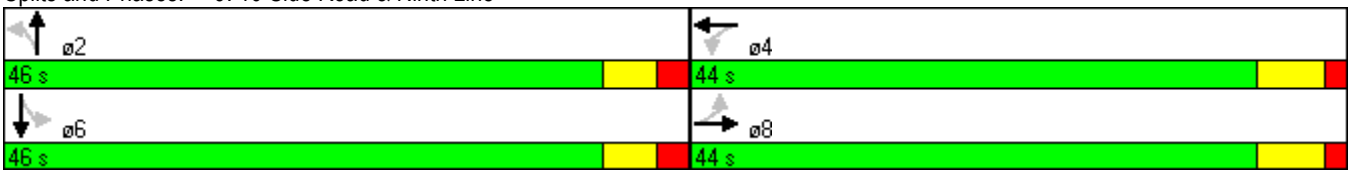


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	175	60	25	355	235	190	640	25	130	295	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.3	3.5	3.5	3.3	3.5	3.5	3.3	3.5	3.5	3.3	3.5	3.5
Storage Length (m)	59.0		0.0	57.0		0.0	59.0		0.0	64.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5		7.5	7.5		7.5	7.5		7.5	7.5		7.5
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	0.95	0.95	1.00	0.95	0.95
Ped Bike Factor	1.00				0.99			1.00		1.00		
Frt		0.962			0.940			0.994			0.951	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1616	3264	0	1678	3182	0	1694	3384	0	1558	3105	0
Flt Permitted	0.372			0.604			0.477			0.335		
Satd. Flow (perm)	632	3264	0	1067	3182	0	851	3384	0	549	3105	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		61			161			5			119	
Link Speed (k/h)		80			80			80			60	
Link Distance (m)		590.7			493.0			377.3			1021.3	
Travel Time (s)		26.6			22.2			17.0			61.3	
Confl. Peds. (#/hr)	4					4			1	1		
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Heavy Vehicles (%)	8%	6%	3%	4%	6%	3%	3%	5%	0%	12%	11%	6%
Adj. Flow (vph)	187	177	61	25	359	237	192	646	25	131	298	146
Shared Lane Traffic (%)												
Lane Group Flow (vph)	187	238	0	25	596	0	192	671	0	131	444	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.3			3.3			3.3			3.3	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.01	1.01	1.04	1.01	1.01	1.04	1.01	1.01	1.04	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		8			4			2			6	
Permitted Phases	8			4			2			6		
Minimum Split (s)	39.2	39.2		39.2	39.2		39.0	39.0		39.0	39.0	
Total Split (s)	44.0	44.0	0.0	44.0	44.0	0.0	46.0	46.0	0.0	46.0	46.0	0.0
Total Split (%)	48.9%	48.9%	0.0%	48.9%	48.9%	0.0%	51.1%	51.1%	0.0%	51.1%	51.1%	0.0%
Maximum Green (s)	37.8	37.8		37.8	37.8		40.0	40.0		40.0	40.0	
Yellow Time (s)	4.6	4.6		4.6	4.6		3.7	3.7		3.7	3.7	
All-Red Time (s)	1.6	1.6		1.6	1.6		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	4.0	6.2	6.2	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	26.0	26.0		26.0	26.0		26.0	26.0		26.0	26.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Act Effct Green (s)	37.8	37.8		37.8	37.8		40.0	40.0		40.0	40.0	
Actuated g/C Ratio	0.42	0.42		0.42	0.42		0.44	0.44		0.44	0.44	
v/c Ratio	0.71	0.17		0.06	0.42		0.51	0.45		0.54	0.31	
Control Delay	38.7	12.3		16.1	14.0		29.0	24.1		28.3	12.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	38.7	12.3		16.1	14.0		29.0	24.1		28.3	12.2	
LOS	D	B		B	B		C	C		C	B	
Approach Delay		24.0			14.1			25.2			15.8	
Approach LOS		C			B			C			B	

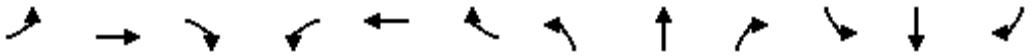
Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 80			
Control Type: Pretimed			
Maximum v/c Ratio: 0.71			
Intersection Signal Delay: 20.1		Intersection LOS: C	
Intersection Capacity Utilization 102.2%		ICU Level of Service G	
Analysis Period (min) 15			

Splits and Phases: 9: 10 Side Road & Ninth Line

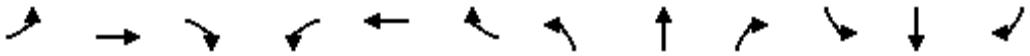


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	175	60	25	355	235	190	640	25	130	295	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.5	3.3	3.5	3.5	3.3	3.5	3.5	3.3	3.5	3.5
Total Lost time (s)	6.2	6.2		6.2	6.2		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
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	0.96		1.00	0.94		1.00	0.99		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1613	3262		1678	3184		1694	3385		1557	3103	
Flt Permitted	0.37	1.00		0.60	1.00		0.48	1.00		0.34	1.00	
Satd. Flow (perm)	632	3262		1066	3184		850	3385		549	3103	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	187	177	61	25	359	237	192	646	25	131	298	146
RTOR Reduction (vph)	0	35	0	0	93	0	0	3	0	0	66	0
Lane Group Flow (vph)	187	203	0	25	503	0	192	668	0	131	378	0
Confl. Peds. (#/hr)	4					4			1	1		
Heavy Vehicles (%)	8%	6%	3%	4%	6%	3%	3%	5%	0%	12%	11%	6%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		8			4			2			6	
Permitted Phases	8			4			2			6		
Actuated Green, G (s)	37.8	37.8		37.8	37.8		40.0	40.0		40.0	40.0	
Effective Green, g (s)	37.8	37.8		37.8	37.8		40.0	40.0		40.0	40.0	
Actuated g/C Ratio	0.42	0.42		0.42	0.42		0.44	0.44		0.44	0.44	
Clearance Time (s)	6.2	6.2		6.2	6.2		6.0	6.0		6.0	6.0	
Lane Grp Cap (vph)	265	1370		448	1337		378	1504		244	1379	
v/s Ratio Prot		0.06			0.16			0.20			0.12	
v/s Ratio Perm	c0.30			0.02			0.23			c0.24		
v/c Ratio	0.71	0.15		0.06	0.38		0.51	0.44		0.54	0.27	
Uniform Delay, d1	21.5	16.1		15.5	18.0		17.9	17.3		18.2	15.8	
Progression Factor	1.00	1.00		1.00	1.00		1.33	1.35		1.00	1.00	
Incremental Delay, d2	14.7	0.2		0.2	0.8		3.7	0.7		8.2	0.5	
Delay (s)	36.2	16.4		15.7	18.8		27.6	24.0		26.5	16.3	
Level of Service	D	B		B	B		C	C		C	B	
Approach Delay (s)		25.1			18.7			24.8			18.6	
Approach LOS		C			B			C			B	

Intersection Summary			
HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	102.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



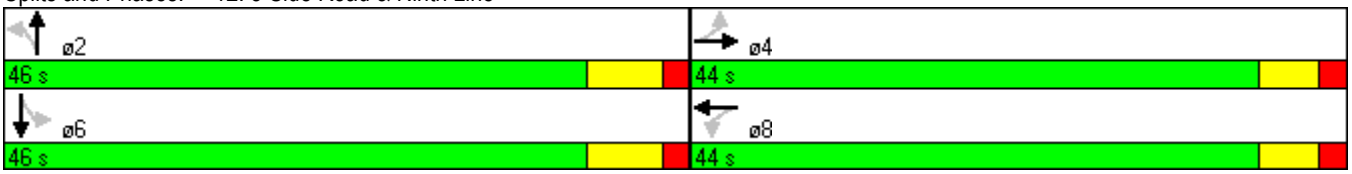
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	195	20	5	330	235	25	505	0	15	330	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor											1.00	
Frt		0.988			0.944						0.995	
Flt Protected		0.997						0.998			0.998	
Satd. Flow (prot)	0	1851	0	0	1774	0	0	1823	0	0	1811	0
Flt Permitted		0.954			0.998			0.969			0.970	
Satd. Flow (perm)	0	1771	0	0	1770	0	0	1770	0	0	1760	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			49						3	
Link Speed (k/h)		80			80			80			60	
Link Distance (m)		1278.9			1255.0			2500.3			2720.0	
Travel Time (s)		57.6			56.5			112.5			163.2	
Confl. Peds. (#/hr)									1	1		
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	3%	0%	7%	3%	0%
Adj. Flow (vph)	15	201	21	5	340	242	26	521	0	15	340	15
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	237	0	0	587	0	0	547	0	0	370	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	13.0	13.0		13.0	13.0		27.0	27.0		27.0	27.0	
Total Split (s)	44.0	44.0	0.0	44.0	44.0	0.0	46.0	46.0	0.0	46.0	46.0	0.0
Total Split (%)	48.9%	48.9%	0.0%	48.9%	48.9%	0.0%	51.1%	51.1%	0.0%	51.1%	51.1%	0.0%
Maximum Green (s)	38.0	38.0		38.0	38.0		39.0	39.0		39.0	39.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	7.0	7.0	4.0	7.0	7.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		38.0			38.0			39.0			39.0	
Actuated g/C Ratio		0.42			0.42			0.43			0.43	
v/c Ratio		0.32			0.76			0.71			0.48	
Control Delay		18.2			27.7			27.3			15.1	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		18.2			27.7			27.3			15.1	

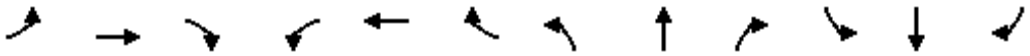


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS		B			C			C			B	
Approach Delay		18.2			27.7			27.3			15.1	
Approach LOS		B			C			C			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 55			
Control Type: Pretimed			
Maximum v/c Ratio: 0.76			
Intersection Signal Delay: 23.6		Intersection LOS: C	
Intersection Capacity Utilization 79.9%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 12: 5 Side Road & Ninth Line



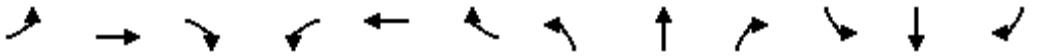


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	195	20	5	330	235	25	505	0	15	330	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Lost time (s)		6.0			6.0			7.0			7.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.94			1.00			0.99	
Flt Protected		1.00			1.00			1.00			1.00	
Satd. Flow (prot)		1851			1774			1822			1810	
Flt Permitted		0.95			1.00			0.97			0.97	
Satd. Flow (perm)		1771			1770			1771			1759	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	15	201	21	5	340	242	26	521	0	15	340	15
RTOR Reduction (vph)	0	4	0	0	28	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	233	0	0	559	0	0	547	0	0	368	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	3%	0%	7%	3%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		38.0			38.0			39.0			39.0	
Effective Green, g (s)		38.0			38.0			39.0			39.0	
Actuated g/C Ratio		0.42			0.42			0.43			0.43	
Clearance Time (s)		6.0			6.0			7.0			7.0	
Lane Grp Cap (vph)		748			747			767			762	
v/s Ratio Prot												
v/s Ratio Perm		0.13			c0.32			c0.31			0.21	
v/c Ratio		0.31			0.75			0.71			0.48	
Uniform Delay, d1		17.3			22.0			20.9			18.3	
Progression Factor		1.00			1.00			1.00			0.70	
Incremental Delay, d2		1.1			6.7			5.6			2.1	
Delay (s)		18.4			28.7			26.5			14.9	
Level of Service		B			C			C			B	
Approach Delay (s)		18.4			28.7			26.5			14.9	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM Average Control Delay	23.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	79.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

Future (2031) Weekday PM Peak Operations

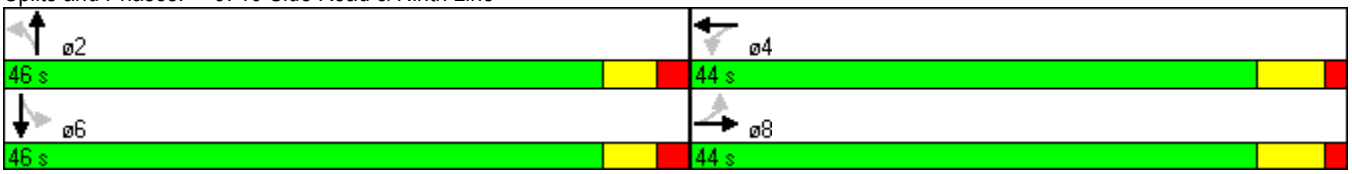


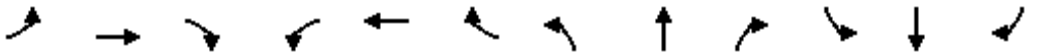
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	260	250	85	40	555	370	510	1695	60	170	390	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.3	3.5	3.5	3.3	3.5	3.5	3.3	3.5	3.5	3.3	3.5	3.5
Storage Length (m)	59.0		0.0	57.0		0.0	59.0		0.0	64.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5		7.5	7.5		7.5	7.5		7.5	7.5		7.5
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	0.95	0.95	1.00	0.95	0.95
Ped Bike Factor	1.00				0.99			1.00				
Frt		0.962			0.940			0.995			0.950	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1616	3263	0	1678	3183	0	1694	3387	0	1558	3102	0
Flt Permitted	0.197			0.548			0.381			0.100		
Satd. Flow (perm)	335	3263	0	968	3183	0	679	3387	0	164	3102	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		64			5			5			124	
Link Speed (k/h)		80			80			80			60	
Link Distance (m)		590.7			493.0			377.3			1021.3	
Travel Time (s)		26.6			22.2			17.0			61.3	
Confl. Peds. (#/hr)	4					4			1	1		
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Heavy Vehicles (%)	8%	6%	3%	4%	6%	3%	3%	5%	0%	12%	11%	6%
Adj. Flow (vph)	263	253	86	40	561	374	515	1712	61	172	394	197
Shared Lane Traffic (%)												
Lane Group Flow (vph)	263	339	0	40	935	0	515	1773	0	172	591	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.3			3.3			3.3			3.3	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.01	1.01	1.04	1.01	1.01	1.04	1.01	1.01	1.04	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		8			4			2			6	
Permitted Phases	8			4			2			6		
Minimum Split (s)	39.2	39.2		39.2	39.2		39.0	39.0		39.0	39.0	
Total Split (s)	44.0	44.0	0.0	44.0	44.0	0.0	46.0	46.0	0.0	46.0	46.0	0.0
Total Split (%)	48.9%	48.9%	0.0%	48.9%	48.9%	0.0%	51.1%	51.1%	0.0%	51.1%	51.1%	0.0%
Maximum Green (s)	37.8	37.8		37.8	37.8		40.0	40.0		40.0	40.0	
Yellow Time (s)	4.6	4.6		4.6	4.6		3.7	3.7		3.7	3.7	
All-Red Time (s)	1.6	1.6		1.6	1.6		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	4.0	6.2	6.2	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	26.0	26.0		26.0	26.0		26.0	26.0		26.0	26.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Act Effct Green (s)	37.8	37.8		37.8	37.8		40.0	40.0		40.0	40.0	
Actuated g/C Ratio	0.42	0.42		0.42	0.42		0.44	0.44		0.44	0.44	
v/c Ratio	1.87	0.24		0.10	0.70		1.71	1.18		2.36	0.41	
Control Delay	437.7	14.0		16.7	24.7		345.8	113.9		669.7	14.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	437.7	14.0		16.7	24.7		345.8	113.9		669.7	14.1	
LOS	F	B		B	C		F	F		F	B	
Approach Delay		199.1			24.4			166.1			161.9	
Approach LOS		F			C			F			F	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 90			
Control Type: Pretimed			
Maximum v/c Ratio: 2.36			
Intersection Signal Delay: 139.9		Intersection LOS: F	
Intersection Capacity Utilization 127.7%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 9: 10 Side Road & Ninth Line

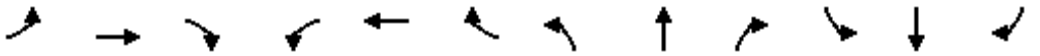




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	260	250	85	40	555	370	510	1695	60	170	390	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.5	3.3	3.5	3.5	3.3	3.5	3.5	3.3	3.5	3.5
Total Lost time (s)	6.2	6.2		6.2	6.2		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
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	0.96		1.00	0.94		1.00	0.99		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1614	3263		1678	3183		1694	3386		1558	3102	
Flt Permitted	0.20	1.00		0.55	1.00		0.38	1.00		0.10	1.00	
Satd. Flow (perm)	335	3263		967	3183		680	3386		164	3102	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	263	253	86	40	561	374	515	1712	61	172	394	197
RTOR Reduction (vph)	0	37	0	0	3	0	0	3	0	0	69	0
Lane Group Flow (vph)	263	302	0	40	932	0	515	1770	0	172	522	0
Confl. Peds. (#/hr)	4					4			1	1		
Heavy Vehicles (%)	8%	6%	3%	4%	6%	3%	3%	5%	0%	12%	11%	6%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		8			4			2			6	
Permitted Phases	8			4			2			6		
Actuated Green, G (s)	37.8	37.8		37.8	37.8		40.0	40.0		40.0	40.0	
Effective Green, g (s)	37.8	37.8		37.8	37.8		40.0	40.0		40.0	40.0	
Actuated g/C Ratio	0.42	0.42		0.42	0.42		0.44	0.44		0.44	0.44	
Clearance Time (s)	6.2	6.2		6.2	6.2		6.0	6.0		6.0	6.0	
Lane Grp Cap (vph)	141	1370		406	1337		302	1505		73	1379	
v/s Ratio Prot		0.09			0.29			0.52			0.17	
v/s Ratio Perm	c0.79			0.04			0.76			c1.05		
v/c Ratio	1.87	0.22		0.10	0.70		1.71	1.18		2.36	0.38	
Uniform Delay, d1	26.1	16.7		15.8	21.4		25.0	25.0		25.0	16.7	
Progression Factor	1.00	1.00		1.00	1.00		1.47	1.47		1.00	1.00	
Incremental Delay, d2	415.2	0.4		0.5	3.0		318.7	80.0		650.5	0.8	
Delay (s)	441.3	17.1		16.3	24.4		355.3	116.9		675.5	17.5	
Level of Service	F	B		B	C		F	F		F	B	
Approach Delay (s)		202.4			24.1			170.5			165.8	
Approach LOS		F			C			F			F	

Intersection Summary			
HCM Average Control Delay	143.1	HCM Level of Service	F
HCM Volume to Capacity ratio	2.12		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	127.7%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

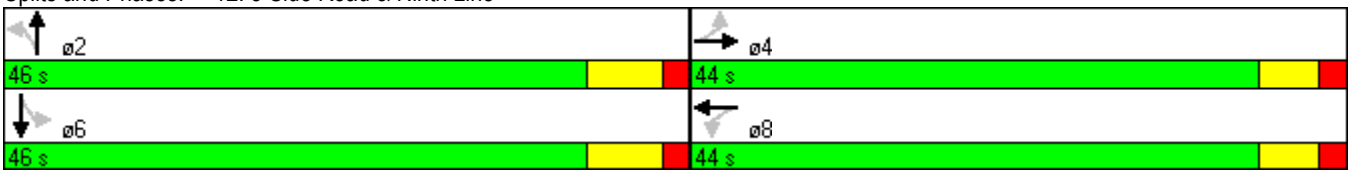


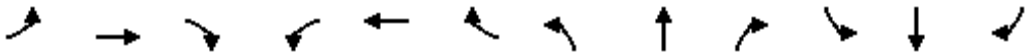
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	245	30	5	275	195	80	1700	5	55	1080	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor								1.00			1.00	
Frt		0.986			0.945						0.995	
Flt Protected		0.997			0.999			0.998			0.998	
Satd. Flow (prot)	0	1847	0	0	1774	0	0	1823	0	0	1810	0
Flt Permitted		0.952			0.997			0.773			0.719	
Satd. Flow (perm)	0	1764	0	0	1770	0	0	1412	0	0	1304	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			4						3	
Link Speed (k/h)		80			80			80			60	
Link Distance (m)		1278.9			1255.0			2500.3			2720.0	
Travel Time (s)		57.6			56.5			112.5			163.2	
Confl. Peds. (#/hr)									1	1		
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	3%	0%	7%	3%	0%
Adj. Flow (vph)	21	253	31	5	284	201	82	1753	5	57	1113	46
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	305	0	0	490	0	0	1840	0	0	1216	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Minimum Split (s)	13.0	13.0		13.0	13.0		27.0	27.0		27.0	27.0	
Total Split (s)	44.0	44.0	0.0	44.0	44.0	0.0	46.0	46.0	0.0	46.0	46.0	0.0
Total Split (%)	48.9%	48.9%	0.0%	48.9%	48.9%	0.0%	51.1%	51.1%	0.0%	51.1%	51.1%	0.0%
Maximum Green (s)	38.0	38.0		38.0	38.0		39.0	39.0		39.0	39.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	7.0	7.0	4.0	7.0	7.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Act Effct Green (s)		38.0			38.0			39.0			39.0	
Actuated g/C Ratio		0.42			0.42			0.43			0.43	
v/c Ratio		0.41			0.65			3.01			2.14	
Control Delay		19.7			25.6			923.5			540.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		19.7			25.6			923.5			540.8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS		B			C			F			F	
Approach Delay		19.7			25.6			923.5			540.8	
Approach LOS		B			C			F			F	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 150			
Control Type: Pretimed			
Maximum v/c Ratio: 3.01			
Intersection Signal Delay: 616.8		Intersection LOS: F	
Intersection Capacity Utilization 156.3%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 12: 5 Side Road & Ninth Line





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	245	30	5	275	195	80	1700	5	55	1080	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Lost time (s)		6.0			6.0			7.0			7.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.94			1.00			0.99	
Flt Protected		1.00			1.00			1.00			1.00	
Satd. Flow (prot)		1847			1774			1822			1809	
Flt Permitted		0.95			1.00			0.77			0.72	
Satd. Flow (perm)		1764			1769			1411			1303	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	21	253	31	5	284	201	82	1753	5	57	1113	46
RTOR Reduction (vph)	0	5	0	0	2	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	300	0	0	488	0	0	1840	0	0	1214	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	3%	0%	7%	3%	0%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		38.0			38.0			39.0			39.0	
Effective Green, g (s)		38.0			38.0			39.0			39.0	
Actuated g/C Ratio		0.42			0.42			0.43			0.43	
Clearance Time (s)		6.0			6.0			7.0			7.0	
Lane Grp Cap (vph)		745			747			611			565	
v/s Ratio Prot												
v/s Ratio Perm		0.17			c0.28			c1.30			0.93	
v/c Ratio		0.40			0.65			3.01			2.15	
Uniform Delay, d1		18.1			20.7			25.5			25.5	
Progression Factor		1.00			1.00			1.00			0.90	
Incremental Delay, d2		1.6			4.4			909.5			523.0	
Delay (s)		19.7			25.1			935.0			545.8	
Level of Service		B			C			F			F	
Approach Delay (s)		19.7			25.1			935.0			545.8	
Approach LOS		B			C			F			F	

Intersection Summary			
HCM Average Control Delay	623.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	156.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

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