



paradigm
TRANSPORTATION SOLUTIONS LIMITED

694-698 Niagara Street, Welland Transportation Assessment

Paradigm Transportation Solutions Limited

2025-10
250351



Project Summary



Project Number:

250351

694-698 Niagara Street, Welland Transportation Assessment

Date and Version:

2025-10

1.0.0

Client:

100044827 Ontario Inc.

4071 Maitland Street
Beamsville ON L2J 0R7

Client Contact:

Darryl Trudel

<< Original Signed By >>

Consultant Project Team

Adam Makarewicz, CET, LET, RSP1
Greg Lue, M.A.Sc., P.Eng.

Adam Makarewicz, CET, LET, RSP1

Paradigm Transportation Solutions Limited

5A-150 Pinebush Road
Cambridge ON N1R 8J8

p: 519.896.3163

905.381.2229

416.479.9684

www.ptsl.com

Disclaimer

This document has been prepared for the titled project or named part thereof (the "project") and except for approval and commenting municipalities and agencies in their review and approval of this project, should not be relied upon or used for any other project without an independent check being carried out as to its suitability and prior written authorization of Paradigm Transportation Solutions Limited being obtained. Paradigm Transportation Solutions Limited accepts no responsibility or liability for the consequence of this document being used for a purpose other than the project for which it was commissioned. Any person using or relying on the document for such other purpose agrees and will by such use or reliance be taken to confirm their agreement to indemnify Paradigm

Transportation Solutions Limited for all loss or damage resulting therefrom.

Paradigm Transportation Solutions Limited accepts no responsibility or liability for this document to any party other than the person by whom it was commissioned and the approval and commenting municipalities and agencies for the project.

To the extent that this report is based on information supplied by other parties, Paradigm Transportation Solutions Limited accepts no liability for any loss or damage suffered by the client, whether through contract or tort, stemming from any conclusions based on data supplied by parties other than Paradigm Transportation Solutions Limited and used by Paradigm Transportation Solutions Limited in preparing this report.

© 1998 Paradigm Transportation Solutions Limited. All rights reserved.

Executive Summary

Content

Paradigm Transportation Solutions Limited (Paradigm) was retained to conduct this Transportation Assessment (TA) study for a proposed residential development in the City of Welland.

This study examines the impact of the additional traffic generated by the subject site on the surrounding road network and identifies the remedial measures necessary to accommodate future traffic satisfactorily.

Development Concept

The subject site is located on the east side of Niagara Street, south of Woodlawn Road, at municipal address 698 Niagara Street in the City of Welland. The applicant proposes constructing a condominium development consisting of 217 units and 142 parking spaces. Vehicle access is proposed to be provided through a driveway connection to Niagara Street.

Conclusions

Based on the investigations carried out, it is concluded that:

- ▶ **Development Trip Generation:** The subject site is forecast to generate 83 and 81 trips during the AM and PM peak hours, respectively.
- ▶ **Traffic Operations:** Intersection operational analysis under current and future traffic conditions indicates the following:
 - **Base Year (2025):** Localized congestion occurs at the Niagara Street at Woodlawn Road intersection and Niagara Street at Thorold Road intersection during the PM peak hour with overall intersection delays in the LOS D-F range and v/c ratios between 0.89 and 0.92.
 - **Future Horizons (2029, 2034, 2039):** Under background conditions, the Niagara Street at Woodlawn Road intersection and Niagara Street at Thorold Road intersection are forecast to experience additional critical movements, particularly in the PM peak hour. Overall intersection delay at these intersections is forecast to be in the LOS F range, with delays expected to exceed 100 seconds. The overall intersection v/c is forecast to be over 1.00 for both intersections.



- ▶ **Development Impacts:** The subject development is forecast to have minimal impact on the study area road system and intersections. Delays are generally not expected to increase significantly with the addition of site traffic, except for movements forecast to operate at/near capacity under background conditions.

The proposed site access is forecast to operate at LOS C or better during the peak hours.

- ▶ **Mitigation Measures:** Potential mitigation measures could include:
 - Niagara Street and Woodlawn Road
 - Adding dual eastbound left turn and protected phasing;
 - Adding dual westbound left-turn and protected phasing;
 - Adding an exclusive northbound right-turn lane; and
 - Adding an exclusive southbound right-turn lane.
 - Niagara Street and Thorold Road
 - Adding dual eastbound left and protected phasing; and
 - Adding an exclusive southbound right-turn lane.

Although the dual left and exclusive right turn lanes are expected to reduce intersection delays significantly, the addition of the turn lanes may not be feasible at the intersections due to right-of-way and physical constraints.

Recommendations

Based on the findings of this study, the following is recommended:

- ▶ The City and Region recognize the traffic findings above.
- ▶ The City and Region review the feasibility of providing dual left and exclusive right turn lanes for the Niagara Street at Woodlawn Road intersection and the Niagara Street at Thorold Road intersection.



“Plain Language” Summary

The Transportation Impact Study (TIS) for the proposed 7-storey, 217-unit condominium at 694–698 Niagara Street in Welland assesses the impact of the development on nearby traffic. With 142 parking spaces and access via a single driveway on Niagara Street, the project is forecast to generate 83 vehicle trips in the morning and 81 in the evening peak hours.

These volumes were estimated using standard industry methods (ITE Trip Generation Manual) and do not factor in reductions from transit or active transportation. The study area includes major intersections such as Niagara Street at Woodlawn Road and Thorold Road, both of which are already experiencing congestion and are expected to operate at high levels of delay during commuter rush hour times in the future, even without the new development.

The development’s traffic adds minimal delay, less than five seconds per movement at nearby intersections and is not seen as the primary cause of future congestion.

Nevertheless, the report recommends potential mitigation measures, including dual left-turn and exclusive right-turn lanes at the key intersections. While these could improve traffic flow, physical space limitations may restrict their implementation.

The study concludes that the proposed development is not expected to worsen local traffic conditions significantly and can therefore proceed.



Contents

| | | |
|----------|--|-----------|
| 1 | Introduction | 1 |
| 1.1 | Overview | 1 |
| 1.2 | Study Area | 3 |
| 2 | Existing Conditions | 4 |
| 2.1 | Roadway Characteristics | 4 |
| 2.2 | Existing Transit Service | 6 |
| 2.3 | Pedestrian and Cycling Network | 8 |
| 2.4 | Traffic Volumes | 8 |
| 3 | Development | 10 |
| 3.1 | Description | 10 |
| 3.2 | Trip Generation and Distribution | 12 |
| 4 | Future Forecasts | 15 |
| 4.1 | Future Traffic Growth | 15 |
| 4.2 | Background Developments | 15 |
| 4.3 | Future Road Network | 16 |
| 4.4 | Future Traffic Volumes | 16 |
| 5 | Operational Assessment | 26 |
| 5.1 | Level of Service Criteria | 26 |
| 5.2 | Intersection Capacity Analysis | 27 |
| 5.2.1 | Niagara Street and Woodlawn Road | 27 |
| 5.2.2 | Niagara Street and Abbey Road | 30 |
| 5.2.3 | Niagara Street and Aqueduct Street | 32 |
| 5.2.4 | Niagara Street and Roger Drive | 34 |
| 5.2.5 | Niagara Street and Thorold Road | 36 |
| 5.2.6 | Niagara Street and Site Access | 38 |
| 6 | Mitigation Measures | 40 |
| 6.1 | Intersection Modifications | 40 |
| 6.1.1 | Niagara Street and Woodlawn Road | 40 |
| 6.1.2 | Niagara Street and Thorold Road | 42 |
| 7 | Conclusions and Recommendations | 44 |
| 7.1 | Conclusions | 44 |
| 7.2 | Recommendations | 45 |



Appendices

| | |
|-------------------|---------------------------------------|
| Appendix A | Terms of Reference |
| Appendix B | Existing Traffic Data |
| Appendix C | Background Development Traffic |
| Appendix D | Synchro Reports |
| Appendix E | Synchro Reports – Sensitivity |



Figures

| | |
|---|----|
| Figure 1.1: Subject Site Location | 2 |
| Figure 2.1: Existing Lane Configuration and Traffic Control | 5 |
| Figure 2.2: Existing Transit Routes..... | 7 |
| Figure 2.3: Base Year Traffic Volumes | 9 |
| Figure 3.1: Site Concept Plan | 11 |
| Figure 3.2A: Site Generated Traffic Volumes – AM Peak Hour | 13 |
| Figure 3.2B: Site Generated Traffic Volumes – AM Peak Hour | 14 |
| Figure 4.1: Future Background Traffic Volumes – Opening Year | 17 |
| Figure 4.2: Future Background Traffic Volumes – Five Year | 18 |
| Figure 4.3: Future Background Traffic Volumes – Ten Year..... | 19 |
| Figure 4.4A: Future Total Traffic Volumes – Opening Year – AM Peak Hour | 20 |
| Figure 4.4B: Future Total Traffic Volumes – Opening Year – PM Peak Hour | 21 |
| Figure 4.5A: Future Total Traffic Volumes – Five Year – AM Peak Hour | 22 |
| Figure 4.5B: Future Total Traffic Volumes – Five Year – PM Peak Hour | 23 |
| Figure 4.6A: Future Total Traffic Volumes – Ten Year – AM Peak Hour | 24 |
| Figure 4.6B: Future Total Traffic Volumes – Ten Year – PM Peak Hour | 25 |

Tables

| | |
|--|----|
| Table 3.1: Estimated Trip Generation | 12 |
| Table 3.2: Estimated Trip Generation | 12 |
| Table 5.1: LOS Operations – Niagara Street and Woodlawn Road..... | 29 |
| Table 5.2: LOS Operations – Niagara Street and Abbey Road .. | 31 |
| Table 5.3: LOS Operations – Niagara Street and Aqueduct Street | 33 |
| Table 5.4: LOS Operations – Niagara Street and Roger Drive... | 35 |
| Table 5.5: LOS Operations – Niagara Street and Thorold Road | 37 |
| Table 5.6: LOS Operations – Niagara Street and Site Access... | 39 |
| Table 6.1: Niagara Street and Woodlawn Road – Sensitivity | 41 |
| Table 6.2: LOS Operations – Niagara Street and Thorold Road – Sensitivity..... | 43 |



1 Introduction

1.1 Overview

Paradigm Transportation Solutions Limited (Paradigm) was retained to conduct this Transportation Assessment (TA) study for a proposed residential development in the City of Welland.

This study examines the impact of the additional traffic generated by the subject site on the surrounding road network and identifies the remedial measures necessary to accommodate future traffic satisfactorily.

The development is situated on the east side of Niagara Street, south of Woodlawn Road, with a municipal address of 694-698 Niagara Street in the City of Welland.

Figure 1.1 details the location of the subject development.

The study aims to assess the current and additional traffic generated by the proposed development, analyze the traffic impact on the adjacent roadway network, and provide recommendations for any improvements required to mitigate the identified effects of the site-generated traffic.

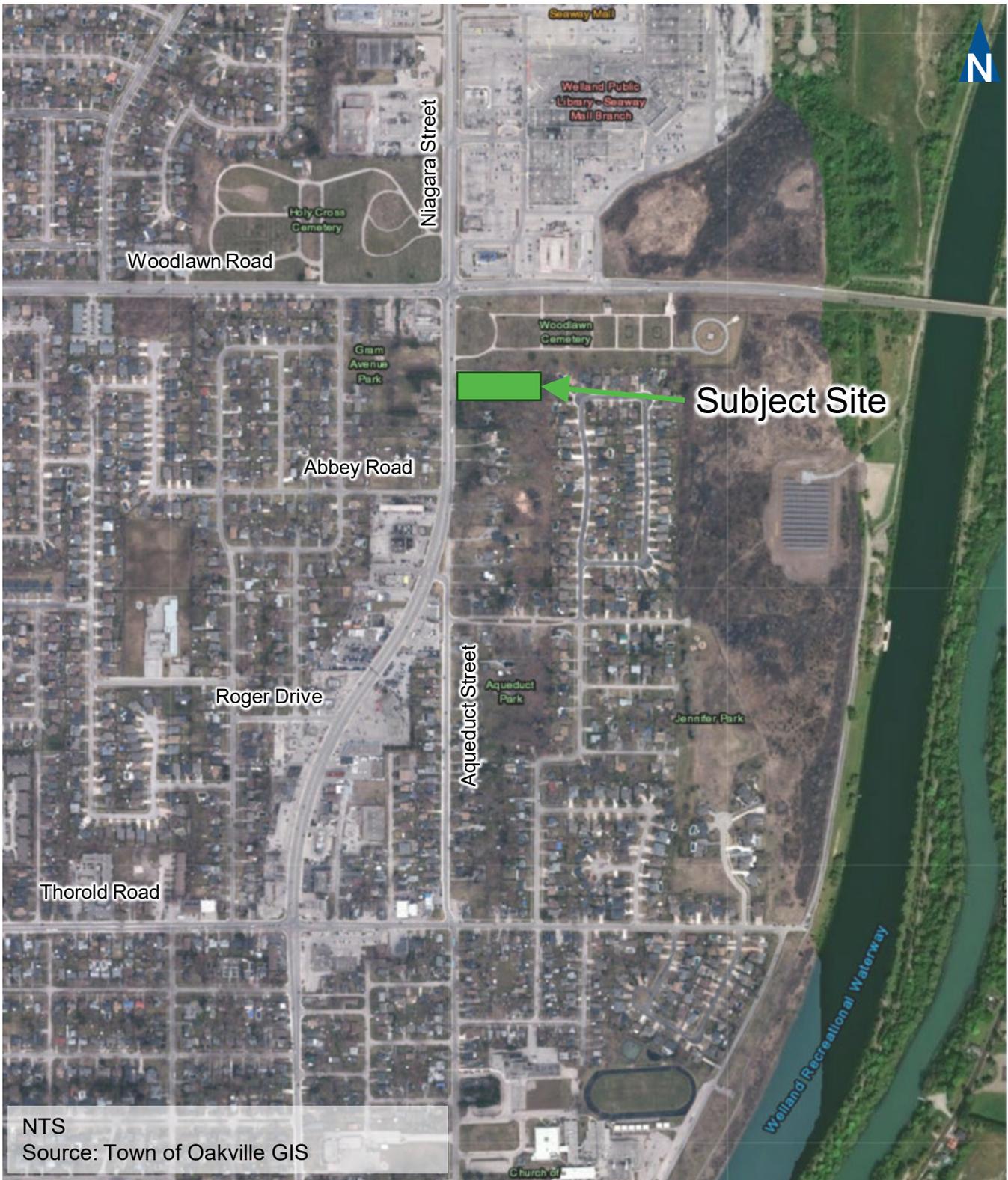
More specifically, the scope of this study is to:

- ▶ Forecast traffic from the proposed development;
- ▶ Assign the projected volumes to the surrounding road network based on the existing traffic patterns at the driveway connections;
- ▶ Assess total future traffic within the study area. The following horizons have been considered: Opening Year (2029), five years from Build-Out (2034), and ten years from Build-Out (2039); and
- ▶ Identify operational concerns and any mitigation measures that may be required to improve operations.

This report adheres to the terms of reference developed by Paradigm and agreed upon by the City of Welland and Niagara Region.

Appendix A contains the pre-study consultation material.





Subject Site Location

694-698 Niagara Street, Welland TA
250351

Figure 1.1

1.2 Study Area

The study area intersections assessed in this study include:

- ▶ Niagara Street at Woodlawn Road (signalized);
- ▶ Niagara Street at Abbey Road (unsignalized);
- ▶ Niagara Street at Aqueduct Street (signalized);
- ▶ Niagara Street at Roger Drive (unsignalized);
- ▶ Niagara Street at Thorold Road (signalized); and
- ▶ One site driveway.



2 Existing Conditions

2.1 Roadway Characteristics

The roadways of interest within the study area include:

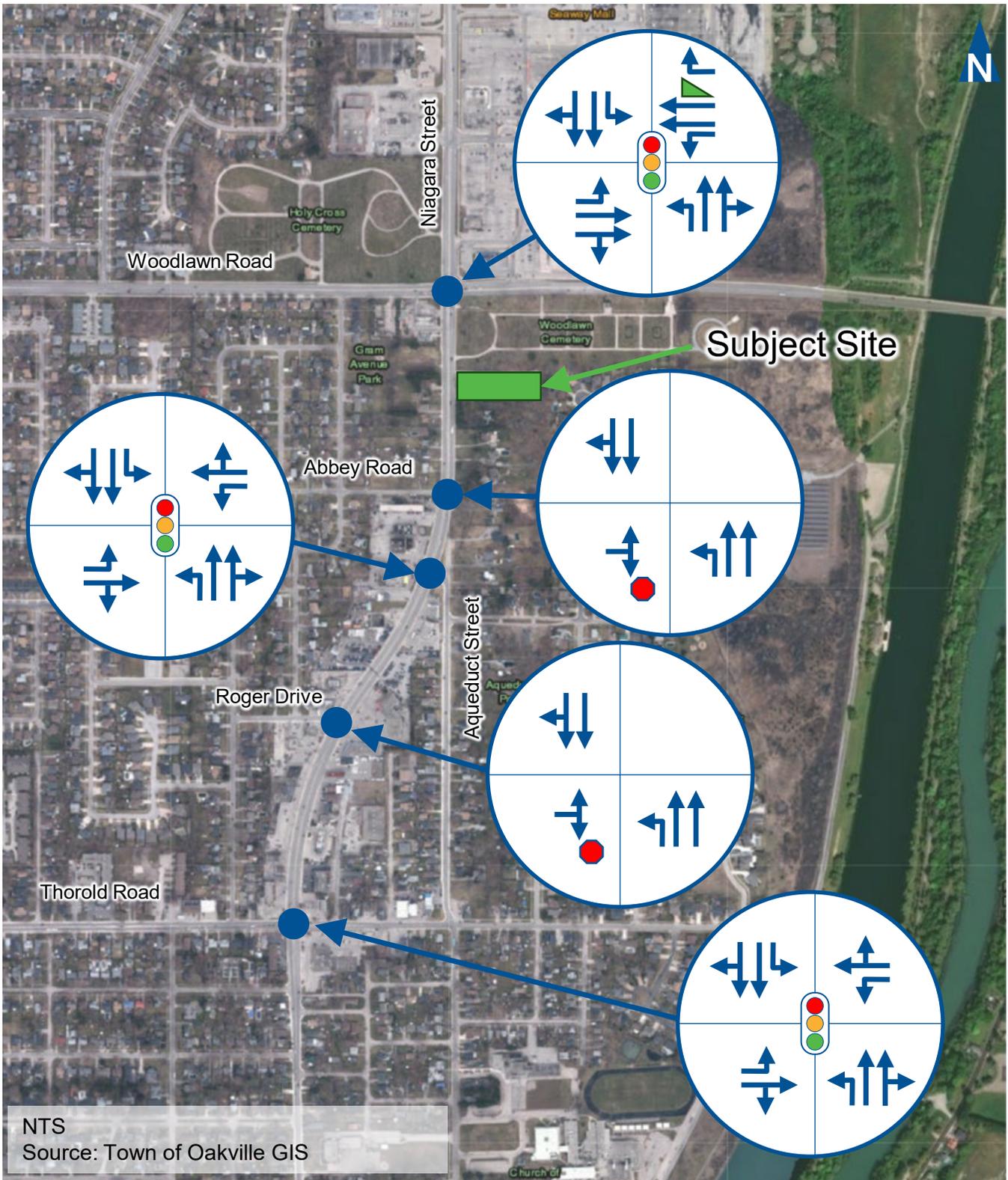
- ▶ **Niagara Street (Regional Road 50)** is a north-south regional arterial road¹ with a five-lane cross-section (two lanes in each direction and centre two-way left-turn lane). The road has a posted speed limit of 50 km/h. There are sidewalks on both sides of the road.
- ▶ **Woodlawn Road (Regional Road 41)** an east-west regional arterial road with a four-lane cross-section. The road has a posted speed limit of 60 km/h. There are sidewalks on both sides of the road.
- ▶ **Abby Road** is an east-west local road² with a two-lane cross-section. As there is no posted speed limit in the study area, a statutory speed limit of 50 km/h is assumed. There are sidewalks on both sides of the road.
- ▶ **Aqueduct Street** is a north-south local road that curves east-west to intersect with Niagara Street. The roadway has a two-lane cross-section and a posted speed limit of 40 km/h. There are sidewalks on one side of the road at the Niagara Street intersection and on both sides of the road beginning approximately 70 m south of the Niagara Street intersection.
- ▶ **Roger Drive** is an east-west local road with a two-lane cross-section. As there is no posted speed limit in the study area, a statutory speed limit of 50 km/h is assumed. A sidewalk is on the south side of the road.
- ▶ **Thorold Road** is an east-west arterial road with a three-lane cross-section (one lane in each direction and a centre two-way left-turn lane) west of Niagara Street and a collector road with a two-lane cross-section east of Niagara Street. The road has a posted speed limit of 50 km/h. There are sidewalks and bike lanes on both sides of the road.

Figure 2.1 illustrates the existing lane configuration and traffic control in the study area.

¹ Niagara Region, List of Niagara Regional Roads, <https://www.niagararegion.ca/living/roads/regional-roads.aspx>

² City of Welland, Official Plan – Schedule E: Road Hierarchy, 2010





2.2 Existing Transit Service

Niagara Transit is the public transit operator for the City of Welland. The following routes serve the site:

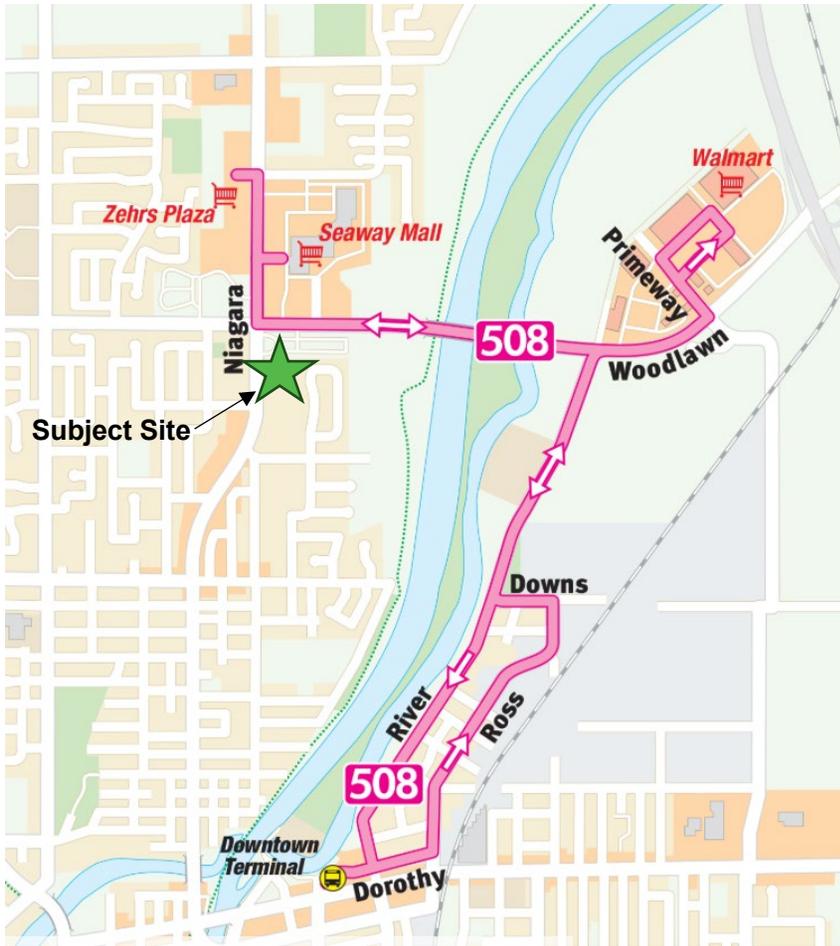
- ▶ **508 Woodlawn Road** connects the Welland Bus Terminal and the Seaway Mall, operating along Woodlawn Road. The route operates weekdays from 6:00 AM to 10:50 PM, with headways as low as 30 minutes; Saturdays from 6:30 AM to 9:50 PM, with headways as low as 30 minutes; and Sundays from 10:30 AM to 5:50 PM, with headways as low as 60 minutes.
- ▶ **509 Niagara Street** operates along Niagara Street connecting Welland Bus Terminal, Seaway Mall, and Niagara College Welland Campus. Weekday service typically runs from 6:00 AM to 10:30 PM, with headways as low as 30 minutes. On Saturdays, service runs from 6:00 AM to 9:30 PM, with headways as low as 30 minutes. On Sundays, service runs from 10:00 AM to 5:50 PM, with headways as low as 60 minutes.

Figure 2.2 shows the existing Niagara Transit services that serve this part of the city.

The closest bus stop is located approximately 180 meters south, at the northwest corner of Niagara Street and Abbey Road.

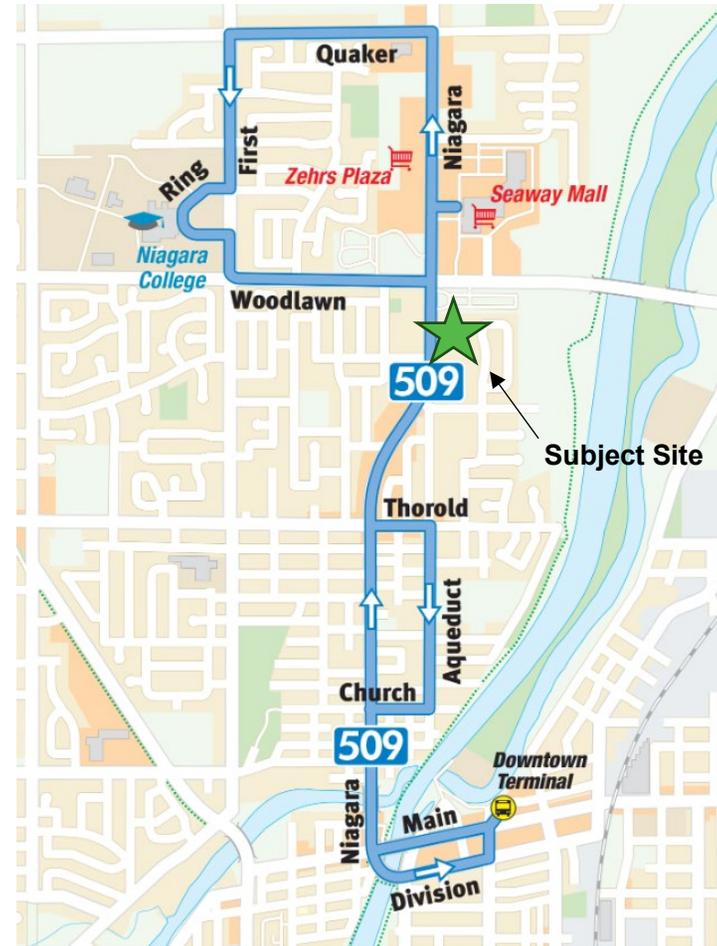


Route 508 – Woodlawn Rd.



NTS
Source: Niagara Transit

Route 509 – Niagara St.



Existing Transit Routes



2.3 Pedestrian and Cycling Network

Sidewalks are provided on both sides of the road along Niagara Street and generally on both sides of all the study area roadways. The exception is Roger Drive, which has sidewalks on the south side of the roadway.

The city's cycling infrastructure comprises on-street and off-street facilities. On-street routes include bicycle lanes, signed bicycle routes, and paved shoulders. Off-street facilities are in the form of multi-use pathways.

There are dedicated bike facilities along Thorold Road, west of Niagara Street.

2.4 Traffic Volumes

Turning movement counts (TMC) are used to quantify the movement of vehicles through the area to assess intersection operation. Existing traffic data at an intersection or road section forms the foundation for analysis. The counts are usually taken during peak periods at an intersection to complete the level of service analysis. **Appendix B** contains the traffic data utilized in this report.

Turning Movement Count (TMC) data at the study area intersections were collected in October 2023 and April 2024 and are referenced from the 418-430 Aqueduct Road and 650-678 Niagara Street Transportation Study³ and addendum letter⁴.

Traffic volumes are projected to grow to a 2025 base year using a compound annual growth rate of 2% per annum.

Figure 2.3 illustrates the base-year weekday AM and PM peak-hour volumes.

³ R.J. Burnside & Associates Limited, *670 Niagara Street Transportation Study, Welland, ON*, November 2023

⁴ R.J. Burnside & Associates Limited, *418-430 Aqueduct St & 650-678 Niagara St Response to Transportation Comments Welland, ON*, June 2024



3 Development

3.1 Description

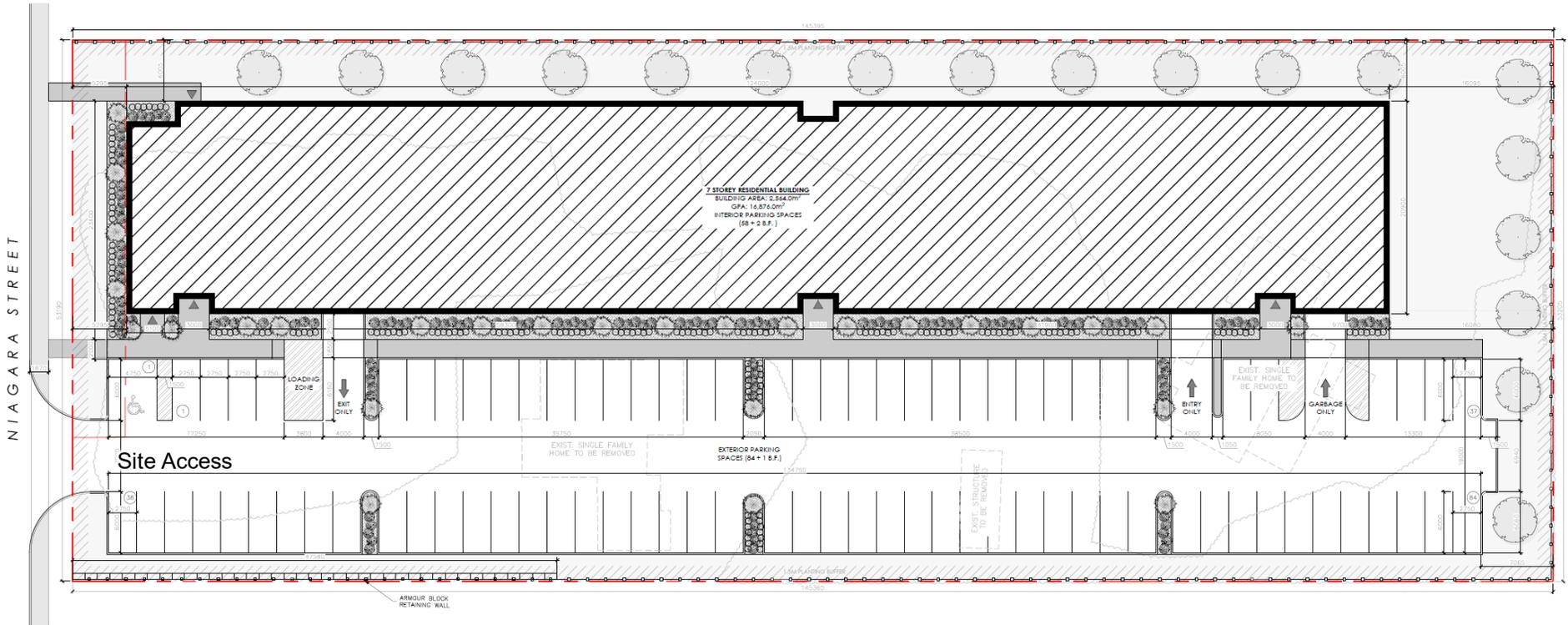
The subject site is located on the east side of Niagara Street, south of Woodlawn Road, with a municipal address of 698 Niagara Street in the City of Welland. The applicant proposes constructing a seven-storey condominium development consisting of 217 units and 142 parking spaces.

Vehicle access is proposed to be provided through a driveway connection to Niagara Street, located approximately 160 meters south of the intersection of Niagara Street and Woodlawn Road.

Figure 3.1 illustrates the site concept plan.

The assumed build-out date is 2029.





NTS



Site Concept Plan

694-698 Niagara Street, Welland TA
250351

Figure 3.1

3.2 Trip Generation and Distribution

The Institute of Transportation Engineers (ITE) Trip Generation Manual⁵ methods are used to forecast site-generated trips. Land Use Code (LUC) 221 (Multifamily Housing – Mid-Rise) is used to estimate the site trip generation.

Table 3.1 summarizes the forecast site-generated trips for the development. The site's trip generation is estimated to be approximately 84 AM and 85 PM peak-hour trips. To remain conservative, no reductions in alternative modes of transportation have been applied.

TABLE 3.1: ESTIMATED TRIP GENERATION

| ITE Land Use Code / Number of Units | AM Peak Hour | | | | PM Peak Hour | | | |
|--|--------------|-----------|-----------|-----------|--------------|-----------|-----------|-----------|
| | Rate | In | Out | Sum | Rate | In | Out | Sum |
| 221 - Multifamily Housing (Mid-Rise) - 217 Units | Eqn. | 19 | 64 | 83 | Eqn. | 49 | 32 | 81 |
| Total | -- | 19 | 64 | 83 | -- | 49 | 32 | 81 |

Equations

LUC 221 Eqn. per Unit AM: $T = 0.42(X) - 7.77$ | PM: $T = 0.36(X) + 3.07$

Table 3.2 summarizes the estimated trip distribution for the subject site. The trip distribution is based on existing travel patterns. Low-rise residential homes generally characterize the surrounding land use. The proposed residential land use, although mid-rise, is expected to follow the travel patterns of the existing residential use generally.

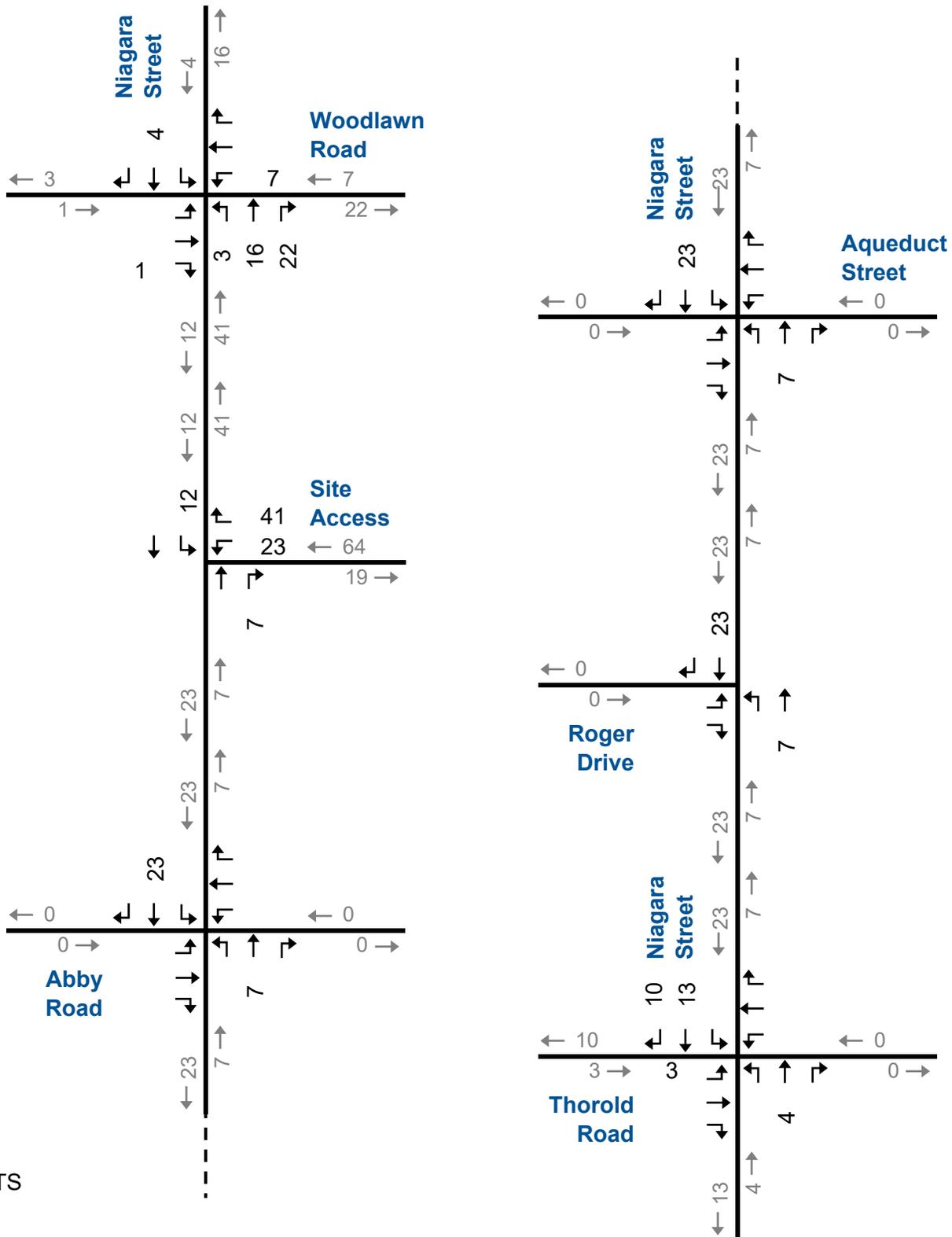
Figure 3.2 illustrates site-generated peak-hour traffic volumes.

TABLE 3.2: ESTIMATED TRIP GENERATION

| From/To | AM Peak Hour | | PM Peak Hour | |
|--------------------------|--------------|-------------|--------------|-------------|
| | In | Out | In | Out |
| North via Niagara Street | 20% | 25% | 20% | 25% |
| South via Niagara Street | 20% | 20% | 20% | 25% |
| East via Woodlawn Road | 35% | 35% | 35% | 20% |
| West via Woodlawn Road | 5% | 5% | 5% | 5% |
| East via Thorold Road | 0% | 0% | 0% | 0% |
| West via Thorold Road | 20% | 15% | 20% | 25% |
| Total | 100% | 100% | 100% | 100% |

⁵ Institute of Transportation Engineers, *Trip Generation Manual*, 12th ed., (Washington DC: ITE, 2025).





NTS



Site Generated Traffic Volumes AM Peak Hour

4 Future Forecasts

4.1 Future Traffic Growth

Traffic growth on area roadways is a function of the expected land development, economic activity, and demographic changes. A frequently used procedure estimates an annual percentage increase and applies that increase to the study area traffic volumes. An alternative approach is to identify the estimated traffic generated by specific planned significant developments that are expected to affect the project study area roadways. Both methods were utilized for this assessment.

Three horizon years have been assessed: the Opening Year (2029), five years after the opening year (2034), and ten years after the opening year (2039). The likely future traffic volumes near the subject site are estimated to consist of:

- ▶ Increased non-site traffic (generalized background traffic growth). A growth rate of 2.0% per annum was applied to the base year traffic for all intersections⁶;
- ▶ Background developments in the study area; and
- ▶ Traffic generated by the subject site.

4.2 Background Developments

The following background developments are included in the future traffic:

- ▶ **418-430 Aqueduct Road and 650-678 Niagara Street** – This development, located south of the subject site, proposes 925 residential units and 1,121 m² of retail space. Build-out is assumed by 2029.

Background development traffic in the study area is shown in **Appendix C**.

⁶ Growth rate identified by Halton Region Staff (Appendix A)



4.3 Future Road Network

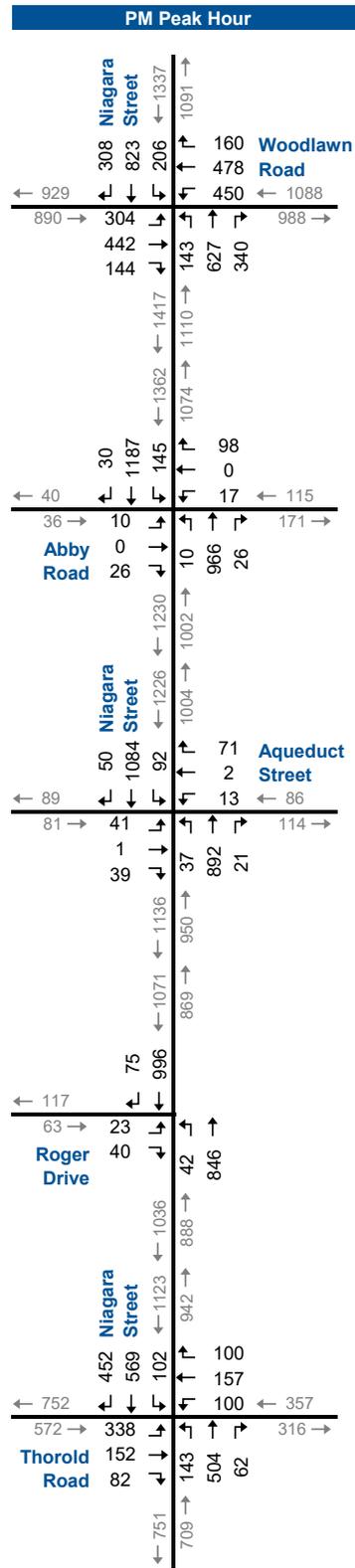
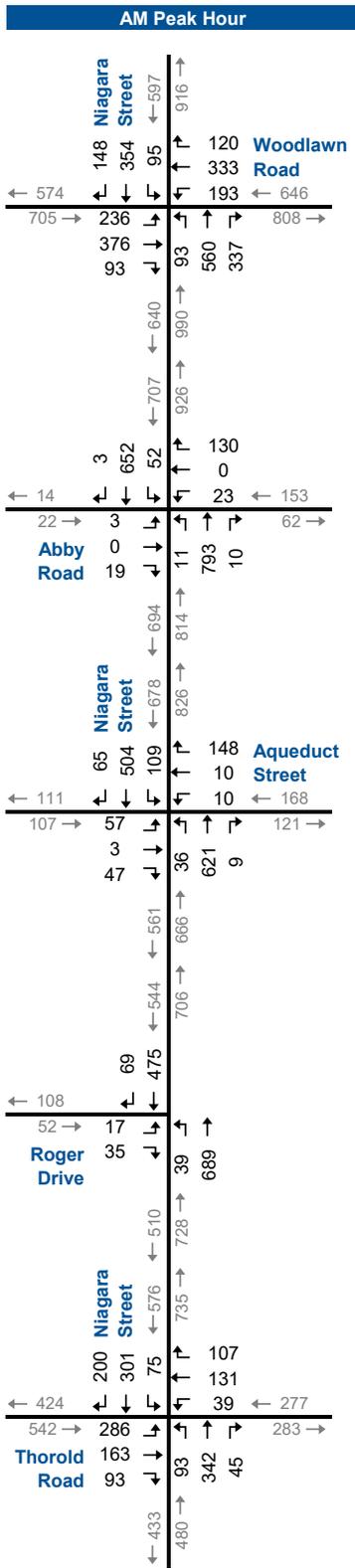
The east leg of the Niagara Street at Abbey Road intersection is assumed to be constructed to connect to the 418-430 Aqueduct Road and 650-678 Niagara Street development. The east leg is assumed to have a shared left-through-right lane configuration.

4.4 Future Traffic Volumes

Figures 4.1-4.3 illustrate the Opening, Five-year, and Ten-year background traffic volumes, respectively.

The total traffic volumes consist of the background traffic volumes and development site-generated traffic. **Figure 4.4-4.6** illustrate the Opening, Five-year, and Ten-year Total traffic volumes, respectively.



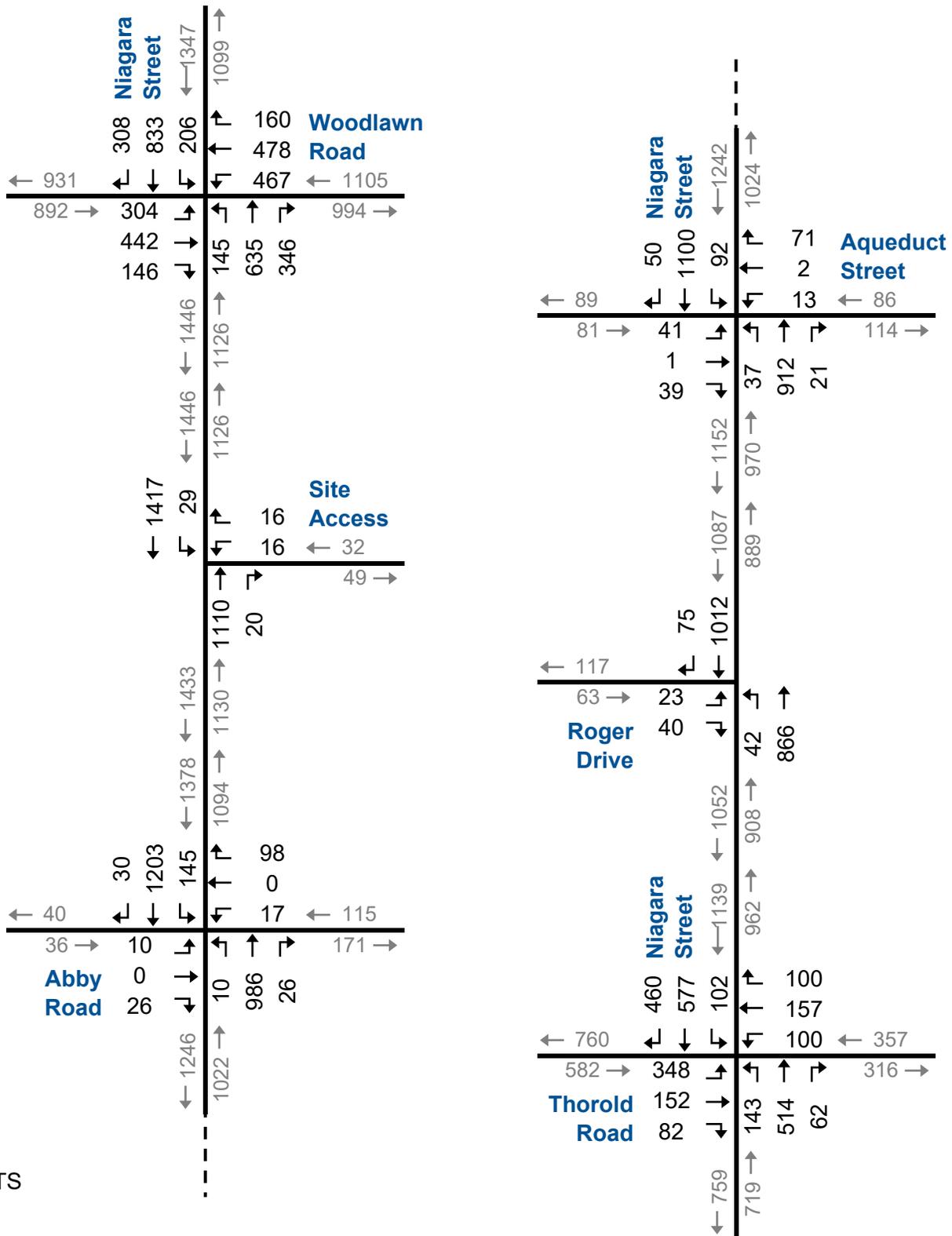


NTS



Future Background Traffic Volumes Opening Year

Figure 4.1

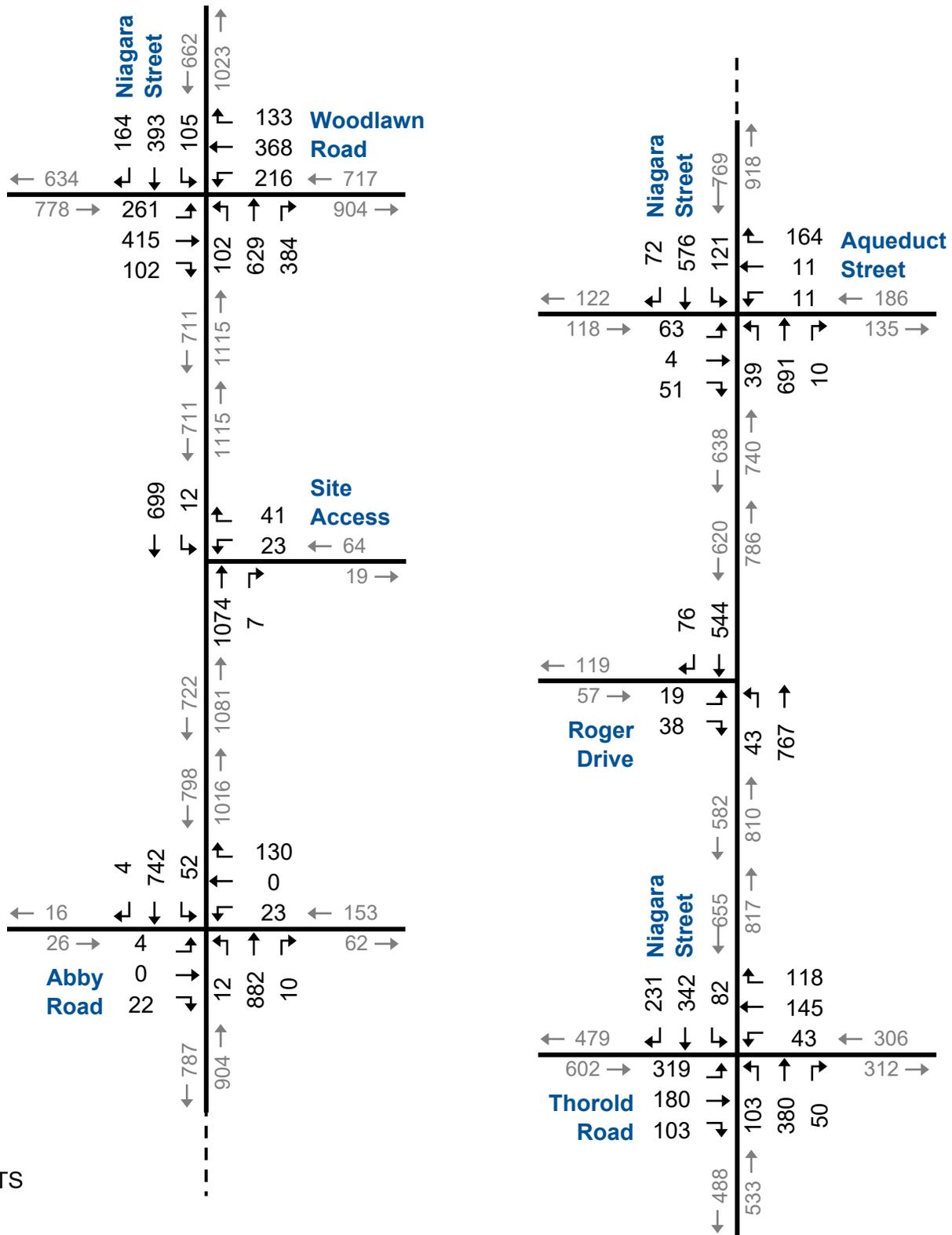


NTS



Future Total Traffic Volumes Opening Year PM Peak Hour

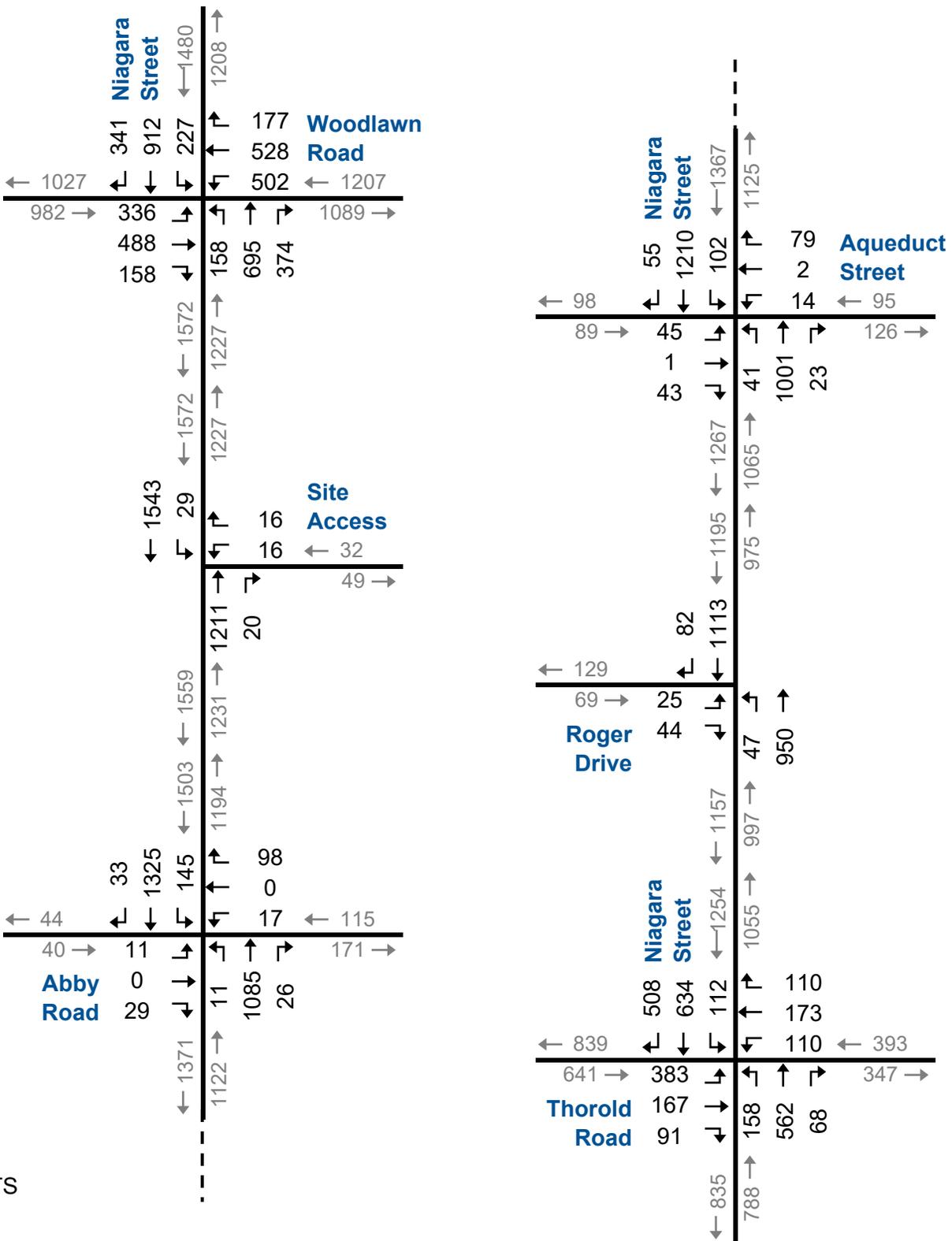
Figure 4.4B



NTS



Future Total Traffic Volumes Five Year AM Peak Hour



NTS



Future Total Traffic Volumes Five Year PM Peak Hour

5 Operational Assessment

5.1 Level of Service Criteria

Intersection level of service (LOS) is a recognized method of quantifying the efficiency of traffic flow at intersections. It is based on the delay experienced by individual vehicles as they execute the various movements. The delay is related to the number of vehicles desiring to move, compared to the estimated capacity for that movement. The capacity is based on several criteria related to the opposing traffic flows. The highest possible rating is LOS A, under which the average total delay is equal to or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds at signalized intersections (50 seconds at unsignalized intersections), the movement is considered to have a LOS F, and remedial measures are usually implemented if feasible.

The operations of the study area intersections were evaluated under existing traffic volumes using Synchro and HCM 2000 procedures. The intersection analysis considered the following measures of performance:

- ▶ The LOS for each turning movement. LOS is based on the average control delay per vehicle.
- ▶ The volume to capacity ratio (v/c) for each intersection; and
- ▶ 95th percentile queue length (metres) using Synchro.

Under the Niagara Region's TIS Guidelines⁷, the following criteria indicate critical conditions and signify that mitigation measures may need to be considered:

- ▶ At signalized intersections,
 - Movements increased to v/c 0.85 or above; and
 - Movements increased to v/c 0.95 or above for exclusive turning movements.
- ▶ At unsignalized intersections,
 - LOS, based on average delay per vehicle, on individual movements, is expected to operate at a LOS "D" or worse.
- ▶ At all intersections,

⁷ Halton Region, Transportation Impact Study Guidelines, January 2015



- An exclusive turning movement in which the 95th percentile queue will exceed the available storage space.

5.2 Intersection Capacity Analysis

Intersection capacity analyses were conducted at all intersections in the study area. Analyses were conducted for the Base Conditions (2025), Opening-Year (2029 Background and Total Conditions), Five Years after Opening (2034 Background and Total Conditions), and the Ten Years after Opening (2039 Background and Total Conditions).

Tables 5.1 – 5.5 summarize the capacity analyses for the study area intersections for all horizon years. The capacity analysis results are included in **Appendix D**. The following sub-sections outline the operations of the study area intersections.

It should be noted that the intersection capacity analysis was completed with a more conservative trip generation forecast from a previous site concept estimating 84 AM peak hour and 85 PM peak hour trips. The difference of 1-4 additional site trips is not expected to significantly change the results of the analysis and provides a more conservative (err on the high side) estimate for intersection delays.

5.2.1 Niagara Street and Woodlawn Road

| Horizon Year | Overall Operations |
|-----------------|---|
| 2025 Base Year | At Capacity  |
| 2029 Background | At Capacity  |
| 2029 Total | At Capacity  |
| 2034 Background | At Capacity  |
| 2034 Total | At Capacity  |
| 2039 Background | At Capacity  |
| 2039 Total | At Capacity  |

The intersection of Niagara Street and Woodlawn Road currently experiences critical congestion. During the PM peak hour, the eastbound, northbound, and southbound through/right movements experience delays in the LOS E range and v/c ratios greater than 0.85.

Under the 2029 Background horizon, the critical movements are forecast to degrade with delays reaching the LOS F range in the PM peak hour and the eastbound through/right movement operating at LOS E and v/c greater than 0.85 during the AM peak hour. The westbound left and southbound left-turn movements are also forecast to operate with delays in the LOS F range and v/c ratios greater than 1.00 during the PM peak hour.



Under the 2039 Background horizon, the northbound through movement is forecast to degrade to LOS E range with a v/c greater than 0.85 during the AM peak hour.

The addition of site traffic is generally forecast to increase delays by less than five seconds during the peak hours. The exceptions are the movements forecast to operate at/near capacity under background conditions.

Critical Movements (v/c over 0.85, v/c over 0.95 for exclusive turn lanes, 95th Percentile queues over storage)

- ▶ Eastbound through/right (2025 Base)
- ▶ Northbound through/right (2025 Base)
- ▶ Southbound through/right (2025 Base)
- ▶ Westbound left (2029 Background)
- ▶ Southbound left (2029 Background)
- ▶ Eastbound left (2039 Total)



TABLE 5.1: LOS OPERATIONS – NIAGARA STREET AND WOODLAWN ROAD

| Analysis Period | Intersection | Scenario | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | Overall |
|--------------------|------------------------------------|-------------------------|-----------|---------------------------------|---------|-------|----------|-----------|---------|-------|----------|------------|---------|-------|----------|------------|---------|-------|----------|---------|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | 1 - Niagara Street & Woodlawn Road | Base | LOS Delay | D 52 | E 74 | > | E 66 | D 53 | E 67 | E 59 | E 62 | B 16 | C 25 | > | C 24 | B 15 | C 20 | > | B 19 | D 43 |
| | | V/C | 0.71 | 0.84 | > | | 0.59 | 0.67 | 0.09 | | 0.12 | 0.48 | > | | 0.26 | 0.30 | > | | | 0.58 |
| | | Q | 74 | 87 | > | | 48 | 67 | 19 | | 16 | 109 | > | | 24 | 61 | > | | | |
| | | Background Opening Year | LOS Delay | D 46 | E 73 | > | E 64 | D 51 | E 60 | D 54 | E 57 | B 18 | D 35 | > | C 34 | C 20 | C 27 | > | C 26 | D 44 |
| | | V/C | 0.70 | 0.86 | > | | 0.70 | 0.58 | 0.10 | | 0.22 | 0.69 | > | | 0.38 | 0.38 | > | | | 0.72 |
| | | Q | 74 | 95 | > | | 60 | 69 | 18 | | 27 | 175 | > | | 28 | 81 | > | | | |
| | | Total Opening Year | LOS Delay | D 46 | E 73 | > | E 64 | D 51 | E 59 | D 54 | E 56 | B 19 | D 38 | > | D 36 | C 21 | C 28 | > | C 27 | D 45 |
| V/C | 0.69 | 0.86 | > | | 0.72 | 0.56 | 0.10 | | 0.23 | 0.73 | > | | 0.40 | 0.39 | > | | | 0.74 | | |
| Q | 74 | 96 | > | | 62 | 69 | 18 | | 28 | 197 | > | | 28 | 83 | > | | | | | |
| Background 5 Year | LOS Delay | D 46 | E 71 | > | E 63 | D 52 | E 59 | D 53 | E 56 | C 21 | D 44 | > | D 42 | C 24 | C 31 | > | C 30 | D 48 | | |
| V/C | 0.74 | 0.86 | > | | 0.74 | 0.59 | 0.11 | | 0.26 | 0.81 | > | | 0.47 | 0.45 | > | | | 0.79 | | |
| Q | 80 | 104 | > | | 63 | 76 | 19 | | 30 | 227 | > | | 32 | 95 | > | | | | | |
| Total 5 Year | LOS Delay | D 45 | E 71 | > | E 62 | D 52 | E 58 | D 52 | E 55 | C 22 | D 48 | > | D 45 | C 25 | C 31 | > | C 31 | D 48 | | |
| V/C | 0.73 | 0.86 | > | | 0.75 | 0.58 | 0.11 | | 0.28 | 0.85 | > | | 0.50 | 0.46 | > | | | 0.82 | | |
| Q | 79 | 104 | > | | 65 | 75 | 19 | | 31 | 244 | > | | 32 | 97 | > | | | | | |
| Background 10 Year | LOS Delay | D 45 | E 69 | > | E 61 | D 51 | E 57 | D 50 | D 54 | C 24 | E 63 | > | E 59 | C 33 | D 36 | > | D 35 | D 54 | | |
| V/C | 0.77 | 0.86 | > | | 0.77 | 0.60 | 0.13 | | 0.32 | 0.95 | > | | 0.62 | 0.53 | > | | | 0.88 | | |
| Q | 85 | 117 | > | | 66 | 83 | 20 | | 33 | 265 | > | | 38 | 111 | > | | | | | |
| Total 10 Year | LOS Delay | D 45 | E 69 | > | E 61 | D 52 | E 57 | D 50 | D 54 | C 24 | E 72 | > | E 68 | D 37 | D 37 | > | D 37 | E 57 | | |
| V/C | 0.77 | 0.87 | > | | 0.78 | 0.58 | 0.12 | | 0.33 | 0.99 | > | | 0.66 | 0.54 | > | | | 0.90 | | |
| Q | 85 | 119 | > | | 68 | 83 | 20 | | 34 | 278 | > | | 41 | 113 | > | | | | | |
| PM Peak Hour | 1 - Niagara Street & Woodlawn Road | Base | LOS Delay | D 40 | E 69 | > | E 59 | D 46 | D 49 | D 43 | D 47 | D 39 | E 59 | > | E 56 | D 44 | E 75 | > | E 70 | E 59 |
| | | V/C | 0.72 | 0.87 | > | | 0.83 | 0.50 | 0.13 | | 0.62 | 0.86 | > | | 0.78 | 0.99 | > | | 0.92 | |
| | | Q | 84 | 133 | > | | 94 | 90 | 20 | | 35 | 172 | > | | 64 | 242 | > | | | |
| | | Background Opening Year | LOS Delay | D 46 | F 153 | > | F 116 | F 124 | D 48 | D 43 | E 79 | E 63 | F 133 | > | F 124 | F 124 | F 171 | > | F 164 | F 123 |
| | | V/C | 0.77 | 1.16 | > | | 1.12 | 0.53 | 0.14 | | 0.80 | 1.14 | > | | 1.04 | 1.24 | > | | 1.20 | |
| | | Q | 91 | 161 | > | | 223 | 100 | 21 | | 60 | 238 | > | | 116 | 301 | > | | | |
| | | Total Opening Year | LOS Delay | D 43 | F 155 | > | F 117 | F 143 | D 50 | D 44 | F 89 | E 64 | F 140 | > | F 130 | F 124 | F 177 | > | F 169 | F 129 |
| V/C | 0.75 | 1.16 | > | | 1.17 | 0.55 | 0.14 | | 0.81 | 1.16 | > | | 1.04 | 1.26 | > | | 1.23 | | | |
| Q | 91 | 162 | > | | 238 | 100 | 21 | | 62 | 243 | > | | 116 | 305 | > | | | | | |
| Background 5 Year | LOS Delay | D 54 | F 202 | > | F 151 | F 183 | D 52 | D 44 | F 104 | E 71 | F 177 | > | F 163 | F 159 | F 237 | > | F 225 | F 165 | | |
| V/C | 0.86 | 1.28 | > | | 1.26 | 0.61 | 0.15 | | 0.84 | 1.25 | > | | 1.15 | 1.39 | > | | 1.34 | | | |
| Q | 102 | 184 | > | | 262 | 111 | 23 | | 72 | 271 | > | | 134 | 343 | > | | | | | |
| Total 5 Year | LOS Delay | D 52 | F 203 | > | F 152 | F 205 | D 53 | D 45 | F 115 | E 73 | F 184 | > | F 170 | F 159 | F 241 | > | F 228 | F 170 | | |
| V/C | 0.85 | 1.28 | > | | 1.31 | 0.63 | 0.15 | | 0.85 | 1.27 | > | | 1.15 | 1.40 | > | | 1.37 | | | |
| Q | 102 | 185 | > | | 277 | 111 | 23 | | 73 | 277 | > | | 134 | 347 | > | | | | | |
| Background 10 Year | LOS Delay | D 54 | F 202 | > | F 151 | F 183 | D 52 | D 44 | F 104 | E 71 | F 177 | > | F 163 | F 159 | F 237 | > | F 225 | F 165 | | |
| V/C | 0.86 | 1.28 | > | | 1.26 | 0.61 | 0.15 | | 0.84 | 1.25 | > | | 1.15 | 1.39 | > | | 1.34 | | | |
| Q | 102 | 184 | > | | 262 | 111 | 23 | | 72 | 271 | > | | 134 | 343 | > | | | | | |
| Total 10 Year | LOS Delay | E 70 | F 258 | > | F 194 | F 268 | E 58 | D 47 | F 143 | F 82 | F 239 | > | F 219 | F 205 | F 312 | > | F 295 | F 218 | | |
| V/C | 0.96 | 1.41 | > | | 1.45 | 0.74 | 0.17 | | 0.89 | 1.39 | > | | 1.27 | 1.56 | > | | 1.51 | | | |
| Q | 143 | 209 | > | | 314 | 124 | 24 | | 83 | 315 | > | | 153 | 393 | > | | | | | |

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds
 Q - 95th Percentile Queue Length
 Ex. - Existing Available Storage
 Avail. - Available Storage
 TCS - Traffic Control Signal
 TWSC - Two-Way Stop Control
 AWSC - All-Way Stop Control
 RBT - Roundabout
 < - Shared Left-turn
 > - Shared Right-turn

5.2.2 Niagara Street and Abbey Road

| Horizon Year | Overall Operations | |
|-----------------|--------------------|---|
| 2025 Base Year | Within Capacity | ● |
| 2029 Background | Within Capacity | ● |
| 2029 Total | Within Capacity | ● |
| 2034 Background | Within Capacity | ● |
| 2034 Total | Within Capacity | ● |
| 2039 Background | Within Capacity | ● |
| 2039 Total | Within Capacity | ● |

The intersection of Niagara Street and Abbey Road presently operates with individual movements performing at acceptable levels, with a LOS C or better for all movements and v/c ratios less than 0.50 during the peak hours.

Under background horizons, the operations are forecast to be similar to Base conditions.

The addition of site traffic is not expected to cause significant delays to individual movements at the intersection. Delays are forecast to increase by less than seven seconds during the peak hours. Under the 2039 Total horizon, the eastbound approach is expected to operate at LOS D with delays less than 30 seconds.

Critical Movements (LOS D or worse)

- ▶ Eastbound approach (2039 Total)



TABLE 5.2: LOS OPERATIONS – NIAGARA STREET AND ABBEY ROAD

| Analysis Period | Intersection | Scenario | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | Overall |
|-----------------|---------------------------------|-------------------------|-----------------|---------------------------------|---------|----------------|----------|-----------|------------------------|-------|----------|------------------------|---------|-------|----------|------------|---------|-------|----------|---------|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | 2 - Niagara Street & Abbey Road | Base | LOS Delay V/C Q | B 11 0.03 1 | > | | | | | | | | | | | | | | A 0 | A 0 |
| | | Background Opening Year | LOS Delay V/C Q | < B 12 0.04 1 | > | < B 14 0.29 10 | > | B 14 | A A 9 0 0.01 0.33 0 0 | > | A 0 | A A 10 0 0.07 0.27 2 0 | > | A 1 | B 2 | | | | | |
| | | Total Opening Year | LOS Delay V/C Q | < B 12 0.04 1 | > | < B 14 0.29 10 | > | B 14 | A A 9 0 0.01 0.33 0 0 | > | A 0 | A A 10 0 0.07 0.28 2 0 | > | A 1 | B 2 | | | | | |
| | | Background 5 Year | LOS Delay V/C Q | < B 13 0.05 1 | > | < B 14 0.30 10 | > | B 14 | A A 9 0 0.02 0.36 0 0 | > | A 0 | A A 10 0 0.07 0.30 2 0 | > | A 1 | B 2 | | | | | |
| | | Total 5 Year | LOS Delay V/C Q | < B 13 0.06 1 | > | < B 15 0.30 10 | > | B 15 | A A 9 0 0.02 0.36 0 0 | > | A 0 | A A 10 0 0.07 0.31 2 0 | > | A 1 | B 2 | | | | | |
| | | Background 10 Year | LOS Delay V/C Q | < B 13 0.06 2 | > | < B 15 0.31 11 | > | B 15 | A A 10 0 0.02 0.40 0 0 | > | A 0 | B A 10 0 0.08 0.33 2 0 | > | A 1 | B 2 | | | | | |
| | | Total 10 Year | LOS Delay V/C Q | < B 13 0.06 2 | > | < C 15 0.32 11 | > | C 15 | A A 10 0 0.02 0.40 0 0 | > | A 0 | B A 10 0 0.08 0.34 2 0 | > | A 1 | B 2 | | | | | |
| PM Peak Hour | 2 - Niagara Street & Abbey Road | Base | LOS Delay V/C Q | C 16 0.09 3 | > | | | | | | | | | | | | | | A 0 | A 0 |
| | | Background Opening Year | LOS Delay V/C Q | < C 20 0.13 4 | > | < B 14 0.24 7 | > | B 14 | B A 11 0 0.02 0.40 0 0 | > | A 0 | B A 11 0 0.22 0.49 7 0 | > | A 1 | C 2 | | | | | |
| | | Total Opening Year | LOS Delay V/C Q | < C 20 0.14 4 | > | < B 14 0.24 7 | > | B 14 | B A 11 0 0.02 0.41 0 0 | > | A 0 | B A 12 0 0.22 0.50 7 0 | > | A 1 | C 2 | | | | | |
| | | Background 5 Year | LOS Delay V/C Q | < C 22 0.17 5 | > | < B 14 0.24 8 | > | B 14 | B A 12 0 0.02 0.44 1 0 | > | A 0 | B A 12 0 0.24 0.54 7 0 | > | A 1 | C 2 | | | | | |
| | | Total 5 Year | LOS Delay V/C Q | < C 22 0.17 5 | > | < B 14 0.25 8 | > | B 14 | B A 12 0 0.02 0.45 1 0 | > | A 0 | B A 12 0 0.24 0.55 8 0 | > | A 1 | C 2 | | | | | |
| | | Background 10 Year | LOS Delay V/C Q | < C 22 0.17 5 | > | < B 14 0.24 8 | > | B 14 | B A 12 0 0.02 0.44 1 0 | > | A 0 | B A 12 0 0.24 0.54 7 0 | > | A 1 | C 2 | | | | | |
| | | Total 10 Year | LOS Delay V/C Q | < D 28 0.23 7 | > | < B 15 0.25 8 | > | B 15 | B A 13 0 0.03 0.49 1 0 | > | A 0 | B A 13 0 0.26 0.60 8 0 | > | A 1 | D 2 | | | | | |

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds
 Q - 95th Percentile Queue Length
 Ex. - Existing Available Storage
 Avail. - Available Storage
 TCS - Traffic Control Signal
 TWSC - Two-Way Stop Control
 AWS - All-Way Stop Control
 RBT - Roundabout
 < - Shared Left-turn
 > - Shared Right-turn

5.2.3 Niagara Street and Aqueduct Street

| Horizon Year | Overall Operations | |
|-----------------|--------------------|---|
| 2025 Base Year | Within Capacity | ● |
| 2029 Background | Within Capacity | ● |
| 2029 Total | Within Capacity | ● |
| 2034 Background | Within Capacity | ● |
| 2034 Total | Within Capacity | ● |
| 2039 Background | Within Capacity | ● |
| 2039 Total | Within Capacity | ● |

The intersection of Niagara Street and Aqueduct Street generally operates with individual movements performing at acceptable levels, with a LOS D or better for all movements and v/c ratios less than 0.50 during the peak hours. The eastbound left-turn 95th percentile queue length currently extends beyond the existing 10 m storage during the AM and PM peak hours.

Under background horizons, the operations are forecast to be similar to Base conditions.

The addition of site traffic is generally forecast to increase delays by less than five seconds during the peak hours. No new critical movements are expected.

Critical Movements (v/c over 0.85, v/c over 0.95 for exclusive turn lanes, 95th Percentile queues over storage)

- ▶ Eastbound left (2025 Base)



TABLE 5.3: LOS OPERATIONS – NIAGARA STREET AND AQUEDUCT STREET

| Analysis Period | Intersection | Scenario | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | Overall | | | | |
|--------------------|--------------------------------------|-------------------------|-------|---------------------------------|---------|-------|----------|-----------|---------|-------|----------|------------|---------|-------|----------|------------|---------|-------|----------|---------|------|----|------|----|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | | | | | |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | | | | | |
| AM Peak Hour | 3 - Niagara Street & Aqueduct Street | Base | LOS | D | C | > | C | C | > | C | A | A | > | A | A | > | A | A | > | A | B | | | |
| | | | Delay | 37 | 33 | > | 35 | 33 | 34 | > | 34 | 4 | 5 | > | 5 | 5 | > | 5 | 5 | > | 5 | 10 | | |
| | | | V/C | 0.41 | 0.05 | > | | 0.07 | 0.18 | > | | 0.07 | 0.31 | > | | 0.22 | 0.27 | > | | 0.22 | 0.27 | > | 0.32 | |
| | | Q | 19 | 10 | > | | 6 | 18 | > | | 5 | 29 | > | | 14 | 24 | > | | 14 | 24 | > | | | |
| | | Background Opening Year | LOS | D | C | > | C | C | > | C | A | A | > | A | A | > | A | A | > | A | A | > | B | |
| | | | Delay | 36 | 32 | > | 34 | 32 | 33 | > | 33 | 4 | 6 | > | 6 | 5 | > | 6 | 5 | > | 6 | 5 | > | 10 |
| | | | V/C | 0.44 | 0.06 | > | | 0.07 | 0.19 | > | | 0.08 | 0.34 | > | | 0.26 | 0.32 | > | | 0.26 | 0.32 | > | 0.36 | |
| Q | 21 | 10 | > | | 6 | 18 | > | | 6 | 35 | > | | 17 | 30 | > | | 17 | 30 | > | | | | | |
| Total Opening Year | LOS | D | C | > | C | C | > | C | A | A | > | A | A | > | A | A | > | A | A | > | B | | | |
| | Delay | 36 | 32 | > | 34 | 32 | 33 | > | 33 | 5 | 6 | > | 6 | 6 | > | 6 | 6 | > | 6 | 6 | > | 10 | | |
| | V/C | 0.42 | 0.06 | > | | 0.07 | 0.19 | > | | 0.08 | 0.35 | > | | 0.26 | 0.33 | > | | 0.26 | 0.33 | > | 0.36 | | | |
| Q | 21 | 10 | > | | 6 | 18 | > | | 6 | 36 | > | | 17 | 32 | > | | 17 | 32 | > | | | | | |
| Background 5 Year | LOS | D | C | > | C | C | > | C | A | A | > | A | A | > | A | A | > | A | A | > | B | | | |
| | Delay | 38 | 32 | > | 35 | 32 | 33 | > | 33 | 5 | 6 | > | 6 | 6 | > | 6 | 6 | > | 6 | 6 | > | 11 | | |
| | V/C | 0.50 | 0.06 | > | | 0.07 | 0.20 | > | | 0.09 | 0.38 | > | | 0.31 | 0.35 | > | | 0.31 | 0.35 | > | 0.40 | | | |
| Q | 23 | 10 | > | | 6 | 19 | > | | 7 | 41 | > | | 20 | 35 | > | | 20 | 35 | > | | | | | |
| Total 5 Year | LOS | D | C | > | C | C | > | C | A | A | > | A | A | > | A | A | > | A | A | > | B | | | |
| | Delay | 38 | 32 | > | 35 | 32 | 33 | > | 33 | 5 | 6 | > | 6 | 6 | > | 6 | 6 | > | 6 | 6 | > | 11 | | |
| | V/C | 0.50 | 0.06 | > | | 0.07 | 0.20 | > | | 0.09 | 0.39 | > | | 0.31 | 0.36 | > | | 0.31 | 0.36 | > | 0.41 | | | |
| Q | 23 | 10 | > | | 6 | 19 | > | | 7 | 41 | > | | 20 | 37 | > | | 20 | 37 | > | | | | | |
| Background 10 Year | LOS | D | C | > | D | C | > | C | A | A | > | A | A | > | A | A | > | A | A | > | B | | | |
| | Delay | 40 | 31 | > | 36 | 31 | 34 | > | 34 | 5 | 7 | > | 7 | 7 | > | 7 | 7 | > | 7 | 7 | > | 12 | | |
| | V/C | 0.57 | 0.07 | > | | 0.07 | 0.41 | > | | 0.11 | 0.43 | > | | 0.38 | 0.39 | > | | 0.38 | 0.39 | > | 0.45 | | | |
| Q | 24 | 11 | > | | 6 | 28 | > | | 8 | 50 | > | | 26 | 43 | > | | 26 | 43 | > | | | | | |
| Total 10 Year | LOS | D | C | > | D | C | > | C | A | A | > | A | A | > | A | A | > | A | A | > | B | | | |
| | Delay | 40 | 31 | > | 36 | 31 | 34 | > | 34 | 5 | 7 | > | 7 | 7 | > | 7 | 7 | > | 7 | 7 | > | 12 | | |
| | V/C | 0.56 | 0.07 | > | | 0.07 | 0.42 | > | | 0.12 | 0.43 | > | | 0.38 | 0.40 | > | | 0.38 | 0.40 | > | 0.46 | | | |
| Q | 24 | 11 | > | | 6 | 29 | > | | 8 | 51 | > | | 27 | 45 | > | | 27 | 45 | > | | | | | |
| PM Peak Hour | 3 - Niagara Street & Aqueduct Street | Base | LOS | D | C | > | D | D | > | D | A | A | > | A | A | > | A | A | > | A | A | | | |
| | | | Delay | 38 | 35 | > | 37 | 36 | 35 | > | 35 | 4 | 5 | > | 5 | 5 | > | 5 | 5 | > | 5 | 7 | | |
| | | | V/C | 0.35 | 0.04 | > | | 0.11 | 0.07 | > | | 0.11 | 0.40 | > | | 0.21 | 0.50 | > | | 0.21 | 0.50 | > | 0.48 | |
| | | Q | 15 | 9 | > | | 7 | 12 | > | | 5 | 39 | > | | 11 | 54 | > | | 11 | 54 | > | | | |
| | | Background Opening Year | LOS | D | C | > | D | C | > | C | A | A | > | A | A | > | A | A | > | A | A | > | A | |
| | | | Delay | 38 | 35 | > | 36 | 35 | 35 | > | 35 | 4 | 5 | > | 5 | 6 | > | 6 | 6 | > | 6 | 6 | > | 8 |
| | | | V/C | 0.37 | 0.04 | > | | 0.11 | 0.07 | > | | 0.14 | 0.45 | > | | 0.26 | 0.56 | > | | 0.26 | 0.56 | > | 0.53 | |
| Q | 16 | 9 | > | | 7 | 12 | > | | 6 | 47 | > | | 13 | 66 | > | | 13 | 66 | > | | | | | |
| Total Opening Year | LOS | D | C | > | D | C | > | C | A | A | > | A | A | > | A | A | > | A | A | > | A | | | |
| | Delay | 38 | 35 | > | 36 | 35 | 35 | > | 35 | 5 | 5 | > | 5 | 6 | > | 6 | 6 | > | 6 | 6 | > | 8 | | |
| | V/C | 0.37 | 0.04 | > | | 0.11 | 0.07 | > | | 0.14 | 0.46 | > | | 0.27 | 0.56 | > | | 0.27 | 0.56 | > | 0.54 | | | |
| Q | 16 | 9 | > | | 7 | 12 | > | | 6 | 49 | > | | 14 | 68 | > | | 14 | 68 | > | | | | | |
| Background 5 Year | LOS | D | C | > | D | C | > | C | A | A | > | A | A | > | A | A | > | A | A | > | A | | | |
| | Delay | 38 | 34 | > | 36 | 35 | 35 | > | 35 | 5 | 6 | > | 6 | 7 | > | 7 | 7 | > | 7 | 7 | > | 8 | | |
| | V/C | 0.39 | 0.04 | > | | 0.12 | 0.08 | > | | 0.18 | 0.50 | > | | 0.32 | 0.61 | > | | 0.32 | 0.61 | > | 0.59 | | | |
| Q | 17 | 9 | > | | 7 | 13 | > | | 7 | 56 | > | | 17 | 80 | > | | 17 | 80 | > | | | | | |
| Total 5 Year | LOS | D | C | > | D | C | > | C | A | A | > | A | A | > | A | A | > | A | A | > | A | | | |
| | Delay | 38 | 34 | > | 36 | 35 | 35 | > | 35 | 5 | 6 | > | 6 | 7 | > | 7 | 7 | > | 7 | 7 | > | 9 | | |
| | V/C | 0.39 | 0.04 | > | | 0.12 | 0.09 | > | | 0.18 | 0.51 | > | | 0.33 | 0.62 | > | | 0.33 | 0.62 | > | 0.59 | | | |
| Q | 17 | 9 | > | | 7 | 13 | > | | 7 | 58 | > | | 17 | 82 | > | | 17 | 82 | > | | | | | |
| Background 10 Year | LOS | D | C | > | D | C | > | C | A | A | > | A | A | > | A | A | > | A | A | > | A | | | |
| | Delay | 38 | 34 | > | 36 | 35 | 35 | > | 35 | 5 | 6 | > | 6 | 7 | > | 7 | 7 | > | 7 | 7 | > | 8 | | |
| | V/C | 0.39 | 0.04 | > | | 0.12 | 0.08 | > | | 0.18 | 0.50 | > | | 0.32 | 0.61 | > | | 0.32 | 0.61 | > | 0.59 | | | |
| Q | 17 | 9 | > | | 7 | 13 | > | | 7 | 56 | > | | 17 | 80 | > | | 17 | 80 | > | | | | | |
| Total 10 Year | LOS | D | C | > | D | C | > | D | A | A | > | A | A | > | A | A | > | A | A | > | A | | | |
| | Delay | 39 | 35 | > | 37 | 35 | 36 | > | 36 | 7 | 6 | > | 7 | 8 | > | 8 | 8 | > | 8 | 8 | > | 10 | | |
| | V/C | 0.42 | 0.15 | > | | 0.13 | 0.27 | > | | 0.24 | 0.56 | > | | 0.42 | 0.69 | > | | 0.42 | 0.69 | > | 0.65 | | | |
| Q | 18 | 12 | > | | 8 | 18 | > | | 9 | 69 | > | | 23 | 102 | > | | 23 | 102 | > | | | | | |

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds
 Q - 95th Percentile Queue Length
 Ex. - Existing Available Storage
 Avail. - Available Storage
 TCS - Traffic Control Signal
 TWSC - Two-Way Stop Control
 AWSC - All-Way Stop Control
 RBT - Roundabout
 < - Shared Left-turn
 > - Shared Right-turn

5.2.4 Niagara Street and Roger Drive

| Horizon Year | Overall Operations | |
|-----------------|--------------------|---|
| 2025 Base Year | Within Capacity | ● |
| 2029 Background | Within Capacity | ● |
| 2029 Total | Within Capacity | ● |
| 2034 Background | Within Capacity | ● |
| 2034 Total | Within Capacity | ● |
| 2039 Background | Within Capacity | ● |
| 2039 Total | Within Capacity | ● |

The intersection of Niagara Street and Roger Drive presently operates with individual movements performing at acceptable levels, with a LOS B or better for all movements and v/c ratios less than 0.40 during the peak hours.

Under background horizons, the operations are forecast to be similar to Base conditions.

The addition of site traffic is generally forecast to increase delays by less than five seconds during the peak hours. No new critical movements are expected.



TABLE 5.4: LOS OPERATIONS – NIAGARA STREET AND ROGER DRIVE

| Analysis Period | Intersection | Scenario | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | Overall |
|-----------------|----------------------------------|-------------------------|--------------------------|---------------------------------|------------------|---------|----------|-----------|---------|-------|----------|------------|----------------------|----------------------|---------------------|---------------------|---------------------|------------------|------------------|---------|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | 4 - Niagara Street & Roger Drive | Base | LOS Delay V/C Q | B 11 0.08 2 | > > > > | B 11 | | | | | | | | A 9 0.04 1 | A 0 0.20 0 | A 1 | A 0 0 0 | > > > > | A 0 0 0 | A 1 |
| | | Background Opening Year | LOS Delay V/C Q | B 12 0.10 3 | > > > > | B 12 | | | | | | | | A 9 0.04 1 | A 0 0.22 0 | A 1 | A 0 0 0 | > > > > | A 0 0 0 | A 1 |
| | | Total Opening Year | LOS Delay V/C Q | B 12 0.10 3 | > > > > | B 12 | | | | | | | | A 9 0.04 1 | A 0 0.22 0 | A 1 | A 0 0.21 0 | > > > > | A 0 0 0 | A 1 |
| | | Background 5 Year | LOS Delay V/C Q | B 13 0.11 3 | > > > > | B 13 | | | | | | | | A 9 0.05 1 | A 0 0.24 0 | A 1 | A 0 0.22 0 | > > > > | A 0 0 0 | A 1 |
| | | Total 5 Year | LOS Delay V/C Q | B 13 0.12 3 | > > > > | B 13 | | | | | | | | A 9 0.05 1 | A 0 0.25 0 | A 1 | A 0 0.23 0 | > > > > | A 0 0 0 | A 1 |
| | | Background 10 Year | LOS Delay V/C Q | B 13 0.14 4 | > > > > | B 13 | | | | | | | | A 9 0.06 2 | A 0 0.27 0 | A 1 | A 0 0.24 0 | > > > > | A 0 0 0 | A 1 |
| | | Total 10 Year | LOS Delay V/C Q | B 13 0.14 4 | > > > > | B 13 | | | | | | | | A 9 0.06 2 | A 0 0.27 0 | A 1 | A 0 0.25 0 | > > > > | A 0 0 0 | A 1 |
| PM Peak Hour | 4 - Niagara Street & Roger Drive | Base | LOS Delay V/C Q | B 14 0.14 4 | > > > > | B 14 | | | | | | | B 10 0.06 2 | A 0 0.24 0 | A 1 | A 0 0.38 0 | > > > > | A 0 0 0 | A 1 | |
| | | Background Opening Year | LOS Delay V/C Q | B 14 0.15 4 | > > > > | B 14 | | | | | | | | B 11 0.07 2 | A 0 0.27 0 | A 1 | A 0 0.42 0 | > > > > | A 0 0 0 | A 1 |
| | | Total Opening Year | LOS Delay V/C Q | B 14 0.15 4 | > > > > | B 14 | | | | | | | | B 11 0.07 2 | A 0 0.28 0 | A 1 | A 0 0.43 0 | > > > > | A 0 0 0 | A 1 |
| | | Background 5 Year | LOS Delay V/C Q | B 15 0.17 5 | > > > > | B 15 | | | | | | | | B 11 0.08 2 | A 0 0.30 0 | A 1 | A 0 0.47 0 | > > > > | A 0 0 0 | B 1 |
| | | Total 5 Year | LOS Delay V/C Q | B 15 0.17 5 | > > > > | B 15 | | | | | | | | B 12 0.08 2 | A 0 0.30 0 | A 1 | A 0 0.47 0 | > > > > | A 0 0 0 | B 1 |
| | | Background 10 Year | LOS Delay V/C Q | B 15 0.17 5 | > > > > | B 15 | | | | | | | | B 11 0.08 2 | A 0 0.30 0 | A 1 | A 0 0.47 0 | > > > > | A 0 0 0 | B 1 |
| | | Total 10 Year | LOS Delay V/C Q | B 15 0.18 5 | > > > > | B 15 | | | | | | | | B 12 0.10 3 | A 0 0.33 0 | A 1 | A 0 0.52 0 | > > > > | A 0 0 0 | B 1 |

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds
 Q - 95th Percentile Queue Length
 Ex. - Existing Available Storage
 Avail. - Available Storage
 TCS - Traffic Control Signal
 TWSC - Two-Way Stop Control
 AWSC - All-Way Stop Control
 RBT - Roundabout
 < - Shared Left-turn
 > - Shared Right-turn

5.2.5 Niagara Street and Thorold Road

| Horizon Year | Overall Operations | |
|-----------------|----------------------|---|
| 2025 Base Year | Approaching Capacity | ● |
| 2029 Background | At Capacity | ● |
| 2029 Total | At Capacity | ● |
| 2034 Background | At Capacity | ● |
| 2034 Total | At Capacity | ● |
| 2039 Background | At Capacity | ● |
| 2039 Total | At Capacity | ● |

The intersection of Niagara Street and Thorold Road presently operates with delays in the eastbound left-turn movement in the LOS E range and v/c ratio greater than 1.00 during the PM peak hour. The overall intersection capacity during the PM peak hour is approaching capacity with a v/c ratio of 0.89.

Under the 2029 Background horizon, the southbound left and southbound through/right-turn movement is forecast to degrade to the LOS D range and v/c ratios greater than 0.85 during the PM peak hour.

Under the 2034 Background horizon, the westbound through/right-turn movement is forecast to degrade to LOS E range with a v/c greater than 0.85 during the AM and PM peak hours.

The addition of site traffic is generally forecast to increase delays by less than five seconds during the peak hours. The exceptions are the movements forecast to operate at/near capacity under background conditions.

Critical Movements (v/c over 0.85, v/c over 0.95 for exclusive turn lanes, 95th Percentile queues over storage)

- ▶ Eastbound left (2025 Base)
- ▶ Southbound through/right (2029 Background)
- ▶ Westbound through/right (2034 Background)



TABLE 5.5: LOS OPERATIONS – NIAGARA STREET AND THOROLD ROAD

| Analysis Period | Intersection | Scenario | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | Overall |
|-----------------|-----------------------------------|-------------------------|--------------------------|---------------------------------|------------------------|------------------|----------|-----------------------|------------------------|------------------|----------|-----------------------|-----------------------|------------------|----------|-----------------------|-------------------------|------------------|----------|------------------|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | 5 - Niagara Street & Thorold Road | Base | LOS Delay V/C Q | E 60 0.91 78 | D 38 0.68 75 | > > > > | D 50 | C 31 0.16 12 | D 52 0.78 68 | > > > > | D 49 | B 14 0.26 20 | C 20 0.32 45 | > > > > | B 19 | B 14 0.18 16 | C 21 0.33 40 | > > > > | B 20 | C 33 0.58 |
| | | Background Opening Year | LOS Delay V/C Q | E 77 0.98 95 | D 38 0.71 88 | > > > > | E 59 | C 29 0.17 12 | D 52 0.80 77 | > > > > | D 49 | B 15 0.30 21 | C 22 0.37 51 | > > > > | C 21 | B 16 0.22 17 | C 24 0.43 53 | > > > > | C 23 | D 37 0.67 |
| | | Total Opening Year | LOS Delay V/C Q | F 80 1.00 97 | D 38 0.71 88 | > > > > | E 61 | C 29 0.17 12 | D 52 0.80 77 | > > > > | D 49 | B 15 0.31 21 | C 22 0.38 52 | > > > > | C 21 | B 16 0.22 17 | C 24 0.46 56 | > > > > | C 23 | D 37 0.69 |
| | | Background 5 Year | LOS Delay V/C Q | F 119 1.12 98 | D 46 0.80 104 | > > > > | F 84 | C 28 0.19 13 | E 60 0.86 94 | > > > > | E 56 | B 16 0.36 23 | C 23 0.42 57 | > > > > | C 22 | B 17 0.25 19 | C 26 0.49 61 | > > > > | C 25 | D 46 0.78 |
| | | Total 5 Year | LOS Delay V/C Q | F 124 1.14 100 | D 46 0.80 104 | > > > > | F 87 | C 28 0.19 13 | E 60 0.86 94 | > > > > | E 56 | B 16 0.37 23 | C 24 0.43 58 | > > > > | C 22 | B 17 0.25 19 | C 26 0.52 64 | > > > > | C 25 | D 47 0.79 |
| | | Background 10 Year | LOS Delay V/C Q | F 157 1.23 123 | D 48 0.83 123 | > > > > | F 105 | C 26 0.21 14 | E 61 0.89 110 | > > > > | E 56 | B 18 0.44 25 | C 26 0.49 64 | > > > > | C 25 | B 18 0.31 20 | C 30 0.58 69 | > > > > | C 28 | D 54 0.89 |
| | | Total 10 Year | LOS Delay V/C Q | F 162 1.24 125 | D 48 0.83 123 | > > > > | F 108 | C 26 0.21 14 | E 61 0.89 110 | > > > > | E 56 | B 18 0.45 25 | C 26 0.50 64 | > > > > | C 25 | B 18 0.31 20 | C 30 0.61 73 | > > > > | C 29 | D 55 0.91 |
| PM Peak Hour | 5 - Niagara Street & Thorold Road | Base | LOS Delay V/C Q | F 97 1.05 85 | D 38 0.62 64 | > > > > | E 73 | C 30 0.31 23 | D 54 0.80 70 | > > > > | D 47 | B 18 0.57 27 | C 21 0.41 62 | > > > > | C 21 | B 15 0.26 20 | C 32 0.77 129 | > > > > | C 30 | D 39 0.89 |
| | | Background Opening Year | LOS Delay V/C Q | F 133 1.16 103 | D 41 0.68 70 | > > > > | F 96 | C 28 0.33 24 | E 58 0.84 79 | > > > > | D 50 | C 26 0.69 39 | C 24 0.50 74 | > > > > | C 25 | B 16 0.30 22 | D 41 0.89 156 | > > > > | D 38 | D 48 1.01 |
| | | Total Opening Year | LOS Delay V/C Q | F 147 1.19 108 | D 41 0.68 70 | > > > > | F 105 | C 28 0.33 24 | E 58 0.84 79 | > > > > | D 50 | C 27 0.70 41 | C 25 0.51 75 | > > > > | C 25 | B 16 0.30 22 | D 42 0.91 161 | > > > > | D 40 | D 51 1.03 |
| | | Background 5 Year | LOS Delay V/C Q | F 187 1.30 129 | D 44 0.73 81 | > > > > | F 128 | C 27 0.37 27 | E 62 0.88 96 | > > > > | D 52 | D 43 0.80 55 | C 27 0.57 82 | > > > > | C 30 | B 17 0.36 23 | E 72 1.04 184 | > > > > | E 67 | E 68 1.15 |
| | | Total 5 Year | LOS Delay V/C Q | F 201 1.33 134 | D 44 0.73 81 | > > > > | F 137 | C 27 0.37 27 | E 62 0.88 96 | > > > > | D 52 | D 43 0.80 55 | C 27 0.58 84 | > > > > | C 30 | B 17 0.36 23 | E 77 1.06 187 | > > > > | E 71 | E 72 1.17 |
| | | Background 10 Year | LOS Delay V/C Q | F 187 1.30 129 | D 44 0.73 81 | > > > > | F 128 | C 27 0.37 27 | E 62 0.88 96 | > > > > | D 52 | D 43 0.80 55 | C 27 0.57 82 | > > > > | C 30 | B 17 0.36 23 | E 72 1.04 184 | > > > > | E 67 | E 68 1.15 |
| | | Total 10 Year | LOS Delay V/C Q | F 266 1.49 160 | D 45 0.78 99 | > > > > | F 177 | C 26 0.40 29 | E 67 0.92 112 | > > > > | E 56 | D 52 0.85 63 | C 31 0.67 94 | > > > > | C 35 | B 19 0.44 26 | F 149 1.24 217 | > > > > | F 137 | F 109 1.33 |

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds
 Q - 95th Percentile Queue Length
 Ex. - Existing Available Storage
 Avail. - Available Storage
 TCS - Traffic Control Signal
 TWSC - Two-Way Stop Control
 AWSC - All-Way Stop Control
 RBT - Roundabout
 < - Shared Left-turn
 > - Shared Right-turn

5.2.6 Niagara Street and Site Access

| Horizon Year | Overall Operations |
|--------------|---|
| 2029 Total | Within Capacity  |
| 2034 Total | Within Capacity  |
| 2039 Total | Within Capacity  |

Individual movements at the site access are expected to operate at acceptable levels under the future Total conditions, with a LOS C or better for all movements.



TABLE 5.6: LOS OPERATIONS – NIAGARA STREET AND SITE ACCESS

| Analysis Period | Intersection | Scenario | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | Overall | | | | | | | | | | | |
|-----------------|----------------------------------|--------------------|-----------------|---------------------------------|---------|-------|----------|-----------|---------|-------|----------|------------|---------|-------|----------|------------|---------|---------|-------|----------|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | | | | | | | | | | |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | | Right | Approach | | | | | | | | | |
| AM Peak Hour | 6 - Niagara Street & Site Access | Total Opening Year | LOS Delay V/C Q | | | | | C | > | > | C | > | > | A | > | > | A | > | A | > | A | > | A | > | A | > | A | > | 1 |
| | | Total 5 Year | LOS Delay V/C Q | | | | | C | > | > | C | > | > | A | > | > | A | > | A | > | A | > | A | > | A | > | A | > | 1 |
| | | Total 10 Year | LOS Delay V/C Q | | | | | C | > | > | C | > | > | A | > | > | A | > | A | > | A | > | A | > | A | > | A | > | 1 |
| PM Peak Hour | 6 - Niagara Street & Site Access | Total Opening Year | LOS Delay V/C Q | | | | | C | > | > | C | > | > | A | > | > | A | > | A | > | A | > | A | > | A | > | B | > | 0 |
| | | Total 5 Year | LOS Delay V/C Q | | | | | C | > | > | C | > | > | A | > | > | A | > | A | > | A | > | A | > | A | > | B | > | 0 |
| | | Total 10 Year | LOS Delay V/C Q | | | | | C | > | > | C | > | > | A | > | > | A | > | A | > | A | > | A | > | A | > | B | > | 0 |

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length
 Ex. - Existing Available Storage
 Avail. - Available Storage

TCS - Traffic Control Signal
 TWSC - Two-Way Stop Control
 AWSC - All-Way Stop Control

RBT - Roundabout
 < - Shared Left-turn
 > - Shared Right-turn

6 Mitigation Measures

6.1 Intersection Modifications

A sensitivity analysis has been conducted for the 2039 Total horizon to assess the intersection operations with intersection modifications, including adjusting cycle splits, lane configurations, or traffic control.

Table 6.1 summarizes the results of the sensitivity analysis. **Appendix E** contains the detailed Synchro reports and signal timings.

The following subsections outline the mitigation measures for the critical intersections.

6.1.1 Niagara Street and Woodlawn Road

Critical movements are forecast for the eastbound left, eastbound through/right, westbound left, northbound through/right, southbound left, and southbound through/right movements. The overall intersection operations are expected to be in the LOS F range with a v/c ratio exceeding 1.00 during the 2039 Total PM peak hour.

The delay is caused by existing traffic and overall growth, not specifically by the proposed development. As a general comparison, the proposed development is expected to contribute to 1% of the total traffic volumes at the intersection over the 10-year period.

To mitigate the operations, the following changes are assessed:

- ▶ Adding dual eastbound left turn and protected phasing;
- ▶ Adding dual westbound left-turn and protected phasing;
- ▶ Adding an exclusive northbound right-turn lane; and
- ▶ Adding an exclusive southbound right-turn lane.

Due to the high volume of vehicles on all approaches, optimizing signal timings with the existing lane configuration is not expected to have a significant impact on reducing forecasted delays.

The addition of the dual left and exclusive right-turn lanes is forecast to improve operations at the intersection.

Overall, the mitigation measures are expected to reduce the overall intersection delay by over 130 seconds, with the overall intersection V/C ratio forecasted to decrease from 1.51 to 1.31 during the PM peak hour.



The eastbound through/right, westbound left, northbound left, northbound through, southbound left, and southbound through movements are still forecast to operate at critical levels during the PM peak hour, albeit with significantly reduced delays.

The addition of dual left and exclusive right turn lanes is expected to reduce intersection delays at Niagara Street and Woodlawn Road significantly. However, the addition of the turn lanes may not be feasible at the intersection due to the right-of-way and physical constraints.

TABLE 6.1: NIAGARA STREET AND WOODLAWN ROAD – SENSITIVITY

| Analysis Period | Scenario | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | Overall |
|-----------------|----------------------|-------|---------------------------------|---------|-------|----------|-----------|---------|-------|----------|------------|---------|-------|----------|------------|---------|-------|----------|---------|
| | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | |
| | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | Total 10 Year | LOS | D | E | > | E | D | E | D | D | C | E | > | E | D | D | > | D | E |
| | | Delay | 45 | 69 | > | 61 | 52 | 57 | 50 | 54 | 24 | 72 | > | 68 | 37 | 37 | > | 37 | 57 |
| | | V/C | 0.77 | 0.87 | > | | 0.78 | 0.58 | 0.12 | | 0.33 | 0.99 | > | | 0.66 | 0.54 | > | | 0.90 |
| AM Peak Hour | Total 10 Year (Sens) | LOS | E | E | > | E | E | D | E | C | C | D | C | C | C | C | C | C | D |
| | | Delay | 77 | 70 | > | 72 | 78 | 55 | 49 | 61 | 21 | 33 | 35 | 33 | 21 | 27 | 26 | 26 | 47 |
| | | V/C | 0.79 | 0.87 | > | | 0.75 | 0.57 | 0.13 | | 0.25 | 0.55 | 0.55 | | 0.38 | 0.33 | 0.23 | | 0.66 |
| PM Peak Hour | Total 10 Year | LOS | E | F | > | F | F | D | F | F | F | > | F | F | F | > | F | F | |
| | | Delay | 70 | 258 | > | 194 | 268 | 58 | 47 | 143 | 82 | 239 | > | 219 | 205 | 312 | > | 295 | 218 |
| | | V/C | 0.96 | 1.41 | > | | 1.45 | 0.74 | 0.17 | | 0.89 | 1.39 | > | | 1.27 | 1.56 | > | | 1.51 |
| PM Peak Hour | Total 10 Year (Sens) | LOS | E | F | > | F | F | D | F | F | E | E | F | F | E | D | E | F | |
| | | Delay | 78 | 125 | > | 109 | 131 | 48 | 41 | 81 | 179 | 63 | 71 | 81 | 115 | 78 | 55 | 79 | 86 |
| | | V/C | 0.84 | 1.11 | > | | 1.09 | 0.60 | 0.19 | | 1.20 | 0.88 | 0.84 | | 1.07 | 1.00 | 0.74 | | 1.13 |
| PM Peak Hour | Total 10 Year (Sens) | Q | 82 | 184 | > | | 146 | 114 | 25 | | 99 | 161 | 156 | | 121 | 230 | 137 | | |

MOE - Measure of Effectiveness
 LOS - Level of Service
 Delay - Average Delay per Vehicle in Seconds
 Q - 95th Percentile Queue Length
 Ex. - Existing Available Storage
 Avail. - Available Storage
 TCS - Traffic Control Signal
 TWSC - Two-Way Stop Control
 AWSC - All-Way Stop Control
 RBT - Roundabout
 < - Shared Left-turn
 > - Shared Right-turn



6.1.2 Niagara Street and Thorold Road

Niagara Street and Thorold Road are forecast to experience critical movements on all approaches, especially during the PM peak hour, due to the high volume of northbound and southbound through traffic on Niagara Street, as well as the volume of southbound right-turns and eastbound left-turns going to and from Thorold Road and Niagara Street.

The overall intersection operations are forecast to be in the LOS F range with a v/c ratio greater than 1.00 during the 2039 Total PM peak hour.

The delay is due to current traffic levels and overall growth, rather than being specifically attributed to the proposed development. Generally, the proposed development is expected to account for 1% of the total traffic at the intersection over the 10-year period.

To mitigate the operations, the following changes are assessed:

- ▶ Adding dual eastbound left and protected phasing; and
- ▶ Adding an exclusive southbound right-turn lane.

Due to the high volume of vehicles on multiple approaches, optimizing signal timings with the existing lane configuration is not expected to have a significant impact on reducing forecasted delays.

The addition of the dual left and exclusive right-turn lane is forecast to improve operations at the intersection.

Overall, the mitigation measures are expected to reduce the overall intersection delay by 70 seconds, with the overall intersection V/C ratio forecasted to decrease from 1.33 to 0.85 during the PM peak hour.

The westbound through/right-turn movement is still forecast to operate at critical levels during the AM and PM peak hours with delays in the LOS E range and v/c ratio between 0.85 and 0.95.

The addition of dual left and exclusive right turn lanes is expected to significantly reduce intersection delays at Niagara Street and Thorold Road. However, the addition of the turn lanes may not be feasible at the intersection due to the right-of-way and physical constraints.



TABLE 6.2: LOS OPERATIONS – NIAGARA STREET AND THOROLD ROAD – SENSITIVITY

| Analysis Period | Scenario | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | Overall |
|-----------------|----------------------|--------------------------|---------------------------------|------------------------|-------|----------|-----------------------|------------------------|-------|----------|-----------------------|-----------------------|-------|----------|-----------------------|-------------------------|-----------------------|----------|------------------|
| | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | |
| | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | Total 10 Year | LOS Delay V/C Q | F 162 1.24 125 | D 48 0.83 123 | > | F 108 | C 26 0.21 14 | E 61 0.89 110 | > | E 56 | B 18 0.45 25 | C 26 0.50 64 | > | C 25 | B 18 0.31 20 | C 30 0.61 73 | > | C 29 | D 55 0.91 |
| | Total 10 Year (Sens) | LOS Delay V/C Q | D 51 0.79 57 | C 29 0.65 79 | > | D 40 | C 27 0.20 11 | D 54 0.85 90 | > | D 50 | C 20 0.39 32 | C 30 0.55 70 | > | C 28 | C 23 0.38 26 | C 30 0.45 56 | C 27 0.23 22 | > | C 28 |
| PM Peak Hour | Total 10 Year | LOS Delay V/C Q | F 266 1.49 160 | D 45 0.78 99 | > | F 177 | C 26 0.40 29 | E 67 0.92 112 | > | E 56 | D 52 0.85 63 | C 31 0.67 94 | > | C 35 | B 19 0.44 26 | F 149 1.24 217 | > | F 137 | F 109 1.33 |
| | Total 10 Year (Sens) | LOS Delay V/C Q | E 65 0.91 78 | C 31 0.60 76 | > | D 51 | C 28 0.39 27 | E 69 0.92 113 | > | E 58 | D 37 0.77 52 | C 32 0.70 92 | > | C 33 | C 22 0.55 28 | C 33 0.70 93 | > | C 31 | D 39 0.85 |

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length

Ex. - Existing Available Storage

Avail. - Available Storage

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

RBT - Roundabout

< - Shared Left-turn

> - Shared Right-turn



7 Conclusions and Recommendations

7.1 Conclusions

Based on the investigations carried out, it is concluded that:

- ▶ **Development Trip Generation:** The subject site is forecast to generate 83 and 81 trips during the AM and PM peak hours, respectively.
- ▶ **Traffic Operations:** Intersection operational analysis under current and future traffic conditions indicates the following:
 - Base Year (2025): Localized congestion occurs at the Niagara Street at Woodlawn Road intersection and Niagara Street at Thorold Road intersection during the PM peak hour with overall intersection delay in the LOS D-F range and v/c ratios between 0.89 and 0.92.
 - Future Horizons (2028, 2033, 2038): Under background conditions, the Niagara Street at Woodlawn Road intersection and Niagara Street at Thorold Road intersection are forecast to experience additional critical movements, particularly in the PM peak hour. Overall, intersection delay at these intersections is in the LOS F range, with delays forecasted to exceed 100 seconds. The overall intersection v/c is forecast to be over 1.00 for both intersections.
- ▶ **Development Impacts:** The subject development is forecast to have minimal impact on the study area road system and intersections. Delays are generally not expected to increase significantly with the addition of site traffic; the exception is when movements are forecast to operate at/near capacity under background conditions.

The proposed site access is forecast to operate at LOS C or better during the peak hours.

- ▶ **Mitigation Measures:** Potential mitigation measures could include:
 - Niagara Street and Woodlawn Road
 - Adding dual eastbound left turn and protected phasing;
 - Adding dual westbound left-turn and protected phasing;
 - Adding an exclusive northbound right-turn lane; and
 - Adding an exclusive southbound right-turn lane.



- Niagara Street and Thorold Road
 - Adding dual eastbound left and protected phasing; and
 - Adding an exclusive southbound right-turn lane.

Although the dual left and exclusive right turn lanes are expected to significantly reduce intersection delays, the addition of the turn lanes may not be feasible at the intersections due to right-of-way and physical constraints.

7.2 Recommendations

Based on the findings of this study, the following is recommended:

- ▶ The City and Region recognize the traffic findings above.
- ▶ The City and Region review the feasibility of providing dual left and exclusive right turn lanes for the Niagara Street at Woodlawn Road intersection and the Niagara Street at Thorold Road intersection.



Appendix A

Terms of Reference



Greg Lue

From: Adam Makarewicz
Sent: July 10, 2025 2:13 PM
To: Greg Lue
Subject: FW: 250351 - 694/698 Niagara Street, Welland - TIS - Terms of Reference
Attachments: Q-250351 694-698 Niagara St, Welland, TIA (Proposal).pdf; 698 Niagara - Conceptual Plans - Option C - 2025-04-04.pdf

Hey Greg,

Here is a new project for you out in Welland. See below the comments from the City/Region on the TOR.

Previous studies are in the data folder on SharePoint.

Thanks,

Adam J. Makarewicz, C.E.T., LET, RSP1
Senior Project Manager, Associate



5A-150 Pinebush Road, Cambridge ON, N1R 8J8
p: 519.497.7179 (direct)
p: 905.381.2229 x303
e: amakarewicz@ptsl.com
w: www.ptsl.com

This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this email in error, please notify the sender immediately. Please note that any views or opinions presented in this email are solely those of the author and do not necessarily represent those of Paradigm Transportation Solutions Limited. Finally, the recipient should check this email and any attachments for the presence of viruses. Paradigm Transportation Solutions Limited accepts no liability for any damage caused by any virus transmitted by this email.

From: Adam Makarewicz
Sent: July 10, 2025 2:03 PM
To: Wilson, Josh <Josh.Wilson@niagararegion.ca>
Cc: Ali Khan <ali.khan@welland.ca>
Subject: RE: 250351 - 694/698 Niagara Street, Welland - TIS - Terms of Reference

Very helpful. Thank you!

Thanks,

Adam J. Makarewicz, C.E.T., LET, RSP1
Senior Project Manager, Associate



5A-150 Pinebush Road, Cambridge ON, N1R 8J8
 p: 519.497.7179 (direct)
 p: 905.381.2229 x303
 e: amakarewicz@ptsl.com
 w: www.ptsl.com

This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this email in error, please notify the sender immediately. Please note that any views or opinions presented in this email are solely those of the author and do not necessarily represent those of Paradigm Transportation Solutions Limited. Finally, the recipient should check this email and any attachments for the presence of viruses. Paradigm Transportation Solutions Limited accepts no liability for any damage caused by any virus transmitted by this email.

From: Wilson, Josh <Josh.Wilson@niagararegion.ca>
Sent: July 10, 2025 2:00 PM
To: Adam Makarewicz <amakarewicz@ptsl.com>
Cc: Ali Khan <ali.khan@welland.ca>
Subject: FW: 250351 - 694/698 Niagara Street, Welland - TIS - Terms of Reference

Hi Adam,

Region Transportation staff have added comments below in green (further to Ali's request in red).

Should any design improvements be identified at regional roads/intersections, functional design drawings would be required for review and approval. Requests for regional traffic data can be made online: <https://www.niagararegion.ca/living/roads/permits/traffic-data-requests.aspx>

Thanks

Josh Wilson, P.Eng
 905-980-6000 ext. 3336
 Mobile: 289-668-2971



From: Adam Makarewicz <amakarewicz@ptsl.com>
Sent: Tuesday, July 8, 2025 10:20 AM
To: Ali Khan <ali.khan@welland.ca>; Wilson, Josh <Josh.Wilson@niagararegion.ca>
Subject: 250351 - 694/698 Niagara Street, Welland - TIS - Terms of Reference

Niagara Region Security Warning:

This is an external email, use caution when opening attachments or clicking links

Hi Ali and Josh,

We've been retained to complete a traffic study for a residential development located on the east side of Niagara Street and south of Woodlawn Road; municipal address 698 Niagara Street in the City of Welland. The applicant proposes constructing a condominium development consisting of 218 units and 148 parking spaces. Vehicle access is proposed to be provided through a driveway connection to Niagara Street. We

understand the City has requested a transportation impact assessment as part of the development application. This assessment must include traffic projections from the neighbouring developments located at 418-430 Aqueduct Road and 650-678 Niagara Street.

Would the following work plan be acceptable to the city and Region to satisfy the traffic study requirements?

- Study Area
 - Niagara Street at Woodlawn Road
 - Niagara Street at Aqueduct Street
 - Niagara Street at Rogers Drive
 - One new Site Driveway
 - Niagara Street at Abbey Road
 - Niagara Street at Thorold Rd
- Existing Data
 - We will utilize October 2023 and May 2024 traffic data as contained in the 670 Niagara Street TIS.
If you require Regional transportation data please submit a request through the Regional website using the following link: <https://www.niagararegion.ca/living/roads/permits/traffic-data-requests.aspx>
 - Counts will be adjusted to represent 2025 volumes based on a 1% annual growth rate.
- Peak Hours
 - Weekday AM
 - Weekday PM
- Horizon Years
 - Existing Year (2025 or year of the analysis)
 - At Build-Out
 - 5 Years After Build-Out (Note: If the development will be built in multiple phases, the study should include capacity analysis at the end of each phase, additional to the ultimate buildout year and the 5 years after buildout)
 - 10 Years After Build-Out
- Analysis
 - Synchro 11.
 - HCM 2000
 - Note: The Consultant to follow Niagara Region Guidelines for TIA (2023) for traffic analysis software settings, intersections capacity thresholds and other requirements.
- Background Traffic
 - Generalized growth rate of 1% per annum. A 2% compound annual growth rate is suitable for projecting background traffic volumes into a future planning horizon.
 - Background Development Traffic from 418-430 Aqueduct Rd and 650-678 Niagara Street
- Site Traffic Estimates
 - ITE Trip Generation Data 11th Edition
 - No modal split reductions
- Site Traffic Distribution
 - TTS Data
 - Existing travel patterns for local distribution (i.e. within Welland)

Thanks,

Adam J. Makarewicz, C.E.T., LET

Senior Project Manager, Associate



5A-150 Pinebush Road, Cambridge ON, N1R 8J8

p: 519.497.7179 (direct)

p: 905.381.2229 x303

e: amakarewicz@ptsl.com

w: www.ptsl.com

This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this email in error, please notify the sender immediately. Please note that any views or opinions presented in this email are solely those of the author and do not necessarily represent those of Paradigm Transportation Solutions Limited. Finally, the recipient should check this email and any attachments for the presence of viruses. Paradigm Transportation Solutions Limited accepts no liability for any damage caused by any virus transmitted by this email.

This e-mail and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this e-mail in error please notify the sender immediately. Please note that any views or opinions presented in this e-mail are solely those of the author and do not necessarily represent those of Paradigm Transportation Solutions Limited. Finally, the recipient should check this e-mail and any attachments for the presence of viruses. Paradigm Transportation Solutions Limited accepts no liability for any damage caused by any virus transmitted by this e-mail.

The Regional Municipality of Niagara Confidentiality Notice The information contained in this communication including any attachments may be confidential, is intended only for the use of the recipient(s) named above, and may be legally privileged. If the reader of this message is not the intended recipient, you are hereby notified that any dissemination, distribution, disclosure, or copying of this communication, or any of its contents, is strictly prohibited. If you have received this communication in error, please re-send this communication to the sender and permanently delete the original and any copy of it from your computer system. Thank you.

Appendix B

Existing Traffic Data



Niagara St @ Roger Dr

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 8:00:00

To: 9:00:00

Municipality: Welland
Site #: 000000002
Intersection: Niagara St & Roger Dr
TFR File #: 2
Count date: 23-Apr-2024

Weather conditions:
 Cloudy/Dry
Person(s) who counted:
 Pyramid Traffic Inc

**** Non-Signalized Intersection ****

Major Road: Niagara St runs N/S

North Leg Total: 1093
 North Entering: 464
 North Peds: 1
 Peds Cross: \times

| | | | | |
|---------------|-----------|------------|----------|-----|
| Heavys | 2 | 20 | 0 | 22 |
| Trucks | 0 | 0 | 0 | 0 |
| Cars | 61 | 380 | 1 | 442 |
| Totals | 63 | 400 | 1 | |



| | |
|---------------|------------|
| Heavys | 14 |
| Trucks | 0 |
| Cars | 615 |
| Totals | 629 |

East Leg Total: 11
 East Entering: 2
 East Peds: 4
 Peds Cross: \times

| | | | |
|--------|--------|------|--------|
| Heavys | Trucks | Cars | Totals |
| 2 | 0 | 96 | 98 |

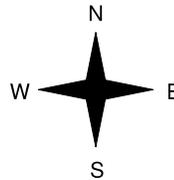


Niagara St

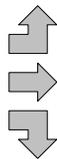
| | | | |
|----------|----------|----------|--------|
| Cars | Trucks | Heavys | Totals |
| 1 | 0 | 0 | 1 |
| 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 |
| 2 | 0 | 0 | |



Roger Dr



| | | | |
|----------|----------|-----------|--------|
| Heavys | Trucks | Cars | Totals |
| 0 | 0 | 16 | 16 |
| 0 | 0 | 0 | 0 |
| 1 | 0 | 30 | 31 |
| 1 | 0 | 46 | |



Driveway



| | | | |
|------|--------|--------|--------|
| Cars | Trucks | Heavys | Totals |
| 9 | 0 | 0 | 9 |

| | | | |
|------|--------|--------|--------|
| Cars | Trucks | Heavys | Totals |
| 9 | 0 | 0 | 9 |

Peds Cross: \times
 West Peds: 6
 West Entering: 47
 West Leg Total: 145

| | | | | | | |
|---------------|------------|---------------|-----------|------------|----------|-----|
| Cars | 411 | Cars | 35 | 598 | 8 | 641 |
| Trucks | 0 | Trucks | 0 | 0 | 0 | 0 |
| Heavys | 21 | Heavys | 0 | 14 | 0 | 14 |
| Totals | 432 | Totals | 35 | 612 | 8 | |



Peds Cross: \times
 South Peds: 0
 South Entering: 655
 South Leg Total: 1087

Comments

Niagara St @ Roger Dr

Afternoon Peak Diagram

Specified Period

From: 16:00:00

To: 18:00:00

One Hour Peak

From: 16:00:00

To: 17:00:00

Municipality: Welland
Site #: 000000002
Intersection: Niagara St & Roger Dr
TFR File #: 2
Count date: 23-Apr-2024

Weather conditions:
 Cloudy/Dry
Person(s) who counted:
 Pyramid Traffic Inc

**** Non-Signalized Intersection ****

Major Road: Niagara St runs N/S

North Leg Total: 1732
 North Entering: 961
 North Peds: 2
 Peds Cross: \times

| | | | | |
|---------------|-----------|------------|-----------|-----|
| Heavys | 0 | 10 | 0 | 10 |
| Trucks | 0 | 0 | 0 | 0 |
| Cars | 68 | 869 | 14 | 951 |
| Totals | 68 | 879 | 14 | |



| | |
|---------------|------------|
| Heavys | 11 |
| Trucks | 0 |
| Cars | 760 |
| Totals | 771 |

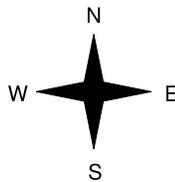
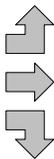
East Leg Total: 77
 East Entering: 37
 East Peds: 7
 Peds Cross: \times

| | | | | |
|--------|---|---|-----|-----|
| Heavys | 0 | 0 | 108 | 108 |
|--------|---|---|-----|-----|



Roger Dr

| | | | | |
|---------------|----------|----------|-----------|----|
| Heavys | 0 | 0 | 21 | 21 |
| Trucks | 0 | 0 | 3 | 3 |
| Cars | 0 | 0 | 36 | 36 |
| Totals | 0 | 0 | 60 | |



Niagara St

| | | | | |
|---------------|-----------|----------|----------|----|
| Cars | 18 | 0 | 0 | 18 |
| Trucks | 2 | 0 | 0 | 2 |
| Heavys | 17 | 0 | 0 | 17 |
| Totals | 37 | 0 | 0 | |

Driveway



| | | | | |
|------|----|---|---|----|
| Cars | 40 | 0 | 0 | 40 |
|------|----|---|---|----|

Peds Cross: \times
 West Peds: 8
 West Entering: 60
 West Leg Total: 168

| | | | | | |
|---------------|------------|-----------|------------|-----------|-----|
| Cars | 922 | 38 | 721 | 23 | 782 |
| Trucks | 0 | 0 | 0 | 0 | 0 |
| Heavys | 10 | 0 | 11 | 0 | 11 |
| Totals | 932 | 38 | 732 | 23 | |



Peds Cross: \times
 South Peds: 1
 South Entering: 793
 South Leg Total: 1725

Comments

Niagara St @ Woodlawn Rd

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 8:00:00

To: 9:00:00

Municipality: Welland
Site #: 000000001
Intersection: Niagara St & Woodlawn Rd
TFR File #: 1
Count date: 4-Oct-2023

Weather conditions:
 Clear/Dry
Person(s) who counted:
 Cam

**** Signalized Intersection ****

Major Road: Niagara St runs N/S

North Leg Total: 1278
 North Entering: 512
 North Peds: 9
 Peds Cross: \times

| | | | | |
|---------------|------------|------------|-----------|-----|
| Heavys | 8 | 9 | 6 | 23 |
| Trucks | 2 | 2 | 1 | 5 |
| Cars | 122 | 284 | 78 | 484 |
| Totals | 132 | 295 | 85 | |



| | |
|---------------|------------|
| Heavys | 22 |
| Trucks | 5 |
| Cars | 739 |
| Totals | 766 |

East Leg Total: 1170
 East Entering: 539
 East Peds: 5
 Peds Cross: \times

| | | | |
|--------|--------|------|--------|
| Heavys | Trucks | Cars | Totals |
| 18 | 3 | 461 | 482 |

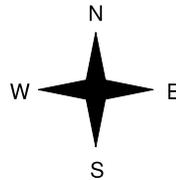


Niagara St

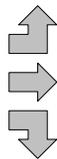
| | | | |
|------------|----------|-----------|--------|
| Cars | Trucks | Heavys | Totals |
| 102 | 2 | 3 | 107 |
| 286 | 0 | 10 | 296 |
| 130 | 4 | 2 | 136 |
| 518 | 6 | 15 | |



Woodlawn Rd



| | | | |
|-----------|----------|------------|--------|
| Heavys | Trucks | Cars | Totals |
| 5 | 0 | 205 | 210 |
| 10 | 3 | 321 | 334 |
| 4 | 1 | 66 | 71 |
| 19 | 4 | 592 | |



Woodlawn Rd



Niagara St



| | | | |
|------|--------|--------|--------|
| Cars | Trucks | Heavys | Totals |
| 606 | 5 | 20 | 631 |

Peds Cross: \times
 West Peds: 3
 West Entering: 615
 West Leg Total: 1097

| | | | | | | |
|---------------|------------|---------------|-----------|------------|------------|-----|
| Cars | 480 | Cars | 53 | 432 | 207 | 692 |
| Trucks | 7 | Trucks | 1 | 3 | 1 | 5 |
| Heavys | 15 | Heavys | 0 | 14 | 4 | 18 |
| Totals | 502 | Totals | 54 | 449 | 212 | |



Peds Cross: \times
 South Peds: 5
 South Entering: 715
 South Leg Total: 1217

Comments

Niagara St @ Woodlawn Rd

Afternoon Peak Diagram

Specified Period

From: 16:00:00

To: 18:00:00

One Hour Peak

From: 16:15:00

To: 17:15:00

Municipality: Welland
Site #: 000000001
Intersection: Niagara St & Woodlawn Rd
TFR File #: 1
Count date: 4-Oct-2023

Weather conditions:
 Clear/Dry
Person(s) who counted:
 Cam

**** Signalized Intersection ****

Major Road: Niagara St runs N/S

North Leg Total: 2064
 North Entering: 1133
 North Peds: 25
 Peds Cross: \times

| | | | | |
|---------------|------------|------------|------------|------|
| Heavys | 1 | 5 | 5 | 11 |
| Trucks | 0 | 3 | 0 | 3 |
| Cars | 273 | 668 | 178 | 1119 |
| Totals | 274 | 676 | 183 | |



| | |
|---------------|------------|
| Heavys | 10 |
| Trucks | 7 |
| Cars | 914 |
| Totals | 931 |

East Leg Total: 1679
 East Entering: 868
 East Peds: 44
 Peds Cross: \times

| | | | |
|--------|--------|------|--------|
| Heavys | Trucks | Cars | Totals |
| 7 | 0 | 799 | 806 |



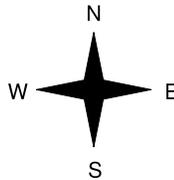
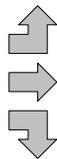
Niagara St

| | | | |
|------------|----------|----------|--------|
| Cars | Trucks | Heavys | Totals |
| 139 | 1 | 2 | 142 |
| 419 | 0 | 6 | 425 |
| 299 | 1 | 1 | 301 |
| 857 | 2 | 9 | |



Woodlawn Rd

| | | | |
|-----------|----------|------------|--------|
| Heavys | Trucks | Cars | Totals |
| 2 | 1 | 267 | 270 |
| 7 | 1 | 384 | 392 |
| 4 | 1 | 92 | 97 |
| 13 | 3 | 743 | |



Niagara St



| | | | |
|------|--------|--------|--------|
| Cars | Trucks | Heavys | Totals |
| 792 | 4 | 15 | 811 |



Peds Cross: \times
 West Peds: 19
 West Entering: 759
 West Leg Total: 1565

| | | | | | | |
|---------------|-------------|---------------|------------|------------|------------|-----|
| Cars | 1059 | Cars | 107 | 508 | 230 | 845 |
| Trucks | 5 | Trucks | 0 | 5 | 3 | 8 |
| Heavys | 10 | Heavys | 0 | 6 | 3 | 9 |
| Totals | 1074 | Totals | 107 | 519 | 236 | |



Peds Cross: \times
 South Peds: 19
 South Entering: 862
 South Leg Total: 1936

Comments

Niagara St @ Abbey Rd

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 7:45:00

To: 8:45:00

Municipality: Welland
Site #: 0000000002
Intersection: Niagara St & Abbey Rd
TFR File #: 2
Count date: 4-Oct-2023

Weather conditions:
 Clear/Dry
Person(s) who counted:
 Cam

**** Non-Signalized Intersection ****

Major Road: Niagara St runs N/S

North Leg Total: 1277
 North Entering: 573
 North Peds: 0
 Peds Cross: ∇

| | | | |
|--------|---|-----|-----|
| Heavys | 0 | 18 | 18 |
| Trucks | 0 | 6 | 6 |
| Cars | 3 | 546 | 549 |
| Totals | 3 | 570 | |

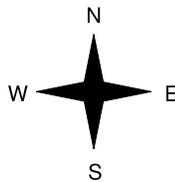
| | |
|--------|-----|
| Heavys | 21 |
| Trucks | 2 |
| Cars | 681 |
| Totals | 704 |

| | | | |
|--------|--------|------|--------|
| Heavys | Trucks | Cars | Totals |
| 0 | 0 | 13 | 13 |



Abbey Rd

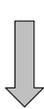
| | | | |
|--------|--------|------|--------|
| Heavys | Trucks | Cars | Totals |
| 0 | 0 | 3 | 3 |
| 0 | 2 | 15 | 17 |
| 0 | 2 | 18 | |



Niagara St

Peds Cross: ∇
 West Peds: 5
 West Entering: 20
 West Leg Total: 33

| | |
|--------|-----|
| Cars | 561 |
| Trucks | 8 |
| Heavys | 18 |
| Totals | 587 |



| | | | |
|--------|----|-----|-----|
| Cars | 10 | 678 | 688 |
| Trucks | 0 | 2 | 2 |
| Heavys | 0 | 21 | 21 |
| Totals | 10 | 701 | |

Peds Cross: ∇
 South Peds: 0
 South Entering: 711
 South Leg Total: 1298

Comments

Niagara St @ Abbey Rd

Afternoon Peak Diagram

Specified Period

From: 16:00:00

To: 18:00:00

One Hour Peak

From: 16:15:00

To: 17:15:00

Municipality: Welland
Site #: 000000002
Intersection: Niagara St & Abbey Rd
TFR File #: 2
Count date: 4-Oct-2023

Weather conditions:
 Clear/Dry
Person(s) who counted:
 Cam

**** Non-Signalized Intersection ****

Major Road: Niagara St runs N/S

North Leg Total: 1931
 North Entering: 1074
 North Peds: 0
 Peds Cross: ∇

| | | | |
|--------|----|------|--|
| Heavys | 0 | 10 | |
| Trucks | 0 | 5 | |
| Cars | 27 | 1032 | |
| Totals | 27 | 1047 | |

10
5
1059



| | |
|--------|-----|
| Heavys | 9 |
| Trucks | 9 |
| Cars | 839 |
| Totals | 857 |

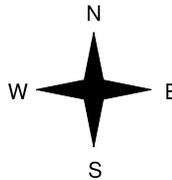
| | | | |
|--------|--------|------|--------|
| Heavys | Trucks | Cars | Totals |
| 0 | 0 | 36 | 36 |



Niagara St



Abbey Rd



| | | | |
|--------|--------|------|--------|
| Heavys | Trucks | Cars | Totals |
| 0 | 0 | 9 | 9 |
| 0 | 0 | 23 | 23 |
| 0 | 0 | 32 | |



Niagara St

Peds Cross: ∇
 West Peds: 19
 West Entering: 32
 West Leg Total: 68

| | |
|--------|------|
| Cars | 1055 |
| Trucks | 5 |
| Heavys | 10 |
| Totals | 1070 |



| | | | |
|--------|---|-----|-----|
| Cars | 9 | 830 | 839 |
| Trucks | 0 | 9 | 9 |
| Heavys | 0 | 9 | 9 |
| Totals | 9 | 848 | |

Peds Cross: ∇
 South Peds: 0
 South Entering: 857
 South Leg Total: 1927

Comments

Niagara St @ Aqueduct St

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 7:45:00

To: 8:45:00

Municipality: Welland
Site #: 000000003
Intersection: Niagara St & Aqueduct St
TFR File #: 3
Count date: 4-Oct-2023

Weather conditions:
Clear/Dry
Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Niagara St runs N/S

North Leg Total: 1295
 North Entering: 573
 North Peds: 2
 Peds Cross: \times

| | | | | |
|---------------|-----------|------------|-----------|-----|
| Heavys | 0 | 17 | 1 | 18 |
| Trucks | 0 | 10 | 0 | 10 |
| Cars | 58 | 391 | 96 | 545 |
| Totals | 58 | 418 | 97 | |



| | |
|---------------|------------|
| Heavys | 20 |
| Trucks | 4 |
| Cars | 698 |
| Totals | 722 |

East Leg Total: 258
 East Entering: 150
 East Peds: 2
 Peds Cross: \times

| | |
|---------------|-----------|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 99 |
| Totals | 99 |

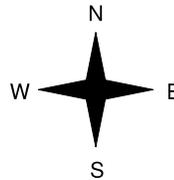


Niagara St

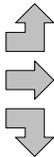
| | | | | | | | |
|---------------|------------|----------|----------|--------|---|---------------|------------|
| Cars | 129 | Trucks | 1 | Heavys | 2 | Totals | 132 |
| | 9 | | 0 | | 0 | | 9 |
| | 9 | | 0 | | 0 | | 9 |
| Totals | 147 | 1 | 2 | | | | |



Driveway



| | |
|---------------|-----------|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 51 |
| Totals | 51 |
| | 3 |
| | 41 |
| Totals | 95 |



Aqueduct St



Peds Cross: \times
 West Peds: 4
 West Entering: 95
 West Leg Total: 194

| | | | | | | |
|---------------|------------|---------------|-----------|------------|----------|------------|
| Cars | 441 | Cars | 32 | 518 | 8 | 558 |
| Trucks | 10 | Trucks | 0 | 3 | 0 | 3 |
| Heavys | 17 | Heavys | 0 | 18 | 0 | 18 |
| Totals | 468 | Totals | 32 | 539 | 8 | |



Niagara St



Peds Cross: \times
 South Peds: 2
 South Entering: 579
 South Leg Total: 1047

Comments

Niagara St @ Aqueduct St

Afternoon Peak Diagram

Specified Period

From: 16:00:00

To: 18:00:00

One Hour Peak

From: 16:15:00

To: 17:15:00

Municipality: Welland
Site #: 000000003
Intersection: Niagara St & Aqueduct St
TFR File #: 3
Count date: 4-Oct-2023

Weather conditions:
 Clear/Dry
Person(s) who counted:
 Cam

**** Signalized Intersection ****

Major Road: Niagara St runs N/S

North Leg Total: 1922
 North Entering: 1066
 North Peds: 2
 Peds Cross: \times

| | | | | |
|---------------|-----------|------------|-----------|------|
| Heavys | 0 | 8 | 0 | 8 |
| Trucks | 0 | 7 | 0 | 7 |
| Cars | 44 | 925 | 82 | 1051 |
| Totals | 44 | 940 | 82 | |



| | |
|---------------|------------|
| Heavys | 7 |
| Trucks | 9 |
| Cars | 840 |
| Totals | 856 |

East Leg Total: 178
 East Entering: 77
 East Peds: 14
 Peds Cross: \times

| | | | |
|--------|--------|------|--------|
| Heavys | Trucks | Cars | Totals |
| 0 | 0 | 79 | 79 |

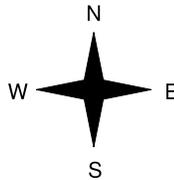


Niagara St

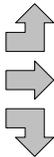
| | | | |
|-----------|----------|----------|--------|
| Cars | Trucks | Heavys | Totals |
| 63 | 0 | 0 | 63 |
| 2 | 0 | 0 | 2 |
| 12 | 0 | 0 | 12 |
| 77 | 0 | 0 | |



Driveway



| | | | |
|--------|--------|------|--------|
| Heavys | Trucks | Cars | Totals |
| 0 | 0 | 37 | 37 |
| 0 | 0 | 1 | 1 |
| 0 | 0 | 35 | 35 |
| 0 | 0 | 73 | |



Aqueduct St



| | | | |
|------|--------|--------|--------|
| Cars | Trucks | Heavys | Totals |
| 101 | 0 | 0 | 101 |



Niagara St

Peds Cross: \times
 West Peds: 12
 West Entering: 73
 West Leg Total: 152

| | | | | | | |
|---------------|------------|---------------|-----------|------------|-----------|-----|
| Cars | 972 | Cars | 33 | 740 | 18 | 791 |
| Trucks | 7 | Trucks | 0 | 9 | 0 | 9 |
| Heavys | 8 | Heavys | 0 | 7 | 0 | 7 |
| Totals | 987 | Totals | 33 | 756 | 18 | |



Peds Cross: \times
 South Peds: 6
 South Entering: 807
 South Leg Total: 1794

Comments

Niagara St @ Thorold Rd

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 7:45:00

To: 8:45:00

Municipality: Welland
Site #: 000000004
Intersection: Niagara St & Thorold Rd
TFR File #: 4
Count date: 4-Oct-2023

Weather conditions:
Clear/Dry
Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Niagara St runs N/S

North Leg Total: 1122
 North Entering: 482
 North Peds: 13
 Peds Cross: \times

| | | | | |
|---------------|------------|------------|-----------|-----|
| Heavys | 3 | 5 | 8 | 16 |
| Trucks | 4 | 3 | 1 | 8 |
| Cars | 171 | 230 | 57 | 458 |
| Totals | 178 | 238 | 66 | |



| | |
|---------------|------------|
| Heavys | 18 |
| Trucks | 3 |
| Cars | 619 |
| Totals | 640 |

East Leg Total: 497
 East Entering: 246
 East Peds: 5
 Peds Cross: \times

| | | | |
|--------|--------|------|--------|
| Heavys | Trucks | Cars | Totals |
| 22 | 5 | 350 | 377 |

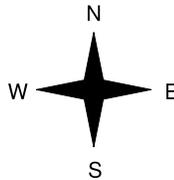


Niagara St

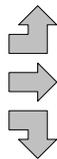
| | | | |
|------------|----------|-----------|--------|
| Cars | Trucks | Heavys | Totals |
| 88 | 1 | 6 | 95 |
| 108 | 0 | 8 | 116 |
| 31 | 1 | 3 | 35 |
| 227 | 2 | 17 | |



Thorold Rd



| | | | |
|-----------|----------|------------|--------|
| Heavys | Trucks | Cars | Totals |
| 4 | 2 | 248 | 254 |
| 18 | 0 | 127 | 145 |
| 8 | 1 | 74 | 83 |
| 30 | 3 | 449 | |



Thorold Rd



Peds Cross: \times
 West Peds: 8
 West Entering: 482
 West Leg Total: 859

| | | | | | | |
|---------------|------------|---------------|-----------|------------|-----------|-----|
| Cars | 335 | Cars | 71 | 283 | 27 | 381 |
| Trucks | 5 | Trucks | 1 | 0 | 2 | 3 |
| Heavys | 16 | Heavys | 11 | 8 | 11 | 30 |
| Totals | 356 | Totals | 83 | 291 | 40 | |



Niagara St



Peds Cross: \times
 South Peds: 8
 South Entering: 414
 South Leg Total: 770

Comments

Niagara St @ Thorold Rd

Afternoon Peak Diagram

Specified Period

From: 16:00:00

To: 18:00:00

One Hour Peak

From: 16:15:00

To: 17:15:00

Municipality: Welland
Site #: 000000004
Intersection: Niagara St & Thorold Rd
TFR File #: 4
Count date: 4-Oct-2023

Weather conditions:
 Clear/Dry
Person(s) who counted:
 Cam

**** Signalized Intersection ****

Major Road: Niagara St runs N/S

North Leg Total: 1777
 North Entering: 975
 North Peds: 11
 Peds Cross: \times

| | | | | |
|---------------|------------|------------|-----------|-----|
| Heavys | 3 | 2 | 3 | 8 |
| Trucks | 1 | 3 | 3 | 7 |
| Cars | 398 | 478 | 84 | 960 |
| Totals | 402 | 483 | 90 | |



| | |
|---------------|------------|
| Heavys | 10 |
| Trucks | 7 |
| Cars | 785 |
| Totals | 802 |

East Leg Total: 595
 East Entering: 315
 East Peds: 11
 Peds Cross: \times

| | | | |
|--------|--------|------|--------|
| Heavys | Trucks | Cars | Totals |
| 14 | 1 | 653 | 668 |

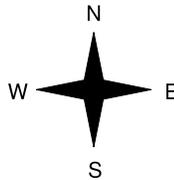


Niagara St

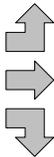
| | | | |
|------------|----------|----------|--------|
| Cars | Trucks | Heavys | Totals |
| 83 | 3 | 2 | 88 |
| 138 | 0 | 1 | 139 |
| 88 | 0 | 0 | 88 |
| 309 | 3 | 3 | |



Thorold Rd



| | | | |
|-----------|----------|------------|--------|
| Heavys | Trucks | Cars | Totals |
| 3 | 3 | 294 | 300 |
| 2 | 0 | 133 | 135 |
| 6 | 0 | 67 | 73 |
| 11 | 3 | 494 | |



Thorold Rd



| | | | |
|------|--------|--------|--------|
| Cars | Trucks | Heavys | Totals |
| 271 | 3 | 6 | 280 |

Peds Cross: \times
 West Peds: 12
 West Entering: 508
 West Leg Total: 1176

| | | | | | | |
|---------------|------------|---------------|------------|------------|-----------|-----|
| Cars | 633 | Cars | 117 | 408 | 54 | 579 |
| Trucks | 3 | Trucks | 0 | 1 | 0 | 1 |
| Heavys | 8 | Heavys | 10 | 5 | 1 | 16 |
| Totals | 644 | Totals | 127 | 414 | 55 | |



Peds Cross: \times
 South Peds: 18
 South Entering: 596
 South Leg Total: 1240

Comments

Signal Code: 041050**Intersection: RR41 (WOODLAWN RD) & RR50 (NIAGARA ST)****Municipality: welland****Owner: region****Last Modified: 2023-10-27 3:14:57 PM**

| Timing Parameters | NBD & SBD ADVANCE NIAGARA ST. | NBD & SBD NIAGARA ST. | WBD & EBD ADVANCE WOODLAWN RD. | EBD & WBD WOODLAWN RD. | n/a | n/a |
|--------------------------|--|--|---|---|------------|------------|
| Min Green | 6 | 10 | 6 | 8 | 0 | 0 |
| Walk | 0 | 12 | 0 | 12 | 0 | 0 |
| Ped Clearance | 0 | 20 | 0 | 20 | 0 | 0 |
| Vehicle Ext. | 2.6 | 2.5 | 2.6 | 2.5 | 0 | 0 |
| Max Green | 17 | 50 | 35 | 35 | 0 | 0 |
| Yellow | 3 | 4.1 | 3 | 4.1 | 0 | 0 |
| All Red | 0 | 3.2 | 0 | 3.3 | 0 | 0 |

Offset

| | | |
|-------------------------|-------|---|
| Minimum Cycle | 32.7 | 0 |
| Pedestrian Cycle | 78.7 | |
| Maximum Cycle | 157.7 | 0 |
| Operation | FA | |

Installed On: 2011-08-02

Count Date: 2010-06-29

FA = Fully Actuated

SA = Semi Actuated

FT = Fixed Time

Copyright 2001 © Regional Niagara

Signal Code: 050AQU**Intersection: RR50 (NIAGARA ST.) & AQUEDUCT ST.****Municipality: welland****Owner: region****Last Modified: 2020-07-14 12:48:24 PM**

| Timing Parameters | NBD & SBD THRU NIAGARA ST. | EBD & WBD THRU MCDONALDS / AQUEDUCT ST. | n/a | n/a | n/a | n/a |
|--------------------------|---------------------------------------|--|------------|------------|------------|------------|
| Min Green | 10 | 8 | 0 | 0 | 0 | 0 |
| Walk | 12 | 12 | 0 | 0 | 0 | 0 |
| Ped Clearance | 18 | 18 | 0 | 0 | 0 | 0 |
| Vehicle Ext. | 3 | 4 | 0 | 0 | 0 | 0 |
| Max Green | 45 | 25 | 0 | 0 | 0 | 0 |
| Yellow | 4.1 | 4.1 | 0 | 0 | 0 | 0 |
| All Red | 3 | 3 | 0 | 0 | 0 | 0 |

Offset

| | | |
|-------------------------|------|---|
| Minimum Cycle | 32.2 | 0 |
| Pedestrian Cycle | 74.2 | |
| Maximum Cycle | 84.2 | 0 |
| Operation | FA | |

Installed On: 2010-06-14

Count Date: 2009-09-03

FA = Fully Actuated

SA = Semi Actuated

FT = Fixed Time

Copyright 2001 © Regional Niagara

Signal Code: 050THR**Intersection: RR50(NIAGARA ST.) & THOROLD RD.****Municipality: welland****Owner: Region****Last Modified: 2023-10-30 3:29:52 PM**

| Timing Parameters | NBD & SBD ADV. NIAGARA ST. | NBD & SBD THRU NIAGARA ST. | EBD & WBD ADV THOROLD RD. | EBD & WBD THRU THOROLD RD. | n/a | n/a |
|--------------------------|---|---|--|---|------------|------------|
| Min Green | 5 | 8 | 5 | 8 | 0 | 0 |
| Walk | 0 | 9 | 0 | 10 | 0 | 0 |
| Ped Clearance | 0 | 15 | 0 | 17 | 0 | 0 |
| Vehicle Ext. | 2.5 | 2.1 | 2.5 | 2.2 | 0 | 0 |
| Max Green | 12 | 35 | 12 | 27 | 0 | 0 |
| Yellow | 3 | 4.1 | 3 | 4.1 | 0 | 0 |
| All Red | 0 | 2.2 | 0 | 2.4 | 0 | 0 |

Offset

| | | |
|-------------------------|-------|---|
| Minimum Cycle | 28.8 | 0 |
| Pedestrian Cycle | 63.8 | |
| Maximum Cycle | 104.8 | 0 |
| Operation | FA | |

Installed On: 2010-06-11

Count Date: 2009-04-06

FA = Fully Actuated

SA = Semi Actuated

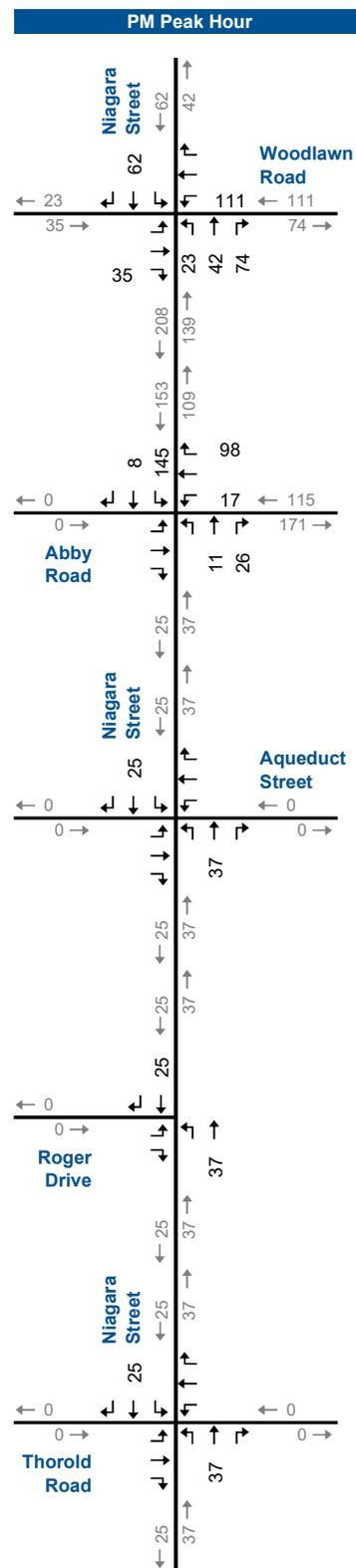
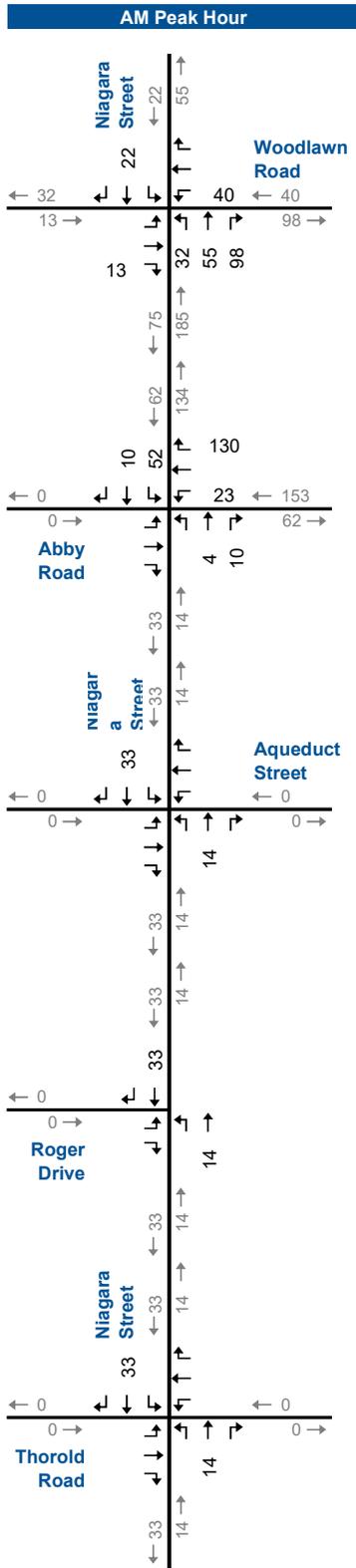
FT = Fixed Time

Copyright 2001 © Regional Niagara

Appendix C

Background Development Traffic





NTS



670 Niagara Street Traffic Volumes

Appendix D

Synchro Reports



Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Base
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 218 | 347 | 74 | 141 | 308 | 111 | 56 | 467 | 221 | 88 | 307 | 137 |
| Future Volume (vph) | 218 | 347 | 74 | 141 | 308 | 111 | 56 | 467 | 221 | 88 | 307 | 137 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 1.00 | | 1.00 | | 0.97 | 1.00 | 0.99 | | 1.00 | 0.99 | |
| Frt | | 0.973 | | | | 0.850 | | 0.952 | | | 0.954 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 2727 | 0 | 1508 | 3276 | 1224 | 1553 | 2687 | 0 | 1452 | 2656 | 0 |
| Flt Permitted | 0.358 | | | 0.392 | | | 0.485 | | | 0.317 | | |
| Satd. Flow (perm) | 575 | 2727 | 0 | 620 | 3276 | 1194 | 791 | 2687 | 0 | 484 | 2656 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 15 | | | | 113 | | 52 | | | 48 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Adj. Flow (vph) | 222 | 354 | 76 | 144 | 314 | 113 | 57 | 477 | 226 | 90 | 313 | 140 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 222 | 430 | 0 | 144 | 314 | 113 | 57 | 703 | 0 | 90 | 453 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

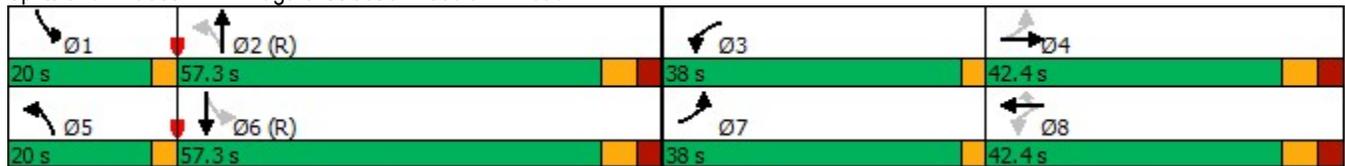
Base
AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 52.6 | 28.8 | | 43.4 | 22.6 | 22.6 | 94.5 | 82.6 | | 98.3 | 86.0 | |
| Actuated g/C Ratio | 0.33 | 0.18 | | 0.28 | 0.14 | 0.14 | 0.60 | 0.52 | | 0.62 | 0.55 | |
| v/c Ratio | 0.67 | 0.84 | | 0.55 | 0.67 | 0.42 | 0.11 | 0.49 | | 0.25 | 0.31 | |
| Control Delay | 50.2 | 75.0 | | 45.6 | 70.9 | 14.1 | 14.1 | 25.4 | | 15.2 | 20.0 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 50.2 | 75.0 | | 45.6 | 70.9 | 14.1 | 14.1 | 25.4 | | 15.2 | 20.0 | |
| LOS | D | E | | D | E | B | B | C | | B | C | |
| Approach Delay | | 66.5 | | | 53.3 | | | 24.5 | | | 19.2 | |
| Approach LOS | | E | | | D | | | C | | | B | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.84
 Intersection Signal Delay: 40.7
 Intersection LOS: D
 Intersection Capacity Utilization 78.8%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Base
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|-------|------|-------|------|------|-------|-------|-------|
| Lane Group Flow (vph) | 222 | 430 | 144 | 314 | 113 | 57 | 703 | 90 | 453 |
| v/c Ratio | 0.67 | 0.84 | 0.55 | 0.67 | 0.42 | 0.11 | 0.49 | 0.25 | 0.31 |
| Control Delay | 50.2 | 75.0 | 45.6 | 70.9 | 14.1 | 14.1 | 25.4 | 15.2 | 20.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 50.2 | 75.0 | 45.6 | 70.9 | 14.1 | 14.1 | 25.4 | 15.2 | 20.0 |
| Queue Length 50th (m) | 57.0 | 70.6 | 35.0 | 52.4 | 0.0 | 7.0 | 70.7 | 11.3 | 38.2 |
| Queue Length 95th (m) | 73.7 | 87.3 | 48.4 | 67.3 | 18.9 | 16.0 | 109.2 | 23.8 | 61.4 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 405 | 619 | 404 | 727 | 352 | 579 | 1431 | 408 | 1469 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.55 | 0.69 | 0.36 | 0.43 | 0.32 | 0.10 | 0.49 | 0.22 | 0.31 |

Intersection Summary

HCM Signalized Intersection Capacity Analysis

1: Niagara Street & Woodlawn Road

Base
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 218 | 347 | 74 | 141 | 308 | 111 | 56 | 467 | 221 | 88 | 307 | 137 |
| Future Volume (vph) | 218 | 347 | 74 | 141 | 308 | 111 | 56 | 467 | 221 | 88 | 307 | 137 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 | 1.00 | 0.99 | | 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 | |
| Frt | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1534 | 2728 | | 1506 | 3276 | 1194 | 1551 | 2687 | | 1451 | 2655 | |
| Flt Permitted | 0.36 | 1.00 | | 0.39 | 1.00 | 1.00 | 0.48 | 1.00 | | 0.32 | 1.00 | |
| Satd. Flow (perm) | 578 | 2728 | | 621 | 3276 | 1194 | 792 | 2687 | | 485 | 2655 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 222 | 354 | 76 | 144 | 314 | 113 | 57 | 477 | 226 | 90 | 313 | 140 |
| RTOR Reduction (vph) | 0 | 12 | 0 | 0 | 0 | 97 | 0 | 25 | 0 | 0 | 22 | 0 |
| Lane Group Flow (vph) | 222 | 418 | 0 | 144 | 314 | 16 | 57 | 678 | 0 | 90 | 431 | 0 |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 48.2 | 28.8 | | 39.0 | 22.6 | 22.6 | 89.0 | 82.6 | | 94.6 | 85.4 | |
| Effective Green, g (s) | 48.2 | 28.8 | | 39.0 | 22.6 | 22.6 | 89.0 | 82.6 | | 94.6 | 85.4 | |
| Actuated g/C Ratio | 0.31 | 0.18 | | 0.25 | 0.14 | 0.14 | 0.56 | 0.52 | | 0.60 | 0.54 | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Lane Grp Cap (vph) | 313 | 498 | | 245 | 469 | 171 | 477 | 1407 | | 347 | 1437 | |
| v/s Ratio Prot | c0.10 | c0.15 | | 0.06 | 0.10 | | 0.00 | c0.25 | | c0.02 | 0.16 | |
| v/s Ratio Perm | 0.11 | | | 0.08 | | 0.01 | 0.06 | | | 0.14 | | |
| v/c Ratio | 0.71 | 0.84 | | 0.59 | 0.67 | 0.09 | 0.12 | 0.48 | | 0.26 | 0.30 | |
| Uniform Delay, d1 | 44.8 | 62.2 | | 49.5 | 64.0 | 58.7 | 15.5 | 23.9 | | 14.3 | 19.8 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 6.8 | 11.6 | | 3.1 | 3.3 | 0.2 | 0.1 | 1.2 | | 0.3 | 0.5 | |
| Delay (s) | 51.6 | 73.8 | | 52.6 | 67.3 | 58.8 | 15.6 | 25.1 | | 14.6 | 20.3 | |
| Level of Service | D | E | | D | E | E | B | C | | B | C | |
| Approach Delay (s) | | 66.2 | | | 61.9 | | | 24.4 | | | 19.4 | |
| Approach LOS | | E | | | E | | | C | | | B | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 42.6 | | | | | | | | | HCM 2000 Level of Service D |
| HCM 2000 Volume to Capacity ratio | | | 0.58 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | | | | | | | | | Sum of lost time (s) 20.7 |
| Intersection Capacity Utilization | | | 78.8% | | | | | | | | | ICU Level of Service D |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Base
AM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 3 | 18 | 10 | 729 | 593 | 3 |
| Future Volume (vph) | 3 | 18 | 10 | 729 | 593 | 3 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Fr _t | 0.883 | | | | 0.999 | |
| Fl _t Protected | 0.993 | | 0.950 | | | |
| Satd. Flow (prot) | 1429 | 0 | 1568 | 3276 | 2802 | 0 |
| Fl _t Permitted | 0.993 | | 0.950 | | | |
| Satd. Flow (perm) | 1429 | 0 | 1568 | 3276 | 2802 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 169.8 | | | 77.8 | 158.1 | |
| Travel Time (s) | 12.2 | | | 5.6 | 11.4 | |
| Confl. Peds. (#/hr) | | | 5 | | | 5 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 3% | 4% | 0% |
| Adj. Flow (vph) | 3 | 19 | 11 | 767 | 624 | 3 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 22 | 0 | 11 | 767 | 627 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 31.6% |
| Analysis Period (min) | 15 |
| | ICU Level of Service A |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Base
AM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|----------------------|------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 3 | 18 | 10 | 729 | 593 | 3 |
| Future Volume (Veh/h) | 3 | 18 | 10 | 729 | 593 | 3 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 3 | 19 | 11 | 767 | 624 | 3 |
| Pedestrians | 5 | | | | | |
| Lane Width (m) | 3.6 | | | | | |
| Walking Speed (m/s) | 1.2 | | | | | |
| Percent Blockage | 0 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | TWLTL | | |
| Median storage veh | | | 2 | 2 | | |
| Upstream signal (m) | | | 142 | 323 | | |
| pX, platoon unblocked | 0.96 | | | | | |
| vC, conflicting volume | 1036 | 318 | 632 | | | |
| vC1, stage 1 conf vol | 630 | | | | | |
| vC2, stage 2 conf vol | 406 | | | | | |
| vCu, unblocked vol | 956 | 318 | 632 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 99 | 97 | 99 | | | |
| cM capacity (veh/h) | 444 | 680 | 956 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 22 | 11 | 384 | 384 | 416 | 211 |
| Volume Left | 3 | 11 | 0 | 0 | 0 | 0 |
| Volume Right | 19 | 0 | 0 | 0 | 0 | 3 |
| cSH | 634 | 956 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.03 | 0.01 | 0.23 | 0.23 | 0.24 | 0.12 |
| Queue Length 95th (m) | 0.9 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 10.9 | 8.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | | | | |
| Approach Delay (s) | 10.9 | 0.1 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.2 | | | |
| Intersection Capacity Utilization | | | 31.6% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | | | |

Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

Base
AM Peak Hour



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 53 | 3 | 43 | 9 | 9 | 137 | 33 | 561 | 8 | 101 | 435 | 60 |
| Future Volume (vph) | 53 | 3 | 43 | 9 | 9 | 137 | 33 | 561 | 8 | 101 | 435 | 60 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.859 | | | 0.860 | | | 0.998 | | | 0.982 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1302 | 0 | 1568 | 1279 | 0 | 1568 | 2799 | 0 | 1553 | 2712 | 0 |
| Flt Permitted | 0.658 | | | 0.725 | | | 0.456 | | | 0.423 | | |
| Satd. Flow (perm) | 1085 | 1302 | 0 | 1195 | 1279 | 0 | 751 | 2799 | 0 | 691 | 2712 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 46 | | | 146 | | | 3 | | | 28 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| Adj. Flow (vph) | 56 | 3 | 46 | 10 | 10 | 146 | 35 | 597 | 9 | 107 | 463 | 64 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 56 | 49 | 0 | 10 | 156 | 0 | 35 | 606 | 0 | 107 | 527 | 0 |
| Enter Blocked Intersection | No |
| Lane Alignment | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

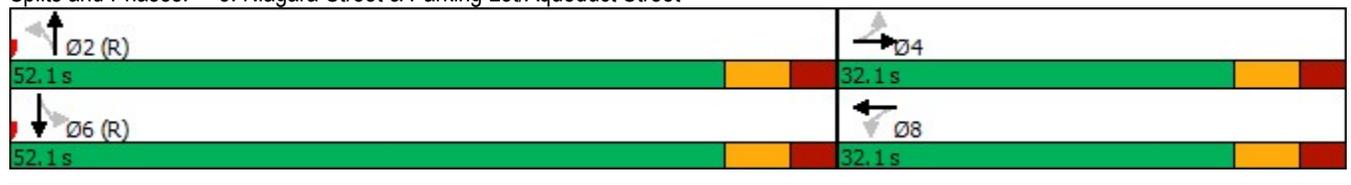
Base
 AM Peak Hour

| | ↖ | → | ↘ | ↙ | ← | ↖ | ↙ | ↑ | ↘ | ↘ | ↓ | ↙ |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effct Green (s) | 11.1 | 11.1 | | 11.1 | 11.1 | | 58.9 | 58.9 | | 58.9 | 58.9 | |
| Actuated g/C Ratio | 0.13 | 0.13 | | 0.13 | 0.13 | | 0.70 | 0.70 | | 0.70 | 0.70 | |
| v/c Ratio | 0.39 | 0.23 | | 0.06 | 0.53 | | 0.07 | 0.31 | | 0.22 | 0.28 | |
| Control Delay | 40.7 | 13.4 | | 30.9 | 13.9 | | 5.2 | 5.7 | | 6.5 | 5.2 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 40.7 | 13.4 | | 30.9 | 13.9 | | 5.2 | 5.7 | | 6.5 | 5.2 | |
| LOS | D | B | | C | B | | A | A | | A | A | |
| Approach Delay | | 28.0 | | | 14.9 | | | 5.6 | | | 5.4 | |
| Approach LOS | | C | | | B | | | A | | | A | |

Intersection Summary

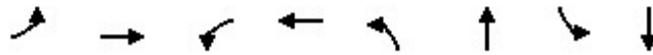
Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 40
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.53
 Intersection Signal Delay: 8.1
 Intersection LOS: A
 Intersection Capacity Utilization 75.8%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Base
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 56 | 49 | 10 | 156 | 35 | 606 | 107 | 527 |
| v/c Ratio | 0.39 | 0.23 | 0.06 | 0.53 | 0.07 | 0.31 | 0.22 | 0.28 |
| Control Delay | 40.7 | 13.4 | 30.9 | 13.9 | 5.2 | 5.7 | 6.5 | 5.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 40.7 | 13.4 | 30.9 | 13.9 | 5.2 | 5.7 | 6.5 | 5.2 |
| Queue Length 50th (m) | 8.9 | 0.5 | 1.5 | 1.5 | 1.6 | 16.9 | 5.3 | 13.4 |
| Queue Length 95th (m) | 19.2 | 9.7 | 5.8 | 17.7 | 5.3 | 29.9 | 14.4 | 24.5 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 322 | 418 | 354 | 482 | 525 | 1960 | 483 | 1906 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.17 | 0.12 | 0.03 | 0.32 | 0.07 | 0.31 | 0.22 | 0.28 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis

3: Niagara Street & Parking Lot/Aqueduct Street

Base
AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|------|-------|------|------|----------------------|---------------------------|-------|------|------|------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 53 | 3 | 43 | 9 | 9 | 137 | 33 | 561 | 8 | 101 | 435 | 60 |
| Future Volume (vph) | 53 | 3 | 43 | 9 | 9 | 137 | 33 | 561 | 8 | 101 | 435 | 60 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 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 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.86 | | 1.00 | 0.86 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1566 | 1302 | | 1566 | 1279 | | 1564 | 2799 | | 1551 | 2712 | |
| Flt Permitted | 0.66 | 1.00 | | 0.73 | 1.00 | | 0.46 | 1.00 | | 0.42 | 1.00 | |
| Satd. Flow (perm) | 1085 | 1302 | | 1195 | 1279 | | 752 | 2799 | | 690 | 2712 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 56 | 3 | 46 | 10 | 10 | 146 | 35 | 597 | 9 | 107 | 463 | 64 |
| RTOR Reduction (vph) | 0 | 40 | 0 | 0 | 127 | 0 | 0 | 1 | 0 | 0 | 8 | 0 |
| Lane Group Flow (vph) | 56 | 9 | 0 | 10 | 29 | 0 | 35 | 605 | 0 | 107 | 519 | 0 |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| 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) | 11.1 | 11.1 | | 11.1 | 11.1 | | 58.9 | 58.9 | | 58.9 | 58.9 | |
| Effective Green, g (s) | 11.1 | 11.1 | | 11.1 | 11.1 | | 58.9 | 58.9 | | 58.9 | 58.9 | |
| Actuated g/C Ratio | 0.13 | 0.13 | | 0.13 | 0.13 | | 0.70 | 0.70 | | 0.70 | 0.70 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 143 | 171 | | 157 | 168 | | 526 | 1957 | | 482 | 1897 | |
| v/s Ratio Prot | | 0.01 | | | 0.02 | | | c0.22 | | | 0.19 | |
| v/s Ratio Perm | c0.05 | | | 0.01 | | | 0.05 | | | 0.16 | | |
| v/c Ratio | 0.39 | 0.05 | | 0.06 | 0.17 | | 0.07 | 0.31 | | 0.22 | 0.27 | |
| Uniform Delay, d1 | 33.5 | 32.0 | | 32.0 | 32.5 | | 4.0 | 4.9 | | 4.5 | 4.7 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.4 | 0.2 | | 0.2 | 0.7 | | 0.2 | 0.4 | | 1.1 | 0.4 | |
| Delay (s) | 35.9 | 32.1 | | 32.2 | 33.2 | | 4.2 | 5.3 | | 5.6 | 5.1 | |
| Level of Service | D | C | | C | C | | A | A | | A | A | |
| Approach Delay (s) | | 34.1 | | | 33.1 | | | 5.2 | | | 5.1 | |
| Approach LOS | | C | | | C | | | A | | | A | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 10.1 | | | | HCM 2000 Level of Service | | | B | | |
| HCM 2000 Volume to Capacity ratio | | | 0.32 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | | | Sum of lost time (s) | | | 14.2 | | | |
| Intersection Capacity Utilization | | | 75.8% | | | ICU Level of Service | | | D | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Base
AM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 16 | 32 | 36 | 624 | 408 | 64 |
| Future Volume (vph) | 16 | 32 | 36 | 624 | 408 | 64 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.909 | | | | 0.980 | |
| Flt Protected | 0.984 | | 0.950 | | | |
| Satd. Flow (prot) | 1429 | 0 | 1568 | 3308 | 2729 | 0 |
| Flt Permitted | 0.984 | | 0.950 | | | |
| Satd. Flow (perm) | 1429 | 0 | 1568 | 3308 | 2729 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 1 | | 6 | | | 6 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 2% | 5% | 3% |
| Adj. Flow (vph) | 17 | 35 | 39 | 678 | 443 | 70 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 52 | 0 | 39 | 678 | 513 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 33.2% |
| ICU Level of Service | A |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

4: Niagara Street & Roger Drive

Base
AM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 16 | 32 | 36 | 624 | 408 | 64 |
| Future Volume (Veh/h) | 16 | 32 | 36 | 624 | 408 | 64 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 17 | 35 | 39 | 678 | 443 | 70 |
| Pedestrians | 6 | | | | 1 | |
| Lane Width (m) | 3.6 | | | | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | | 1.2 | |
| Percent Blockage | 1 | | | | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 902 | 262 | 519 | | | |
| vC1, stage 1 conf vol | 484 | | | | | |
| vC2, stage 2 conf vol | 418 | | | | | |
| vCu, unblocked vol | 902 | 262 | 519 | | | |
| tC, single (s) | 6.8 | 7.0 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 96 | 95 | 96 | | | |
| cM capacity (veh/h) | 478 | 729 | 1052 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 52 | 39 | 339 | 339 | 295 | 218 |
| Volume Left | 17 | 39 | 0 | 0 | 0 | 0 |
| Volume Right | 35 | 0 | 0 | 0 | 0 | 70 |
| cSH | 623 | 1052 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.08 | 0.04 | 0.20 | 0.20 | 0.17 | 0.13 |
| Queue Length 95th (m) | 2.2 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 11.3 | 8.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | | | | |
| Approach Delay (s) | 11.3 | 0.5 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.7 | | | |
| Intersection Capacity Utilization | | | 33.2% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Base
AM Peak Hour



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 264 | 151 | 86 | 36 | 121 | 99 | 86 | 303 | 42 | 69 | 248 | 185 |
| Future Volume (vph) | 264 | 151 | 86 | 36 | 121 | 99 | 86 | 303 | 42 | 69 | 248 | 185 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 0.99 | | 0.99 | 1.00 | | 0.99 | 0.98 | |
| Frt | | 0.945 | | | 0.932 | | | 0.982 | | | 0.936 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1289 | 0 | 1413 | 1321 | 0 | 1376 | 2676 | 0 | 1376 | 2598 | 0 |
| Flt Permitted | 0.375 | | | 0.598 | | | 0.438 | | | 0.521 | | |
| Satd. Flow (perm) | 601 | 1289 | 0 | 884 | 1321 | 0 | 629 | 2676 | 0 | 750 | 2598 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 26 | | | 38 | | | 16 | | | 194 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Peak Hour Factor | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Adj. Flow (vph) | 290 | 166 | 95 | 40 | 133 | 109 | 95 | 333 | 46 | 76 | 273 | 203 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 290 | 261 | 0 | 40 | 242 | 0 | 95 | 379 | 0 | 76 | 476 | 0 |
| Enter Blocked Intersection | No |
| Lane Alignment | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings

5: Niagara Street & Thorold Road

Base
AM Peak Hour

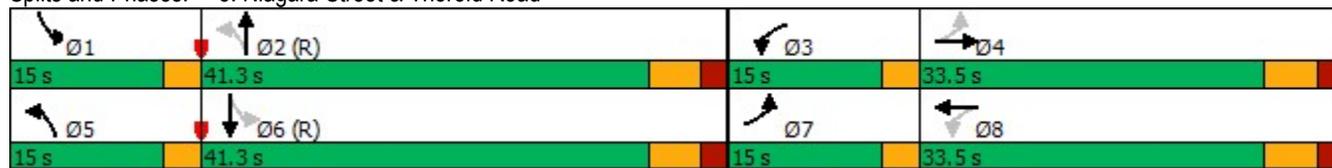


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 38.9 | 28.9 | | 30.8 | 20.4 | | 58.1 | 47.4 | | 56.8 | 46.7 | |
| Actuated g/C Ratio | 0.37 | 0.28 | | 0.29 | 0.19 | | 0.55 | 0.45 | | 0.54 | 0.45 | |
| v/c Ratio | 0.88 | 0.70 | | 0.14 | 0.84 | | 0.23 | 0.31 | | 0.17 | 0.38 | |
| Control Delay | 53.7 | 41.5 | | 20.4 | 58.1 | | 13.4 | 20.7 | | 12.9 | 13.9 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 53.7 | 41.5 | | 20.4 | 58.1 | | 13.4 | 20.7 | | 12.9 | 13.9 | |
| LOS | D | D | | C | E | | B | C | | B | B | |
| Approach Delay | | 47.9 | | | 52.8 | | | 19.2 | | | 13.7 | |
| Approach LOS | | D | | | D | | | B | | | B | |

Intersection Summary

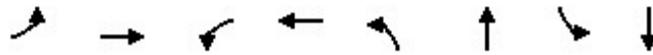
Area Type: Other
 Cycle Length: 104.8
 Actuated Cycle Length: 104.8
 Offset: 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.88
 Intersection Signal Delay: 31.2
 Intersection LOS: C
 Intersection Capacity Utilization 77.9%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Base
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|-------|-------|------|-------|------|-------|------|-------|
| Lane Group Flow (vph) | 290 | 261 | 40 | 242 | 95 | 379 | 76 | 476 |
| v/c Ratio | 0.88 | 0.70 | 0.14 | 0.84 | 0.23 | 0.31 | 0.17 | 0.38 |
| Control Delay | 53.7 | 41.5 | 20.4 | 58.1 | 13.4 | 20.7 | 12.9 | 13.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.7 | 41.5 | 20.4 | 58.1 | 13.4 | 20.7 | 12.9 | 13.9 |
| Queue Length 50th (m) | 47.0 | 47.1 | 5.4 | 42.5 | 9.0 | 26.3 | 7.1 | 20.3 |
| Queue Length 95th (m) | #77.7 | 74.7 | 11.5 | 67.9 | 19.6 | 44.6 | 16.3 | 39.6 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 330 | 377 | 363 | 368 | 442 | 1219 | 494 | 1266 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.88 | 0.69 | 0.11 | 0.66 | 0.21 | 0.31 | 0.15 | 0.38 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Base
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 264 | 151 | 86 | 36 | 121 | 99 | 86 | 303 | 42 | 69 | 248 | 185 |
| Future Volume (vph) | 264 | 151 | 86 | 36 | 121 | 99 | 86 | 303 | 42 | 69 | 248 | 185 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 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 | |
| Frt | 1.00 | 0.95 | | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1533 | 1290 | | 1408 | 1321 | | 1371 | 2675 | | 1371 | 2598 | |
| Flt Permitted | 0.38 | 1.00 | | 0.60 | 1.00 | | 0.44 | 1.00 | | 0.52 | 1.00 | |
| Satd. Flow (perm) | 606 | 1290 | | 886 | 1321 | | 632 | 2675 | | 753 | 2598 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 290 | 166 | 95 | 40 | 133 | 109 | 95 | 333 | 46 | 76 | 273 | 203 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 30 | 0 | 0 | 9 | 0 | 0 | 111 | 0 |
| Lane Group Flow (vph) | 290 | 242 | 0 | 40 | 212 | 0 | 95 | 370 | 0 | 76 | 365 | 0 |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 36.6 | 28.9 | | 26.3 | 21.6 | | 53.0 | 45.6 | | 51.8 | 45.0 | |
| Effective Green, g (s) | 36.6 | 28.9 | | 26.3 | 21.6 | | 53.0 | 45.6 | | 51.8 | 45.0 | |
| Actuated g/C Ratio | 0.35 | 0.28 | | 0.25 | 0.21 | | 0.51 | 0.44 | | 0.49 | 0.43 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 317 | 355 | | 245 | 272 | | 371 | 1163 | | 412 | 1115 | |
| v/s Ratio Prot | c0.10 | 0.19 | | 0.01 | 0.16 | | c0.02 | 0.14 | | 0.01 | c0.14 | |
| v/s Ratio Perm | c0.21 | | | 0.03 | | | 0.11 | | | 0.08 | | |
| v/c Ratio | 0.91 | 0.68 | | 0.16 | 0.78 | | 0.26 | 0.32 | | 0.18 | 0.33 | |
| Uniform Delay, d1 | 30.4 | 33.9 | | 30.3 | 39.3 | | 13.8 | 19.4 | | 14.2 | 19.9 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 29.5 | 4.5 | | 0.2 | 12.3 | | 0.3 | 0.7 | | 0.2 | 0.8 | |
| Delay (s) | 59.9 | 38.4 | | 30.5 | 51.6 | | 14.1 | 20.1 | | 14.3 | 20.6 | |
| Level of Service | E | D | | C | D | | B | C | | B | C | |
| Approach Delay (s) | | 49.7 | | | 48.6 | | | 18.9 | | | 19.8 | |
| Approach LOS | | D | | | D | | | B | | | B | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 32.8 | | | | HCM 2000 Level of Service | | | | C | |
| HCM 2000 Volume to Capacity ratio | | | 0.58 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | | Sum of lost time (s) | | | 18.8 | | |
| Intersection Capacity Utilization | | | 77.9% | | | | ICU Level of Service | | | D | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Base
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 0 | 0 | 744 | 0 | 0 | 522 |
| Future Volume (vph) | 0 | 0 | 744 | 0 | 0 | 522 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | | | | | | |
| Flt Protected | | | | | | |
| Satd. Flow (prot) | 1598 | 0 | 2832 | 0 | 1619 | 2804 |
| Flt Permitted | | | | | | |
| Satd. Flow (perm) | 1598 | 0 | 2832 | 0 | 1619 | 2804 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 3% | 2% | 2% | 4% |
| Adj. Flow (vph) | 0 | 0 | 809 | 0 | 0 | 567 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 0 | 809 | 0 | 0 | 567 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 28.8% | | | ICU Level of Service A | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis

6: Niagara Street & Site Access

Base
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (veh/h) | 0 | 0 | 744 | 0 | 0 | 522 |
| Future Volume (Veh/h) | 0 | 0 | 744 | 0 | 0 | 522 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 0 | 809 | 0 | 0 | 567 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | | | TWLTL |
| Median storage (veh) | | | 2 | | | 2 |
| Upstream signal (m) | | | 300 | | | 165 |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1092 | 404 | | | 809 | |
| vC1, stage 1 conf vol | 809 | | | | | |
| vC2, stage 2 conf vol | 284 | | | | | |
| vCu, unblocked vol | 1092 | 404 | | | 809 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 100 | | | 100 | |
| cM capacity (veh/h) | 373 | 596 | | | 812 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 0 | 539 | 270 | 0 | 284 | 284 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 0 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.00 | 0.32 | 0.16 | 0.00 | 0.17 | 0.17 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | |
| Approach Delay (s) | 0.0 | 0.0 | | | 0.0 | |
| Approach LOS | A | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.0 | | | |
| Intersection Capacity Utilization | | | 28.8% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Base
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 281 | 408 | 101 | 313 | 442 | 148 | 111 | 540 | 246 | 190 | 703 | 285 |
| Future Volume (vph) | 281 | 408 | 101 | 313 | 442 | 148 | 111 | 540 | 246 | 190 | 703 | 285 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.98 | 0.99 | | 0.99 | | 0.95 | | 0.98 | | 0.99 | 0.99 | |
| Frt | | 0.970 | | | | 0.850 | | 0.953 | | | 0.957 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1553 | 2274 | 0 | 1553 | 3341 | 1248 | 1568 | 2652 | 0 | 1523 | 2740 | 0 |
| Flt Permitted | 0.395 | | | 0.286 | | | 0.116 | | | 0.176 | | |
| Satd. Flow (perm) | 635 | 2274 | 0 | 463 | 3341 | 1188 | 192 | 2652 | 0 | 279 | 2740 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 18 | | | | 153 | | 49 | | | 41 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| 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 (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Adj. Flow (vph) | 290 | 421 | 104 | 323 | 456 | 153 | 114 | 557 | 254 | 196 | 725 | 294 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 290 | 525 | 0 | 323 | 456 | 153 | 114 | 811 | 0 | 196 | 1019 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

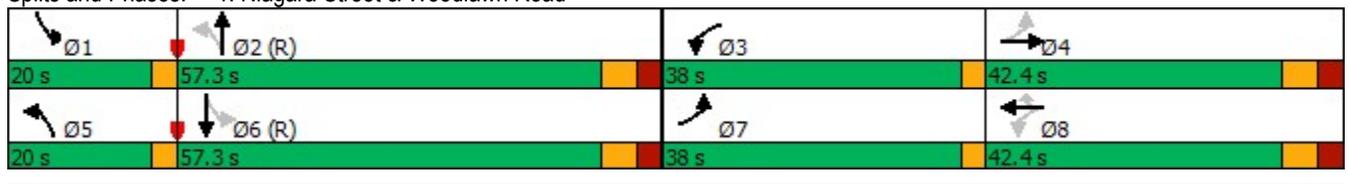
Base
PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 69.3 | 40.7 | | 74.2 | 43.2 | 43.2 | 70.5 | 54.1 | | 76.2 | 57.6 | |
| Actuated g/C Ratio | 0.44 | 0.26 | | 0.47 | 0.27 | 0.27 | 0.45 | 0.34 | | 0.48 | 0.37 | |
| v/c Ratio | 0.69 | 0.88 | | 0.80 | 0.50 | 0.35 | 0.60 | 0.86 | | 0.76 | 0.99 | |
| Control Delay | 35.9 | 70.1 | | 43.1 | 50.9 | 8.9 | 36.8 | 56.4 | | 44.6 | 73.7 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 35.9 | 70.1 | | 43.1 | 50.9 | 8.9 | 36.8 | 56.4 | | 44.6 | 73.7 | |
| LOS | D | E | | D | D | A | D | E | | D | E | |
| Approach Delay | | 58.0 | | | 41.3 | | | 54.0 | | | 69.0 | |
| Approach LOS | | E | | | D | | | D | | | E | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.99
 Intersection Signal Delay: 56.5 Intersection LOS: E
 Intersection Capacity Utilization 104.1% ICU Level of Service G
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Base
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|--------|------|-------|------|------|--------|-------|--------|
| Lane Group Flow (vph) | 290 | 525 | 323 | 456 | 153 | 114 | 811 | 196 | 1019 |
| v/c Ratio | 0.69 | 0.88 | 0.80 | 0.50 | 0.35 | 0.60 | 0.86 | 0.76 | 0.99 |
| Control Delay | 35.9 | 70.1 | 43.1 | 50.9 | 8.9 | 36.8 | 56.4 | 44.6 | 73.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 35.9 | 70.1 | 43.1 | 50.9 | 8.9 | 36.8 | 56.4 | 44.6 | 73.7 |
| Queue Length 50th (m) | 58.9 | 82.9 | 67.4 | 65.0 | 0.0 | 21.2 | 130.1 | 38.7 | ~184.4 |
| Queue Length 95th (m) | 83.7 | #133.0 | 94.4 | 90.1 | 20.0 | 34.5 | #172.0 | #65.2 | #245.7 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 502 | 600 | 461 | 914 | 436 | 239 | 941 | 268 | 1025 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.58 | 0.88 | 0.70 | 0.50 | 0.35 | 0.48 | 0.86 | 0.73 | 0.99 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Niagara Street & Woodlawn Road

Base
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 281 | 408 | 101 | 313 | 442 | 148 | 111 | 540 | 246 | 190 | 703 | 285 |
| Future Volume (vph) | 281 | 408 | 101 | 313 | 442 | 148 | 111 | 540 | 246 | 190 | 703 | 285 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.98 | | 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 | |
| Frt | 1.00 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1543 | 2274 | | 1549 | 3341 | 1188 | 1568 | 2652 | | 1520 | 2739 | |
| Flt Permitted | 0.40 | 1.00 | | 0.29 | 1.00 | 1.00 | 0.12 | 1.00 | | 0.18 | 1.00 | |
| Satd. Flow (perm) | 642 | 2274 | | 466 | 3341 | 1188 | 191 | 2652 | | 282 | 2739 | |
| 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) | 290 | 421 | 104 | 323 | 456 | 153 | 114 | 557 | 254 | 196 | 725 | 294 |
| RTOR Reduction (vph) | 0 | 13 | 0 | 0 | 0 | 111 | 0 | 32 | 0 | 0 | 26 | 0 |
| Lane Group Flow (vph) | 290 | 512 | 0 | 323 | 456 | 42 | 114 | 779 | 0 | 196 | 993 | 0 |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| Heavy Vehicles (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 65.0 | 40.8 | | 69.8 | 43.2 | 43.2 | 66.1 | 54.0 | | 72.6 | 57.5 | |
| Effective Green, g (s) | 65.0 | 40.8 | | 69.8 | 43.2 | 43.2 | 66.1 | 54.0 | | 72.6 | 57.5 | |
| Actuated g/C Ratio | 0.41 | 0.26 | | 0.44 | 0.27 | 0.27 | 0.42 | 0.34 | | 0.46 | 0.36 | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Lane Grp Cap (vph) | 402 | 588 | | 388 | 915 | 325 | 185 | 908 | | 252 | 998 | |
| v/s Ratio Prot | 0.11 | 0.22 | | c0.14 | 0.14 | | 0.05 | 0.29 | | c0.08 | c0.36 | |
| v/s Ratio Perm | 0.19 | | | c0.23 | | 0.04 | 0.21 | | | 0.28 | | |
| v/c Ratio | 0.72 | 0.87 | | 0.83 | 0.50 | 0.13 | 0.62 | 0.86 | | 0.78 | 0.99 | |
| Uniform Delay, d1 | 33.9 | 55.9 | | 32.4 | 48.1 | 43.1 | 32.9 | 48.3 | | 30.2 | 50.0 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 6.0 | 13.2 | | 13.9 | 0.3 | 0.1 | 5.3 | 10.3 | | 13.6 | 27.3 | |
| Delay (s) | 39.8 | 69.1 | | 46.4 | 48.5 | 43.2 | 38.2 | 58.6 | | 43.8 | 77.3 | |
| Level of Service | D | E | | D | D | D | D | E | | D | E | |
| Approach Delay (s) | | 58.7 | | | 46.9 | | | 56.1 | | | 71.9 | |
| Approach LOS | | E | | | D | | | E | | | E | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 59.3 | HCM 2000 Level of Service | | | | E | | | | |
| HCM 2000 Volume to Capacity ratio | | | 0.92 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | Sum of lost time (s) | | | | 20.7 | | | | |
| Intersection Capacity Utilization | | | 104.1% | ICU Level of Service | | | | G | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Base
PM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 9 | 24 | 9 | 882 | 1089 | 28 |
| Future Volume (vph) | 9 | 24 | 9 | 882 | 1089 | 28 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Fr _t | 0.901 | | | | 0.996 | |
| Fl _t Protected | 0.987 | | 0.950 | | | |
| Satd. Flow (prot) | 1450 | 0 | 1568 | 3308 | 2877 | 0 |
| Fl _t Permitted | 0.987 | | 0.950 | | | |
| Satd. Flow (perm) | 1450 | 0 | 1568 | 3308 | 2877 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 169.8 | | | 77.8 | 158.1 | |
| Travel Time (s) | 12.2 | | | 5.6 | 11.4 | |
| Confl. Peds. (#/hr) | | | 19 | | | 19 |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 1% | 0% |
| Adj. Flow (vph) | 9 | 25 | 9 | 928 | 1146 | 29 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 34 | 0 | 9 | 928 | 1175 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 48.4% |
| ICU Level of Service | A |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Base
PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|----------------------|------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 9 | 24 | 9 | 882 | 1089 | 28 |
| Future Volume (Veh/h) | 9 | 24 | 9 | 882 | 1089 | 28 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 9 | 25 | 9 | 928 | 1146 | 29 |
| Pedestrians | 19 | | | | | |
| Lane Width (m) | 3.6 | | | | | |
| Walking Speed (m/s) | 1.2 | | | | | |
| Percent Blockage | 2 | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | TWLTL | | |
| Median storage veh | | | 2 | 2 | | |
| Upstream signal (m) | | | 142 | 323 | | |
| pX, platoon unblocked | 0.92 | | | | | |
| vC, conflicting volume | 1662 | 606 | 1194 | | | |
| vC1, stage 1 conf vol | 1180 | | | | | |
| vC2, stage 2 conf vol | 482 | | | | | |
| vCu, unblocked vol | 1552 | 606 | 1194 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 96 | 94 | 98 | | | |
| cM capacity (veh/h) | 240 | 438 | 582 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 34 | 9 | 464 | 464 | 764 | 411 |
| Volume Left | 9 | 9 | 0 | 0 | 0 | 0 |
| Volume Right | 25 | 0 | 0 | 0 | 0 | 29 |
| cSH | 359 | 582 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.09 | 0.02 | 0.27 | 0.27 | 0.45 | 0.24 |
| Queue Length 95th (m) | 2.5 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 16.1 | 11.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | C | B | | | | |
| Approach Delay (s) | 16.1 | 0.1 | 0.0 | | | |
| Approach LOS | C | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.3 | | | |
| Intersection Capacity Utilization | | | 48.4% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

Base
 PM Peak Hour



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 38 | 1 | 36 | 12 | 2 | 66 | 34 | 790 | 19 | 85 | 978 | 46 |
| Future Volume (vph) | 38 | 1 | 36 | 12 | 2 | 66 | 34 | 790 | 19 | 85 | 978 | 46 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.98 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 0.99 | 1.00 | |
| Frt | | 0.854 | | | 0.854 | | | 0.997 | | | 0.993 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1289 | 0 | 1568 | 1294 | 0 | 1568 | 2822 | 0 | 1568 | 2837 | 0 |
| Flt Permitted | 0.712 | | | 0.732 | | | 0.262 | | | 0.341 | | |
| Satd. Flow (perm) | 1174 | 1289 | 0 | 1203 | 1294 | 0 | 431 | 2822 | 0 | 560 | 2837 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 37 | | | 67 | | | 4 | | | 9 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| Adj. Flow (vph) | 39 | 1 | 37 | 12 | 2 | 67 | 35 | 806 | 19 | 87 | 998 | 47 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 39 | 38 | 0 | 12 | 69 | 0 | 35 | 825 | 0 | 87 | 1045 | 0 |
| Enter Blocked Intersection | No |
| Lane Alignment | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

Base
 PM Peak Hour

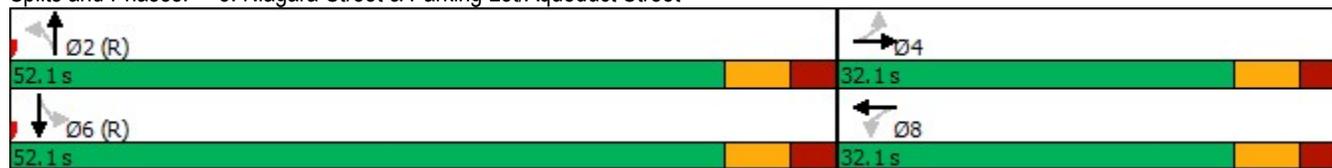


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effct Green (s) | 9.7 | 9.7 | | 9.7 | 9.7 | | 64.7 | 64.7 | | 64.7 | 64.7 | |
| Actuated g/C Ratio | 0.12 | 0.12 | | 0.12 | 0.12 | | 0.77 | 0.77 | | 0.77 | 0.77 | |
| v/c Ratio | 0.29 | 0.21 | | 0.09 | 0.33 | | 0.11 | 0.38 | | 0.20 | 0.48 | |
| Control Delay | 39.0 | 14.5 | | 33.4 | 14.1 | | 5.1 | 5.1 | | 5.8 | 5.9 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 39.0 | 14.5 | | 33.4 | 14.1 | | 5.1 | 5.1 | | 5.8 | 5.9 | |
| LOS | D | B | | C | B | | A | A | | A | A | |
| Approach Delay | | 26.9 | | | 17.0 | | | 5.1 | | | 5.9 | |
| Approach LOS | | C | | | B | | | A | | | A | |

Intersection Summary

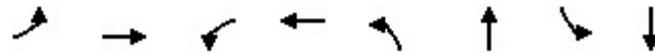
Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 45
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.48
 Intersection Signal Delay: 6.7
 Intersection LOS: A
 Intersection Capacity Utilization 73.4%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Base
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 39 | 38 | 12 | 69 | 35 | 825 | 87 | 1045 |
| v/c Ratio | 0.29 | 0.21 | 0.09 | 0.33 | 0.11 | 0.38 | 0.20 | 0.48 |
| Control Delay | 39.0 | 14.5 | 33.4 | 14.1 | 5.1 | 5.1 | 5.8 | 5.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 39.0 | 14.5 | 33.4 | 14.1 | 5.1 | 5.1 | 5.8 | 5.9 |
| Queue Length 50th (m) | 6.2 | 0.2 | 1.9 | 0.3 | 1.5 | 23.4 | 4.0 | 33.1 |
| Queue Length 95th (m) | 15.0 | 8.7 | 6.6 | 11.6 | 5.3 | 39.2 | 11.2 | 54.7 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 348 | 408 | 357 | 431 | 331 | 2170 | 430 | 2183 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.11 | 0.09 | 0.03 | 0.16 | 0.11 | 0.38 | 0.20 | 0.48 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
 3: Niagara Street & Parking Lot/Aqueduct Street

Base
 PM Peak Hour



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|------|-------|------|------|----------------------|---------------------------|------|------|------|-------|------|
| Lane Configurations | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↕ | | ↖ | ↗ | |
| Traffic Volume (vph) | 38 | 1 | 36 | 12 | 2 | 66 | 34 | 790 | 19 | 85 | 978 | 46 |
| Future Volume (vph) | 38 | 1 | 36 | 12 | 2 | 66 | 34 | 790 | 19 | 85 | 978 | 46 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.98 | | 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 | | 0.99 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.85 | | 1.00 | 1.00 | | 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) | 1566 | 1289 | | 1561 | 1294 | | 1563 | 2821 | | 1559 | 2838 | |
| Flt Permitted | 0.71 | 1.00 | | 0.73 | 1.00 | | 0.26 | 1.00 | | 0.34 | 1.00 | |
| Satd. Flow (perm) | 1174 | 1289 | | 1203 | 1294 | | 431 | 2821 | | 559 | 2838 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 39 | 1 | 37 | 12 | 2 | 67 | 35 | 806 | 19 | 87 | 998 | 47 |
| RTOR Reduction (vph) | 0 | 33 | 0 | 0 | 61 | 0 | 0 | 1 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 39 | 5 | 0 | 12 | 8 | 0 | 35 | 824 | 0 | 87 | 1043 | 0 |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| 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) | 8.1 | 8.1 | | 8.1 | 8.1 | | 61.9 | 61.9 | | 61.9 | 61.9 | |
| Effective Green, g (s) | 8.1 | 8.1 | | 8.1 | 8.1 | | 61.9 | 61.9 | | 61.9 | 61.9 | |
| Actuated g/C Ratio | 0.10 | 0.10 | | 0.10 | 0.10 | | 0.74 | 0.74 | | 0.74 | 0.74 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 112 | 124 | | 115 | 124 | | 316 | 2073 | | 410 | 2086 | |
| v/s Ratio Prot | | 0.00 | | | 0.01 | | | 0.29 | | | c0.37 | |
| v/s Ratio Perm | c0.03 | | | 0.01 | | | 0.08 | | | 0.16 | | |
| v/c Ratio | 0.35 | 0.04 | | 0.10 | 0.07 | | 0.11 | 0.40 | | 0.21 | 0.50 | |
| Uniform Delay, d1 | 35.6 | 34.5 | | 34.7 | 34.6 | | 3.2 | 4.2 | | 3.5 | 4.7 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.6 | 0.2 | | 0.5 | 0.3 | | 0.7 | 0.6 | | 1.2 | 0.9 | |
| Delay (s) | 38.1 | 34.7 | | 35.3 | 34.9 | | 3.9 | 4.7 | | 4.7 | 5.5 | |
| Level of Service | D | C | | D | C | | A | A | | A | A | |
| Approach Delay (s) | | 36.4 | | | 35.0 | | | 4.7 | | | 5.5 | |
| Approach LOS | | D | | | C | | | A | | | A | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 7.4 | | | | HCM 2000 Level of Service | | | A | | |
| HCM 2000 Volume to Capacity ratio | | | 0.48 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | | | Sum of lost time (s) | | | 14.2 | | | |
| Intersection Capacity Utilization | | | 73.4% | | | ICU Level of Service | | | D | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Base
PM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 21 | 37 | 39 | 747 | 897 | 69 |
| Future Volume (vph) | 21 | 37 | 39 | 747 | 897 | 69 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.914 | | | | 0.989 | |
| Flt Protected | 0.982 | | 0.950 | | | |
| Satd. Flow (prot) | 1463 | 0 | 1568 | 3308 | 2858 | 0 |
| Flt Permitted | 0.982 | | 0.950 | | | |
| Satd. Flow (perm) | 1463 | 0 | 1568 | 3308 | 2858 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 2 | 1 | 8 | | | 8 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 1% | 0% |
| Adj. Flow (vph) | 23 | 40 | 42 | 812 | 975 | 75 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 63 | 0 | 42 | 812 | 1050 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 48.3% |
| ICU Level of Service | A |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

4: Niagara Street & Roger Drive

Base
PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 21 | 37 | 39 | 747 | 897 | 69 |
| Future Volume (Veh/h) | 21 | 37 | 39 | 747 | 897 | 69 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 23 | 40 | 42 | 812 | 975 | 75 |
| Pedestrians | 8 | | | 1 | 2 | |
| Lane Width (m) | 3.6 | | | 3.6 | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | 1.2 | 1.2 | |
| Percent Blockage | 1 | | | 0 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | 0.91 | 0.91 | 0.91 | | | |
| vC, conflicting volume | 1512 | 534 | 1058 | | | |
| vC1, stage 1 conf vol | 1020 | | | | | |
| vC2, stage 2 conf vol | 492 | | | | | |
| vCu, unblocked vol | 1360 | 281 | 858 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 93 | 94 | 94 | | | |
| cM capacity (veh/h) | 313 | 650 | 713 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 63 | 42 | 406 | 406 | 650 | 400 |
| Volume Left | 23 | 42 | 0 | 0 | 0 | 0 |
| Volume Right | 40 | 0 | 0 | 0 | 0 | 75 |
| cSH | 466 | 713 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.14 | 0.06 | 0.24 | 0.24 | 0.38 | 0.24 |
| Queue Length 95th (m) | 3.7 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 13.9 | 10.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | B | | | | |
| Approach Delay (s) | 13.9 | 0.5 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.7 | | | |
| Intersection Capacity Utilization | | | 48.3% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Base
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 312 | 140 | 76 | 92 | 145 | 92 | 132 | 431 | 57 | 94 | 503 | 418 |
| Future Volume (vph) | 312 | 140 | 76 | 92 | 145 | 92 | 132 | 431 | 57 | 94 | 503 | 418 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 0.99 | | 1.00 | 0.99 | | 0.99 | 0.98 | |
| Frt | | 0.947 | | | 0.942 | | | 0.983 | | | 0.932 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1389 | 0 | 1568 | 1391 | 0 | 1452 | 2821 | 0 | 1466 | 2636 | 0 |
| Flt Permitted | 0.360 | | | 0.596 | | | 0.167 | | | 0.446 | | |
| Satd. Flow (perm) | 578 | 1389 | 0 | 970 | 1391 | 0 | 254 | 2821 | 0 | 681 | 2636 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 25 | | | 29 | | | 15 | | | 216 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Adj. Flow (vph) | 325 | 146 | 79 | 96 | 151 | 96 | 138 | 449 | 59 | 98 | 524 | 435 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 325 | 225 | 0 | 96 | 247 | 0 | 138 | 508 | 0 | 98 | 959 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings

5: Niagara Street & Thorold Road

Base
PM Peak Hour

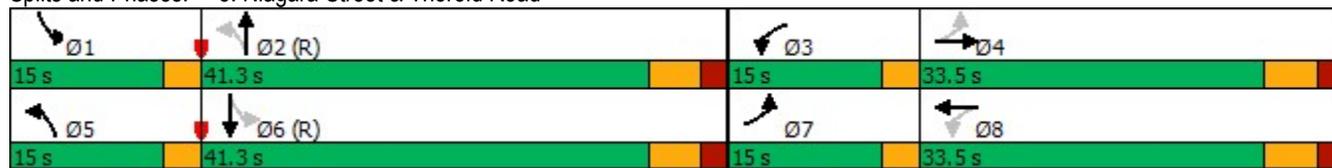


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 38.2 | 25.3 | | 33.3 | 20.6 | | 58.3 | 46.6 | | 55.6 | 43.8 | |
| Actuated g/C Ratio | 0.36 | 0.24 | | 0.32 | 0.20 | | 0.56 | 0.44 | | 0.53 | 0.42 | |
| v/c Ratio | 1.02 | 0.64 | | 0.27 | 0.83 | | 0.55 | 0.40 | | 0.23 | 0.78 | |
| Control Delay | 83.9 | 40.6 | | 22.5 | 58.0 | | 20.9 | 22.5 | | 13.4 | 27.2 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 83.9 | 40.6 | | 22.5 | 58.0 | | 20.9 | 22.5 | | 13.4 | 27.2 | |
| LOS | F | D | | C | E | | C | C | | B | C | |
| Approach Delay | | 66.2 | | | 48.1 | | | 22.2 | | | 25.9 | |
| Approach LOS | | E | | | D | | | C | | | C | |

Intersection Summary

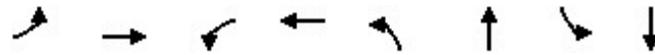
Area Type: Other
 Cycle Length: 104.8
 Actuated Cycle Length: 104.8
 Offset: 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 70
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.02
 Intersection Signal Delay: 36.5
 Intersection LOS: D
 Intersection Capacity Utilization 98.6%
 ICU Level of Service F
 Analysis Period (min) 15

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Base
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|-------|-------|------|-------|------|-------|------|--------|
| Lane Group Flow (vph) | 325 | 225 | 96 | 247 | 138 | 508 | 98 | 959 |
| v/c Ratio | 1.02 | 0.64 | 0.27 | 0.83 | 0.55 | 0.40 | 0.23 | 0.78 |
| Control Delay | 83.9 | 40.6 | 22.5 | 58.0 | 20.9 | 22.5 | 13.4 | 27.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 83.9 | 40.6 | 22.5 | 58.0 | 20.9 | 22.5 | 13.4 | 27.2 |
| Queue Length 50th (m) | 54.1 | 39.3 | 13.4 | 45.2 | 13.5 | 38.0 | 9.3 | 74.0 |
| Queue Length 95th (m) | #84.8 | 64.2 | 22.8 | 70.4 | 27.1 | 61.5 | 20.0 | #129.1 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 320 | 377 | 402 | 379 | 279 | 1263 | 469 | 1227 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.02 | 0.60 | 0.24 | 0.65 | 0.49 | 0.40 | 0.21 | 0.78 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Base
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |   | |  |   | |
| Traffic Volume (vph) | 312 | 140 | 76 | 92 | 145 | 92 | 132 | 431 | 57 | 94 | 503 | 418 |
| Future Volume (vph) | 312 | 140 | 76 | 92 | 145 | 92 | 132 | 431 | 57 | 94 | 503 | 418 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 0.99 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.95 | | 1.00 | 0.94 | | 1.00 | 0.98 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1534 | 1389 | | 1555 | 1391 | | 1452 | 2820 | | 1459 | 2635 | |
| Flt Permitted | 0.36 | 1.00 | | 0.60 | 1.00 | | 0.17 | 1.00 | | 0.45 | 1.00 | |
| Satd. Flow (perm) | 582 | 1389 | | 975 | 1391 | | 256 | 2820 | | 685 | 2635 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 325 | 146 | 79 | 96 | 151 | 96 | 138 | 449 | 59 | 98 | 524 | 435 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 23 | 0 | 0 | 8 | 0 | 0 | 127 | 0 |
| Lane Group Flow (vph) | 325 | 206 | 0 | 96 | 224 | 0 | 138 | 500 | 0 | 98 | 832 | 0 |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 36.2 | 25.3 | | 29.1 | 21.2 | | 55.1 | 45.5 | | 50.5 | 43.2 | |
| Effective Green, g (s) | 36.2 | 25.3 | | 29.1 | 21.2 | | 55.1 | 45.5 | | 50.5 | 43.2 | |
| Actuated g/C Ratio | 0.35 | 0.24 | | 0.28 | 0.20 | | 0.53 | 0.43 | | 0.48 | 0.41 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 310 | 335 | | 314 | 281 | | 244 | 1224 | | 383 | 1086 | |
| v/s Ratio Prot | c0.12 | 0.15 | | 0.02 | 0.16 | | c0.05 | 0.18 | | 0.02 | c0.32 | |
| v/s Ratio Perm | c0.24 | | | 0.06 | | | 0.25 | | | 0.11 | | |
| v/c Ratio | 1.05 | 0.62 | | 0.31 | 0.80 | | 0.57 | 0.41 | | 0.26 | 0.77 | |
| Uniform Delay, d1 | 32.2 | 35.4 | | 29.1 | 39.8 | | 15.8 | 20.4 | | 15.1 | 26.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 64.3 | 2.6 | | 0.4 | 13.7 | | 2.4 | 1.0 | | 0.3 | 5.2 | |
| Delay (s) | 96.5 | 38.0 | | 29.5 | 53.5 | | 18.2 | 21.4 | | 15.4 | 31.6 | |
| Level of Service | F | D | | C | D | | B | C | | B | C | |
| Approach Delay (s) | | 72.6 | | | 46.8 | | | 20.7 | | | 30.1 | |
| Approach LOS | | E | | | D | | | C | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 39.0 | | | | HCM 2000 Level of Service | | | | D | |
| HCM 2000 Volume to Capacity ratio | | | 0.89 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | | Sum of lost time (s) | | | 18.8 | | |
| Intersection Capacity Utilization | | | 98.6% | | | | ICU Level of Service | | | F | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Base
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 0 | 0 | 897 | 0 | 0 | 1117 |
| Future Volume (vph) | 0 | 0 | 897 | 0 | 0 | 1117 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | | | | | | |
| Flt Protected | | | | | | |
| Satd. Flow (prot) | 1598 | 0 | 2859 | 0 | 1619 | 2888 |
| Flt Permitted | | | | | | |
| Satd. Flow (perm) | 1598 | 0 | 2859 | 0 | 1619 | 2888 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 0 | 0 | 975 | 0 | 0 | 1214 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 0 | 975 | 0 | 0 | 1214 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 41.6% | | | ICU Level of Service A | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis

6: Niagara Street & Site Access

Base
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |  | |  |  |
| Traffic Volume (veh/h) | 0 | 0 | 897 | 0 | 0 | 1117 |
| Future Volume (Veh/h) | 0 | 0 | 897 | 0 | 0 | 1117 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 0 | 975 | 0 | 0 | 1214 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | | | TWLTL |
| Median storage veh | | | 2 | | | 2 |
| Upstream signal (m) | | | 300 | | | 165 |
| pX, platoon unblocked | 0.98 | 0.98 | | | 0.98 | |
| vC, conflicting volume | 1582 | 488 | | | 975 | |
| vC1, stage 1 conf vol | 975 | | | | | |
| vC2, stage 2 conf vol | 607 | | | | | |
| vCu, unblocked vol | 1551 | 432 | | | 931 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 100 | | | 100 | |
| cM capacity (veh/h) | 289 | 559 | | | 715 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 0 | 650 | 325 | 0 | 607 | 607 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 0 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.00 | 0.38 | 0.19 | 0.00 | 0.36 | 0.36 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | |
| Approach Delay (s) | 0.0 | 0.0 | | 0.0 | | |
| Approach LOS | A | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.0 | | | |
| Intersection Capacity Utilization | | | 41.6% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Background Opening Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 236 | 376 | 93 | 193 | 333 | 120 | 93 | 560 | 337 | 95 | 354 | 148 |
| Future Volume (vph) | 236 | 376 | 93 | 193 | 333 | 120 | 93 | 560 | 337 | 95 | 354 | 148 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 1.00 | | 1.00 | | 0.97 | 1.00 | 0.99 | | | 1.00 | |
| Frt | | 0.970 | | | | 0.850 | | 0.944 | | | 0.956 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 2715 | 0 | 1508 | 3276 | 1224 | 1553 | 2663 | 0 | 1452 | 2663 | 0 |
| Flt Permitted | 0.375 | | | 0.309 | | | 0.424 | | | 0.215 | | |
| Satd. Flow (perm) | 602 | 2715 | 0 | 489 | 3276 | 1194 | 692 | 2663 | 0 | 329 | 2663 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 18 | | | | 122 | | 83 | | | 43 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Adj. Flow (vph) | 241 | 384 | 95 | 197 | 340 | 122 | 95 | 571 | 344 | 97 | 361 | 151 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 241 | 479 | 0 | 197 | 340 | 122 | 95 | 915 | 0 | 97 | 512 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

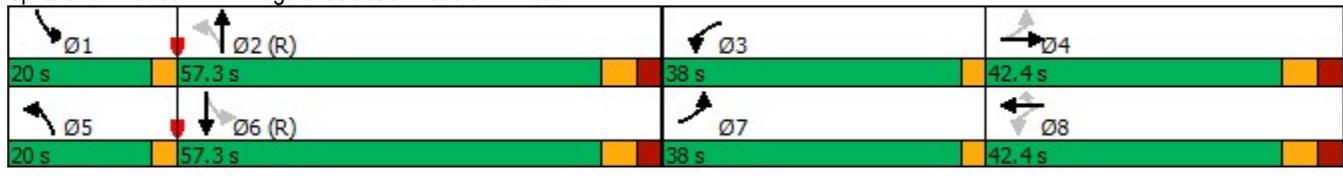
Background Opening Year
AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 58.8 | 31.5 | | 52.9 | 28.4 | 28.4 | 89.0 | 75.1 | | 90.4 | 75.8 | |
| Actuated g/C Ratio | 0.37 | 0.20 | | 0.34 | 0.18 | 0.18 | 0.56 | 0.48 | | 0.57 | 0.48 | |
| v/c Ratio | 0.67 | 0.86 | | 0.67 | 0.58 | 0.39 | 0.21 | 0.70 | | 0.37 | 0.39 | |
| Control Delay | 44.8 | 74.0 | | 46.0 | 62.6 | 11.7 | 17.6 | 34.7 | | 20.6 | 26.9 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 44.8 | 74.0 | | 46.0 | 62.6 | 11.7 | 17.6 | 34.7 | | 20.6 | 26.9 | |
| LOS | D | E | | D | E | B | B | C | | C | C | |
| Approach Delay | | 64.2 | | | 48.2 | | | 33.1 | | | 25.9 | |
| Approach LOS | | E | | | D | | | C | | | C | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.86
 Intersection Signal Delay: 42.4
 Intersection LOS: D
 Intersection Capacity Utilization 88.2%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Background Opening Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|-------|------|-------|------|------|--------|-------|-------|
| Lane Group Flow (vph) | 241 | 479 | 197 | 340 | 122 | 95 | 915 | 97 | 512 |
| v/c Ratio | 0.67 | 0.86 | 0.67 | 0.58 | 0.39 | 0.21 | 0.70 | 0.37 | 0.39 |
| Control Delay | 44.8 | 74.0 | 46.0 | 62.6 | 11.7 | 17.6 | 34.7 | 20.6 | 26.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 44.8 | 74.0 | 46.0 | 62.6 | 11.7 | 17.6 | 34.7 | 20.6 | 26.9 |
| Queue Length 50th (m) | 58.6 | 78.4 | 46.5 | 54.5 | 0.0 | 13.4 | 112.4 | 13.7 | 51.2 |
| Queue Length 95th (m) | 74.2 | 95.4 | 60.4 | 69.0 | 18.4 | 27.3 | #175.1 | 27.9 | 80.8 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 432 | 629 | 409 | 727 | 359 | 498 | 1311 | 314 | 1302 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.56 | 0.76 | 0.48 | 0.47 | 0.34 | 0.19 | 0.70 | 0.31 | 0.39 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Niagara Street & Woodlawn Road

Background Opening Year
AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR | |
|-----------------------------------|-------|-------|-------|-------|------|------|-------|-------|------|-------|------|---------------------------|------|
| Lane Configurations | | | | | | | | | | | | | |
| Traffic Volume (vph) | 236 | 376 | 93 | 193 | 333 | 120 | 93 | 560 | 337 | 95 | 354 | 148 | |
| Future Volume (vph) | 236 | 376 | 93 | 193 | 333 | 120 | 93 | 560 | 337 | 95 | 354 | 148 | |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | | |
| Frbp, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 | 1.00 | 0.99 | | 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 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.96 | | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | |
| Satd. Flow (prot) | 1534 | 2716 | | 1507 | 3276 | 1194 | 1552 | 2662 | | 1452 | 2663 | | |
| Flt Permitted | 0.38 | 1.00 | | 0.31 | 1.00 | 1.00 | 0.42 | 1.00 | | 0.21 | 1.00 | | |
| Satd. Flow (perm) | 606 | 2716 | | 490 | 3276 | 1194 | 692 | 2662 | | 328 | 2663 | | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | |
| Adj. Flow (vph) | 241 | 384 | 95 | 197 | 340 | 122 | 95 | 571 | 344 | 97 | 361 | 151 | |
| RTOR Reduction (vph) | 0 | 14 | 0 | 0 | 0 | 100 | 0 | 43 | 0 | 0 | 22 | 0 | |
| Lane Group Flow (vph) | 241 | 465 | 0 | 197 | 340 | 22 | 95 | 872 | 0 | 97 | 490 | 0 | |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 | |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% | |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | | |
| Actuated Green, G (s) | 54.6 | 31.5 | | 48.5 | 28.4 | 28.4 | 84.7 | 75.1 | | 86.1 | 75.8 | | |
| Effective Green, g (s) | 54.6 | 31.5 | | 48.5 | 28.4 | 28.4 | 84.7 | 75.1 | | 86.1 | 75.8 | | |
| Actuated g/C Ratio | 0.35 | 0.20 | | 0.31 | 0.18 | 0.18 | 0.54 | 0.48 | | 0.55 | 0.48 | | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | | |
| Lane Grp Cap (vph) | 346 | 542 | | 280 | 589 | 215 | 424 | 1267 | | 252 | 1279 | | |
| v/s Ratio Prot | c0.10 | c0.17 | | 0.09 | 0.10 | | 0.01 | c0.33 | | c0.03 | 0.18 | | |
| v/s Ratio Perm | 0.14 | | | 0.13 | | 0.02 | 0.11 | | | 0.18 | | | |
| v/c Ratio | 0.70 | 0.86 | | 0.70 | 0.58 | 0.10 | 0.22 | 0.69 | | 0.38 | 0.38 | | |
| Uniform Delay, d1 | 40.4 | 60.9 | | 43.9 | 59.2 | 54.0 | 18.1 | 32.2 | | 19.6 | 26.1 | | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | |
| Incremental Delay, d2 | 5.6 | 12.5 | | 7.3 | 1.1 | 0.2 | 0.2 | 3.1 | | 0.8 | 0.9 | | |
| Delay (s) | 46.0 | 73.4 | | 51.3 | 60.3 | 54.2 | 18.4 | 35.2 | | 20.4 | 26.9 | | |
| Level of Service | D | E | | D | E | D | B | D | | C | C | | |
| Approach Delay (s) | | 64.3 | | | 56.5 | | | 33.6 | | | 25.9 | | |
| Approach LOS | | E | | | E | | | C | | | C | | |
| Intersection Summary | | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 44.4 | | | | | | | | | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | | | 0.72 | | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | | | | | | | | | Sum of lost time (s) | 20.7 |
| Intersection Capacity Utilization | | | 88.2% | | | | | | | | | ICU Level of Service | E |
| Analysis Period (min) | | | 15 | | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Background Opening Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  |  |
| Traffic Volume (vph) | 3 | 0 | 19 | 23 | 0 | 130 | 11 | 793 | 10 | 52 | 652 | 3 |
| Future Volume (vph) | 3 | 0 | 19 | 23 | 0 | 130 | 11 | 793 | 10 | 52 | 652 | 3 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.883 | | | 0.885 | | | 0.998 | | | 0.999 | |
| Flt Protected | | 0.994 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1431 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Flt Permitted | | 0.994 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1431 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 5 | | | | | 5 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 3% | 2% | 2% | 4% | 0% |
| Adj. Flow (vph) | 3 | 0 | 20 | 25 | 0 | 141 | 12 | 835 | 11 | 57 | 686 | 3 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 23 | 0 | 0 | 166 | 0 | 12 | 846 | 0 | 57 | 689 | 0 |
| Enter Blocked Intersection | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 55.8% |
| Analysis Period (min) | 15 |
| | ICU Level of Service B |

HCM Unsignalized Intersection Capacity Analysis
 2: Niagara Street & Abbey Road

Background Opening Year
 AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  | |
| Traffic Volume (veh/h) | 3 | 0 | 19 | 23 | 0 | 130 | 11 | 793 | 10 | 52 | 652 | 3 |
| Future Volume (Veh/h) | 3 | 0 | 19 | 23 | 0 | 130 | 11 | 793 | 10 | 52 | 652 | 3 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 3 | 0 | 20 | 25 | 0 | 141 | 12 | 835 | 11 | 57 | 686 | 3 |
| Pedestrians | | 5 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 0 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage veh | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.95 | 0.95 | | 0.95 | 0.95 | 0.95 | | | | 0.95 | | |
| vC, conflicting volume | 1389 | 1676 | 350 | 1342 | 1672 | 423 | 694 | | | 846 | | |
| vC1, stage 1 conf vol | 806 | 806 | | 864 | 864 | | | | | | | |
| vC2, stage 2 conf vol | 582 | 870 | | 477 | 808 | | | | | | | |
| vCu, unblocked vol | 1296 | 1600 | 350 | 1246 | 1596 | 274 | 694 | | | 721 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 99 | 100 | 97 | 91 | 100 | 79 | 99 | | | 93 | | |
| cM capacity (veh/h) | 249 | 256 | 650 | 293 | 271 | 684 | 907 | | | 828 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 23 | 166 | 12 | 557 | 289 | 57 | 457 | 232 | | | | |
| Volume Left | 3 | 25 | 12 | 0 | 0 | 57 | 0 | 0 | | | | |
| Volume Right | 20 | 141 | 0 | 0 | 11 | 0 | 0 | 3 | | | | |
| cSH | 537 | 569 | 907 | 1700 | 1700 | 828 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.04 | 0.29 | 0.01 | 0.33 | 0.17 | 0.07 | 0.27 | 0.14 | | | | |
| Queue Length 95th (m) | 1.1 | 9.6 | 0.3 | 0.0 | 0.0 | 1.8 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 12.0 | 13.9 | 9.0 | 0.0 | 0.0 | 9.7 | 0.0 | 0.0 | | | | |
| Lane LOS | B | B | A | | | A | | | | | | |
| Approach Delay (s) | 12.0 | 13.9 | 0.1 | | | 0.7 | | | | | | |
| Approach LOS | B | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.8 | | | | | | | | | |
| Intersection Capacity Utilization | | | 55.8% | | ICU Level of Service | | | | B | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

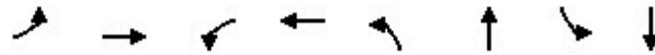
Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

Background Opening Year
 AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 57 | 3 | 47 | 10 | 10 | 148 | 36 | 621 | 9 | 109 | 504 | 65 |
| Future Volume (vph) | 57 | 3 | 47 | 10 | 10 | 148 | 36 | 621 | 9 | 109 | 504 | 65 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.858 | | | 0.860 | | | 0.998 | | | 0.983 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1300 | 0 | 1568 | 1279 | 0 | 1568 | 2799 | 0 | 1553 | 2714 | 0 |
| Flt Permitted | 0.628 | | | 0.722 | | | 0.423 | | | 0.397 | | |
| Satd. Flow (perm) | 1035 | 1300 | 0 | 1190 | 1279 | 0 | 697 | 2799 | 0 | 648 | 2714 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 50 | | | 157 | | | 3 | | | 25 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| Adj. Flow (vph) | 61 | 3 | 50 | 11 | 11 | 157 | 38 | 661 | 10 | 116 | 536 | 69 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 61 | 53 | 0 | 11 | 168 | 0 | 38 | 671 | 0 | 116 | 605 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Background Opening Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|-----------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 61 | 53 | 11 | 168 | 38 | 671 | 116 | 605 |
| v/c Ratio | 0.44 | 0.24 | 0.07 | 0.54 | 0.08 | 0.34 | 0.26 | 0.32 |
| Control Delay | 42.2 | 12.9 | 30.5 | 13.6 | 5.5 | 6.1 | 7.3 | 5.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 42.2 | 12.9 | 30.5 | 13.6 | 5.5 | 6.1 | 7.3 | 5.7 |
| Queue Length 50th (m) | 9.7 | 0.5 | 1.7 | 1.7 | 1.7 | 19.7 | 6.1 | 16.6 |
| Queue Length 95th (m) | 20.7 | 9.9 | 6.0 | 18.3 | 5.9 | 34.7 | 16.6 | 29.9 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 307 | 421 | 353 | 490 | 484 | 1947 | 450 | 1895 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.20 | 0.13 | 0.03 | 0.34 | 0.08 | 0.34 | 0.26 | 0.32 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
3: Niagara Street & Parking Lot/Aqueduct Street

Background Opening Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |   | |  |   | |
| Traffic Volume (vph) | 57 | 3 | 47 | 10 | 10 | 148 | 36 | 621 | 9 | 109 | 504 | 65 |
| Future Volume (vph) | 57 | 3 | 47 | 10 | 10 | 148 | 36 | 621 | 9 | 109 | 504 | 65 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 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 | 0.86 | | 1.00 | 0.86 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1566 | 1301 | | 1566 | 1279 | | 1565 | 2799 | | 1551 | 2714 | |
| Flt Permitted | 0.63 | 1.00 | | 0.72 | 1.00 | | 0.42 | 1.00 | | 0.40 | 1.00 | |
| Satd. Flow (perm) | 1036 | 1301 | | 1191 | 1279 | | 697 | 2799 | | 648 | 2714 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 61 | 3 | 50 | 11 | 11 | 157 | 38 | 661 | 10 | 116 | 536 | 69 |
| RTOR Reduction (vph) | 0 | 43 | 0 | 0 | 136 | 0 | 0 | 1 | 0 | 0 | 8 | 0 |
| Lane Group Flow (vph) | 61 | 10 | 0 | 11 | 32 | 0 | 38 | 670 | 0 | 116 | 597 | 0 |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| 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) | 11.4 | 11.4 | | 11.4 | 11.4 | | 58.6 | 58.6 | | 58.6 | 58.6 | |
| Effective Green, g (s) | 11.4 | 11.4 | | 11.4 | 11.4 | | 58.6 | 58.6 | | 58.6 | 58.6 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | 0.14 | 0.14 | | 0.70 | 0.70 | | 0.70 | 0.70 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 140 | 176 | | 161 | 173 | | 485 | 1947 | | 450 | 1888 | |
| v/s Ratio Prot | | 0.01 | | | 0.03 | | | c0.24 | | | 0.22 | |
| v/s Ratio Perm | c0.06 | | | 0.01 | | | 0.05 | | | 0.18 | | |
| v/c Ratio | 0.44 | 0.06 | | 0.07 | 0.19 | | 0.08 | 0.34 | | 0.26 | 0.32 | |
| Uniform Delay, d1 | 33.4 | 31.7 | | 31.8 | 32.3 | | 4.1 | 5.1 | | 4.7 | 5.0 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.9 | 0.2 | | 0.2 | 0.7 | | 0.3 | 0.5 | | 1.4 | 0.4 | |
| Delay (s) | 36.4 | 31.9 | | 32.0 | 33.0 | | 4.4 | 5.6 | | 6.1 | 5.4 | |
| Level of Service | D | C | | C | C | | A | A | | A | A | |
| Approach Delay (s) | | 34.3 | | | 32.9 | | | 5.5 | | | 5.5 | |
| Approach LOS | | C | | | C | | | A | | | A | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 10.3 | | | | HCM 2000 Level of Service | | | B | | |
| HCM 2000 Volume to Capacity ratio | | | 0.36 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | | | Sum of lost time (s) | | | 14.2 | | | |
| Intersection Capacity Utilization | | | 76.7% | | | ICU Level of Service | | | D | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Background Opening Year
AM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 17 | 35 | 39 | 689 | 475 | 69 |
| Future Volume (vph) | 17 | 35 | 39 | 689 | 475 | 69 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.908 | | | | 0.981 | |
| Flt Protected | 0.984 | | 0.950 | | | |
| Satd. Flow (prot) | 1427 | 0 | 1568 | 3308 | 2731 | 0 |
| Flt Permitted | 0.984 | | 0.950 | | | |
| Satd. Flow (perm) | 1427 | 0 | 1568 | 3308 | 2731 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 1 | | 6 | | | 6 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 2% | 5% | 3% |
| Adj. Flow (vph) | 18 | 38 | 42 | 749 | 516 | 75 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 56 | 0 | 42 | 749 | 591 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 36.0% |
| Analysis Period (min) | 15 |
| | ICU Level of Service A |

HCM Unsignalized Intersection Capacity Analysis
4: Niagara Street & Roger Drive

Background Opening Year
AM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 17 | 35 | 39 | 689 | 475 | 69 |
| Future Volume (Veh/h) | 17 | 35 | 39 | 689 | 475 | 69 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 18 | 38 | 42 | 749 | 516 | 75 |
| Pedestrians | 6 | | | | 1 | |
| Lane Width (m) | 3.6 | | | | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | | 1.2 | |
| Percent Blockage | 1 | | | | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1019 | 302 | 597 | | | |
| vC1, stage 1 conf vol | 560 | | | | | |
| vC2, stage 2 conf vol | 460 | | | | | |
| vCu, unblocked vol | 1019 | 302 | 597 | | | |
| tC, single (s) | 6.8 | 7.0 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 96 | 94 | 96 | | | |
| cM capacity (veh/h) | 437 | 688 | 985 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 56 | 42 | 374 | 374 | 344 | 247 |
| Volume Left | 18 | 42 | 0 | 0 | 0 | 0 |
| Volume Right | 38 | 0 | 0 | 0 | 0 | 75 |
| cSH | 581 | 985 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.10 | 0.04 | 0.22 | 0.22 | 0.20 | 0.15 |
| Queue Length 95th (m) | 2.5 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 11.9 | 8.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | | | | |
| Approach Delay (s) | 11.9 | 0.5 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.7 | | | |
| Intersection Capacity Utilization | | | 36.0% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Background Opening Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 286 | 163 | 93 | 39 | 131 | 107 | 93 | 342 | 45 | 75 | 301 | 200 |
| Future Volume (vph) | 286 | 163 | 93 | 39 | 131 | 107 | 93 | 342 | 45 | 75 | 301 | 200 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 0.99 | | 0.99 | 1.00 | | 0.99 | 0.99 | |
| Frt | | 0.946 | | | 0.932 | | | 0.983 | | | 0.940 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1291 | 0 | 1413 | 1321 | 0 | 1376 | 2683 | 0 | 1376 | 2612 | 0 |
| Flt Permitted | 0.359 | | | 0.585 | | | 0.370 | | | 0.496 | | |
| Satd. Flow (perm) | 576 | 1291 | 0 | 865 | 1321 | 0 | 532 | 2683 | 0 | 714 | 2612 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 26 | | | 38 | | | 14 | | | 162 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Peak Hour Factor | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Adj. Flow (vph) | 314 | 179 | 102 | 43 | 144 | 118 | 102 | 376 | 49 | 82 | 331 | 220 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 314 | 281 | 0 | 43 | 262 | 0 | 102 | 425 | 0 | 82 | 551 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Background Opening Year
AM Peak Hour

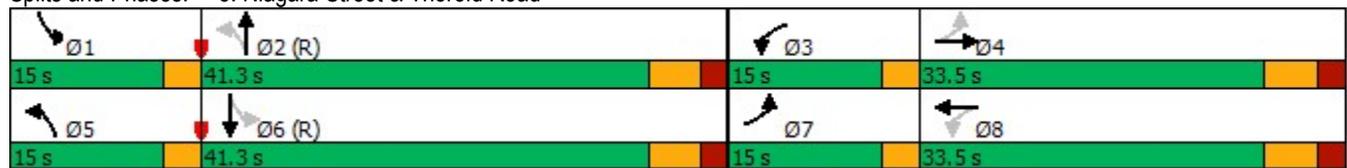


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 40.3 | 30.3 | | 32.3 | 21.9 | | 56.7 | 45.7 | | 54.7 | 43.3 | |
| Actuated g/C Ratio | 0.38 | 0.29 | | 0.31 | 0.21 | | 0.54 | 0.44 | | 0.52 | 0.41 | |
| v/c Ratio | 0.95 | 0.72 | | 0.14 | 0.86 | | 0.28 | 0.36 | | 0.19 | 0.47 | |
| Control Delay | 65.5 | 42.1 | | 19.8 | 59.2 | | 14.7 | 22.5 | | 13.7 | 18.3 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 65.5 | 42.1 | | 19.8 | 59.2 | | 14.7 | 22.5 | | 13.7 | 18.3 | |
| LOS | E | D | | B | E | | B | C | | B | B | |
| Approach Delay | | 54.4 | | | 53.6 | | | 21.0 | | | 17.7 | |
| Approach LOS | | D | | | D | | | C | | | B | |

Intersection Summary

Area Type: Other
 Cycle Length: 104.8
 Actuated Cycle Length: 104.8
 Offset: 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.95
 Intersection Signal Delay: 34.5
 Intersection LOS: C
 Intersection Capacity Utilization 80.6%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Background Opening Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|-------|-------|------|-------|------|-------|------|-------|
| Lane Group Flow (vph) | 314 | 281 | 43 | 262 | 102 | 425 | 82 | 551 |
| v/c Ratio | 0.95 | 0.72 | 0.14 | 0.86 | 0.28 | 0.36 | 0.19 | 0.47 |
| Control Delay | 65.5 | 42.1 | 19.8 | 59.2 | 14.7 | 22.5 | 13.7 | 18.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 65.5 | 42.1 | 19.8 | 59.2 | 14.7 | 22.5 | 13.7 | 18.3 |
| Queue Length 50th (m) | 50.2 | 50.8 | 5.6 | 46.3 | 10.2 | 31.8 | 8.1 | 31.2 |
| Queue Length 95th (m) | #94.9 | #87.9 | 12.1 | #77.2 | 20.8 | 51.0 | 17.3 | 53.1 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 331 | 391 | 371 | 368 | 390 | 1176 | 467 | 1174 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.95 | 0.72 | 0.12 | 0.71 | 0.26 | 0.36 | 0.18 | 0.47 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Background Opening Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |   | |  |   |  |
| Traffic Volume (vph) | 286 | 163 | 93 | 39 | 131 | 107 | 93 | 342 | 45 | 75 | 301 | 200 |
| Future Volume (vph) | 286 | 163 | 93 | 39 | 131 | 107 | 93 | 342 | 45 | 75 | 301 | 200 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 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 | 0.95 | | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1533 | 1290 | | 1408 | 1321 | | 1373 | 2683 | | 1372 | 2612 | |
| Flt Permitted | 0.36 | 1.00 | | 0.59 | 1.00 | | 0.37 | 1.00 | | 0.50 | 1.00 | |
| Satd. Flow (perm) | 579 | 1290 | | 867 | 1321 | | 535 | 2683 | | 717 | 2612 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 314 | 179 | 102 | 43 | 144 | 118 | 102 | 376 | 49 | 82 | 331 | 220 |
| RTOR Reduction (vph) | 0 | 18 | 0 | 0 | 30 | 0 | 0 | 8 | 0 | 0 | 97 | 0 |
| Lane Group Flow (vph) | 314 | 263 | 0 | 43 | 232 | 0 | 102 | 417 | 0 | 82 | 454 | 0 |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 38.1 | 30.3 | | 27.9 | 23.1 | | 52.6 | 43.8 | | 49.2 | 42.1 | |
| Effective Green, g (s) | 38.1 | 30.3 | | 27.9 | 23.1 | | 52.6 | 43.8 | | 49.2 | 42.1 | |
| Actuated g/C Ratio | 0.36 | 0.29 | | 0.27 | 0.22 | | 0.50 | 0.42 | | 0.47 | 0.40 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 319 | 372 | | 255 | 291 | | 338 | 1121 | | 380 | 1049 | |
| v/s Ratio Prot | c0.11 | 0.20 | | 0.01 | 0.18 | | c0.03 | 0.16 | | 0.01 | c0.17 | |
| v/s Ratio Perm | c0.24 | | | 0.04 | | | 0.13 | | | 0.09 | | |
| v/c Ratio | 0.98 | 0.71 | | 0.17 | 0.80 | | 0.30 | 0.37 | | 0.22 | 0.43 | |
| Uniform Delay, d1 | 30.9 | 33.3 | | 29.1 | 38.6 | | 14.4 | 21.0 | | 15.7 | 22.7 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 45.8 | 5.2 | | 0.2 | 13.4 | | 0.4 | 0.9 | | 0.2 | 1.3 | |
| Delay (s) | 76.6 | 38.4 | | 29.3 | 52.1 | | 14.7 | 22.0 | | 15.9 | 24.0 | |
| Level of Service | E | D | | C | D | | B | C | | B | C | |
| Approach Delay (s) | | 58.6 | | | 48.9 | | | 20.6 | | | 23.0 | |
| Approach LOS | | E | | | D | | | C | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 36.5 | | | | HCM 2000 Level of Service | | | | D | |
| HCM 2000 Volume to Capacity ratio | | | 0.67 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | | Sum of lost time (s) | | | 18.8 | | |
| Intersection Capacity Utilization | | | 80.6% | | | | ICU Level of Service | | | D | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Background Opening Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 0 | 0 | 990 | 0 | 0 | 640 |
| Future Volume (vph) | 0 | 0 | 990 | 0 | 0 | 640 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | | | | | | |
| Flt Protected | | | | | | |
| Satd. Flow (prot) | 1598 | 0 | 2832 | 0 | 1619 | 2804 |
| Flt Permitted | | | | | | |
| Satd. Flow (perm) | 1598 | 0 | 2832 | 0 | 1619 | 2804 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 3% | 2% | 2% | 4% |
| Adj. Flow (vph) | 0 | 0 | 1076 | 0 | 0 | 696 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 0 | 1076 | 0 | 0 | 696 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 37.2% | | | ICU Level of Service A | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis
6: Niagara Street & Site Access

Background Opening Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |  | |  |  |
| Traffic Volume (veh/h) | 0 | 0 | 990 | 0 | 0 | 640 |
| Future Volume (Veh/h) | 0 | 0 | 990 | 0 | 0 | 640 |
| Sign Control | Stop | | Free | | Free | Free |
| Grade | 0% | | 0% | | 0% | 0% |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 0 | 1076 | 0 | 0 | 696 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | | | TWLTL |
| Median storage veh | | | 2 | | | 2 |
| Upstream signal (m) | | | 300 | | | 165 |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1424 | 538 | | | 1076 | |
| vC1, stage 1 conf vol | 1076 | | | | | |
| vC2, stage 2 conf vol | 348 | | | | | |
| vCu, unblocked vol | 1424 | 538 | | | 1076 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 100 | | | 100 | |
| cM capacity (veh/h) | 272 | 488 | | | 644 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 0 | 717 | 359 | 0 | 348 | 348 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 0 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.00 | 0.42 | 0.21 | 0.00 | 0.20 | 0.20 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | |
| Approach Delay (s) | 0.0 | 0.0 | | | 0.0 | |
| Approach LOS | A | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.0 | | | |
| Intersection Capacity Utilization | | | 37.2% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Background Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 304 | 442 | 144 | 450 | 478 | 160 | 143 | 627 | 340 | 206 | 823 | 308 |
| Future Volume (vph) | 304 | 442 | 144 | 450 | 478 | 160 | 143 | 627 | 340 | 206 | 823 | 308 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | | 0.95 | | 0.97 | | | 0.99 | |
| Frt | | 0.963 | | | | 0.850 | | 0.947 | | | 0.959 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1553 | 2273 | 0 | 1553 | 3341 | 1248 | 1568 | 2626 | 0 | 1523 | 2747 | 0 |
| Flt Permitted | 0.439 | | | 0.179 | | | 0.080 | | | 0.076 | | |
| Satd. Flow (perm) | 707 | 2273 | 0 | 290 | 3341 | 1188 | 132 | 2626 | 0 | 122 | 2747 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 26 | | | | 165 | | 67 | | | 36 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| 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 (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Adj. Flow (vph) | 313 | 456 | 148 | 464 | 493 | 165 | 147 | 646 | 351 | 212 | 848 | 318 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 313 | 604 | 0 | 464 | 493 | 165 | 147 | 997 | 0 | 212 | 1166 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

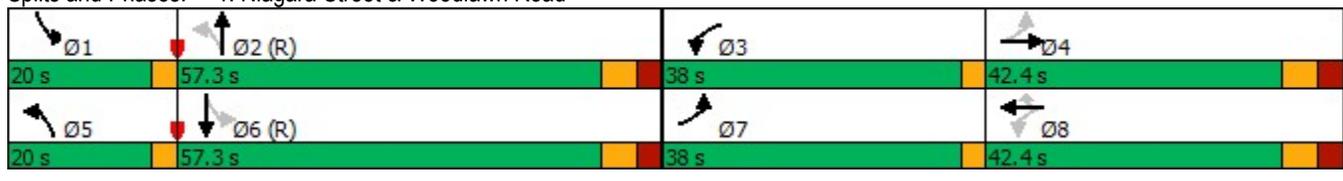
Background Opening Year
PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 65.1 | 35.0 | | 76.8 | 44.3 | 44.3 | 68.5 | 50.0 | | 72.9 | 52.8 | |
| Actuated g/C Ratio | 0.41 | 0.22 | | 0.49 | 0.28 | 0.28 | 0.43 | 0.32 | | 0.46 | 0.33 | |
| v/c Ratio | 0.73 | 1.15 | | 1.10 | 0.53 | 0.37 | 0.79 | 1.14 | | 1.02 | 1.24 | |
| Control Delay | 37.2 | 139.2 | | 111.6 | 51.5 | 8.9 | 64.4 | 119.6 | | 111.9 | 157.2 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 37.2 | 139.2 | | 111.6 | 51.5 | 8.9 | 64.4 | 119.6 | | 111.9 | 157.2 | |
| LOS | D | F | | F | D | A | E | F | | F | F | |
| Approach Delay | | 104.4 | | | 70.1 | | | 112.5 | | | 150.3 | |
| Approach LOS | | F | | | E | | | F | | | F | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 140
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.24
 Intersection Signal Delay: 111.9 Intersection LOS: F
 Intersection Capacity Utilization 121.4% ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Background Opening Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|--------|--------|-------|------|-------|--------|--------|--------|
| Lane Group Flow (vph) | 313 | 604 | 464 | 493 | 165 | 147 | 997 | 212 | 1166 |
| v/c Ratio | 0.73 | 1.15 | 1.10 | 0.53 | 0.37 | 0.79 | 1.14 | 1.02 | 1.24 |
| Control Delay | 37.2 | 139.2 | 111.6 | 51.5 | 8.9 | 64.4 | 119.6 | 111.9 | 157.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 37.2 | 139.2 | 111.6 | 51.5 | 8.9 | 64.4 | 119.6 | 111.9 | 157.2 |
| Queue Length 50th (m) | 64.7 | ~119.5 | ~145.7 | 72.4 | 0.0 | 31.6 | ~192.7 | ~58.8 | ~249.4 |
| Queue Length 95th (m) | 91.1 | #160.6 | #222.9 | 100.0 | 21.3 | #59.8 | #237.8 | #115.8 | #300.5 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 521 | 524 | 421 | 938 | 452 | 214 | 878 | 207 | 944 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.60 | 1.15 | 1.10 | 0.53 | 0.37 | 0.69 | 1.14 | 1.02 | 1.24 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Niagara Street & Woodlawn Road

Background Opening Year
PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR | |
|-----------------------------------|-------|-------|--------|---------------------------|------|------|-------|-------|------|-------|-------|------|--|
| Lane Configurations | | | | | | | | | | | | | |
| Traffic Volume (vph) | 304 | 442 | 144 | 450 | 478 | 160 | 143 | 627 | 340 | 206 | 823 | 308 | |
| Future Volume (vph) | 304 | 442 | 144 | 450 | 478 | 160 | 143 | 627 | 340 | 206 | 823 | 308 | |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.97 | | 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 | | |
| Frt | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.96 | | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | |
| Satd. Flow (prot) | 1542 | 2274 | | 1551 | 3341 | 1188 | 1568 | 2627 | | 1523 | 2747 | | |
| Flt Permitted | 0.44 | 1.00 | | 0.18 | 1.00 | 1.00 | 0.08 | 1.00 | | 0.08 | 1.00 | | |
| Satd. Flow (perm) | 713 | 2274 | | 293 | 3341 | 1188 | 132 | 2627 | | 121 | 2747 | | |
| 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) | 313 | 456 | 148 | 464 | 493 | 165 | 147 | 646 | 351 | 212 | 848 | 318 | |
| RTOR Reduction (vph) | 0 | 20 | 0 | 0 | 0 | 119 | 0 | 46 | 0 | 0 | 24 | 0 | |
| Lane Group Flow (vph) | 313 | 584 | 0 | 464 | 493 | 46 | 147 | 951 | 0 | 212 | 1142 | 0 | |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 | |
| Heavy Vehicles (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% | |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | | |
| Actuated Green, G (s) | 60.7 | 35.0 | | 73.0 | 44.3 | 44.3 | 64.2 | 50.0 | | 69.8 | 52.8 | | |
| Effective Green, g (s) | 60.7 | 35.0 | | 73.0 | 44.3 | 44.3 | 64.2 | 50.0 | | 69.8 | 52.8 | | |
| Actuated g/C Ratio | 0.38 | 0.22 | | 0.46 | 0.28 | 0.28 | 0.41 | 0.32 | | 0.44 | 0.33 | | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | | |
| Lane Grp Cap (vph) | 409 | 504 | | 414 | 938 | 333 | 183 | 832 | | 204 | 919 | | |
| v/s Ratio Prot | 0.12 | 0.26 | | c0.25 | 0.15 | | 0.07 | 0.36 | | c0.11 | c0.42 | | |
| v/s Ratio Perm | 0.17 | | | c0.27 | | 0.04 | 0.25 | | | 0.35 | | | |
| v/c Ratio | 0.77 | 1.16 | | 1.12 | 0.53 | 0.14 | 0.80 | 1.14 | | 1.04 | 1.24 | | |
| Uniform Delay, d1 | 37.5 | 61.3 | | 42.5 | 47.8 | 42.4 | 41.0 | 53.8 | | 49.8 | 52.4 | | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | |
| Incremental Delay, d2 | 8.0 | 91.6 | | 81.3 | 0.4 | 0.1 | 21.5 | 78.6 | | 73.7 | 118.5 | | |
| Delay (s) | 45.5 | 152.9 | | 123.9 | 48.2 | 42.6 | 62.5 | 132.5 | | 123.5 | 170.9 | | |
| Level of Service | D | F | | F | D | D | E | F | | F | F | | |
| Approach Delay (s) | | 116.2 | | | 78.7 | | | 123.5 | | | 163.6 | | |
| Approach LOS | | F | | | E | | | F | | | F | | |
| Intersection Summary | | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 123.1 | HCM 2000 Level of Service | | | | | | F | | | |
| HCM 2000 Volume to Capacity ratio | | | 1.20 | | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | Sum of lost time (s) | | | | | | 20.7 | | | |
| Intersection Capacity Utilization | | | 121.4% | ICU Level of Service | | | | | | H | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Background Opening Year
PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|------|-------|-------|------|-------|-------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 0 | 26 | 17 | 0 | 98 | 10 | 966 | 26 | 145 | 1187 | 30 |
| Future Volume (vph) | 10 | 0 | 26 | 17 | 0 | 98 | 10 | 966 | 26 | 145 | 1187 | 30 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.904 | | | 0.884 | | | 0.996 | | | 0.996 | |
| Flt Protected | | 0.986 | | | 0.993 | | 0.950 | | 0.950 | | | |
| Satd. Flow (prot) | 0 | 1453 | 0 | 0 | 1403 | 0 | 1568 | 2848 | 0 | 1538 | 2877 | 0 |
| Flt Permitted | | 0.986 | | | 0.993 | | 0.950 | | 0.950 | | | |
| Satd. Flow (perm) | 0 | 1453 | 0 | 0 | 1403 | 0 | 1568 | 2848 | 0 | 1538 | 2877 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 19 | | | | | 19 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 2% | 2% | 2% | 1% | 0% |
| Adj. Flow (vph) | 11 | 0 | 27 | 18 | 0 | 107 | 11 | 1017 | 28 | 158 | 1249 | 32 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 38 | 0 | 0 | 125 | 0 | 11 | 1045 | 0 | 158 | 1281 | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 100 | | 100 | 25 | | 100 | 100 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 64.5% |
| ICU Level of Service | C |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Background Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  | |
| Traffic Volume (veh/h) | 10 | 0 | 26 | 17 | 0 | 98 | 10 | 966 | 26 | 145 | 1187 | 30 |
| Future Volume (Veh/h) | 10 | 0 | 26 | 17 | 0 | 98 | 10 | 966 | 26 | 145 | 1187 | 30 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 11 | 0 | 27 | 18 | 0 | 107 | 11 | 1017 | 28 | 158 | 1249 | 32 |
| Pedestrians | | 19 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 2 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage veh | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.84 | 0.84 | 0.79 | 0.84 | 0.84 | 0.90 | 0.79 | | | 0.90 | | |
| vC, conflicting volume | 2238 | 2667 | 660 | 2020 | 2669 | 522 | 1300 | | | 1045 | | |
| vC1, stage 1 conf vol | 1600 | 1600 | | 1053 | 1053 | | | | | | | |
| vC2, stage 2 conf vol | 638 | 1067 | | 968 | 1616 | | | | | | | |
| vCu, unblocked vol | 1551 | 2064 | 24 | 1291 | 2067 | 247 | 838 | | | 828 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 90 | 100 | 97 | 92 | 100 | 84 | 98 | | | 78 | | |
| cM capacity (veh/h) | 110 | 116 | 815 | 227 | 126 | 677 | 623 | | | 719 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 38 | 125 | 11 | 678 | 367 | 158 | 833 | 448 | | | | |
| Volume Left | 11 | 18 | 11 | 0 | 0 | 158 | 0 | 0 | | | | |
| Volume Right | 27 | 107 | 0 | 0 | 28 | 0 | 0 | 32 | | | | |
| cSH | 286 | 527 | 623 | 1700 | 1700 | 719 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.13 | 0.24 | 0.02 | 0.40 | 0.22 | 0.22 | 0.49 | 0.26 | | | | |
| Queue Length 95th (m) | 3.6 | 7.3 | 0.4 | 0.0 | 0.0 | 6.7 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 19.5 | 13.9 | 10.9 | 0.0 | 0.0 | 11.4 | 0.0 | 0.0 | | | | |
| Lane LOS | C | B | B | | | B | | | | | | |
| Approach Delay (s) | 19.5 | 13.9 | 0.1 | | | 1.3 | | | | | | |
| Approach LOS | C | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.7 | | | | | | | | | |
| Intersection Capacity Utilization | | 64.5% | | ICU Level of Service | | C | | | | | | |
| Analysis Period (min) | | 15 | | | | | | | | | | |

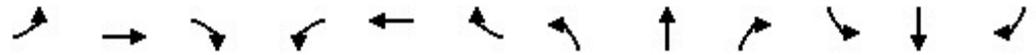
Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

Background Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 41 | 1 | 39 | 13 | 2 | 71 | 37 | 892 | 21 | 92 | 1084 | 50 |
| Future Volume (vph) | 41 | 1 | 39 | 13 | 2 | 71 | 37 | 892 | 21 | 92 | 1084 | 50 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.98 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.854 | | | 0.854 | | | 0.997 | | | 0.993 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1289 | 0 | 1568 | 1293 | 0 | 1568 | 2822 | 0 | 1568 | 2837 | 0 |
| Flt Permitted | 0.709 | | | 0.730 | | | 0.228 | | | 0.300 | | |
| Satd. Flow (perm) | 1169 | 1289 | 0 | 1199 | 1293 | 0 | 375 | 2822 | 0 | 493 | 2837 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 40 | | | 72 | | | 4 | | | 8 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| Adj. Flow (vph) | 42 | 1 | 40 | 13 | 2 | 72 | 38 | 910 | 21 | 94 | 1106 | 51 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 42 | 41 | 0 | 13 | 74 | 0 | 38 | 931 | 0 | 94 | 1157 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

Background Opening Year
 PM Peak Hour

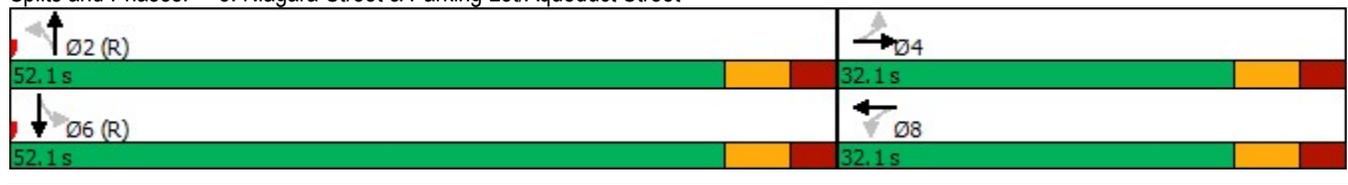


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effct Green (s) | 9.9 | 9.9 | | 9.9 | 9.9 | | 64.6 | 64.6 | | 64.6 | 64.6 | |
| Actuated g/C Ratio | 0.12 | 0.12 | | 0.12 | 0.12 | | 0.77 | 0.77 | | 0.77 | 0.77 | |
| v/c Ratio | 0.31 | 0.22 | | 0.09 | 0.34 | | 0.13 | 0.43 | | 0.25 | 0.53 | |
| Control Delay | 39.2 | 14.2 | | 33.3 | 13.7 | | 5.7 | 5.6 | | 6.7 | 6.6 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 39.2 | 14.2 | | 33.3 | 13.7 | | 5.7 | 5.6 | | 6.7 | 6.6 | |
| LOS | D | B | | C | B | | A | A | | A | A | |
| Approach Delay | | 26.9 | | | 16.7 | | | 5.6 | | | 6.6 | |
| Approach LOS | | C | | | B | | | A | | | A | |

Intersection Summary

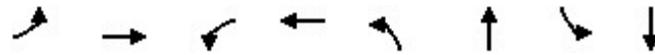
Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 50
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.53
 Intersection Signal Delay: 7.2
 Intersection LOS: A
 Intersection Capacity Utilization 77.3%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Background Opening Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|-----------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 42 | 41 | 13 | 74 | 38 | 931 | 94 | 1157 |
| v/c Ratio | 0.31 | 0.22 | 0.09 | 0.34 | 0.13 | 0.43 | 0.25 | 0.53 |
| Control Delay | 39.2 | 14.2 | 33.3 | 13.7 | 5.7 | 5.6 | 6.7 | 6.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 39.2 | 14.2 | 33.3 | 13.7 | 5.7 | 5.6 | 6.7 | 6.6 |
| Queue Length 50th (m) | 6.7 | 0.2 | 2.0 | 0.3 | 1.7 | 28.4 | 4.5 | 39.8 |
| Queue Length 95th (m) | 16.0 | 9.0 | 7.1 | 12.0 | 6.0 | 47.0 | 13.2 | 65.5 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 347 | 410 | 355 | 434 | 287 | 2164 | 378 | 2177 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.12 | 0.10 | 0.04 | 0.17 | 0.13 | 0.43 | 0.25 | 0.53 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis

3: Niagara Street & Parking Lot/Aqueduct Street

Background Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR | |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  | |
| Traffic Volume (vph) | 41 | 1 | 39 | 13 | 2 | 71 | 37 | 892 | 21 | 92 | 1084 | 50 | |
| Future Volume (vph) | 41 | 1 | 39 | 13 | 2 | 71 | 37 | 892 | 21 | 92 | 1084 | 50 | |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | | |
| Frbp, ped/bikes | 1.00 | 0.98 | | 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 | | 0.99 | 1.00 | | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.85 | | 1.00 | 1.00 | | 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) | 1566 | 1289 | | 1561 | 1294 | | 1564 | 2821 | | 1560 | 2838 | | |
| Flt Permitted | 0.71 | 1.00 | | 0.73 | 1.00 | | 0.23 | 1.00 | | 0.30 | 1.00 | | |
| Satd. Flow (perm) | 1169 | 1289 | | 1200 | 1294 | | 375 | 2821 | | 493 | 2838 | | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | |
| Adj. Flow (vph) | 42 | 1 | 40 | 13 | 2 | 72 | 38 | 910 | 21 | 94 | 1106 | 51 | |
| RTOR Reduction (vph) | 0 | 36 | 0 | 0 | 65 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | |
| Lane Group Flow (vph) | 42 | 5 | 0 | 13 | 9 | 0 | 38 | 930 | 0 | 94 | 1155 | 0 | |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% | |
| 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) | 8.3 | 8.3 | | 8.3 | 8.3 | | 61.7 | 61.7 | | 61.7 | 61.7 | | |
| Effective Green, g (s) | 8.3 | 8.3 | | 8.3 | 8.3 | | 61.7 | 61.7 | | 61.7 | 61.7 | | |
| Actuated g/C Ratio | 0.10 | 0.10 | | 0.10 | 0.10 | | 0.73 | 0.73 | | 0.73 | 0.73 | | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | |
| Lane Grp Cap (vph) | 115 | 127 | | 118 | 127 | | 274 | 2067 | | 361 | 2079 | | |
| v/s Ratio Prot | | 0.00 | | | 0.01 | | | 0.33 | | | c0.41 | | |
| v/s Ratio Perm | c0.04 | | | 0.01 | | | 0.10 | | | 0.19 | | | |
| v/c Ratio | 0.37 | 0.04 | | 0.11 | 0.07 | | 0.14 | 0.45 | | 0.26 | 0.56 | | |
| Uniform Delay, d1 | 35.5 | 34.3 | | 34.6 | 34.5 | | 3.3 | 4.5 | | 3.7 | 5.1 | | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | |
| Incremental Delay, d2 | 2.7 | 0.2 | | 0.6 | 0.3 | | 1.1 | 0.7 | | 1.7 | 1.1 | | |
| Delay (s) | 38.2 | 34.5 | | 35.2 | 34.8 | | 4.4 | 5.2 | | 5.5 | 6.1 | | |
| Level of Service | D | C | | D | C | | A | A | | A | A | | |
| Approach Delay (s) | | 36.4 | | | 34.8 | | | 5.2 | | | 6.1 | | |
| Approach LOS | | D | | | C | | | A | | | A | | |
| Intersection Summary | | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 7.8 | | | | HCM 2000 Level of Service | | | A | | | |
| HCM 2000 Volume to Capacity ratio | | | 0.53 | | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | | | | Sum of lost time (s) | | | 14.2 | | | |
| Intersection Capacity Utilization | | | 77.3% | | | | ICU Level of Service | | | D | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Background Opening Year
PM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 23 | 40 | 42 | 846 | 996 | 75 |
| Future Volume (vph) | 23 | 40 | 42 | 846 | 996 | 75 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.915 | | | | 0.989 | |
| Flt Protected | 0.982 | | 0.950 | | | |
| Satd. Flow (prot) | 1465 | 0 | 1568 | 3308 | 2858 | 0 |
| Flt Permitted | 0.982 | | 0.950 | | | |
| Satd. Flow (perm) | 1465 | 0 | 1568 | 3308 | 2858 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 2 | 1 | 8 | | | 8 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 1% | 0% |
| Adj. Flow (vph) | 25 | 43 | 46 | 920 | 1083 | 82 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 68 | 0 | 46 | 920 | 1165 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 51.5% |
| Analysis Period (min) | 15 |
| | ICU Level of Service A |

HCM Unsignalized Intersection Capacity Analysis

4: Niagara Street & Roger Drive

Background Opening Year
PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|-------|------|------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 23 | 40 | 42 | 846 | 996 | 75 |
| Future Volume (Veh/h) | 23 | 40 | 42 | 846 | 996 | 75 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 25 | 43 | 46 | 920 | 1083 | 82 |
| Pedestrians | 8 | | | 1 | 2 | |
| Lane Width (m) | 3.6 | | | 3.6 | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | 1.2 | 1.2 | |
| Percent Blockage | 1 | | | 0 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage (veh) | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | 0.89 | 0.87 | 0.87 | | | |
| vC, conflicting volume | 1686 | 592 | 1173 | | | |
| vC1, stage 1 conf vol | 1132 | | | | | |
| vC2, stage 2 conf vol | 554 | | | | | |
| vCu, unblocked vol | 1332 | 233 | 901 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 91 | 94 | 93 | | | |
| cM capacity (veh/h) | 294 | 670 | 659 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 68 | 46 | 460 | 460 | 722 | 443 |
| Volume Left | 25 | 46 | 0 | 0 | 0 | 0 |
| Volume Right | 43 | 0 | 0 | 0 | 0 | 82 |
| cSH | 456 | 659 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.15 | 0.07 | 0.27 | 0.27 | 0.42 | 0.26 |
| Queue Length 95th (m) | 4.2 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 14.3 | 10.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | B | | | | |
| Approach Delay (s) | 14.3 | 0.5 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 0.7 | | | | | |
| Intersection Capacity Utilization | 51.5% | | | ICU Level of Service | A | |
| Analysis Period (min) | 15 | | | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Background Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 338 | 152 | 82 | 100 | 157 | 100 | 143 | 504 | 62 | 102 | 569 | 452 |
| Future Volume (vph) | 338 | 152 | 82 | 100 | 157 | 100 | 143 | 504 | 62 | 102 | 569 | 452 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 0.99 | | | 1.00 | | 0.99 | 0.98 | |
| Frt | | 0.948 | | | 0.942 | | | 0.983 | | | 0.934 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1391 | 0 | 1568 | 1391 | 0 | 1452 | 2822 | 0 | 1466 | 2643 | 0 |
| Flt Permitted | 0.337 | | | 0.517 | | | 0.123 | | | 0.376 | | |
| Satd. Flow (perm) | 541 | 1391 | 0 | 842 | 1391 | 0 | 188 | 2822 | 0 | 575 | 2643 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 25 | | | 29 | | | 14 | | | 206 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Adj. Flow (vph) | 352 | 158 | 85 | 104 | 164 | 104 | 149 | 525 | 65 | 106 | 593 | 471 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 352 | 243 | 0 | 104 | 268 | 0 | 149 | 590 | 0 | 106 | 1064 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Background Opening Year
PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 39.4 | 24.6 | | 34.8 | 22.0 | | 56.6 | 43.2 | | 54.1 | 42.0 | |
| Actuated g/C Ratio | 0.38 | 0.23 | | 0.33 | 0.21 | | 0.54 | 0.41 | | 0.52 | 0.40 | |
| v/c Ratio | 1.11 | 0.70 | | 0.30 | 0.85 | | 0.67 | 0.50 | | 0.29 | 0.90 | |
| Control Delay | 111.1 | 44.1 | | 22.4 | 59.4 | | 31.2 | 25.7 | | 14.7 | 36.9 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 111.1 | 44.1 | | 22.4 | 59.4 | | 31.2 | 25.7 | | 14.7 | 36.9 | |
| LOS | F | D | | C | E | | C | C | | B | D | |
| Approach Delay | | 83.8 | | | 49.1 | | | 26.8 | | | 34.9 | |
| Approach LOS | | F | | | D | | | C | | | C | |

Intersection Summary

Area Type: Other
 Cycle Length: 104.8
 Actuated Cycle Length: 104.8
 Offset: 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.11
 Intersection Signal Delay: 44.8 Intersection LOS: D
 Intersection Capacity Utilization 105.5% ICU Level of Service G
 Analysis Period (min) 15

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Background Opening Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|--------|-------|------|-------|-------|-------|------|--------|
| Lane Group Flow (vph) | 352 | 243 | 104 | 268 | 149 | 590 | 106 | 1064 |
| v/c Ratio | 1.11 | 0.70 | 0.30 | 0.85 | 0.67 | 0.50 | 0.29 | 0.90 |
| Control Delay | 111.1 | 44.1 | 22.4 | 59.4 | 31.2 | 25.7 | 14.7 | 36.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 111.1 | 44.1 | 22.4 | 59.4 | 31.2 | 25.7 | 14.7 | 36.9 |
| Queue Length 50th (m) | ~65.1 | 42.6 | 14.2 | 49.3 | 15.3 | 48.0 | 10.6 | 95.8 |
| Queue Length 95th (m) | #103.2 | 70.0 | 24.4 | #78.5 | #39.0 | 73.6 | 21.5 | #156.4 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 317 | 379 | 384 | 379 | 248 | 1172 | 413 | 1181 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.11 | 0.64 | 0.27 | 0.71 | 0.60 | 0.50 | 0.26 | 0.90 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Background Opening Year
PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|------|--------|-------|------|------|---------------------------|------|------|-------|-------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 338 | 152 | 82 | 100 | 157 | 100 | 143 | 504 | 62 | 102 | 569 | 452 |
| Future Volume (vph) | 338 | 152 | 82 | 100 | 157 | 100 | 143 | 504 | 62 | 102 | 569 | 452 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 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 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 0.99 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.95 | | 1.00 | 0.94 | | 1.00 | 0.98 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1534 | 1390 | | 1558 | 1391 | | 1452 | 2823 | | 1461 | 2641 | |
| Flt Permitted | 0.34 | 1.00 | | 0.52 | 1.00 | | 0.12 | 1.00 | | 0.38 | 1.00 | |
| Satd. Flow (perm) | 545 | 1390 | | 847 | 1391 | | 188 | 2823 | | 578 | 2641 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 352 | 158 | 85 | 104 | 164 | 104 | 149 | 525 | 65 | 106 | 593 | 471 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 23 | 0 | 0 | 8 | 0 | 0 | 124 | 0 |
| Lane Group Flow (vph) | 352 | 224 | 0 | 104 | 245 | 0 | 149 | 582 | 0 | 106 | 940 | 0 |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 36.7 | 24.7 | | 31.3 | 22.0 | | 53.3 | 43.2 | | 50.7 | 41.9 | |
| Effective Green, g (s) | 36.7 | 24.7 | | 31.3 | 22.0 | | 53.3 | 43.2 | | 50.7 | 41.9 | |
| Actuated g/C Ratio | 0.35 | 0.24 | | 0.30 | 0.21 | | 0.51 | 0.41 | | 0.48 | 0.40 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 304 | 327 | | 316 | 292 | | 217 | 1163 | | 353 | 1055 | |
| v/s Ratio Prot | c0.13 | 0.16 | | 0.03 | 0.18 | | c0.07 | 0.21 | | 0.03 | c0.36 | |
| v/s Ratio Perm | c0.27 | | | 0.07 | | | 0.28 | | | 0.12 | | |
| v/c Ratio | 1.16 | 0.68 | | 0.33 | 0.84 | | 0.69 | 0.50 | | 0.30 | 0.89 | |
| Uniform Delay, d1 | 31.7 | 36.5 | | 27.7 | 39.7 | | 18.2 | 22.8 | | 15.2 | 29.3 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 101.5 | 4.9 | | 0.4 | 18.1 | | 8.0 | 1.5 | | 0.3 | 11.4 | |
| Delay (s) | 133.2 | 41.4 | | 28.1 | 57.8 | | 26.2 | 24.3 | | 15.6 | 40.7 | |
| Level of Service | F | D | | C | E | | C | C | | B | D | |
| Approach Delay (s) | | 95.7 | | | 49.5 | | | 24.7 | | | 38.4 | |
| Approach LOS | | F | | | D | | | C | | | D | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 48.2 | | | | HCM 2000 Level of Service | | | | D | |
| HCM 2000 Volume to Capacity ratio | | | 1.01 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | | Sum of lost time (s) | | | | 18.8 | |
| Intersection Capacity Utilization | | | 105.5% | | | | ICU Level of Service | | | | G | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Background Opening Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 0 | 0 | 1110 | 0 | 0 | 1417 |
| Future Volume (vph) | 0 | 0 | 1110 | 0 | 0 | 1417 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | | | | | | |
| Flt Protected | | | | | | |
| Satd. Flow (prot) | 1598 | 0 | 2859 | 0 | 1619 | 2888 |
| Flt Permitted | | | | | | |
| Satd. Flow (perm) | 1598 | 0 | 2859 | 0 | 1619 | 2888 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 0 | 0 | 1207 | 0 | 0 | 1540 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 0 | 1207 | 0 | 0 | 1540 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 51.8% | | | ICU Level of Service A | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis

6: Niagara Street & Site Access

Background Opening Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |  | |  |  |
| Traffic Volume (veh/h) | 0 | 0 | 1110 | 0 | 0 | 1417 |
| Future Volume (Veh/h) | 0 | 0 | 1110 | 0 | 0 | 1417 |
| Sign Control | Stop | | Free | | Free | |
| Grade | 0% | | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 0 | 1207 | 0 | 0 | 1540 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | TWLTL | | | TWLTL | | |
| Median storage veh | 2 | | | 2 | | |
| Upstream signal (m) | 300 | | | 165 | | |
| pX, platoon unblocked | 0.72 | 0.96 | | | 0.96 | |
| vC, conflicting volume | 1977 | 604 | | | 1207 | |
| vC1, stage 1 conf vol | 1207 | | | | | |
| vC2, stage 2 conf vol | 770 | | | | | |
| vCu, unblocked vol | 1299 | 494 | | | 1125 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 100 | | | 100 | |
| cM capacity (veh/h) | 247 | 498 | | | 590 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 0 | 805 | 402 | 0 | 770 | 770 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 0 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.00 | 0.47 | 0.24 | 0.00 | 0.45 | 0.45 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | |
| Approach Delay (s) | 0.0 | 0.0 | 0.0 | | | |
| Approach LOS | A | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 0.0 | | | | | |
| Intersection Capacity Utilization | 51.8% | | ICU Level of Service | | A | |
| Analysis Period (min) | 15 | | | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Background 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  |  |
| Traffic Volume (vph) | 261 | 415 | 101 | 209 | 368 | 133 | 99 | 613 | 362 | 105 | 389 | 164 |
| Future Volume (vph) | 261 | 415 | 101 | 209 | 368 | 133 | 99 | 613 | 362 | 105 | 389 | 164 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 1.00 | | 1.00 | | 0.97 | 1.00 | 0.99 | | | 1.00 | |
| Frt | | 0.971 | | | | 0.850 | | 0.944 | | | 0.956 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 2718 | 0 | 1508 | 3276 | 1224 | 1553 | 2663 | 0 | 1452 | 2663 | 0 |
| Flt Permitted | 0.350 | | | 0.294 | | | 0.393 | | | 0.163 | | |
| Satd. Flow (perm) | 563 | 2718 | 0 | 465 | 3276 | 1194 | 641 | 2663 | 0 | 249 | 2663 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 17 | | | | 136 | | 80 | | | 43 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Adj. Flow (vph) | 266 | 423 | 103 | 213 | 376 | 136 | 101 | 626 | 369 | 107 | 397 | 167 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 266 | 526 | 0 | 213 | 376 | 136 | 101 | 995 | 0 | 107 | 564 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

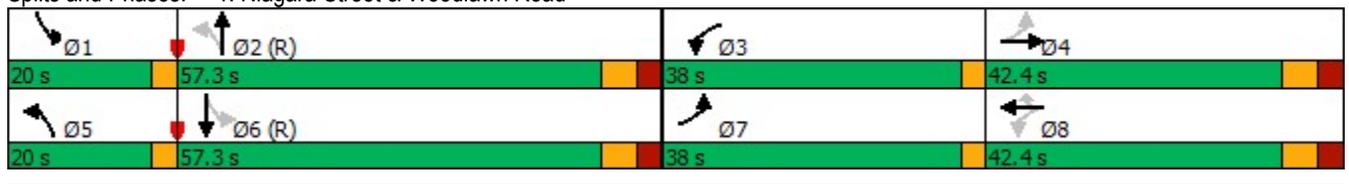
Background 5 Year
AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 62.7 | 34.6 | | 55.6 | 30.5 | 30.5 | 83.9 | 69.4 | | 87.9 | 71.6 | |
| Actuated g/C Ratio | 0.40 | 0.22 | | 0.35 | 0.19 | 0.19 | 0.53 | 0.44 | | 0.56 | 0.45 | |
| v/c Ratio | 0.71 | 0.86 | | 0.71 | 0.59 | 0.40 | 0.25 | 0.82 | | 0.46 | 0.46 | |
| Control Delay | 44.3 | 71.8 | | 45.9 | 61.5 | 10.9 | 19.8 | 43.2 | | 24.8 | 30.7 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 44.3 | 71.8 | | 45.9 | 61.5 | 10.9 | 19.8 | 43.2 | | 24.8 | 30.7 | |
| LOS | D | E | | D | E | B | B | D | | C | C | |
| Approach Delay | | 62.6 | | | 47.4 | | | 41.0 | | | 29.8 | |
| Approach LOS | | E | | | D | | | D | | | C | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 80
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.86
 Intersection Signal Delay: 45.3 Intersection LOS: D
 Intersection Capacity Utilization 94.0% ICU Level of Service F
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Background 5 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|-------|------|-------|------|------|--------|-------|-------|
| Lane Group Flow (vph) | 266 | 526 | 213 | 376 | 136 | 101 | 995 | 107 | 564 |
| v/c Ratio | 0.71 | 0.86 | 0.71 | 0.59 | 0.40 | 0.25 | 0.82 | 0.46 | 0.46 |
| Control Delay | 44.3 | 71.8 | 45.9 | 61.5 | 10.9 | 19.8 | 43.2 | 24.8 | 30.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 44.3 | 71.8 | 45.9 | 61.5 | 10.9 | 19.8 | 43.2 | 24.8 | 30.7 |
| Queue Length 50th (m) | 63.2 | 86.1 | 48.7 | 59.9 | 0.0 | 15.2 | 140.3 | 16.3 | 61.8 |
| Queue Length 95th (m) | 79.6 | 103.7 | 63.3 | 75.5 | 19.4 | 29.8 | #227.3 | 31.5 | 94.6 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 440 | 648 | 416 | 729 | 371 | 455 | 1217 | 272 | 1232 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.60 | 0.81 | 0.51 | 0.52 | 0.37 | 0.22 | 0.82 | 0.39 | 0.46 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Niagara Street & Woodlawn Road

Background 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 261 | 415 | 101 | 209 | 368 | 133 | 99 | 613 | 362 | 105 | 389 | 164 |
| Future Volume (vph) | 261 | 415 | 101 | 209 | 368 | 133 | 99 | 613 | 362 | 105 | 389 | 164 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 | 1.00 | 0.99 | | 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 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1535 | 2717 | | 1507 | 3276 | 1194 | 1552 | 2665 | | 1452 | 2662 | |
| Flt Permitted | 0.35 | 1.00 | | 0.29 | 1.00 | 1.00 | 0.39 | 1.00 | | 0.16 | 1.00 | |
| Satd. Flow (perm) | 565 | 2717 | | 466 | 3276 | 1194 | 642 | 2665 | | 249 | 2662 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 266 | 423 | 103 | 213 | 376 | 136 | 101 | 626 | 369 | 107 | 397 | 167 |
| RTOR Reduction (vph) | 0 | 13 | 0 | 0 | 0 | 110 | 0 | 45 | 0 | 0 | 23 | 0 |
| Lane Group Flow (vph) | 266 | 513 | 0 | 213 | 376 | 26 | 101 | 950 | 0 | 107 | 541 | 0 |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 58.2 | 34.6 | | 51.1 | 30.5 | 30.5 | 79.6 | 69.5 | | 84.0 | 71.7 | |
| Effective Green, g (s) | 58.2 | 34.6 | | 51.1 | 30.5 | 30.5 | 79.6 | 69.5 | | 84.0 | 71.7 | |
| Actuated g/C Ratio | 0.37 | 0.22 | | 0.32 | 0.19 | 0.19 | 0.50 | 0.44 | | 0.53 | 0.45 | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Lane Grp Cap (vph) | 360 | 596 | | 286 | 633 | 230 | 382 | 1174 | | 226 | 1210 | |
| v/s Ratio Prot | c0.12 | c0.19 | | 0.10 | 0.11 | | 0.02 | c0.36 | | c0.04 | 0.20 | |
| v/s Ratio Perm | 0.16 | | | 0.14 | | 0.02 | 0.12 | | | 0.21 | | |
| v/c Ratio | 0.74 | 0.86 | | 0.74 | 0.59 | 0.11 | 0.26 | 0.81 | | 0.47 | 0.45 | |
| Uniform Delay, d1 | 38.6 | 59.2 | | 42.5 | 58.0 | 52.5 | 20.9 | 38.3 | | 22.6 | 29.4 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 7.4 | 12.0 | | 9.7 | 1.3 | 0.2 | 0.3 | 6.1 | | 1.2 | 1.2 | |
| Delay (s) | 45.9 | 71.2 | | 52.2 | 59.2 | 52.6 | 21.2 | 44.4 | | 23.9 | 30.6 | |
| Level of Service | D | E | | D | E | D | C | D | | C | C | |
| Approach Delay (s) | | 62.7 | | | 55.9 | | | 42.3 | | | 29.5 | |
| Approach LOS | | E | | | E | | | D | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 47.6 | | | | HCM 2000 Level of Service | | | | D | |
| HCM 2000 Volume to Capacity ratio | | | 0.79 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | | | | Sum of lost time (s) | | | 20.7 | | |
| Intersection Capacity Utilization | | | 94.0% | | | | ICU Level of Service | | | F | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Background 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  |  |
| Traffic Volume (vph) | 4 | 0 | 22 | 23 | 0 | 130 | 12 | 875 | 10 | 52 | 719 | 4 |
| Future Volume (vph) | 4 | 0 | 22 | 23 | 0 | 130 | 12 | 875 | 10 | 52 | 719 | 4 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.885 | | | 0.885 | | | 0.998 | | | 0.999 | |
| Flt Protected | | 0.993 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1432 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Flt Permitted | | 0.993 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1432 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 5 | | | | | 5 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 3% | 2% | 2% | 4% | 0% |
| Adj. Flow (vph) | 4 | 0 | 23 | 25 | 0 | 141 | 13 | 921 | 11 | 57 | 757 | 4 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 27 | 0 | 0 | 166 | 0 | 13 | 932 | 0 | 57 | 761 | 0 |
| Enter Blocked Intersection | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 58.1% |
| ICU Level of Service | B |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Background 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  |  |
| Traffic Volume (veh/h) | 4 | 0 | 22 | 23 | 0 | 130 | 12 | 875 | 10 | 52 | 719 | 4 |
| Future Volume (Veh/h) | 4 | 0 | 22 | 23 | 0 | 130 | 12 | 875 | 10 | 52 | 719 | 4 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 4 | 0 | 23 | 25 | 0 | 141 | 13 | 921 | 11 | 57 | 757 | 4 |
| Pedestrians | | 5 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 0 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage (veh) | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.93 | 0.93 | | 0.93 | 0.93 | 0.93 | | | | 0.93 | | |
| vC, conflicting volume | 1506 | 1836 | 386 | 1468 | 1832 | 466 | 766 | | | 932 | | |
| vC1, stage 1 conf vol | 878 | 878 | | 952 | 952 | | | | | | | |
| vC2, stage 2 conf vol | 628 | 958 | | 516 | 880 | | | | | | | |
| vCu, unblocked vol | 1389 | 1745 | 386 | 1349 | 1742 | 269 | 766 | | | 771 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 98 | 100 | 96 | 91 | 100 | 79 | 98 | | | 93 | | |
| cM capacity (veh/h) | 229 | 231 | 616 | 266 | 245 | 676 | 853 | | | 779 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 27 | 166 | 13 | 614 | 318 | 57 | 505 | 256 | | | | |
| Volume Left | 4 | 25 | 13 | 0 | 0 | 57 | 0 | 0 | | | | |
| Volume Right | 23 | 141 | 0 | 0 | 11 | 0 | 0 | 4 | | | | |
| cSH | 492 | 549 | 853 | 1700 | 1700 | 779 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.05 | 0.30 | 0.02 | 0.36 | 0.19 | 0.07 | 0.30 | 0.15 | | | | |
| Queue Length 95th (m) | 1.4 | 10.1 | 0.4 | 0.0 | 0.0 | 1.9 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 12.7 | 14.4 | 9.3 | 0.0 | 0.0 | 10.0 | 0.0 | 0.0 | | | | |
| Lane LOS | B | B | A | | | A | | | | | | |
| Approach Delay (s) | 12.7 | 14.4 | 0.1 | | | 0.7 | | | | | | |
| Approach LOS | B | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.7 | | | | | | | | | |
| Intersection Capacity Utilization | | | 58.1% | ICU Level of Service | B | | | | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

Background 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 63 | 4 | 51 | 11 | 11 | 164 | 39 | 684 | 10 | 121 | 553 | 72 |
| Future Volume (vph) | 63 | 4 | 51 | 11 | 11 | 164 | 39 | 684 | 10 | 121 | 553 | 72 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.860 | | | 0.860 | | | 0.998 | | | 0.983 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1303 | 0 | 1568 | 1279 | 0 | 1568 | 2799 | 0 | 1553 | 2714 | 0 |
| Flt Permitted | 0.575 | | | 0.719 | | | 0.399 | | | 0.370 | | |
| Satd. Flow (perm) | 948 | 1303 | 0 | 1185 | 1279 | 0 | 657 | 2799 | 0 | 604 | 2714 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 54 | | | 174 | | | 3 | | | 26 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| Adj. Flow (vph) | 67 | 4 | 54 | 12 | 12 | 174 | 41 | 728 | 11 | 129 | 588 | 77 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 67 | 58 | 0 | 12 | 186 | 0 | 41 | 739 | 0 | 129 | 665 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

Background 5 Year
 AM Peak Hour

| | ↖ | | → | | ↗ | | ↖ | | ↗ | | ↘ | |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effct Green (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 58.0 | 58.0 | | 58.0 | 58.0 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | 0.14 | 0.14 | | 0.69 | 0.69 | | 0.69 | 0.69 | |
| v/c Ratio | 0.50 | 0.25 | | 0.07 | 0.56 | | 0.09 | 0.38 | | 0.31 | 0.35 | |
| Control Delay | 45.2 | 12.6 | | 29.9 | 13.2 | | 5.9 | 6.7 | | 8.5 | 6.2 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 45.2 | 12.6 | | 29.9 | 13.2 | | 5.9 | 6.7 | | 8.5 | 6.2 | |
| LOS | D | B | | C | B | | A | A | | A | A | |
| Approach Delay | | 30.1 | | | 14.3 | | | 6.6 | | | 6.6 | |
| Approach LOS | | C | | | B | | | A | | | A | |

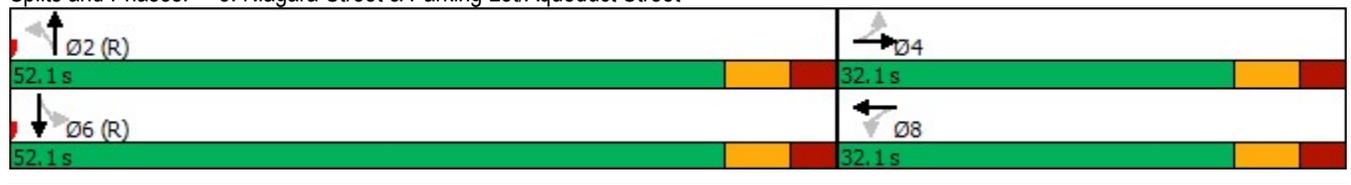
Intersection Summary

Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 45
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.56
 Intersection Signal Delay: 9.0
 Intersection Capacity Utilization 77.9%
 Analysis Period (min) 15

Intersection LOS: A

ICU Level of Service D

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Background 5 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 67 | 58 | 12 | 186 | 41 | 739 | 129 | 665 |
| v/c Ratio | 0.50 | 0.25 | 0.07 | 0.56 | 0.09 | 0.38 | 0.31 | 0.35 |
| Control Delay | 45.2 | 12.6 | 29.9 | 13.2 | 5.9 | 6.7 | 8.5 | 6.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 45.2 | 12.6 | 29.9 | 13.2 | 5.9 | 6.7 | 8.5 | 6.2 |
| Queue Length 50th (m) | 10.7 | 0.6 | 1.8 | 1.8 | 1.9 | 23.2 | 7.2 | 19.4 |
| Queue Length 95th (m) | 22.4 | 10.4 | 6.2 | 19.4 | 6.6 | 40.8 | 20.2 | 35.0 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 281 | 424 | 351 | 502 | 452 | 1930 | 416 | 1878 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.24 | 0.14 | 0.03 | 0.37 | 0.09 | 0.38 | 0.31 | 0.35 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
 3: Niagara Street & Parking Lot/Aqueduct Street

Background 5 Year
 AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |   | |  |   | |
| Traffic Volume (vph) | 63 | 4 | 51 | 11 | 11 | 164 | 39 | 684 | 10 | 121 | 553 | 72 |
| Future Volume (vph) | 63 | 4 | 51 | 11 | 11 | 164 | 39 | 684 | 10 | 121 | 553 | 72 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 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 | 0.86 | | 1.00 | 0.86 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1566 | 1304 | | 1566 | 1279 | | 1565 | 2799 | | 1551 | 2713 | |
| Flt Permitted | 0.58 | 1.00 | | 0.72 | 1.00 | | 0.40 | 1.00 | | 0.37 | 1.00 | |
| Satd. Flow (perm) | 948 | 1304 | | 1186 | 1279 | | 657 | 2799 | | 605 | 2713 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 67 | 4 | 54 | 12 | 12 | 174 | 41 | 728 | 11 | 129 | 588 | 77 |
| RTOR Reduction (vph) | 0 | 46 | 0 | 0 | 149 | 0 | 0 | 1 | 0 | 0 | 8 | 0 |
| Lane Group Flow (vph) | 67 | 12 | 0 | 12 | 37 | 0 | 41 | 738 | 0 | 129 | 657 | 0 |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| 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) | 12.0 | 12.0 | | 12.0 | 12.0 | | 58.0 | 58.0 | | 58.0 | 58.0 | |
| Effective Green, g (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 58.0 | 58.0 | | 58.0 | 58.0 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | 0.14 | 0.14 | | 0.69 | 0.69 | | 0.69 | 0.69 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 135 | 185 | | 169 | 182 | | 452 | 1928 | | 416 | 1868 | |
| v/s Ratio Prot | | 0.01 | | | 0.03 | | | c0.26 | | | 0.24 | |
| v/s Ratio Perm | c0.07 | | | 0.01 | | | 0.06 | | | 0.21 | | |
| v/c Ratio | 0.50 | 0.06 | | 0.07 | 0.20 | | 0.09 | 0.38 | | 0.31 | 0.35 | |
| Uniform Delay, d1 | 33.3 | 31.2 | | 31.3 | 31.9 | | 4.3 | 5.5 | | 5.2 | 5.4 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.9 | 0.2 | | 0.2 | 0.8 | | 0.4 | 0.6 | | 1.9 | 0.5 | |
| Delay (s) | 37.2 | 31.4 | | 31.5 | 32.6 | | 4.7 | 6.1 | | 7.1 | 5.9 | |
| Level of Service | D | C | | C | C | | A | A | | A | A | |
| Approach Delay (s) | | 34.5 | | | 32.6 | | | 6.0 | | | 6.1 | |
| Approach LOS | | C | | | C | | | A | | | A | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 10.7 | | | | HCM 2000 Level of Service | | | B | | |
| HCM 2000 Volume to Capacity ratio | | | 0.40 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | | | Sum of lost time (s) | | | 14.2 | | | |
| Intersection Capacity Utilization | | | 77.9% | | | ICU Level of Service | | | D | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Background 5 Year
AM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 19 | 38 | 43 | 760 | 521 | 76 |
| Future Volume (vph) | 19 | 38 | 43 | 760 | 521 | 76 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.911 | | | | 0.981 | |
| Flt Protected | 0.983 | | 0.950 | | | |
| Satd. Flow (prot) | 1431 | 0 | 1568 | 3308 | 2731 | 0 |
| Flt Permitted | 0.983 | | 0.950 | | | |
| Satd. Flow (perm) | 1431 | 0 | 1568 | 3308 | 2731 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 1 | | 6 | | | 6 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 2% | 5% | 3% |
| Adj. Flow (vph) | 21 | 41 | 47 | 826 | 566 | 83 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 62 | 0 | 47 | 826 | 649 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 38.2% |
| Analysis Period (min) | 15 |
| | ICU Level of Service A |

HCM Unsignalized Intersection Capacity Analysis
4: Niagara Street & Roger Drive

Background 5 Year
AM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 19 | 38 | 43 | 760 | 521 | 76 |
| Future Volume (Veh/h) | 19 | 38 | 43 | 760 | 521 | 76 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 21 | 41 | 47 | 826 | 566 | 83 |
| Pedestrians | 6 | | | | 1 | |
| Lane Width (m) | 3.6 | | | | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | | 1.2 | |
| Percent Blockage | 1 | | | | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1122 | 330 | 655 | | | |
| vC1, stage 1 conf vol | 614 | | | | | |
| vC2, stage 2 conf vol | 508 | | | | | |
| vCu, unblocked vol | 1122 | 330 | 655 | | | |
| tC, single (s) | 6.8 | 7.0 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 95 | 94 | 95 | | | |
| cM capacity (veh/h) | 403 | 659 | 937 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 62 | 47 | 413 | 413 | 377 | 272 |
| Volume Left | 21 | 47 | 0 | 0 | 0 | 0 |
| Volume Right | 41 | 0 | 0 | 0 | 0 | 83 |
| cSH | 543 | 937 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.11 | 0.05 | 0.24 | 0.24 | 0.22 | 0.16 |
| Queue Length 95th (m) | 3.1 | 1.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 12.5 | 9.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | | | | |
| Approach Delay (s) | 12.5 | 0.5 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.8 | | | |
| Intersection Capacity Utilization | | | 38.2% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Background 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 316 | 180 | 103 | 43 | 145 | 118 | 103 | 376 | 50 | 82 | 329 | 221 |
| Future Volume (vph) | 316 | 180 | 103 | 43 | 145 | 118 | 103 | 376 | 50 | 82 | 329 | 221 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 1.00 | 0.99 | | 0.99 | 1.00 | | 0.99 | 0.99 | |
| Frt | | 0.945 | | | 0.933 | | | 0.982 | | | 0.940 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1289 | 0 | 1413 | 1322 | 0 | 1376 | 2679 | 0 | 1376 | 2612 | 0 |
| Flt Permitted | 0.323 | | | 0.493 | | | 0.332 | | | 0.463 | | |
| Satd. Flow (perm) | 518 | 1289 | 0 | 730 | 1322 | 0 | 478 | 2679 | 0 | 667 | 2612 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 26 | | | 38 | | | 15 | | | 167 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Peak Hour Factor | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Adj. Flow (vph) | 347 | 198 | 113 | 47 | 159 | 130 | 113 | 413 | 55 | 90 | 362 | 243 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 347 | 311 | 0 | 47 | 289 | 0 | 113 | 468 | 0 | 90 | 605 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Queues
5: Niagara Street & Thorold Road

Background 5 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|-------|--------|------|-------|------|-------|------|-------|
| Lane Group Flow (vph) | 347 | 311 | 47 | 289 | 113 | 468 | 90 | 605 |
| v/c Ratio | 1.07 | 0.81 | 0.17 | 0.89 | 0.34 | 0.41 | 0.23 | 0.53 |
| Control Delay | 99.1 | 49.6 | 19.7 | 63.3 | 16.1 | 24.2 | 14.5 | 20.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 99.1 | 49.6 | 19.7 | 63.3 | 16.1 | 24.2 | 14.5 | 20.4 |
| Queue Length 50th (m) | ~58.3 | 56.6 | 5.9 | 51.7 | 12.0 | 37.5 | 9.4 | 38.2 |
| Queue Length 95th (m) | #97.8 | #104.4 | 13.0 | #94.0 | 22.8 | 57.1 | 18.7 | 60.5 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 323 | 385 | 348 | 368 | 359 | 1129 | 436 | 1133 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.07 | 0.81 | 0.14 | 0.79 | 0.31 | 0.41 | 0.21 | 0.53 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Background 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |   | |  |   | |
| Traffic Volume (vph) | 316 | 180 | 103 | 43 | 145 | 118 | 103 | 376 | 50 | 82 | 329 | 221 |
| Future Volume (vph) | 316 | 180 | 103 | 43 | 145 | 118 | 103 | 376 | 50 | 82 | 329 | 221 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 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 | 0.95 | | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1534 | 1290 | | 1409 | 1322 | | 1373 | 2680 | | 1373 | 2611 | |
| Flt Permitted | 0.32 | 1.00 | | 0.49 | 1.00 | | 0.33 | 1.00 | | 0.46 | 1.00 | |
| Satd. Flow (perm) | 522 | 1290 | | 732 | 1322 | | 479 | 2680 | | 669 | 2611 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 347 | 198 | 113 | 47 | 159 | 130 | 113 | 413 | 55 | 90 | 362 | 243 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 29 | 0 | 0 | 9 | 0 | 0 | 102 | 0 |
| Lane Group Flow (vph) | 347 | 292 | 0 | 47 | 260 | 0 | 113 | 459 | 0 | 90 | 503 | 0 |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 38.9 | 29.8 | | 30.0 | 23.9 | | 51.9 | 42.7 | | 48.3 | 40.9 | |
| Effective Green, g (s) | 38.9 | 29.8 | | 30.0 | 23.9 | | 51.9 | 42.7 | | 48.3 | 40.9 | |
| Actuated g/C Ratio | 0.37 | 0.28 | | 0.29 | 0.23 | | 0.50 | 0.41 | | 0.46 | 0.39 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 309 | 366 | | 248 | 301 | | 315 | 1091 | | 358 | 1018 | |
| v/s Ratio Prot | c0.13 | 0.23 | | 0.01 | 0.20 | | c0.03 | 0.17 | | 0.02 | c0.19 | |
| v/s Ratio Perm | c0.29 | | | 0.04 | | | 0.15 | | | 0.10 | | |
| v/c Ratio | 1.12 | 0.80 | | 0.19 | 0.86 | | 0.36 | 0.42 | | 0.25 | 0.49 | |
| Uniform Delay, d1 | 30.5 | 34.7 | | 27.7 | 38.9 | | 15.0 | 22.2 | | 16.3 | 24.1 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 88.6 | 11.0 | | 0.3 | 21.2 | | 0.5 | 1.2 | | 0.3 | 1.7 | |
| Delay (s) | 119.0 | 45.7 | | 27.9 | 60.0 | | 15.6 | 23.4 | | 16.6 | 25.9 | |
| Level of Service | F | D | | C | E | | B | C | | B | C | |
| Approach Delay (s) | | 84.4 | | | 55.5 | | | 21.9 | | | 24.7 | |
| Approach LOS | | F | | | E | | | C | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 45.8 | | | HCM 2000 Level of Service | | | | D | | |
| HCM 2000 Volume to Capacity ratio | | | 0.78 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | Sum of lost time (s) | | | | 18.8 | | |
| Intersection Capacity Utilization | | | 84.6% | | | ICU Level of Service | | | | E | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Background 5 Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 0 | 0 | 1074 | 0 | 0 | 699 |
| Future Volume (vph) | 0 | 0 | 1074 | 0 | 0 | 699 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | | | | | | |
| Flt Protected | | | | | | |
| Satd. Flow (prot) | 1598 | 0 | 2832 | 0 | 1619 | 2804 |
| Flt Permitted | | | | | | |
| Satd. Flow (perm) | 1598 | 0 | 2832 | 0 | 1619 | 2804 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 3% | 2% | 2% | 4% |
| Adj. Flow (vph) | 0 | 0 | 1167 | 0 | 0 | 760 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 0 | 1167 | 0 | 0 | 760 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 40.1% | | | ICU Level of Service A | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis
6: Niagara Street & Site Access

Background 5 Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (veh/h) | 0 | 0 | 1074 | 0 | 0 | 699 |
| Future Volume (Veh/h) | 0 | 0 | 1074 | 0 | 0 | 699 |
| Sign Control | Stop | | Free | | Free | |
| Grade | 0% | | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 0 | 1167 | 0 | 0 | 760 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | | TWLTL | |
| Median storage veh | | | 2 | | 2 | |
| Upstream signal (m) | | | 300 | | 165 | |
| pX, platoon unblocked | 0.99 | 0.99 | | | 0.99 | |
| vC, conflicting volume | 1547 | 584 | | | 1167 | |
| vC1, stage 1 conf vol | 1167 | | | | | |
| vC2, stage 2 conf vol | 380 | | | | | |
| vCu, unblocked vol | 1531 | 557 | | | 1147 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 100 | | | 100 | |
| cM capacity (veh/h) | 247 | 469 | | | 598 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 0 | 778 | 389 | 0 | 380 | 380 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 0 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.00 | 0.46 | 0.23 | 0.00 | 0.22 | 0.22 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | |
| Approach Delay (s) | 0.0 | 0.0 | 0.0 | | | |
| Approach LOS | A | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 0.0 | | | | | |
| Intersection Capacity Utilization | 40.1% | | ICU Level of Service | | A | |
| Analysis Period (min) | 15 | | | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Background 5 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 336 | 488 | 156 | 485 | 528 | 177 | 156 | 687 | 368 | 227 | 902 | 341 |
| Future Volume (vph) | 336 | 488 | 156 | 485 | 528 | 177 | 156 | 687 | 368 | 227 | 902 | 341 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | | 0.95 | | 0.97 | | | 0.99 | |
| Frt | | 0.964 | | | | 0.850 | | 0.948 | | | 0.959 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1553 | 2275 | 0 | 1553 | 3341 | 1248 | 1568 | 2630 | 0 | 1523 | 2747 | 0 |
| Flt Permitted | 0.338 | | | 0.135 | | | 0.080 | | | 0.077 | | |
| Satd. Flow (perm) | 545 | 2275 | 0 | 219 | 3341 | 1188 | 132 | 2630 | 0 | 123 | 2747 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 25 | | | | 182 | | 66 | | | 36 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| 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 (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Adj. Flow (vph) | 346 | 503 | 161 | 500 | 544 | 182 | 161 | 708 | 379 | 234 | 930 | 352 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 346 | 664 | 0 | 500 | 544 | 182 | 161 | 1087 | 0 | 234 | 1282 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

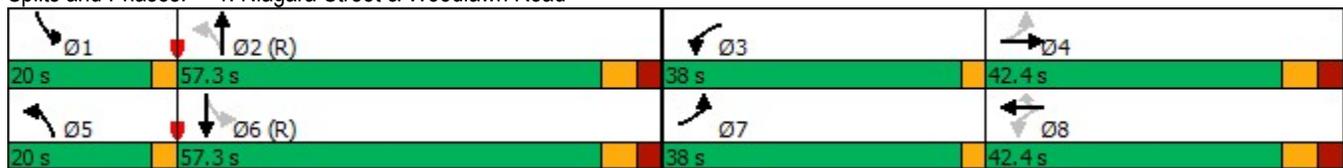
Background 5 Year
PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 68.4 | 35.0 | | 76.3 | 41.0 | 41.0 | 69.4 | 50.0 | | 72.5 | 51.9 | |
| Actuated g/C Ratio | 0.43 | 0.22 | | 0.48 | 0.26 | 0.26 | 0.44 | 0.32 | | 0.46 | 0.33 | |
| v/c Ratio | 0.82 | 1.27 | | 1.25 | 0.63 | 0.41 | 0.83 | 1.24 | | 1.13 | 1.38 | |
| Control Delay | 43.7 | 181.0 | | 167.8 | 56.6 | 9.4 | 69.4 | 158.7 | | 143.0 | 216.7 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 43.7 | 181.0 | | 167.8 | 56.6 | 9.4 | 69.4 | 158.7 | | 143.0 | 216.7 | |
| LOS | D | F | | F | E | A | E | F | | F | F | |
| Approach Delay | | 134.0 | | | 94.9 | | | 147.2 | | | 205.4 | |
| Approach LOS | | F | | | F | | | F | | | F | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 130
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.38
 Intersection Signal Delay: 149.3 Intersection LOS: F
 Intersection Capacity Utilization 129.5% ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Background 5 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|--------|--------|-------|------|-------|--------|--------|--------|
| Lane Group Flow (vph) | 346 | 664 | 500 | 544 | 182 | 161 | 1087 | 234 | 1282 |
| v/c Ratio | 0.82 | 1.27 | 1.25 | 0.63 | 0.41 | 0.83 | 1.24 | 1.13 | 1.38 |
| Control Delay | 43.7 | 181.0 | 167.8 | 56.6 | 9.4 | 69.4 | 158.7 | 143.0 | 216.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 43.7 | 181.0 | 167.8 | 56.6 | 9.4 | 69.4 | 158.7 | 143.0 | 216.7 |
| Queue Length 50th (m) | 73.6 | ~141.5 | ~184.0 | 85.2 | 0.0 | 36.0 | ~225.5 | ~74.7 | ~297.2 |
| Queue Length 95th (m) | 102.4 | #183.8 | #261.7 | 111.0 | 22.5 | #71.6 | #270.6 | #133.6 | #342.8 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 480 | 524 | 401 | 867 | 443 | 214 | 878 | 207 | 928 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.72 | 1.27 | 1.25 | 0.63 | 0.41 | 0.75 | 1.24 | 1.13 | 1.38 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Niagara Street & Woodlawn Road

Background 5 Year
PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|-------|--------|-------|-------|----------------------|---------------------------|-------|------|-------|-------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 336 | 488 | 156 | 485 | 528 | 177 | 156 | 687 | 368 | 227 | 902 | 341 |
| Future Volume (vph) | 336 | 488 | 156 | 485 | 528 | 177 | 156 | 687 | 368 | 227 | 902 | 341 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.97 | | 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 | |
| Frt | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1546 | 2274 | | 1552 | 3341 | 1188 | 1568 | 2629 | | 1523 | 2746 | |
| Flt Permitted | 0.34 | 1.00 | | 0.13 | 1.00 | 1.00 | 0.08 | 1.00 | | 0.08 | 1.00 | |
| Satd. Flow (perm) | 550 | 2274 | | 220 | 3341 | 1188 | 132 | 2629 | | 124 | 2746 | |
| 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) | 346 | 503 | 161 | 500 | 544 | 182 | 161 | 708 | 379 | 234 | 930 | 352 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 0 | 135 | 0 | 45 | 0 | 0 | 24 | 0 |
| Lane Group Flow (vph) | 346 | 645 | 0 | 500 | 544 | 47 | 161 | 1042 | 0 | 234 | 1258 | 0 |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| Heavy Vehicles (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 64.0 | 35.0 | | 73.0 | 41.0 | 41.0 | 65.1 | 50.0 | | 68.9 | 51.9 | |
| Effective Green, g (s) | 64.0 | 35.0 | | 73.0 | 41.0 | 41.0 | 65.1 | 50.0 | | 68.9 | 51.9 | |
| Actuated g/C Ratio | 0.41 | 0.22 | | 0.46 | 0.26 | 0.26 | 0.41 | 0.32 | | 0.44 | 0.33 | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Lane Grp Cap (vph) | 406 | 504 | | 397 | 868 | 308 | 191 | 833 | | 204 | 903 | |
| v/s Ratio Prot | 0.16 | 0.28 | | c0.28 | 0.16 | | 0.08 | 0.40 | | c0.12 | c0.46 | |
| v/s Ratio Perm | 0.19 | | | c0.30 | | 0.04 | 0.27 | | | 0.38 | | |
| v/c Ratio | 0.85 | 1.28 | | 1.26 | 0.63 | 0.15 | 0.84 | 1.25 | | 1.15 | 1.39 | |
| Uniform Delay, d1 | 36.3 | 61.3 | | 46.8 | 51.6 | 45.0 | 43.6 | 53.8 | | 50.2 | 52.9 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 15.6 | 140.2 | | 135.7 | 1.2 | 0.2 | 26.9 | 122.8 | | 108.3 | 183.6 | |
| Delay (s) | 51.9 | 201.5 | | 182.5 | 52.8 | 45.1 | 70.5 | 176.6 | | 158.5 | 236.5 | |
| Level of Service | D | F | | F | D | D | E | F | | F | F | |
| Approach Delay (s) | | 150.3 | | | 104.6 | | | 162.9 | | | 224.5 | |
| Approach LOS | | F | | | F | | | F | | | F | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 164.7 | | | | HCM 2000 Level of Service | | | | F | |
| HCM 2000 Volume to Capacity ratio | | | 1.34 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | | | Sum of lost time (s) | | | 20.7 | | | |
| Intersection Capacity Utilization | | | 129.5% | | | ICU Level of Service | | | | | H | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Background 5 Year
PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 0 | 29 | 17 | 0 | 98 | 11 | 1065 | 26 | 145 | 1309 | 33 |
| Future Volume (vph) | 11 | 0 | 29 | 17 | 0 | 98 | 11 | 1065 | 26 | 145 | 1309 | 33 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.903 | | | 0.884 | | | 0.996 | | | 0.996 | |
| Flt Protected | | 0.986 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1451 | 0 | 0 | 1403 | 0 | 1568 | 2848 | 0 | 1538 | 2877 | 0 |
| Flt Permitted | | 0.986 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1451 | 0 | 0 | 1403 | 0 | 1568 | 2848 | 0 | 1538 | 2877 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 19 | | | | | 19 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 2% | 2% | 2% | 1% | 0% |
| Adj. Flow (vph) | 12 | 0 | 31 | 18 | 0 | 107 | 12 | 1121 | 28 | 158 | 1378 | 35 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 43 | 0 | 0 | 125 | 0 | 12 | 1149 | 0 | 158 | 1413 | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 100 | | 100 | 25 | | 100 | 100 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 68.8% |
| ICU Level of Service | C |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Background 5 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  | |
| Traffic Volume (veh/h) | 11 | 0 | 29 | 17 | 0 | 98 | 11 | 1065 | 26 | 145 | 1309 | 33 |
| Future Volume (Veh/h) | 11 | 0 | 29 | 17 | 0 | 98 | 11 | 1065 | 26 | 145 | 1309 | 33 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 12 | 0 | 31 | 18 | 0 | 107 | 12 | 1121 | 28 | 158 | 1378 | 35 |
| Pedestrians | | 19 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 2 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage veh | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.80 | 0.80 | 0.74 | 0.80 | 0.80 | 0.88 | 0.74 | | | 0.88 | | |
| vC, conflicting volume | 2422 | 2904 | 726 | 2195 | 2907 | 574 | 1432 | | | 1149 | | |
| vC1, stage 1 conf vol | 1730 | 1730 | | 1159 | 1159 | | | | | | | |
| vC2, stage 2 conf vol | 692 | 1173 | | 1036 | 1748 | | | | | | | |
| vCu, unblocked vol | 1583 | 2184 | 0 | 1300 | 2188 | 231 | 880 | | | 887 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 87 | 100 | 96 | 91 | 100 | 84 | 98 | | | 76 | | |
| cM capacity (veh/h) | 94 | 97 | 794 | 211 | 106 | 675 | 565 | | | 665 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 43 | 125 | 12 | 747 | 402 | 158 | 919 | 494 | | | | |
| Volume Left | 12 | 18 | 12 | 0 | 0 | 158 | 0 | 0 | | | | |
| Volume Right | 31 | 107 | 0 | 0 | 28 | 0 | 0 | 35 | | | | |
| cSH | 257 | 513 | 565 | 1700 | 1700 | 665 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.17 | 0.24 | 0.02 | 0.44 | 0.24 | 0.24 | 0.54 | 0.29 | | | | |
| Queue Length 95th (m) | 4.7 | 7.6 | 0.5 | 0.0 | 0.0 | 7.4 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 21.8 | 14.3 | 11.5 | 0.0 | 0.0 | 12.1 | 0.0 | 0.0 | | | | |
| Lane LOS | C | B | B | | | B | | | | | | |
| Approach Delay (s) | 21.8 | 14.3 | 0.1 | | | 1.2 | | | | | | |
| Approach LOS | C | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.6 | | | | | | | | | |
| Intersection Capacity Utilization | | | 68.8% | | ICU Level of Service | | | | | C | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

Background 5 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 45 | 1 | 43 | 14 | 2 | 79 | 41 | 981 | 23 | 102 | 1194 | 55 |
| Future Volume (vph) | 45 | 1 | 43 | 14 | 2 | 79 | 41 | 981 | 23 | 102 | 1194 | 55 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.98 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.853 | | | 0.854 | | | 0.997 | | | 0.993 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1288 | 0 | 1568 | 1293 | 0 | 1568 | 2822 | 0 | 1568 | 2837 | 0 |
| Flt Permitted | 0.703 | | | 0.728 | | | 0.195 | | | 0.268 | | |
| Satd. Flow (perm) | 1159 | 1288 | 0 | 1196 | 1293 | 0 | 321 | 2822 | 0 | 441 | 2837 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 44 | | | 81 | | | 4 | | | 8 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| Adj. Flow (vph) | 46 | 1 | 44 | 14 | 2 | 81 | 42 | 1001 | 23 | 104 | 1218 | 56 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 46 | 45 | 0 | 14 | 83 | 0 | 42 | 1024 | 0 | 104 | 1274 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

Background 5 Year
 PM Peak Hour

| | ↖ | | → | | ↘ | | ↙ | | ← | | ↖ | | ↘ | | ↑ | | ↖ | | ↘ | | ↓ | | ↙ | | |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|---|--|---|--|---|--|---|--|------|-------|-------|--|--|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR | | | | | | | | | | | | | |
| Turn Type | Perm | NA | | | | | | | | | | Perm | NA | | | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | | | | | | | | | | | | 6 | | | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | | | | | | | | | | | | | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | | | | | | | | | | | | | | |
| Switch Phase | | | | | | | | | | | | | | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | | | | | | | | | | | 10.0 | 10.0 | | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | | | | | | | | | | | 17.1 | 17.1 | | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | | | | | | | | | | | 52.1 | 52.1 | | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | | | | | | | | | | | 61.9% | 61.9% | | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | | | | | | | | | | | 45.0 | 45.0 | | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | | | | | | | | | | 4.1 | 4.1 | | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | | | | | | | | | | 3.0 | 3.0 | | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | | | | | | | | | | 0.0 | 0.0 | | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | | | | | | | | | | 7.1 | 7.1 | | |
| Lead/Lag | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | | | | | | | | | | 3.0 | 3.0 | | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | | | | | | | | | | | C-Max | C-Max | | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | | | | | | | | | | 12.0 | 12.0 | | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | | | | | | | | | | 18.0 | 18.0 | | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | | | | | | | | | | 0 | 0 | | |
| Act Effct Green (s) | 10.1 | 10.1 | | 10.1 | 10.1 | | 64.3 | 64.3 | | 64.3 | 64.3 | | | | | | | | | | | 64.3 | 64.3 | | |
| Actuated g/C Ratio | 0.12 | 0.12 | | 0.12 | 0.12 | | 0.76 | 0.76 | | 0.76 | 0.76 | | | | | | | | | | | 0.76 | 0.76 | | |
| v/c Ratio | 0.33 | 0.23 | | 0.10 | 0.37 | | 0.17 | 0.47 | | 0.31 | 0.59 | | | | | | | | | | | 0.31 | 0.59 | | |
| Control Delay | 39.6 | 13.7 | | 32.9 | 13.2 | | 6.8 | 6.1 | | 8.2 | 7.5 | | | | | | | | | | | 8.2 | 7.5 | | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | | | | | | | | | | 0.0 | 0.0 | | |
| Total Delay | 39.6 | 13.7 | | 32.9 | 13.2 | | 6.8 | 6.1 | | 8.2 | 7.5 | | | | | | | | | | | 8.2 | 7.5 | | |
| LOS | D | B | | C | B | | A | A | | A | A | | | | | | | | | | | A | A | | |
| Approach Delay | | 26.8 | | | 16.0 | | | 6.2 | | | 7.5 | | | | | | | | | | | | | | |
| Approach LOS | | C | | | B | | | A | | | A | | | | | | | | | | | | | | |

Intersection Summary

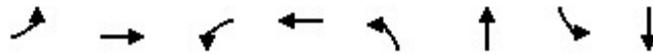
Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 55
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.59
 Intersection Signal Delay: 7.9
 Intersection Capacity Utilization 81.5%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service D

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Background 5 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 46 | 45 | 14 | 83 | 42 | 1024 | 104 | 1274 |
| v/c Ratio | 0.33 | 0.23 | 0.10 | 0.37 | 0.17 | 0.47 | 0.31 | 0.59 |
| Control Delay | 39.6 | 13.7 | 32.9 | 13.2 | 6.8 | 6.1 | 8.2 | 7.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 39.6 | 13.7 | 32.9 | 13.2 | 6.8 | 6.1 | 8.2 | 7.5 |
| Queue Length 50th (m) | 7.3 | 0.2 | 2.2 | 0.3 | 1.9 | 33.4 | 5.4 | 48.0 |
| Queue Length 95th (m) | 16.9 | 9.2 | 7.3 | 12.6 | 7.2 | 55.7 | 16.8 | 80.2 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 344 | 413 | 355 | 440 | 245 | 2156 | 336 | 2168 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.13 | 0.11 | 0.04 | 0.19 | 0.17 | 0.47 | 0.31 | 0.59 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis

3: Niagara Street & Parking Lot/Aqueduct Street

Background 5 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 45 | 1 | 43 | 14 | 2 | 79 | 41 | 981 | 23 | 102 | 1194 | 55 |
| Future Volume (vph) | 45 | 1 | 43 | 14 | 2 | 79 | 41 | 981 | 23 | 102 | 1194 | 55 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.98 | | 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 | 0.85 | | 1.00 | 0.85 | | 1.00 | 1.00 | | 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) | 1566 | 1288 | | 1561 | 1293 | | 1564 | 2821 | | 1561 | 2838 | |
| Flt Permitted | 0.70 | 1.00 | | 0.73 | 1.00 | | 0.20 | 1.00 | | 0.27 | 1.00 | |
| Satd. Flow (perm) | 1159 | 1288 | | 1196 | 1293 | | 322 | 2821 | | 440 | 2838 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 46 | 1 | 44 | 14 | 2 | 81 | 42 | 1001 | 23 | 104 | 1218 | 56 |
| RTOR Reduction (vph) | 0 | 40 | 0 | 0 | 73 | 0 | 0 | 1 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 46 | 5 | 0 | 14 | 10 | 0 | 42 | 1023 | 0 | 104 | 1272 | 0 |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| 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) | 8.5 | 8.5 | | 8.5 | 8.5 | | 61.5 | 61.5 | | 61.5 | 61.5 | |
| Effective Green, g (s) | 8.5 | 8.5 | | 8.5 | 8.5 | | 61.5 | 61.5 | | 61.5 | 61.5 | |
| Actuated g/C Ratio | 0.10 | 0.10 | | 0.10 | 0.10 | | 0.73 | 0.73 | | 0.73 | 0.73 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 117 | 130 | | 120 | 130 | | 235 | 2060 | | 321 | 2072 | |
| v/s Ratio Prot | | 0.00 | | | 0.01 | | | 0.36 | | | c0.45 | |
| v/s Ratio Perm | c0.04 | | | 0.01 | | | 0.13 | | | 0.24 | | |
| v/c Ratio | 0.39 | 0.04 | | 0.12 | 0.08 | | 0.18 | 0.50 | | 0.32 | 0.61 | |
| Uniform Delay, d1 | 35.4 | 34.2 | | 34.4 | 34.3 | | 3.5 | 4.8 | | 4.0 | 5.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.0 | 0.2 | | 0.6 | 0.4 | | 1.7 | 0.9 | | 2.7 | 1.4 | |
| Delay (s) | 38.4 | 34.4 | | 35.0 | 34.7 | | 5.2 | 5.7 | | 6.7 | 6.9 | |
| Level of Service | D | C | | D | C | | A | A | | A | A | |
| Approach Delay (s) | | 36.4 | | | 34.7 | | | 5.6 | | | 6.9 | |
| Approach LOS | | D | | | C | | | A | | | A | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 8.4 | | | | HCM 2000 Level of Service | | | A | | |
| HCM 2000 Volume to Capacity ratio | | | 0.59 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | | | | Sum of lost time (s) | | | 14.2 | | |
| Intersection Capacity Utilization | | | 81.5% | | | | ICU Level of Service | | | D | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Background 5 Year
PM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 25 | 44 | 47 | 930 | 1097 | 82 |
| Future Volume (vph) | 25 | 44 | 47 | 930 | 1097 | 82 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.914 | | | | 0.990 | |
| Flt Protected | 0.982 | | 0.950 | | | |
| Satd. Flow (prot) | 1463 | 0 | 1568 | 3308 | 2861 | 0 |
| Flt Permitted | 0.982 | | 0.950 | | | |
| Satd. Flow (perm) | 1463 | 0 | 1568 | 3308 | 2861 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 2 | 1 | 8 | | | 8 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 1% | 0% |
| Adj. Flow (vph) | 27 | 48 | 51 | 1011 | 1192 | 89 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 75 | 0 | 51 | 1011 | 1281 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 56.7% |
| Analysis Period (min) | 15 |
| | ICU Level of Service B |

HCM Unsignalized Intersection Capacity Analysis

4: Niagara Street & Roger Drive

Background 5 Year
PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|-------|------|------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 25 | 44 | 47 | 930 | 1097 | 82 |
| Future Volume (Veh/h) | 25 | 44 | 47 | 930 | 1097 | 82 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 27 | 48 | 51 | 1011 | 1192 | 89 |
| Pedestrians | 8 | | | 1 | 2 | |
| Lane Width (m) | 3.6 | | | 3.6 | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | 1.2 | 1.2 | |
| Percent Blockage | 1 | | | 0 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | 0.86 | 0.83 | 0.83 | | | |
| vC, conflicting volume | 1854 | 650 | 1289 | | | |
| vC1, stage 1 conf vol | 1244 | | | | | |
| vC2, stage 2 conf vol | 610 | | | | | |
| vCu, unblocked vol | 1330 | 162 | 934 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 90 | 93 | 92 | | | |
| cM capacity (veh/h) | 275 | 707 | 610 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 75 | 51 | 506 | 506 | 795 | 486 |
| Volume Left | 27 | 51 | 0 | 0 | 0 | 0 |
| Volume Right | 48 | 0 | 0 | 0 | 0 | 89 |
| cSH | 451 | 610 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.17 | 0.08 | 0.30 | 0.30 | 0.47 | 0.29 |
| Queue Length 95th (m) | 4.7 | 2.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 14.6 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | B | | | | |
| Approach Delay (s) | 14.6 | 0.5 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 0.7 | | | | | |
| Intersection Capacity Utilization | 56.7% | | | ICU Level of Service | B | |
| Analysis Period (min) | 15 | | | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Background 5 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 373 | 167 | 91 | 110 | 173 | 110 | 158 | 552 | 68 | 112 | 626 | 500 |
| Future Volume (vph) | 373 | 167 | 91 | 110 | 173 | 110 | 158 | 552 | 68 | 112 | 626 | 500 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 0.99 | | | 1.00 | | 0.99 | 0.98 | |
| Frt | | 0.947 | | | 0.942 | | | 0.984 | | | 0.933 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1389 | 0 | 1568 | 1391 | 0 | 1452 | 2825 | 0 | 1466 | 2639 | 0 |
| Flt Permitted | 0.313 | | | 0.467 | | | 0.097 | | | 0.335 | | |
| Satd. Flow (perm) | 503 | 1389 | 0 | 761 | 1391 | 0 | 148 | 2825 | 0 | 513 | 2639 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 25 | | | 30 | | | 14 | | | 207 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Adj. Flow (vph) | 389 | 174 | 95 | 115 | 180 | 115 | 165 | 575 | 71 | 117 | 652 | 521 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 389 | 269 | 0 | 115 | 295 | 0 | 165 | 646 | 0 | 117 | 1173 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Background 5 Year
PM Peak Hour

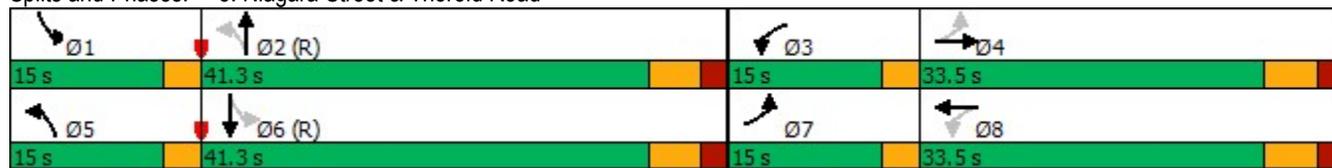


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 40.8 | 25.8 | | 36.5 | 23.4 | | 55.4 | 41.4 | | 52.3 | 39.8 | |
| Actuated g/C Ratio | 0.39 | 0.25 | | 0.35 | 0.22 | | 0.53 | 0.40 | | 0.50 | 0.38 | |
| v/c Ratio | 1.24 | 0.75 | | 0.34 | 0.88 | | 0.78 | 0.58 | | 0.35 | 1.04 | |
| Control Delay | 158.8 | 46.4 | | 22.3 | 62.3 | | 46.7 | 28.2 | | 16.1 | 65.1 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 158.8 | 46.4 | | 22.3 | 62.3 | | 46.7 | 28.2 | | 16.1 | 65.1 | |
| LOS | F | D | | C | E | | D | C | | B | E | |
| Approach Delay | | 112.9 | | | 51.1 | | | 31.9 | | | 60.7 | |
| Approach LOS | | F | | | D | | | C | | | E | |

Intersection Summary

Area Type: Other
 Cycle Length: 104.8
 Actuated Cycle Length: 104.8
 Offset: 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.24
 Intersection Signal Delay: 62.9 Intersection LOS: E
 Intersection Capacity Utilization 113.8% ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Background 5 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|--------|-------|------|-------|-------|-------|------|--------|
| Lane Group Flow (vph) | 389 | 269 | 115 | 295 | 165 | 646 | 117 | 1173 |
| v/c Ratio | 1.24 | 0.75 | 0.34 | 0.88 | 0.78 | 0.58 | 0.35 | 1.04 |
| Control Delay | 158.8 | 46.4 | 22.3 | 62.3 | 46.7 | 28.2 | 16.1 | 65.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 158.8 | 46.4 | 22.3 | 62.3 | 46.7 | 28.2 | 16.1 | 65.1 |
| Queue Length 50th (m) | ~66.4 | 47.4 | 15.1 | 54.2 | 20.2 | 57.0 | 12.5 | ~136.6 |
| Queue Length 95th (m) | #128.9 | #81.2 | 26.6 | #95.8 | #54.9 | 82.0 | 23.3 | #183.6 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 314 | 380 | 375 | 380 | 228 | 1123 | 377 | 1131 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.24 | 0.71 | 0.31 | 0.78 | 0.72 | 0.58 | 0.31 | 1.04 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Background 5 Year
PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|-------|--------|-------|------|---------------------------|-------|------|------|-------|-------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 373 | 167 | 91 | 110 | 173 | 110 | 158 | 552 | 68 | 112 | 626 | 500 |
| Future Volume (vph) | 373 | 167 | 91 | 110 | 173 | 110 | 158 | 552 | 68 | 112 | 626 | 500 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 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 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 0.99 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.95 | | 1.00 | 0.94 | | 1.00 | 0.98 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1535 | 1389 | | 1559 | 1390 | | 1452 | 2823 | | 1462 | 2641 | |
| Flt Permitted | 0.31 | 1.00 | | 0.47 | 1.00 | | 0.10 | 1.00 | | 0.34 | 1.00 | |
| Satd. Flow (perm) | 506 | 1389 | | 767 | 1390 | | 148 | 2823 | | 516 | 2641 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 389 | 174 | 95 | 115 | 180 | 115 | 165 | 575 | 71 | 117 | 652 | 521 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 23 | 0 | 0 | 8 | 0 | 0 | 128 | 0 |
| Lane Group Flow (vph) | 389 | 250 | 0 | 115 | 272 | 0 | 165 | 638 | 0 | 117 | 1045 | 0 |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 37.8 | 25.8 | | 33.0 | 23.4 | | 52.1 | 41.4 | | 49.1 | 39.9 | |
| Effective Green, g (s) | 37.8 | 25.8 | | 33.0 | 23.4 | | 52.1 | 41.4 | | 49.1 | 39.9 | |
| Actuated g/C Ratio | 0.36 | 0.25 | | 0.31 | 0.22 | | 0.50 | 0.40 | | 0.47 | 0.38 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 300 | 341 | | 314 | 310 | | 206 | 1115 | | 324 | 1005 | |
| v/s Ratio Prot | c0.15 | 0.18 | | 0.03 | 0.20 | | c0.08 | 0.23 | | 0.03 | c0.40 | |
| v/s Ratio Perm | c0.32 | | | 0.08 | | | 0.32 | | | 0.14 | | |
| v/c Ratio | 1.30 | 0.73 | | 0.37 | 0.88 | | 0.80 | 0.57 | | 0.36 | 1.04 | |
| Uniform Delay, d1 | 30.9 | 36.3 | | 26.7 | 39.3 | | 23.4 | 24.8 | | 16.4 | 32.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 155.9 | 7.1 | | 0.5 | 22.7 | | 19.1 | 2.1 | | 0.5 | 39.2 | |
| Delay (s) | 186.8 | 43.5 | | 27.2 | 62.0 | | 42.5 | 26.9 | | 16.9 | 71.7 | |
| Level of Service | F | D | | C | E | | D | C | | B | E | |
| Approach Delay (s) | | 128.2 | | | 52.2 | | | 30.1 | | | 66.7 | |
| Approach LOS | | F | | | D | | | C | | | E | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 68.2 | | | HCM 2000 Level of Service | | E | | | | |
| HCM 2000 Volume to Capacity ratio | | | 1.15 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | Sum of lost time (s) | | 18.8 | | | | |
| Intersection Capacity Utilization | | | 113.8% | | | ICU Level of Service | | H | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |
| c Critical Lane Group | | | | | | | | | | | | |

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Background 5 Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 0 | 0 | 1211 | 0 | 0 | 1543 |
| Future Volume (vph) | 0 | 0 | 1211 | 0 | 0 | 1543 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | | | | | | |
| Flt Protected | | | | | | |
| Satd. Flow (prot) | 1598 | 0 | 2859 | 0 | 1619 | 2888 |
| Flt Permitted | | | | | | |
| Satd. Flow (perm) | 1598 | 0 | 2859 | 0 | 1619 | 2888 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 0 | 0 | 1316 | 0 | 0 | 1677 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 0 | 1316 | 0 | 0 | 1677 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 56.1% | | | ICU Level of Service B | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis
6: Niagara Street & Site Access

Background 5 Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (veh/h) | 0 | 0 | 1211 | 0 | 0 | 1543 |
| Future Volume (Veh/h) | 0 | 0 | 1211 | 0 | 0 | 1543 |
| Sign Control | Stop | | Free | | Free | |
| Grade | 0% | | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 0 | 1316 | 0 | 0 | 1677 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | TWLTL | | | TWLTL | | |
| Median storage veh | 2 | | | 2 | | |
| Upstream signal (m) | 300 | | | 165 | | |
| pX, platoon unblocked | 0.73 | 0.93 | | | 0.93 | |
| vC, conflicting volume | 2154 | 658 | | | 1316 | |
| vC1, stage 1 conf vol | 1316 | | | | | |
| vC2, stage 2 conf vol | 838 | | | | | |
| vCu, unblocked vol | 1386 | 471 | | | 1182 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 100 | | | 100 | |
| cM capacity (veh/h) | 224 | 499 | | | 543 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 0 | 877 | 439 | 0 | 838 | 838 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 0 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.00 | 0.52 | 0.26 | 0.00 | 0.49 | 0.49 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | |
| Approach Delay (s) | 0.0 | 0.0 | | 0.0 | | |
| Approach LOS | A | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 0.0 | | | | | |
| Intersection Capacity Utilization | 56.1% | | ICU Level of Service | | B | |
| Analysis Period (min) | 15 | | | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Background 10 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  |  |
| Traffic Volume (vph) | 288 | 458 | 111 | 226 | 406 | 146 | 106 | 671 | 390 | 116 | 427 | 181 |
| Future Volume (vph) | 288 | 458 | 111 | 226 | 406 | 146 | 106 | 671 | 390 | 116 | 427 | 181 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 1.00 | | 1.00 | | 0.97 | 1.00 | 0.99 | | | 1.00 | |
| Frt | | 0.971 | | | | 0.850 | | 0.945 | | | 0.955 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 2719 | 0 | 1508 | 3276 | 1224 | 1553 | 2666 | 0 | 1452 | 2660 | 0 |
| Flt Permitted | 0.332 | | | 0.273 | | | 0.345 | | | 0.114 | | |
| Satd. Flow (perm) | 534 | 2719 | 0 | 432 | 3276 | 1194 | 563 | 2666 | 0 | 174 | 2660 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 17 | | | | 149 | | 77 | | | 44 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Adj. Flow (vph) | 294 | 467 | 113 | 231 | 414 | 149 | 108 | 685 | 398 | 118 | 436 | 185 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 294 | 580 | 0 | 231 | 414 | 149 | 108 | 1083 | 0 | 118 | 621 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

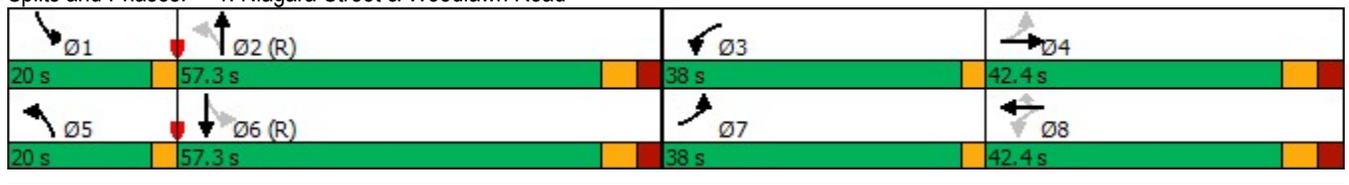
Background 10 Year
AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 67.2 | 38.1 | | 59.6 | 33.5 | 33.5 | 79.6 | 64.5 | | 83.3 | 66.4 | |
| Actuated g/C Ratio | 0.43 | 0.24 | | 0.38 | 0.21 | 0.21 | 0.50 | 0.41 | | 0.53 | 0.42 | |
| v/c Ratio | 0.75 | 0.87 | | 0.74 | 0.59 | 0.40 | 0.31 | 0.95 | | 0.61 | 0.54 | |
| Control Delay | 43.3 | 69.7 | | 45.0 | 59.5 | 10.3 | 22.7 | 59.5 | | 35.1 | 35.9 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 43.3 | 69.7 | | 45.0 | 59.5 | 10.3 | 22.7 | 59.5 | | 35.1 | 35.9 | |
| LOS | D | E | | D | E | B | C | E | | D | D | |
| Approach Delay | | 60.8 | | | 46.0 | | | 56.2 | | | 35.7 | |
| Approach LOS | | E | | | D | | | E | | | D | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.95
 Intersection Signal Delay: 50.9 Intersection LOS: D
 Intersection Capacity Utilization 100.5% ICU Level of Service G
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Background 10 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|-------|------|-------|------|------|--------|-------|-------|
| Lane Group Flow (vph) | 294 | 580 | 231 | 414 | 149 | 108 | 1083 | 118 | 621 |
| v/c Ratio | 0.75 | 0.87 | 0.74 | 0.59 | 0.40 | 0.31 | 0.95 | 0.61 | 0.54 |
| Control Delay | 43.3 | 69.7 | 45.0 | 59.5 | 10.3 | 22.7 | 59.5 | 35.1 | 35.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 43.3 | 69.7 | 45.0 | 59.5 | 10.3 | 22.7 | 59.5 | 35.1 | 35.9 |
| Queue Length 50th (m) | 67.5 | 93.6 | 50.6 | 64.8 | 0.0 | 17.6 | 174.6 | 19.5 | 75.4 |
| Queue Length 95th (m) | 85.2 | 117.4 | 65.8 | 82.5 | 20.2 | 33.1 | #264.7 | 37.9 | 111.3 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 450 | 680 | 422 | 738 | 384 | 404 | 1135 | 230 | 1144 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.65 | 0.85 | 0.55 | 0.56 | 0.39 | 0.27 | 0.95 | 0.51 | 0.54 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Niagara Street & Woodlawn Road

Background 10 Year
AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR | |
|-----------------------------------|-------|-------|--------|-------|------|------|-------|-------|------|-------|------|---------------------------|------|
| Lane Configurations | | | | | | | | | | | | | |
| Traffic Volume (vph) | 288 | 458 | 111 | 226 | 406 | 146 | 106 | 671 | 390 | 116 | 427 | 181 | |
| Future Volume (vph) | 288 | 458 | 111 | 226 | 406 | 146 | 106 | 671 | 390 | 116 | 427 | 181 | |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 | 1.00 | 0.99 | | 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 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.96 | | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | |
| Satd. Flow (prot) | 1535 | 2718 | | 1507 | 3276 | 1194 | 1552 | 2666 | | 1452 | 2661 | | |
| Flt Permitted | 0.33 | 1.00 | | 0.27 | 1.00 | 1.00 | 0.35 | 1.00 | | 0.11 | 1.00 | | |
| Satd. Flow (perm) | 537 | 2718 | | 433 | 3276 | 1194 | 564 | 2666 | | 174 | 2661 | | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | |
| Adj. Flow (vph) | 294 | 467 | 113 | 231 | 414 | 149 | 108 | 685 | 398 | 118 | 436 | 185 | |
| RTOR Reduction (vph) | 0 | 13 | 0 | 0 | 0 | 117 | 0 | 46 | 0 | 0 | 25 | 0 | |
| Lane Group Flow (vph) | 294 | 567 | 0 | 231 | 414 | 32 | 108 | 1037 | 0 | 118 | 596 | 0 | |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 | |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% | |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | | |
| Actuated Green, G (s) | 62.8 | 38.1 | | 55.2 | 33.5 | 33.5 | 75.3 | 64.5 | | 79.1 | 66.4 | | |
| Effective Green, g (s) | 62.8 | 38.1 | | 55.2 | 33.5 | 33.5 | 75.3 | 64.5 | | 79.1 | 66.4 | | |
| Actuated g/C Ratio | 0.40 | 0.24 | | 0.35 | 0.21 | 0.21 | 0.48 | 0.41 | | 0.50 | 0.42 | | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | | |
| Lane Grp Cap (vph) | 380 | 656 | | 299 | 695 | 253 | 336 | 1090 | | 190 | 1120 | | |
| v/s Ratio Prot | c0.13 | c0.21 | | 0.11 | 0.13 | | 0.02 | c0.39 | | c0.05 | 0.22 | | |
| v/s Ratio Perm | 0.18 | | | 0.16 | | 0.03 | 0.13 | | | 0.26 | | | |
| v/c Ratio | 0.77 | 0.86 | | 0.77 | 0.60 | 0.13 | 0.32 | 0.95 | | 0.62 | 0.53 | | |
| Uniform Delay, d1 | 36.1 | 57.3 | | 40.1 | 56.0 | 50.2 | 23.6 | 45.1 | | 27.7 | 34.1 | | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | |
| Incremental Delay, d2 | 9.2 | 11.3 | | 11.4 | 1.2 | 0.2 | 0.4 | 17.9 | | 5.5 | 1.8 | | |
| Delay (s) | 45.3 | 68.7 | | 51.4 | 57.1 | 50.4 | 24.0 | 63.0 | | 33.2 | 35.9 | | |
| Level of Service | D | E | | D | E | D | C | E | | C | D | | |
| Approach Delay (s) | | 60.8 | | | 54.2 | | | 59.4 | | | 35.4 | | |
| Approach LOS | | E | | | D | | | E | | | D | | |
| Intersection Summary | | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 53.7 | | | | | | | | | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | | | 0.88 | | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | | | | | | | | | Sum of lost time (s) | 20.7 |
| Intersection Capacity Utilization | | | 100.5% | | | | | | | | | ICU Level of Service | G |
| Analysis Period (min) | | | 15 | | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Background 10 Year
AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 0 | 24 | 23 | 0 | 130 | 13 | 966 | 10 | 52 | 792 | 4 |
| Future Volume (vph) | 4 | 0 | 24 | 23 | 0 | 130 | 13 | 966 | 10 | 52 | 792 | 4 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.884 | | | 0.885 | | | 0.998 | | | 0.999 | |
| Flt Protected | | 0.993 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1431 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Flt Permitted | | 0.993 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1431 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 5 | | | | | 5 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 3% | 2% | 2% | 4% | 0% |
| Adj. Flow (vph) | 4 | 0 | 25 | 25 | 0 | 141 | 14 | 1017 | 11 | 57 | 834 | 4 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 29 | 0 | 0 | 166 | 0 | 14 | 1028 | 0 | 57 | 838 | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 61.5% |
| ICU Level of Service | B |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Background 10 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  | |
| Traffic Volume (veh/h) | 4 | 0 | 24 | 23 | 0 | 130 | 13 | 966 | 10 | 52 | 792 | 4 |
| Future Volume (Veh/h) | 4 | 0 | 24 | 23 | 0 | 130 | 13 | 966 | 10 | 52 | 792 | 4 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 4 | 0 | 25 | 25 | 0 | 141 | 14 | 1017 | 11 | 57 | 834 | 4 |
| Pedestrians | | 5 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 0 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage veh | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.91 | 0.91 | | 0.91 | 0.91 | 0.91 | | | | 0.91 | | |
| vC, conflicting volume | 1632 | 2011 | 424 | 1606 | 2008 | 514 | 843 | | | 1028 | | |
| vC1, stage 1 conf vol | 955 | 955 | | 1050 | 1050 | | | | | | | |
| vC2, stage 2 conf vol | 678 | 1056 | | 556 | 957 | | | | | | | |
| vCu, unblocked vol | 1490 | 1908 | 424 | 1461 | 1904 | 255 | 843 | | | 823 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 98 | 100 | 96 | 90 | 100 | 79 | 98 | | | 92 | | |
| cM capacity (veh/h) | 209 | 207 | 582 | 239 | 221 | 674 | 798 | | | 727 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 29 | 166 | 14 | 678 | 350 | 57 | 556 | 282 | | | | |
| Volume Left | 4 | 25 | 14 | 0 | 0 | 57 | 0 | 0 | | | | |
| Volume Right | 25 | 141 | 0 | 0 | 11 | 0 | 0 | 4 | | | | |
| cSH | 467 | 529 | 798 | 1700 | 1700 | 727 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.06 | 0.31 | 0.02 | 0.40 | 0.21 | 0.08 | 0.33 | 0.17 | | | | |
| Queue Length 95th (m) | 1.6 | 10.7 | 0.4 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 13.2 | 14.9 | 9.6 | 0.0 | 0.0 | 10.4 | 0.0 | 0.0 | | | | |
| Lane LOS | B | B | A | | | B | | | | | | |
| Approach Delay (s) | 13.2 | 14.9 | 0.1 | | | 0.7 | | | | | | |
| Approach LOS | B | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.7 | | | | | | | | | |
| Intersection Capacity Utilization | | | 61.5% | ICU Level of Service | B | | | | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

Background 10 Year
AM Peak Hour



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 70 | 4 | 57 | 12 | 12 | 181 | 44 | 754 | 11 | 133 | 607 | 79 |
| Future Volume (vph) | 70 | 4 | 57 | 12 | 12 | 181 | 44 | 754 | 11 | 133 | 607 | 79 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.859 | | | 0.859 | | | 0.998 | | | 0.983 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1302 | 0 | 1568 | 1278 | 0 | 1568 | 2799 | 0 | 1553 | 2714 | 0 |
| Flt Permitted | 0.526 | | | 0.715 | | | 0.373 | | | 0.336 | | |
| Satd. Flow (perm) | 867 | 1302 | 0 | 1179 | 1278 | 0 | 615 | 2799 | 0 | 549 | 2714 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 61 | | | 150 | | | 3 | | | 26 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| Adj. Flow (vph) | 74 | 4 | 61 | 13 | 13 | 193 | 47 | 802 | 12 | 141 | 646 | 84 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 74 | 65 | 0 | 13 | 206 | 0 | 47 | 814 | 0 | 141 | 730 | 0 |
| Enter Blocked Intersection | No |
| Lane Alignment | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

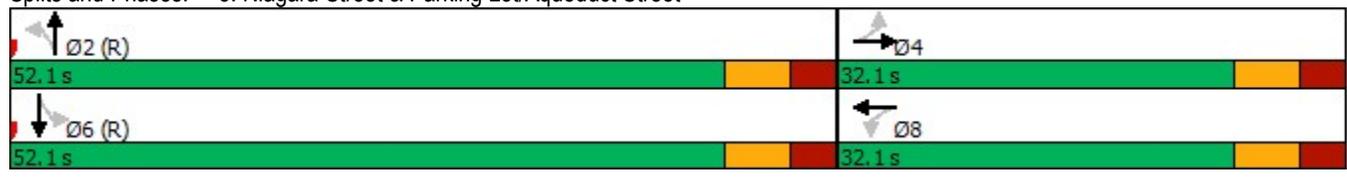
Background 10 Year
AM Peak Hour

| | ↖ | | → | | ↗ | | ↖ | | ↗ | | ↘ | |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effct Green (s) | 12.9 | 12.9 | | 12.9 | 12.9 | | 57.1 | 57.1 | | 57.1 | 57.1 | |
| Actuated g/C Ratio | 0.15 | 0.15 | | 0.15 | 0.15 | | 0.68 | 0.68 | | 0.68 | 0.68 | |
| v/c Ratio | 0.56 | 0.26 | | 0.07 | 0.64 | | 0.11 | 0.43 | | 0.38 | 0.39 | |
| Control Delay | 48.1 | 11.6 | | 28.7 | 19.6 | | 6.8 | 7.6 | | 10.8 | 7.1 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 48.1 | 11.6 | | 28.7 | 19.6 | | 6.8 | 7.6 | | 10.8 | 7.1 | |
| LOS | D | B | | C | B | | A | A | | B | A | |
| Approach Delay | | 31.0 | | | 20.2 | | | 7.6 | | | 7.7 | |
| Approach LOS | | C | | | C | | | A | | | A | |

Intersection Summary

Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 55
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.64
 Intersection Signal Delay: 10.5 Intersection LOS: B
 Intersection Capacity Utilization 80.5% ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Background 10 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 74 | 65 | 13 | 206 | 47 | 814 | 141 | 730 |
| v/c Ratio | 0.56 | 0.26 | 0.07 | 0.64 | 0.11 | 0.43 | 0.38 | 0.39 |
| Control Delay | 48.1 | 11.6 | 28.7 | 19.6 | 6.8 | 7.6 | 10.8 | 7.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 48.1 | 11.6 | 28.7 | 19.6 | 6.8 | 7.6 | 10.8 | 7.1 |
| Queue Length 50th (m) | 11.8 | 0.6 | 1.9 | 8.6 | 2.3 | 27.5 | 8.7 | 23.0 |
| Queue Length 95th (m) | 23.8 | 10.6 | 6.4 | 27.9 | 8.1 | 50.3 | 26.4 | 43.1 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 257 | 429 | 350 | 484 | 417 | 1899 | 372 | 1849 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.29 | 0.15 | 0.04 | 0.43 | 0.11 | 0.43 | 0.38 | 0.39 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
 3: Niagara Street & Parking Lot/Aqueduct Street

Background 10 Year
 AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |   | |  |   | |
| Traffic Volume (vph) | 70 | 4 | 57 | 12 | 12 | 181 | 44 | 754 | 11 | 133 | 607 | 79 |
| Future Volume (vph) | 70 | 4 | 57 | 12 | 12 | 181 | 44 | 754 | 11 | 133 | 607 | 79 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 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 | 0.86 | | 1.00 | 0.86 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1567 | 1302 | | 1566 | 1278 | | 1565 | 2799 | | 1552 | 2714 | |
| Flt Permitted | 0.53 | 1.00 | | 0.71 | 1.00 | | 0.37 | 1.00 | | 0.34 | 1.00 | |
| Satd. Flow (perm) | 867 | 1302 | | 1178 | 1278 | | 614 | 2799 | | 549 | 2714 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 74 | 4 | 61 | 13 | 13 | 193 | 47 | 802 | 12 | 141 | 646 | 84 |
| RTOR Reduction (vph) | 0 | 52 | 0 | 0 | 127 | 0 | 0 | 1 | 0 | 0 | 8 | 0 |
| Lane Group Flow (vph) | 74 | 13 | 0 | 13 | 79 | 0 | 47 | 813 | 0 | 141 | 722 | 0 |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| 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) | 12.9 | 12.9 | | 12.9 | 12.9 | | 57.1 | 57.1 | | 57.1 | 57.1 | |
| Effective Green, g (s) | 12.9 | 12.9 | | 12.9 | 12.9 | | 57.1 | 57.1 | | 57.1 | 57.1 | |
| Actuated g/C Ratio | 0.15 | 0.15 | | 0.15 | 0.15 | | 0.68 | 0.68 | | 0.68 | 0.68 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 132 | 199 | | 180 | 195 | | 416 | 1898 | | 372 | 1840 | |
| v/s Ratio Prot | | 0.01 | | | 0.06 | | | c0.29 | | | 0.27 | |
| v/s Ratio Perm | c0.09 | | | 0.01 | | | 0.08 | | | 0.26 | | |
| v/c Ratio | 0.56 | 0.07 | | 0.07 | 0.41 | | 0.11 | 0.43 | | 0.38 | 0.39 | |
| Uniform Delay, d1 | 33.0 | 30.5 | | 30.5 | 32.2 | | 4.7 | 6.1 | | 5.9 | 5.9 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 6.5 | 0.2 | | 0.2 | 1.9 | | 0.6 | 0.7 | | 2.9 | 0.6 | |
| Delay (s) | 39.5 | 30.7 | | 30.8 | 34.1 | | 5.3 | 6.9 | | 8.8 | 6.6 | |
| Level of Service | D | C | | C | C | | A | A | | A | A | |
| Approach Delay (s) | | 35.4 | | | 33.9 | | | 6.8 | | | 6.9 | |
| Approach LOS | | D | | | C | | | A | | | A | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 11.6 | | | | HCM 2000 Level of Service | | | | B | |
| HCM 2000 Volume to Capacity ratio | | | 0.45 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | | | | Sum of lost time (s) | | | 14.2 | | |
| Intersection Capacity Utilization | | | 80.5% | | | | ICU Level of Service | | | D | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Background 10 Year
AM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 21 | 42 | 48 | 837 | 571 | 84 |
| Future Volume (vph) | 21 | 42 | 48 | 837 | 571 | 84 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.910 | | | | 0.981 | |
| Flt Protected | 0.984 | | 0.950 | | | |
| Satd. Flow (prot) | 1431 | 0 | 1568 | 3308 | 2731 | 0 |
| Flt Permitted | 0.984 | | 0.950 | | | |
| Satd. Flow (perm) | 1431 | 0 | 1568 | 3308 | 2731 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 1 | | 6 | | | 6 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 2% | 5% | 3% |
| Adj. Flow (vph) | 23 | 46 | 52 | 910 | 621 | 91 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 69 | 0 | 52 | 910 | 712 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 40.6% |
| Analysis Period (min) | 15 |
| | ICU Level of Service A |

HCM Unsignalized Intersection Capacity Analysis
4: Niagara Street & Roger Drive

Background 10 Year
AM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 21 | 42 | 48 | 837 | 571 | 84 |
| Future Volume (Veh/h) | 21 | 42 | 48 | 837 | 571 | 84 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 23 | 46 | 52 | 910 | 621 | 91 |
| Pedestrians | 6 | | | | 1 | |
| Lane Width (m) | 3.6 | | | | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | | 1.2 | |
| Percent Blockage | 1 | | | | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | 1.00 | 1.00 | 1.00 | | | |
| vC, conflicting volume | 1232 | 362 | 718 | | | |
| vC1, stage 1 conf vol | 672 | | | | | |
| vC2, stage 2 conf vol | 560 | | | | | |
| vCu, unblocked vol | 1232 | 361 | 717 | | | |
| tC, single (s) | 6.8 | 7.0 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 94 | 93 | 94 | | | |
| cM capacity (veh/h) | 371 | 630 | 888 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 69 | 52 | 455 | 455 | 414 | 298 |
| Volume Left | 23 | 52 | 0 | 0 | 0 | 0 |
| Volume Right | 46 | 0 | 0 | 0 | 0 | 91 |
| cSH | 511 | 888 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.14 | 0.06 | 0.27 | 0.27 | 0.24 | 0.18 |
| Queue Length 95th (m) | 3.7 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 13.1 | 9.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | | | | |
| Approach Delay (s) | 13.1 | 0.5 | | | 0.0 | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.8 | | | |
| Intersection Capacity Utilization | | | 40.6% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

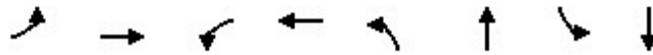
Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Background 10 Year
AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 348 | 199 | 113 | 48 | 160 | 131 | 113 | 414 | 55 | 91 | 360 | 244 |
| Future Volume (vph) | 348 | 199 | 113 | 48 | 160 | 131 | 113 | 414 | 55 | 91 | 360 | 244 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 1.00 | 0.99 | | 0.99 | 1.00 | | 1.00 | 0.99 | |
| Frt | | 0.946 | | | 0.932 | | | 0.983 | | | 0.939 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1291 | 0 | 1413 | 1321 | 0 | 1376 | 2682 | 0 | 1376 | 2609 | 0 |
| Flt Permitted | 0.303 | | | 0.446 | | | 0.283 | | | 0.422 | | |
| Satd. Flow (perm) | 487 | 1291 | 0 | 660 | 1321 | 0 | 408 | 2682 | 0 | 608 | 2609 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 26 | | | 38 | | | 15 | | | 171 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Peak Hour Factor | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Adj. Flow (vph) | 382 | 219 | 124 | 53 | 176 | 144 | 124 | 455 | 60 | 100 | 396 | 268 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 382 | 343 | 0 | 53 | 320 | 0 | 124 | 515 | 0 | 100 | 664 | 0 |
| Enter Blocked Intersection | No |
| Lane Alignment | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Queues
5: Niagara Street & Thorold Road

Background 10 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|--------|--------|------|--------|------|-------|------|-------|
| Lane Group Flow (vph) | 382 | 343 | 53 | 320 | 124 | 515 | 100 | 664 |
| v/c Ratio | 1.18 | 0.84 | 0.19 | 0.92 | 0.42 | 0.48 | 0.28 | 0.62 |
| Control Delay | 135.2 | 52.0 | 19.5 | 65.7 | 18.3 | 26.6 | 15.7 | 23.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 135.2 | 52.0 | 19.5 | 65.7 | 18.3 | 26.6 | 15.7 | 23.3 |
| Queue Length 50th (m) | ~74.2 | 64.0 | 6.5 | 58.7 | 13.8 | 43.8 | 10.9 | 46.3 |
| Queue Length 95th (m) | #122.9 | #122.6 | 14.3 | #110.1 | 24.8 | 63.8 | 20.4 | 69.0 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 323 | 408 | 343 | 368 | 320 | 1067 | 398 | 1074 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.18 | 0.84 | 0.15 | 0.87 | 0.39 | 0.48 | 0.25 | 0.62 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
5: Niagara Street & Thorold Road

Background 10 Year
AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|-------|-------|-------|------|------|---------------------------|------|------|-------|-------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 348 | 199 | 113 | 48 | 160 | 131 | 113 | 414 | 55 | 91 | 360 | 244 |
| Future Volume (vph) | 348 | 199 | 113 | 48 | 160 | 131 | 113 | 414 | 55 | 91 | 360 | 244 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 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 | 0.95 | | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1535 | 1290 | | 1410 | 1322 | | 1374 | 2681 | | 1373 | 2610 | |
| Flt Permitted | 0.30 | 1.00 | | 0.45 | 1.00 | | 0.28 | 1.00 | | 0.42 | 1.00 | |
| Satd. Flow (perm) | 490 | 1290 | | 662 | 1322 | | 410 | 2681 | | 610 | 2610 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 382 | 219 | 124 | 53 | 176 | 144 | 124 | 455 | 60 | 100 | 396 | 268 |
| RTOR Reduction (vph) | 0 | 18 | 0 | 0 | 29 | 0 | 0 | 9 | 0 | 0 | 109 | 0 |
| Lane Group Flow (vph) | 382 | 325 | 0 | 53 | 291 | 0 | 124 | 506 | 0 | 100 | 555 | 0 |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 41.1 | 31.7 | | 32.5 | 26.1 | | 49.8 | 40.1 | | 46.0 | 38.2 | |
| Effective Green, g (s) | 41.1 | 31.7 | | 32.5 | 26.1 | | 49.8 | 40.1 | | 46.0 | 38.2 | |
| Actuated g/C Ratio | 0.39 | 0.30 | | 0.31 | 0.25 | | 0.48 | 0.38 | | 0.44 | 0.36 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 311 | 390 | | 250 | 329 | | 284 | 1025 | | 324 | 951 | |
| v/s Ratio Prot | c0.14 | 0.25 | | 0.01 | 0.22 | | c0.04 | 0.19 | | 0.02 | c0.21 | |
| v/s Ratio Perm | c0.34 | | | 0.05 | | | 0.17 | | | 0.11 | | |
| v/c Ratio | 1.23 | 0.83 | | 0.21 | 0.89 | | 0.44 | 0.49 | | 0.31 | 0.58 | |
| Uniform Delay, d1 | 29.2 | 34.1 | | 26.0 | 37.9 | | 16.7 | 24.6 | | 17.9 | 26.9 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 127.8 | 13.7 | | 0.3 | 23.2 | | 0.8 | 1.7 | | 0.4 | 2.6 | |
| Delay (s) | 156.9 | 47.8 | | 26.4 | 61.1 | | 17.5 | 26.3 | | 18.2 | 29.5 | |
| Level of Service | F | D | | C | E | | B | C | | B | C | |
| Approach Delay (s) | | 105.3 | | | 56.2 | | | 24.6 | | | 28.0 | |
| Approach LOS | | F | | | E | | | C | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 53.7 | | | | HCM 2000 Level of Service | | | | D | |
| HCM 2000 Volume to Capacity ratio | | | 0.89 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | | Sum of lost time (s) | | | 18.8 | | |
| Intersection Capacity Utilization | | | 90.5% | | | | ICU Level of Service | | | E | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Background 10 Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |  | |  |  |
| Traffic Volume (vph) | 0 | 0 | 1167 | 0 | 0 | 764 |
| Future Volume (vph) | 0 | 0 | 1167 | 0 | 0 | 764 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | | | | | | |
| Flt Protected | | | | | | |
| Satd. Flow (prot) | 1598 | 0 | 2832 | 0 | 1619 | 2804 |
| Flt Permitted | | | | | | |
| Satd. Flow (perm) | 1598 | 0 | 2832 | 0 | 1619 | 2804 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 3% | 2% | 2% | 4% |
| Adj. Flow (vph) | 0 | 0 | 1268 | 0 | 0 | 830 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 0 | 1268 | 0 | 0 | 830 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 43.3% | | | ICU Level of Service A | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis

6: Niagara Street & Site Access

Background 10 Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (veh/h) | 0 | 0 | 1167 | 0 | 0 | 764 |
| Future Volume (Veh/h) | 0 | 0 | 1167 | 0 | 0 | 764 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 0 | 1268 | 0 | 0 | 830 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | | | TWLTL |
| Median storage veh | | | 2 | | | 2 |
| Upstream signal (m) | | | 300 | | | 165 |
| pX, platoon unblocked | 0.96 | 0.96 | | | 0.96 | |
| vC, conflicting volume | 1683 | 634 | | | 1268 | |
| vC1, stage 1 conf vol | 1268 | | | | | |
| vC2, stage 2 conf vol | 415 | | | | | |
| vCu, unblocked vol | 1630 | 538 | | | 1198 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 100 | | | 100 | |
| cM capacity (veh/h) | 225 | 469 | | | 556 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 0 | 845 | 423 | 0 | 415 | 415 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 0 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.00 | 0.50 | 0.25 | 0.00 | 0.24 | 0.24 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | |
| Approach Delay (s) | 0.0 | 0.0 | | 0.0 | | |
| Approach LOS | A | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.0 | | | |
| Intersection Capacity Utilization | | | 43.3% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Background 10 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  |  |
| Traffic Volume (vph) | 371 | 538 | 168 | 524 | 583 | 195 | 169 | 755 | 399 | 251 | 990 | 376 |
| Future Volume (vph) | 371 | 538 | 168 | 524 | 583 | 195 | 169 | 755 | 399 | 251 | 990 | 376 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | | 0.95 | | 0.97 | | | 0.99 | |
| Frt | | 0.964 | | | | 0.850 | | 0.948 | | | 0.959 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1553 | 2273 | 0 | 1553 | 3341 | 1248 | 1568 | 2631 | 0 | 1523 | 2747 | 0 |
| Flt Permitted | 0.228 | | | 0.108 | | | 0.080 | | | 0.078 | | |
| Satd. Flow (perm) | 368 | 2273 | 0 | 175 | 3341 | 1188 | 132 | 2631 | 0 | 125 | 2747 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 24 | | | | 201 | | 64 | | | 37 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| 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 (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Adj. Flow (vph) | 382 | 555 | 173 | 540 | 601 | 201 | 174 | 778 | 411 | 259 | 1021 | 388 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 382 | 728 | 0 | 540 | 601 | 201 | 174 | 1189 | 0 | 259 | 1409 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

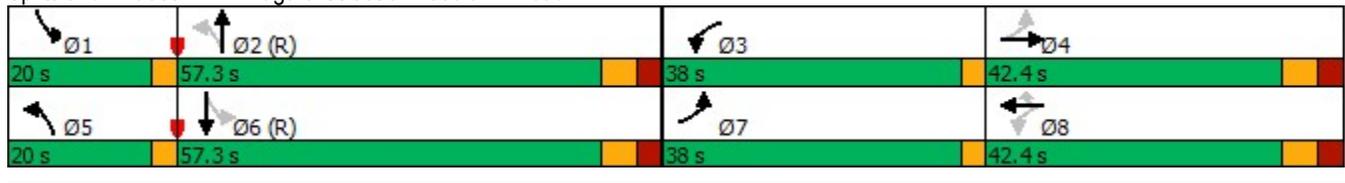
Background 10 Year
PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 72.3 | 35.0 | | 75.3 | 37.1 | 37.1 | 69.9 | 50.0 | | 72.2 | 51.4 | |
| Actuated g/C Ratio | 0.46 | 0.22 | | 0.48 | 0.24 | 0.24 | 0.44 | 0.32 | | 0.46 | 0.33 | |
| v/c Ratio | 0.92 | 1.39 | | 1.39 | 0.77 | 0.46 | 0.87 | 1.36 | | 1.25 | 1.53 | |
| Control Delay | 61.0 | 230.2 | | 226.8 | 64.2 | 9.9 | 76.3 | 206.3 | | 183.0 | 280.3 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 61.0 | 230.2 | | 226.8 | 64.2 | 9.9 | 76.3 | 206.3 | | 183.0 | 280.3 | |
| LOS | E | F | | F | E | A | E | F | | F | F | |
| Approach Delay | | 172.0 | | | 121.5 | | | 189.7 | | | 265.2 | |
| Approach LOS | | F | | | F | | | F | | | F | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 140
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.53
 Intersection Signal Delay: 192.4 Intersection LOS: F
 Intersection Capacity Utilization 138.4% ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Background 10 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|--------|--------|--------|-------|------|-------|--------|--------|--------|
| Lane Group Flow (vph) | 382 | 728 | 540 | 601 | 201 | 174 | 1189 | 259 | 1409 |
| v/c Ratio | 0.92 | 1.39 | 1.39 | 0.77 | 0.46 | 0.87 | 1.36 | 1.25 | 1.53 |
| Control Delay | 61.0 | 230.2 | 226.8 | 64.2 | 9.9 | 76.3 | 206.3 | 183.0 | 280.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 61.0 | 230.2 | 226.8 | 64.2 | 9.9 | 76.3 | 206.3 | 183.0 | 280.3 |
| Queue Length 50th (m) | 88.7 | ~165.2 | ~222.3 | 100.0 | 0.0 | 40.7 | ~263.1 | ~91.6 | ~343.3 |
| Queue Length 95th (m) | #148.4 | #208.2 | #299.1 | 124.2 | 23.7 | #82.0 | #308.6 | #152.5 | #388.8 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 436 | 523 | 389 | 785 | 433 | 214 | 877 | 208 | 920 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.88 | 1.39 | 1.39 | 0.77 | 0.46 | 0.81 | 1.36 | 1.25 | 1.53 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Niagara Street & Woodlawn Road

Background 10 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 371 | 538 | 168 | 524 | 583 | 195 | 169 | 755 | 399 | 251 | 990 | 376 |
| Future Volume (vph) | 371 | 538 | 168 | 524 | 583 | 195 | 169 | 755 | 399 | 251 | 990 | 376 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.97 | | 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 | |
| Frt | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1549 | 2274 | | 1552 | 3341 | 1188 | 1568 | 2631 | | 1523 | 2746 | |
| Flt Permitted | 0.23 | 1.00 | | 0.11 | 1.00 | 1.00 | 0.08 | 1.00 | | 0.08 | 1.00 | |
| Satd. Flow (perm) | 372 | 2274 | | 176 | 3341 | 1188 | 132 | 2631 | | 125 | 2746 | |
| 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) | 382 | 555 | 173 | 540 | 601 | 201 | 174 | 778 | 411 | 259 | 1021 | 388 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 0 | 154 | 0 | 44 | 0 | 0 | 25 | 0 |
| Lane Group Flow (vph) | 382 | 709 | 0 | 540 | 601 | 47 | 174 | 1145 | 0 | 259 | 1384 | 0 |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| Heavy Vehicles (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 67.9 | 35.0 | | 72.1 | 37.1 | 37.1 | 65.6 | 50.0 | | 68.4 | 51.4 | |
| Effective Green, g (s) | 67.9 | 35.0 | | 72.1 | 37.1 | 37.1 | 65.6 | 50.0 | | 68.4 | 51.4 | |
| Actuated g/C Ratio | 0.43 | 0.22 | | 0.46 | 0.24 | 0.24 | 0.42 | 0.32 | | 0.43 | 0.33 | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Lane Grp Cap (vph) | 405 | 504 | | 385 | 785 | 279 | 196 | 834 | | 204 | 895 | |
| v/s Ratio Prot | 0.20 | 0.31 | | c0.31 | 0.18 | | 0.09 | 0.44 | | c0.14 | c0.50 | |
| v/s Ratio Perm | 0.21 | | | c0.33 | | 0.04 | 0.28 | | | 0.41 | | |
| v/c Ratio | 0.94 | 1.41 | | 1.40 | 0.77 | 0.17 | 0.89 | 1.37 | | 1.27 | 1.55 | |
| Uniform Delay, d1 | 36.5 | 61.3 | | 49.7 | 56.2 | 48.0 | 45.7 | 53.8 | | 50.4 | 53.1 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 30.4 | 194.9 | | 196.2 | 4.3 | 0.2 | 34.7 | 175.6 | | 154.0 | 251.5 | |
| Delay (s) | 66.9 | 256.3 | | 245.9 | 60.5 | 48.2 | 80.3 | 229.4 | | 204.5 | 304.6 | |
| Level of Service | E | F | | F | E | D | F | F | | F | F | |
| Approach Delay (s) | | 191.1 | | | 133.3 | | | 210.4 | | | 289.1 | |
| Approach LOS | | F | | | F | | | F | | | F | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 211.5 | HCM 2000 Level of Service | | | | F | | | | |
| HCM 2000 Volume to Capacity ratio | | | 1.47 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | Sum of lost time (s) | | | | 20.7 | | | | |
| Intersection Capacity Utilization | | | 138.4% | ICU Level of Service | | | | H | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Background 10 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  |  |
| Traffic Volume (vph) | 12 | 0 | 32 | 17 | 0 | 98 | 12 | 1175 | 26 | 145 | 1445 | 37 |
| Future Volume (vph) | 12 | 0 | 32 | 17 | 0 | 98 | 12 | 1175 | 26 | 145 | 1445 | 37 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.902 | | | 0.884 | | | 0.997 | | | 0.996 | |
| Flt Protected | | 0.986 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1450 | 0 | 0 | 1403 | 0 | 1568 | 2851 | 0 | 1538 | 2877 | 0 |
| Flt Permitted | | 0.986 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1450 | 0 | 0 | 1403 | 0 | 1568 | 2851 | 0 | 1538 | 2877 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 19 | | | | | 19 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 2% | 2% | 2% | 1% | 0% |
| Adj. Flow (vph) | 13 | 0 | 34 | 18 | 0 | 107 | 13 | 1237 | 28 | 158 | 1521 | 39 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 47 | 0 | 0 | 125 | 0 | 13 | 1265 | 0 | 158 | 1560 | 0 |
| Enter Blocked Intersection | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 100 | | 100 | 25 | | 100 | 100 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 73.6% |
| ICU Level of Service | D |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis
 2: Niagara Street & Abbey Road

Background 10 Year
 PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  | |
| Traffic Volume (veh/h) | 12 | 0 | 32 | 17 | 0 | 98 | 12 | 1175 | 26 | 145 | 1445 | 37 |
| Future Volume (Veh/h) | 12 | 0 | 32 | 17 | 0 | 98 | 12 | 1175 | 26 | 145 | 1445 | 37 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 13 | 0 | 34 | 18 | 0 | 107 | 13 | 1237 | 28 | 158 | 1521 | 39 |
| Pedestrians | | 19 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 2 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage veh | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.80 | 0.80 | 0.72 | 0.80 | 0.80 | 0.85 | 0.72 | | | 0.85 | | |
| vC, conflicting volume | 2627 | 3166 | 799 | 2388 | 3172 | 632 | 1579 | | | 1265 | | |
| vC1, stage 1 conf vol | 1876 | 1876 | | 1277 | 1277 | | | | | | | |
| vC2, stage 2 conf vol | 752 | 1291 | | 1110 | 1895 | | | | | | | |
| vCu, unblocked vol | 1657 | 2334 | 0 | 1356 | 2341 | 199 | 1024 | | | 947 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 82 | 100 | 96 | 90 | 100 | 84 | 97 | | | 74 | | |
| cM capacity (veh/h) | 72 | 76 | 772 | 187 | 82 | 684 | 485 | | | 609 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 47 | 125 | 13 | 825 | 440 | 158 | 1014 | 546 | | | | |
| Volume Left | 13 | 18 | 13 | 0 | 0 | 158 | 0 | 0 | | | | |
| Volume Right | 34 | 107 | 0 | 0 | 28 | 0 | 0 | 39 | | | | |
| cSH | 210 | 494 | 485 | 1700 | 1700 | 609 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.22 | 0.25 | 0.03 | 0.49 | 0.26 | 0.26 | 0.60 | 0.32 | | | | |
| Queue Length 95th (m) | 6.7 | 8.0 | 0.7 | 0.0 | 0.0 | 8.3 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 27.1 | 14.7 | 12.6 | 0.0 | 0.0 | 13.0 | 0.0 | 0.0 | | | | |
| Lane LOS | D | B | B | | | B | | | | | | |
| Approach Delay (s) | 27.1 | 14.7 | 0.1 | | | 1.2 | | | | | | |
| Approach LOS | D | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.7 | | | | | | | | | |
| Intersection Capacity Utilization | | | 73.6% | ICU Level of Service | D | | | | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

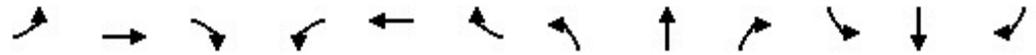
Background 10 Year
PM Peak Hour



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 50 | 1 | 48 | 16 | 3 | 87 | 45 | 1079 | 25 | 112 | 1315 | 61 |
| Future Volume (vph) | 50 | 1 | 48 | 16 | 3 | 87 | 45 | 1079 | 25 | 112 | 1315 | 61 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.98 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.853 | | | 0.855 | | | 0.997 | | | 0.993 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1288 | 0 | 1568 | 1295 | 0 | 1568 | 2822 | 0 | 1568 | 2837 | 0 |
| Flt Permitted | 0.697 | | | 0.724 | | | 0.163 | | | 0.235 | | |
| Satd. Flow (perm) | 1149 | 1288 | 0 | 1190 | 1295 | 0 | 269 | 2822 | 0 | 387 | 2837 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 35 | | | 65 | | | 4 | | | 8 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| Adj. Flow (vph) | 51 | 1 | 49 | 16 | 3 | 89 | 46 | 1101 | 26 | 114 | 1342 | 62 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 51 | 50 | 0 | 16 | 92 | 0 | 46 | 1127 | 0 | 114 | 1404 | 0 |
| Enter Blocked Intersection | No |
| Lane Alignment | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

Background 10 Year
 PM Peak Hour



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effect Green (s) | 10.5 | 10.5 | | 10.5 | 10.5 | | 64.0 | 64.0 | | 64.0 | 64.0 | |
| Actuated g/C Ratio | 0.12 | 0.12 | | 0.12 | 0.12 | | 0.76 | 0.76 | | 0.76 | 0.76 | |
| v/c Ratio | 0.36 | 0.26 | | 0.11 | 0.42 | | 0.23 | 0.53 | | 0.39 | 0.65 | |
| Control Delay | 40.0 | 18.9 | | 32.8 | 19.5 | | 8.6 | 6.9 | | 10.7 | 8.7 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 40.0 | 18.9 | | 32.8 | 19.5 | | 8.6 | 6.9 | | 10.7 | 8.7 | |
| LOS | D | B | | C | B | | A | A | | B | A | |
| Approach Delay | | 29.5 | | | 21.5 | | | 6.9 | | | 8.9 | |
| Approach LOS | | C | | | C | | | A | | | A | |

Intersection Summary

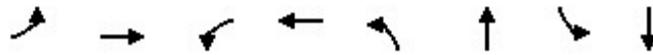
Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.65
 Intersection Signal Delay: 9.3
 Intersection Capacity Utilization 86.1%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service E

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Background 10 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 51 | 50 | 16 | 92 | 46 | 1127 | 114 | 1404 |
| v/c Ratio | 0.36 | 0.26 | 0.11 | 0.42 | 0.23 | 0.53 | 0.39 | 0.65 |
| Control Delay | 40.0 | 18.9 | 32.8 | 19.5 | 8.6 | 6.9 | 10.7 | 8.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 40.0 | 18.9 | 32.8 | 19.5 | 8.6 | 6.9 | 10.7 | 8.7 |
| Queue Length 50th (m) | 8.1 | 2.3 | 2.5 | 4.2 | 2.3 | 39.7 | 6.6 | 58.7 |
| Queue Length 95th (m) | 18.1 | 11.8 | 7.9 | 17.3 | 8.9 | 67.0 | 22.1 | 99.6 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 341 | 407 | 353 | 430 | 204 | 2144 | 294 | 2157 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.15 | 0.12 | 0.05 | 0.21 | 0.23 | 0.53 | 0.39 | 0.65 |

Intersection Summary

HCM Signalized Intersection Capacity Analysis

3: Niagara Street & Parking Lot/Aqueduct Street

Background 10 Year
PM Peak Hour



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|------|------|------|------|------|------|------|------|-------|------|
| Lane Configurations | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↕ | | ↖ | ↗ | |
| Traffic Volume (vph) | 50 | 1 | 48 | 16 | 3 | 87 | 45 | 1079 | 25 | 112 | 1315 | 61 |
| Future Volume (vph) | 50 | 1 | 48 | 16 | 3 | 87 | 45 | 1079 | 25 | 112 | 1315 | 61 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.98 | | 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 | 0.85 | | 1.00 | 0.85 | | 1.00 | 1.00 | | 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) | 1566 | 1288 | | 1561 | 1295 | | 1565 | 2821 | | 1562 | 2838 | |
| Flt Permitted | 0.70 | 1.00 | | 0.72 | 1.00 | | 0.16 | 1.00 | | 0.23 | 1.00 | |
| Satd. Flow (perm) | 1150 | 1288 | | 1190 | 1295 | | 269 | 2821 | | 386 | 2838 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 51 | 1 | 49 | 16 | 3 | 89 | 46 | 1101 | 26 | 114 | 1342 | 62 |
| RTOR Reduction (vph) | 0 | 31 | 0 | 0 | 58 | 0 | 0 | 1 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 51 | 19 | 0 | 16 | 34 | 0 | 46 | 1126 | 0 | 114 | 1402 | 0 |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| 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) | 8.9 | 8.9 | | 8.9 | 8.9 | | 61.1 | 61.1 | | 61.1 | 61.1 | |
| Effective Green, g (s) | 8.9 | 8.9 | | 8.9 | 8.9 | | 61.1 | 61.1 | | 61.1 | 61.1 | |
| Actuated g/C Ratio | 0.11 | 0.11 | | 0.11 | 0.11 | | 0.73 | 0.73 | | 0.73 | 0.73 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 121 | 136 | | 125 | 136 | | 195 | 2047 | | 280 | 2059 | |
| v/s Ratio Prot | | 0.01 | | | 0.03 | | | 0.40 | | | c0.49 | |
| v/s Ratio Perm | c0.04 | | | 0.01 | | | 0.17 | | | 0.30 | | |
| v/c Ratio | 0.42 | 0.14 | | 0.13 | 0.25 | | 0.24 | 0.55 | | 0.41 | 0.68 | |
| Uniform Delay, d1 | 35.2 | 34.2 | | 34.1 | 34.6 | | 3.8 | 5.3 | | 4.5 | 6.3 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.2 | 0.6 | | 0.6 | 1.3 | | 2.8 | 1.1 | | 4.3 | 1.8 | |
| Delay (s) | 38.5 | 34.8 | | 34.8 | 35.9 | | 6.6 | 6.3 | | 8.8 | 8.1 | |
| Level of Service | D | C | | C | D | | A | A | | A | A | |
| Approach Delay (s) | | 36.6 | | | 35.7 | | | 6.4 | | | 8.2 | |
| Approach LOS | | D | | | D | | | A | | | A | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 9.4 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.65 | | |
| Actuated Cycle Length (s) | 84.2 | Sum of lost time (s) | 14.2 |
| Intersection Capacity Utilization | 86.1% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Background 10 Year
PM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 28 | 49 | 51 | 1023 | 1209 | 91 |
| Future Volume (vph) | 28 | 49 | 51 | 1023 | 1209 | 91 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.914 | | | | 0.989 | |
| Flt Protected | 0.982 | | 0.950 | | | |
| Satd. Flow (prot) | 1463 | 0 | 1568 | 3308 | 2858 | 0 |
| Flt Permitted | 0.982 | | 0.950 | | | |
| Satd. Flow (perm) | 1463 | 0 | 1568 | 3308 | 2858 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 2 | 1 | 8 | | | 8 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 1% | 0% |
| Adj. Flow (vph) | 30 | 53 | 55 | 1112 | 1314 | 99 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 83 | 0 | 55 | 1112 | 1413 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 61.1% |
| Analysis Period (min) | 15 |
| | ICU Level of Service B |

HCM Unsignalized Intersection Capacity Analysis
4: Niagara Street & Roger Drive

Background 10 Year
PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|-------|------|------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 28 | 49 | 51 | 1023 | 1209 | 91 |
| Future Volume (Veh/h) | 28 | 49 | 51 | 1023 | 1209 | 91 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 30 | 53 | 55 | 1112 | 1314 | 99 |
| Pedestrians | 8 | | | 1 | 2 | |
| Lane Width (m) | 3.6 | | | 3.6 | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | 1.2 | 1.2 | |
| Percent Blockage | 1 | | | 0 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | 0.82 | 0.77 | 0.77 | | | |
| vC, conflicting volume | 2040 | 716 | 1421 | | | |
| vC1, stage 1 conf vol | 1372 | | | | | |
| vC2, stage 2 conf vol | 668 | | | | | |
| vCu, unblocked vol | 1297 | 40 | 954 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 88 | 93 | 90 | | | |
| cM capacity (veh/h) | 257 | 788 | 559 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 83 | 55 | 556 | 556 | 876 | 537 |
| Volume Left | 30 | 55 | 0 | 0 | 0 | 0 |
| Volume Right | 53 | 0 | 0 | 0 | 0 | 99 |
| cSH | 451 | 559 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.18 | 0.10 | 0.33 | 0.33 | 0.52 | 0.32 |
| Queue Length 95th (m) | 5.3 | 2.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 14.8 | 12.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | B | | | | |
| Approach Delay (s) | 14.8 | 0.6 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 0.7 | | | | | |
| Intersection Capacity Utilization | 61.1% | | | ICU Level of Service | B | |
| Analysis Period (min) | 15 | | | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Background 10 Year
PM Peak Hour



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 412 | 185 | 100 | 121 | 191 | 121 | 174 | 606 | 75 | 124 | 689 | 552 |
| Future Volume (vph) | 412 | 185 | 100 | 121 | 191 | 121 | 174 | 606 | 75 | 124 | 689 | 552 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 0.99 | | | 1.00 | | 0.99 | 0.98 | |
| Frt | | 0.947 | | | 0.942 | | | 0.983 | | | 0.933 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1389 | 0 | 1568 | 1391 | 0 | 1452 | 2822 | 0 | 1466 | 2639 | 0 |
| Flt Permitted | 0.290 | | | 0.422 | | | 0.102 | | | 0.289 | | |
| Satd. Flow (perm) | 466 | 1389 | 0 | 689 | 1391 | 0 | 156 | 2822 | 0 | 443 | 2639 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 25 | | | 29 | | | 14 | | | 207 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Adj. Flow (vph) | 429 | 193 | 104 | 126 | 199 | 126 | 181 | 631 | 78 | 129 | 718 | 575 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 429 | 297 | 0 | 126 | 325 | 0 | 181 | 709 | 0 | 129 | 1293 | 0 |
| Enter Blocked Intersection | No |
| Lane Alignment | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Background 10 Year
PM Peak Hour

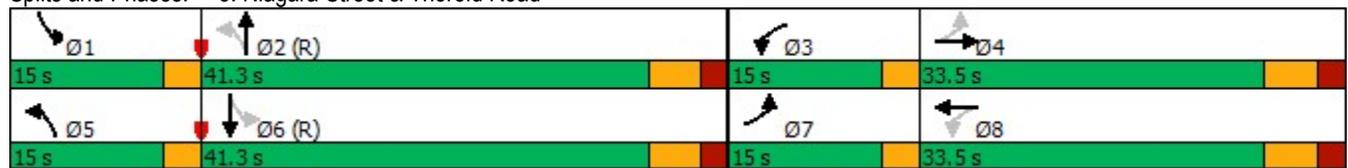


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 42.1 | 27.1 | | 38.4 | 25.0 | | 53.9 | 39.4 | | 50.6 | 37.8 | |
| Actuated g/C Ratio | 0.40 | 0.26 | | 0.37 | 0.24 | | 0.51 | 0.38 | | 0.48 | 0.36 | |
| v/c Ratio | 1.38 | 0.79 | | 0.38 | 0.92 | | 0.83 | 0.66 | | 0.42 | 1.19 | |
| Control Delay | 216.9 | 49.1 | | 22.4 | 67.4 | | 52.5 | 31.3 | | 18.1 | 124.1 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 216.9 | 49.1 | | 22.4 | 67.4 | | 52.5 | 31.3 | | 18.1 | 124.1 | |
| LOS | F | D | | C | E | | D | C | | B | F | |
| Approach Delay | | 148.3 | | | 54.8 | | | 35.6 | | | 114.5 | |
| Approach LOS | | F | | | D | | | D | | | F | |

Intersection Summary

Area Type: Other
 Cycle Length: 104.8
 Actuated Cycle Length: 104.8
 Offset: 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.38
 Intersection Signal Delay: 93.7
 Intersection LOS: F
 Intersection Capacity Utilization 122.9%
 ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Background 10 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|--------|-------|------|--------|-------|-------|------|--------|
| Lane Group Flow (vph) | 429 | 297 | 126 | 325 | 181 | 709 | 129 | 1293 |
| v/c Ratio | 1.38 | 0.79 | 0.38 | 0.92 | 0.83 | 0.66 | 0.42 | 1.19 |
| Control Delay | 216.9 | 49.1 | 22.4 | 67.4 | 52.5 | 31.3 | 18.1 | 124.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 216.9 | 49.1 | 22.4 | 67.4 | 52.5 | 31.3 | 18.1 | 124.1 |
| Queue Length 50th (m) | ~86.6 | 53.4 | 16.2 | 61.2 | 23.9 | 66.8 | 14.3 | ~169.1 |
| Queue Length 95th (m) | #154.5 | #98.6 | 28.9 | #111.7 | #62.7 | 92.1 | 25.5 | #213.2 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 310 | 385 | 367 | 379 | 228 | 1070 | 341 | 1083 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.38 | 0.77 | 0.34 | 0.86 | 0.79 | 0.66 | 0.38 | 1.19 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Background 10 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR | |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  | |
| Traffic Volume (vph) | 412 | 185 | 100 | 121 | 191 | 121 | 174 | 606 | 75 | 124 | 689 | 552 | |
| Future Volume (vph) | 412 | 185 | 100 | 121 | 191 | 121 | 174 | 606 | 75 | 124 | 689 | 552 | |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 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 | 0.98 | | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | |
| Frt | 1.00 | 0.95 | | 1.00 | 0.94 | | 1.00 | 0.98 | | 1.00 | 0.93 | | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | |
| Satd. Flow (prot) | 1535 | 1390 | | 1561 | 1391 | | 1452 | 2823 | | 1463 | 2640 | | |
| Flt Permitted | 0.29 | 1.00 | | 0.42 | 1.00 | | 0.10 | 1.00 | | 0.29 | 1.00 | | |
| Satd. Flow (perm) | 468 | 1390 | | 694 | 1391 | | 155 | 2823 | | 445 | 2640 | | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | |
| Adj. Flow (vph) | 429 | 193 | 104 | 126 | 199 | 126 | 181 | 631 | 78 | 129 | 718 | 575 | |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 22 | 0 | 0 | 9 | 0 | 0 | 132 | 0 | |
| Lane Group Flow (vph) | 429 | 278 | 0 | 126 | 303 | 0 | 181 | 700 | 0 | 129 | 1161 | 0 | |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 | |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% | |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | | |
| Actuated Green, G (s) | 39.1 | 27.1 | | 34.9 | 25.0 | | 50.6 | 39.4 | | 47.4 | 37.8 | | |
| Effective Green, g (s) | 39.1 | 27.1 | | 34.9 | 25.0 | | 50.6 | 39.4 | | 47.4 | 37.8 | | |
| Actuated g/C Ratio | 0.37 | 0.26 | | 0.33 | 0.24 | | 0.48 | 0.38 | | 0.45 | 0.36 | | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | | |
| Lane Grp Cap (vph) | 296 | 359 | | 313 | 331 | | 213 | 1061 | | 294 | 952 | | |
| v/s Ratio Prot | c0.17 | 0.20 | | 0.04 | 0.22 | | c0.09 | 0.25 | | 0.04 | c0.44 | | |
| v/s Ratio Perm | c0.37 | | | 0.10 | | | 0.32 | | | 0.16 | | | |
| v/c Ratio | 1.45 | 0.78 | | 0.40 | 0.92 | | 0.85 | 0.66 | | 0.44 | 1.22 | | |
| Uniform Delay, d1 | 29.9 | 36.0 | | 25.6 | 38.9 | | 26.1 | 27.1 | | 17.8 | 33.5 | | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | |
| Incremental Delay, d2 | 220.2 | 9.4 | | 0.6 | 28.4 | | 25.4 | 3.2 | | 0.8 | 108.2 | | |
| Delay (s) | 250.1 | 45.4 | | 26.2 | 67.3 | | 51.5 | 30.4 | | 18.5 | 141.7 | | |
| Level of Service | F | D | | C | E | | D | C | | B | F | | |
| Approach Delay (s) | | 166.4 | | | 55.8 | | | 34.7 | | | 130.5 | | |
| Approach LOS | | F | | | E | | | C | | | F | | |
| Intersection Summary | | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 103.9 | | | HCM 2000 Level of Service | | | | F | | | |
| HCM 2000 Volume to Capacity ratio | | | 1.30 | | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | Sum of lost time (s) | | | | 18.8 | | | |
| Intersection Capacity Utilization | | | 122.9% | | | ICU Level of Service | | | | H | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Background 10 Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 0 | 0 | 1323 | 0 | 0 | 1682 |
| Future Volume (vph) | 0 | 0 | 1323 | 0 | 0 | 1682 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | | | | | | |
| Flt Protected | | | | | | |
| Satd. Flow (prot) | 1598 | 0 | 2859 | 0 | 1619 | 2888 |
| Flt Permitted | | | | | | |
| Satd. Flow (perm) | 1598 | 0 | 2859 | 0 | 1619 | 2888 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 0 | 0 | 1438 | 0 | 0 | 1828 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 0 | 1438 | 0 | 0 | 1828 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 60.9% | | | ICU Level of Service B | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis
6: Niagara Street & Site Access

Background 10 Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |  | |  |  |
| Traffic Volume (veh/h) | 0 | 0 | 1323 | 0 | 0 | 1682 |
| Future Volume (Veh/h) | 0 | 0 | 1323 | 0 | 0 | 1682 |
| Sign Control | Stop | | Free | | Free | |
| Grade | 0% | | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 0 | 0 | 1438 | 0 | 0 | 1828 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | | TWLTL | |
| Median storage veh) | | | 2 | | 2 | |
| Upstream signal (m) | | | 300 | | 165 | |
| pX, platoon unblocked | 0.75 | 0.89 | | | 0.89 | |
| vC, conflicting volume | 2352 | 719 | | | 1438 | |
| vC1, stage 1 conf vol | 1438 | | | | | |
| vC2, stage 2 conf vol | 914 | | | | | |
| vCu, unblocked vol | 1474 | 434 | | | 1243 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 100 | 100 | | | 100 | |
| cM capacity (veh/h) | 201 | 507 | | | 494 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 0 | 959 | 479 | 0 | 914 | 914 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 0 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.00 | 0.56 | 0.28 | 0.00 | 0.54 | 0.54 |
| Queue Length 95th (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | A | | | | | |
| Approach Delay (s) | 0.0 | 0.0 | | 0.0 | | |
| Approach LOS | A | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 0.0 | | | | | |
| Intersection Capacity Utilization | 60.9% | | ICU Level of Service | | | B |
| Analysis Period (min) | 15 | | | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Total Opening Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 236 | 376 | 94 | 200 | 333 | 120 | 96 | 576 | 360 | 95 | 358 | 148 |
| Future Volume (vph) | 236 | 376 | 94 | 200 | 333 | 120 | 96 | 576 | 360 | 95 | 358 | 148 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 1.00 | | 1.00 | | 0.97 | 1.00 | 0.99 | | | 1.00 | |
| Fr _t | | 0.970 | | | | 0.850 | | 0.942 | | | 0.956 | |
| Fl _t Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 2715 | 0 | 1508 | 3276 | 1224 | 1553 | 2658 | 0 | 1452 | 2664 | 0 |
| Fl _t Permitted | 0.388 | | | 0.301 | | | 0.422 | | | 0.195 | | |
| Satd. Flow (perm) | 623 | 2715 | 0 | 476 | 3276 | 1194 | 689 | 2658 | 0 | 298 | 2664 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 18 | | | | 122 | | 90 | | | 42 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Adj. Flow (vph) | 241 | 384 | 96 | 204 | 340 | 122 | 98 | 588 | 367 | 97 | 365 | 151 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 241 | 480 | 0 | 204 | 340 | 122 | 98 | 955 | 0 | 97 | 516 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

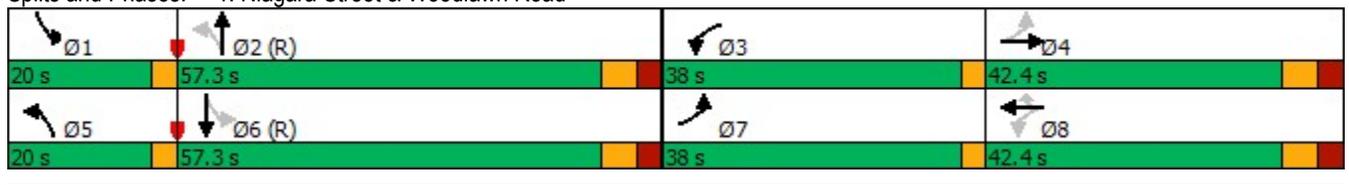
Total Opening Year
AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 58.9 | 31.6 | | 54.1 | 29.1 | 29.1 | 88.1 | 74.0 | | 90.1 | 75.0 | |
| Actuated g/C Ratio | 0.37 | 0.20 | | 0.34 | 0.18 | 0.18 | 0.56 | 0.47 | | 0.57 | 0.48 | |
| v/c Ratio | 0.66 | 0.86 | | 0.68 | 0.56 | 0.38 | 0.22 | 0.74 | | 0.39 | 0.40 | |
| Control Delay | 43.9 | 74.0 | | 46.3 | 61.6 | 11.4 | 18.0 | 36.6 | | 21.4 | 27.6 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 43.9 | 74.0 | | 46.3 | 61.6 | 11.4 | 18.0 | 36.6 | | 21.4 | 27.6 | |
| LOS | D | E | | D | E | B | B | D | | C | C | |
| Approach Delay | | 63.9 | | | 47.7 | | | 34.8 | | | 26.6 | |
| Approach LOS | | E | | | D | | | C | | | C | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.86
 Intersection Signal Delay: 42.9 Intersection LOS: D
 Intersection Capacity Utilization 90.1% ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Total Opening Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|-------|------|-------|------|------|--------|-------|-------|
| Lane Group Flow (vph) | 241 | 480 | 204 | 340 | 122 | 98 | 955 | 97 | 516 |
| v/c Ratio | 0.66 | 0.86 | 0.68 | 0.56 | 0.38 | 0.22 | 0.74 | 0.39 | 0.40 |
| Control Delay | 43.9 | 74.0 | 46.3 | 61.6 | 11.4 | 18.0 | 36.6 | 21.4 | 27.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 43.9 | 74.0 | 46.3 | 61.6 | 11.4 | 18.0 | 36.6 | 21.4 | 27.6 |
| Queue Length 50th (m) | 58.2 | 78.6 | 48.0 | 54.2 | 0.0 | 14.0 | 121.5 | 13.9 | 52.5 |
| Queue Length 95th (m) | 73.7 | 95.6 | 62.1 | 68.6 | 18.4 | 28.1 | #196.8 | 28.1 | 82.6 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 438 | 629 | 408 | 728 | 359 | 493 | 1295 | 298 | 1289 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.55 | 0.76 | 0.50 | 0.47 | 0.34 | 0.20 | 0.74 | 0.33 | 0.40 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Niagara Street & Woodlawn Road

Total Opening Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 236 | 376 | 94 | 200 | 333 | 120 | 96 | 576 | 360 | 95 | 358 | 148 |
| Future Volume (vph) | 236 | 376 | 94 | 200 | 333 | 120 | 96 | 576 | 360 | 95 | 358 | 148 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 | 1.00 | 0.99 | | 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 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1534 | 2715 | | 1507 | 3276 | 1194 | 1552 | 2659 | | 1452 | 2664 | |
| Flt Permitted | 0.39 | 1.00 | | 0.30 | 1.00 | 1.00 | 0.42 | 1.00 | | 0.20 | 1.00 | |
| Satd. Flow (perm) | 627 | 2715 | | 478 | 3276 | 1194 | 689 | 2659 | | 298 | 2664 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 241 | 384 | 96 | 204 | 340 | 122 | 98 | 588 | 367 | 97 | 365 | 151 |
| RTOR Reduction (vph) | 0 | 14 | 0 | 0 | 0 | 99 | 0 | 48 | 0 | 0 | 22 | 0 |
| Lane Group Flow (vph) | 241 | 466 | 0 | 204 | 340 | 23 | 98 | 907 | 0 | 97 | 494 | 0 |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 54.6 | 31.6 | | 49.8 | 29.2 | 29.2 | 83.8 | 74.0 | | 85.8 | 75.0 | |
| Effective Green, g (s) | 54.6 | 31.6 | | 49.8 | 29.2 | 29.2 | 83.8 | 74.0 | | 85.8 | 75.0 | |
| Actuated g/C Ratio | 0.35 | 0.20 | | 0.32 | 0.19 | 0.19 | 0.53 | 0.47 | | 0.54 | 0.48 | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Lane Grp Cap (vph) | 349 | 544 | | 285 | 606 | 221 | 419 | 1247 | | 241 | 1266 | |
| v/s Ratio Prot | c0.10 | c0.17 | | c0.09 | 0.10 | | 0.01 | c0.34 | | c0.03 | 0.19 | |
| v/s Ratio Perm | 0.14 | | | 0.13 | | 0.02 | 0.11 | | | 0.19 | | |
| v/c Ratio | 0.69 | 0.86 | | 0.72 | 0.56 | 0.10 | 0.23 | 0.73 | | 0.40 | 0.39 | |
| Uniform Delay, d1 | 40.4 | 60.9 | | 43.2 | 58.4 | 53.4 | 18.6 | 33.7 | | 20.3 | 26.6 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 5.4 | 12.4 | | 7.8 | 1.0 | 0.1 | 0.2 | 3.7 | | 0.9 | 0.9 | |
| Delay (s) | 45.8 | 73.2 | | 51.0 | 59.4 | 53.5 | 18.9 | 37.5 | | 21.2 | 27.5 | |
| Level of Service | D | E | | D | E | D | B | D | | C | C | |
| Approach Delay (s) | | 64.1 | | | 55.8 | | | 35.7 | | | 26.5 | |
| Approach LOS | | E | | | E | | | D | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 44.9 | | | | HCM 2000 Level of Service | | | D | | |
| HCM 2000 Volume to Capacity ratio | | | 0.74 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | | | Sum of lost time (s) | | | 20.7 | | | |
| Intersection Capacity Utilization | | | 90.1% | | | ICU Level of Service | | | E | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Total Opening Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  |  |
| Traffic Volume (vph) | 3 | 0 | 19 | 23 | 0 | 130 | 11 | 800 | 10 | 52 | 675 | 3 |
| Future Volume (vph) | 3 | 0 | 19 | 23 | 0 | 130 | 11 | 800 | 10 | 52 | 675 | 3 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.883 | | | 0.885 | | | 0.998 | | | 0.999 | |
| Flt Protected | | 0.994 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1431 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Flt Permitted | | 0.994 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1431 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 5 | | | | | 5 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 3% | 2% | 2% | 4% | 0% |
| Adj. Flow (vph) | 3 | 0 | 20 | 25 | 0 | 141 | 12 | 842 | 11 | 57 | 711 | 3 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 23 | 0 | 0 | 166 | 0 | 12 | 853 | 0 | 57 | 714 | 0 |
| Enter Blocked Intersection | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 56.0% |
| Analysis Period (min) | 15 |
| | ICU Level of Service B |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Total Opening Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  | |
| Traffic Volume (veh/h) | 3 | 0 | 19 | 23 | 0 | 130 | 11 | 800 | 10 | 52 | 675 | 3 |
| Future Volume (Veh/h) | 3 | 0 | 19 | 23 | 0 | 130 | 11 | 800 | 10 | 52 | 675 | 3 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 3 | 0 | 20 | 25 | 0 | 141 | 12 | 842 | 11 | 57 | 711 | 3 |
| Pedestrians | | 5 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 0 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage veh | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.94 | 0.94 | | 0.94 | 0.94 | 0.94 | | | | 0.94 | | |
| vC, conflicting volume | 1418 | 1708 | 362 | 1361 | 1704 | 426 | 719 | | | 853 | | |
| vC1, stage 1 conf vol | 832 | 832 | | 872 | 872 | | | | | | | |
| vC2, stage 2 conf vol | 586 | 877 | | 490 | 833 | | | | | | | |
| vCu, unblocked vol | 1323 | 1632 | 362 | 1263 | 1627 | 273 | 719 | | | 725 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 99 | 100 | 97 | 91 | 100 | 79 | 99 | | | 93 | | |
| cM capacity (veh/h) | 243 | 251 | 638 | 289 | 265 | 684 | 888 | | | 824 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 23 | 166 | 12 | 561 | 292 | 57 | 474 | 240 | | | | |
| Volume Left | 3 | 25 | 12 | 0 | 0 | 57 | 0 | 0 | | | | |
| Volume Right | 20 | 141 | 0 | 0 | 11 | 0 | 0 | 3 | | | | |
| cSH | 526 | 567 | 888 | 1700 | 1700 | 824 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.04 | 0.29 | 0.01 | 0.33 | 0.17 | 0.07 | 0.28 | 0.14 | | | | |
| Queue Length 95th (m) | 1.1 | 9.7 | 0.3 | 0.0 | 0.0 | 1.8 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 12.2 | 14.0 | 9.1 | 0.0 | 0.0 | 9.7 | 0.0 | 0.0 | | | | |
| Lane LOS | B | B | A | | | A | | | | | | |
| Approach Delay (s) | 12.2 | 14.0 | 0.1 | | | 0.7 | | | | | | |
| Approach LOS | B | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.8 | | | | | | | | | |
| Intersection Capacity Utilization | | | 56.0% | | ICU Level of Service | | | | B | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

Total Opening Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  | |  |  |  |
| Traffic Volume (vph) | 57 | 3 | 47 | 10 | 10 | 148 | 36 | 628 | 9 | 109 | 527 | 65 |
| Future Volume (vph) | 57 | 3 | 47 | 10 | 10 | 148 | 36 | 628 | 9 | 109 | 527 | 65 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Fr _t | | 0.858 | | | 0.860 | | | 0.998 | | | 0.984 | |
| Fl _t Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1300 | 0 | 1568 | 1279 | 0 | 1568 | 2799 | 0 | 1553 | 2717 | 0 |
| Fl _t Permitted | 0.628 | | | 0.722 | | | 0.413 | | | 0.394 | | |
| Satd. Flow (perm) | 1035 | 1300 | 0 | 1190 | 1279 | 0 | 680 | 2799 | 0 | 643 | 2717 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 50 | | | 157 | | | 3 | | | 24 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| Adj. Flow (vph) | 61 | 3 | 50 | 11 | 11 | 157 | 38 | 668 | 10 | 116 | 561 | 69 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 61 | 53 | 0 | 11 | 168 | 0 | 38 | 678 | 0 | 116 | 630 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

Total Opening Year
 AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effect Green (s) | 11.4 | 11.4 | | 11.4 | 11.4 | | 58.6 | 58.6 | | 58.6 | 58.6 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | 0.14 | 0.14 | | 0.70 | 0.70 | | 0.70 | 0.70 | |
| v/c Ratio | 0.44 | 0.24 | | 0.07 | 0.54 | | 0.08 | 0.35 | | 0.26 | 0.33 | |
| Control Delay | 42.2 | 12.9 | | 30.5 | 13.6 | | 5.5 | 6.1 | | 7.3 | 5.8 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 42.2 | 12.9 | | 30.5 | 13.6 | | 5.5 | 6.1 | | 7.3 | 5.8 | |
| LOS | D | B | | C | B | | A | A | | A | A | |
| Approach Delay | | 28.6 | | | 14.7 | | | 6.1 | | | 6.0 | |
| Approach LOS | | C | | | B | | | A | | | A | |

Intersection Summary

Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 40
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.54
 Intersection Signal Delay: 8.4
 Intersection Capacity Utilization 76.7%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service D

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Total Opening Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|-----------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 61 | 53 | 11 | 168 | 38 | 678 | 116 | 630 |
| v/c Ratio | 0.44 | 0.24 | 0.07 | 0.54 | 0.08 | 0.35 | 0.26 | 0.33 |
| Control Delay | 42.2 | 12.9 | 30.5 | 13.6 | 5.5 | 6.1 | 7.3 | 5.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 42.2 | 12.9 | 30.5 | 13.6 | 5.5 | 6.1 | 7.3 | 5.8 |
| Queue Length 50th (m) | 9.7 | 0.5 | 1.7 | 1.7 | 1.7 | 20.1 | 6.1 | 17.6 |
| Queue Length 95th (m) | 20.7 | 9.9 | 6.0 | 18.3 | 5.9 | 35.1 | 16.7 | 31.5 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 307 | 421 | 353 | 490 | 472 | 1947 | 447 | 1896 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.20 | 0.13 | 0.03 | 0.34 | 0.08 | 0.35 | 0.26 | 0.33 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
 3: Niagara Street & Parking Lot/Aqueduct Street

Total Opening Year
 AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|------|-------|------|------|----------------------|---------------------------|-------|------|------|------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 57 | 3 | 47 | 10 | 10 | 148 | 36 | 628 | 9 | 109 | 527 | 65 |
| Future Volume (vph) | 57 | 3 | 47 | 10 | 10 | 148 | 36 | 628 | 9 | 109 | 527 | 65 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 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 | 0.86 | | 1.00 | 0.86 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1566 | 1301 | | 1566 | 1279 | | 1565 | 2799 | | 1551 | 2715 | |
| Flt Permitted | 0.63 | 1.00 | | 0.72 | 1.00 | | 0.41 | 1.00 | | 0.39 | 1.00 | |
| Satd. Flow (perm) | 1036 | 1301 | | 1191 | 1279 | | 680 | 2799 | | 643 | 2715 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 61 | 3 | 50 | 11 | 11 | 157 | 38 | 668 | 10 | 116 | 561 | 69 |
| RTOR Reduction (vph) | 0 | 43 | 0 | 0 | 136 | 0 | 0 | 1 | 0 | 0 | 7 | 0 |
| Lane Group Flow (vph) | 61 | 10 | 0 | 11 | 32 | 0 | 38 | 677 | 0 | 116 | 623 | 0 |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| 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) | 11.4 | 11.4 | | 11.4 | 11.4 | | 58.6 | 58.6 | | 58.6 | 58.6 | |
| Effective Green, g (s) | 11.4 | 11.4 | | 11.4 | 11.4 | | 58.6 | 58.6 | | 58.6 | 58.6 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | 0.14 | 0.14 | | 0.70 | 0.70 | | 0.70 | 0.70 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 140 | 176 | | 161 | 173 | | 473 | 1947 | | 447 | 1889 | |
| v/s Ratio Prot | | 0.01 | | | 0.03 | | | c0.24 | | | 0.23 | |
| v/s Ratio Perm | c0.06 | | | 0.01 | | | 0.06 | | | 0.18 | | |
| v/c Ratio | 0.44 | 0.06 | | 0.07 | 0.19 | | 0.08 | 0.35 | | 0.26 | 0.33 | |
| Uniform Delay, d1 | 33.4 | 31.7 | | 31.8 | 32.3 | | 4.1 | 5.1 | | 4.7 | 5.1 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.9 | 0.2 | | 0.2 | 0.7 | | 0.3 | 0.5 | | 1.4 | 0.5 | |
| Delay (s) | 36.4 | 31.9 | | 32.0 | 33.0 | | 4.5 | 5.6 | | 6.2 | 5.5 | |
| Level of Service | D | C | | C | C | | A | A | | A | A | |
| Approach Delay (s) | | 34.3 | | | 32.9 | | | 5.6 | | | 5.6 | |
| Approach LOS | | C | | | C | | | A | | | A | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 10.2 | | | | HCM 2000 Level of Service | | | B | | |
| HCM 2000 Volume to Capacity ratio | | | 0.36 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | | | Sum of lost time (s) | | | 14.2 | | | |
| Intersection Capacity Utilization | | | 76.7% | | | ICU Level of Service | | | D | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Total Opening Year
AM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 17 | 35 | 39 | 696 | 498 | 69 |
| Future Volume (vph) | 17 | 35 | 39 | 696 | 498 | 69 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Fr _t | 0.908 | | | | 0.982 | |
| Fl _t Protected | 0.984 | | 0.950 | | | |
| Satd. Flow (prot) | 1427 | 0 | 1568 | 3308 | 2734 | 0 |
| Fl _t Permitted | 0.984 | | 0.950 | | | |
| Satd. Flow (perm) | 1427 | 0 | 1568 | 3308 | 2734 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 1 | | 6 | | | 6 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 2% | 5% | 3% |
| Adj. Flow (vph) | 18 | 38 | 42 | 757 | 541 | 75 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 56 | 0 | 42 | 757 | 616 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 36.8% |
| Analysis Period (min) | 15 |
| | ICU Level of Service A |

HCM Unsignalized Intersection Capacity Analysis
4: Niagara Street & Roger Drive

Total Opening Year
AM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 17 | 35 | 39 | 696 | 498 | 69 |
| Future Volume (Veh/h) | 17 | 35 | 39 | 696 | 498 | 69 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 18 | 38 | 42 | 757 | 541 | 75 |
| Pedestrians | 6 | | | | 1 | |
| Lane Width (m) | 3.6 | | | | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | | 1.2 | |
| Percent Blockage | 1 | | | | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1048 | 314 | 622 | | | |
| vC1, stage 1 conf vol | 584 | | | | | |
| vC2, stage 2 conf vol | 464 | | | | | |
| vCu, unblocked vol | 1048 | 314 | 622 | | | |
| tC, single (s) | 6.8 | 7.0 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 96 | 94 | 96 | | | |
| cM capacity (veh/h) | 427 | 675 | 964 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 56 | 42 | 378 | 378 | 361 | 255 |
| Volume Left | 18 | 42 | 0 | 0 | 0 | 0 |
| Volume Right | 38 | 0 | 0 | 0 | 0 | 75 |
| cSH | 569 | 964 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.10 | 0.04 | 0.22 | 0.22 | 0.21 | 0.15 |
| Queue Length 95th (m) | 2.6 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 12.0 | 8.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | | | | |
| Approach Delay (s) | 12.0 | 0.5 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.7 | | | |
| Intersection Capacity Utilization | | | 36.8% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total Opening Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 289 | 163 | 93 | 39 | 131 | 107 | 93 | 346 | 45 | 75 | 314 | 210 |
| Future Volume (vph) | 289 | 163 | 93 | 39 | 131 | 107 | 93 | 346 | 45 | 75 | 314 | 210 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 0.99 | | 0.99 | 1.00 | | 0.99 | 0.99 | |
| Frt | | 0.946 | | | 0.932 | | | 0.983 | | | 0.940 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1291 | 0 | 1413 | 1321 | 0 | 1376 | 2684 | 0 | 1376 | 2612 | 0 |
| Flt Permitted | 0.359 | | | 0.585 | | | 0.355 | | | 0.493 | | |
| Satd. Flow (perm) | 576 | 1291 | 0 | 865 | 1321 | 0 | 511 | 2684 | 0 | 710 | 2612 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 26 | | | 38 | | | 14 | | | 165 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Peak Hour Factor | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Adj. Flow (vph) | 318 | 179 | 102 | 43 | 144 | 118 | 102 | 380 | 49 | 82 | 345 | 231 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 318 | 281 | 0 | 43 | 262 | 0 | 102 | 429 | 0 | 82 | 576 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total Opening Year
AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 40.3 | 30.3 | | 32.3 | 21.9 | | 56.7 | 45.7 | | 54.7 | 43.3 | |
| Actuated g/C Ratio | 0.38 | 0.29 | | 0.31 | 0.21 | | 0.54 | 0.44 | | 0.52 | 0.41 | |
| v/c Ratio | 0.96 | 0.72 | | 0.14 | 0.86 | | 0.29 | 0.36 | | 0.19 | 0.49 | |
| Control Delay | 68.2 | 42.1 | | 19.8 | 59.2 | | 14.9 | 22.6 | | 13.7 | 18.8 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 68.2 | 42.1 | | 19.8 | 59.2 | | 14.9 | 22.6 | | 13.7 | 18.8 | |
| LOS | E | D | | B | E | | B | C | | B | B | |
| Approach Delay | | 55.9 | | | 53.6 | | | 21.1 | | | 18.1 | |
| Approach LOS | | E | | | D | | | C | | | B | |

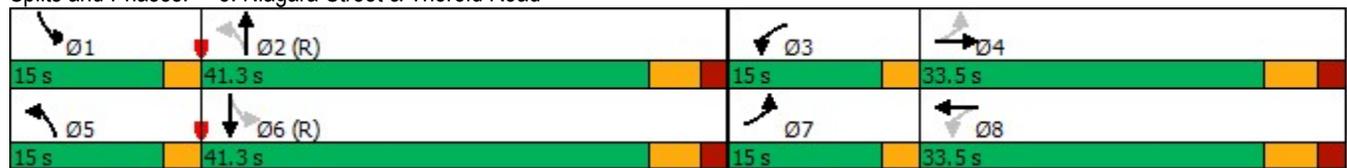
Intersection Summary

Area Type: Other
 Cycle Length: 104.8
 Actuated Cycle Length: 104.8
 Offset: 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.96
 Intersection Signal Delay: 34.9
 Intersection Capacity Utilization 80.8%
 Analysis Period (min) 15

Intersection LOS: C

ICU Level of Service D

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Total Opening Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|-------|-------|------|-------|------|-------|------|-------|
| Lane Group Flow (vph) | 318 | 281 | 43 | 262 | 102 | 429 | 82 | 576 |
| v/c Ratio | 0.96 | 0.72 | 0.14 | 0.86 | 0.29 | 0.36 | 0.19 | 0.49 |
| Control Delay | 68.2 | 42.1 | 19.8 | 59.2 | 14.9 | 22.6 | 13.7 | 18.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 68.2 | 42.1 | 19.8 | 59.2 | 14.9 | 22.6 | 13.7 | 18.8 |
| Queue Length 50th (m) | 51.0 | 50.8 | 5.6 | 46.3 | 10.2 | 32.1 | 8.1 | 33.4 |
| Queue Length 95th (m) | #97.2 | #87.9 | 12.1 | #77.2 | 20.8 | 51.5 | 17.3 | 56.3 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 331 | 391 | 371 | 368 | 381 | 1177 | 466 | 1176 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.96 | 0.72 | 0.12 | 0.71 | 0.27 | 0.36 | 0.18 | 0.49 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Total Opening Year
AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|------|-------|-------|------|------|---------------------------|------|------|-------|-------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 289 | 163 | 93 | 39 | 131 | 107 | 93 | 346 | 45 | 75 | 314 | 210 |
| Future Volume (vph) | 289 | 163 | 93 | 39 | 131 | 107 | 93 | 346 | 45 | 75 | 314 | 210 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 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 | 0.95 | | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1533 | 1290 | | 1408 | 1321 | | 1373 | 2684 | | 1372 | 2611 | |
| Flt Permitted | 0.36 | 1.00 | | 0.59 | 1.00 | | 0.35 | 1.00 | | 0.49 | 1.00 | |
| Satd. Flow (perm) | 579 | 1290 | | 867 | 1321 | | 513 | 2684 | | 712 | 2611 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 318 | 179 | 102 | 43 | 144 | 118 | 102 | 380 | 49 | 82 | 345 | 231 |
| RTOR Reduction (vph) | 0 | 18 | 0 | 0 | 30 | 0 | 0 | 8 | 0 | 0 | 99 | 0 |
| Lane Group Flow (vph) | 318 | 263 | 0 | 43 | 232 | 0 | 102 | 421 | 0 | 82 | 477 | 0 |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 38.1 | 30.3 | | 27.9 | 23.1 | | 52.6 | 43.8 | | 49.2 | 42.1 | |
| Effective Green, g (s) | 38.1 | 30.3 | | 27.9 | 23.1 | | 52.6 | 43.8 | | 49.2 | 42.1 | |
| Actuated g/C Ratio | 0.36 | 0.29 | | 0.27 | 0.22 | | 0.50 | 0.42 | | 0.47 | 0.40 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 319 | 372 | | 255 | 291 | | 329 | 1121 | | 378 | 1048 | |
| v/s Ratio Prot | c0.11 | 0.20 | | 0.01 | 0.18 | | c0.03 | 0.16 | | 0.01 | c0.18 | |
| v/s Ratio Perm | c0.25 | | | 0.04 | | | 0.13 | | | 0.09 | | |
| v/c Ratio | 1.00 | 0.71 | | 0.17 | 0.80 | | 0.31 | 0.38 | | 0.22 | 0.46 | |
| Uniform Delay, d1 | 31.1 | 33.3 | | 29.1 | 38.6 | | 14.4 | 21.1 | | 15.7 | 23.0 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 49.2 | 5.2 | | 0.2 | 13.4 | | 0.4 | 1.0 | | 0.2 | 1.4 | |
| Delay (s) | 80.3 | 38.4 | | 29.3 | 52.1 | | 14.8 | 22.0 | | 15.9 | 24.4 | |
| Level of Service | F | D | | C | D | | B | C | | B | C | |
| Approach Delay (s) | | 60.7 | | | 48.9 | | | 20.6 | | | 23.3 | |
| Approach LOS | | E | | | D | | | C | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 37.1 | | | | HCM 2000 Level of Service | | | | D | |
| HCM 2000 Volume to Capacity ratio | | | 0.69 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | | Sum of lost time (s) | | | 18.8 | | |
| Intersection Capacity Utilization | | | 80.8% | | | | ICU Level of Service | | | | D | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Total Opening Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 23 | 42 | 990 | 7 | 12 | 640 |
| Future Volume (vph) | 23 | 42 | 990 | 7 | 12 | 640 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | 0.913 | | 0.999 | | | |
| Flt Protected | 0.983 | | | | 0.950 | |
| Satd. Flow (prot) | 1434 | 0 | 2829 | 0 | 1538 | 2804 |
| Flt Permitted | 0.983 | | | | 0.950 | |
| Satd. Flow (perm) | 1434 | 0 | 2829 | 0 | 1538 | 2804 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 3% | 2% | 2% | 4% |
| Adj. Flow (vph) | 25 | 46 | 1076 | 8 | 13 | 696 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 71 | 0 | 1084 | 0 | 13 | 696 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 45.3% | | | ICU Level of Service A | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis
6: Niagara Street & Site Access

Total Opening Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (veh/h) | 23 | 42 | 990 | 7 | 12 | 640 |
| Future Volume (Veh/h) | 23 | 42 | 990 | 7 | 12 | 640 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 25 | 46 | 1076 | 8 | 13 | 696 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | TWLTL | | | TWLTL | | |
| Median storage veh | 2 | | | 2 | | |
| Upstream signal (m) | 300 | | | 165 | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1454 | 542 | | | 1084 | |
| vC1, stage 1 conf vol | 1080 | | | | | |
| vC2, stage 2 conf vol | 374 | | | | | |
| vCu, unblocked vol | 1454 | 542 | | | 1084 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 91 | 91 | | | 98 | |
| cM capacity (veh/h) | 269 | 485 | | | 639 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 71 | 717 | 367 | 13 | 348 | 348 |
| Volume Left | 25 | 0 | 0 | 13 | 0 | 0 |
| Volume Right | 46 | 0 | 8 | 0 | 0 | 0 |
| cSH | 378 | 1700 | 1700 | 639 | 1700 | 1700 |
| Volume to Capacity | 0.19 | 0.42 | 0.22 | 0.02 | 0.20 | 0.20 |
| Queue Length 95th (m) | 5.5 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 |
| Control Delay (s) | 16.7 | 0.0 | 0.0 | 10.7 | 0.0 | 0.0 |
| Lane LOS | C | | | B | | |
| Approach Delay (s) | 16.7 | 0.0 | | 0.2 | | |
| Approach LOS | C | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.7 | | | |
| Intersection Capacity Utilization | | | 45.3% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Total Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 304 | 442 | 147 | 469 | 478 | 160 | 145 | 635 | 347 | 206 | 833 | 308 |
| Future Volume (vph) | 304 | 442 | 147 | 469 | 478 | 160 | 145 | 635 | 347 | 206 | 833 | 308 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | | 0.95 | | 0.97 | | | 0.99 | |
| Frt | | 0.962 | | | | 0.850 | | 0.947 | | | 0.959 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1553 | 2272 | 0 | 1553 | 3341 | 1248 | 1568 | 2626 | 0 | 1523 | 2747 | 0 |
| Flt Permitted | 0.439 | | | 0.176 | | | 0.080 | | | 0.076 | | |
| Satd. Flow (perm) | 707 | 2272 | 0 | 285 | 3341 | 1188 | 132 | 2626 | 0 | 122 | 2747 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 27 | | | | 165 | | 68 | | | 35 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| 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 (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Adj. Flow (vph) | 313 | 456 | 152 | 484 | 493 | 165 | 149 | 655 | 358 | 212 | 859 | 318 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 313 | 608 | 0 | 484 | 493 | 165 | 149 | 1013 | 0 | 212 | 1177 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

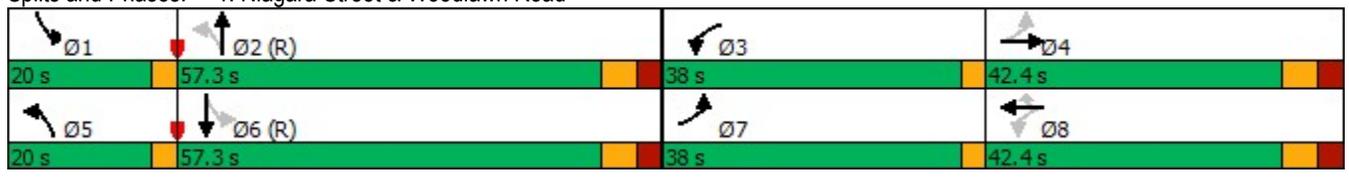
Total Opening Year
PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 65.1 | 35.0 | | 76.8 | 44.3 | 44.3 | 68.6 | 50.0 | | 72.8 | 52.7 | |
| Actuated g/C Ratio | 0.41 | 0.22 | | 0.49 | 0.28 | 0.28 | 0.44 | 0.32 | | 0.46 | 0.33 | |
| v/c Ratio | 0.73 | 1.16 | | 1.15 | 0.53 | 0.37 | 0.80 | 1.15 | | 1.02 | 1.25 | |
| Control Delay | 37.2 | 140.9 | | 129.4 | 51.5 | 8.9 | 65.3 | 125.7 | | 112.0 | 163.3 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 37.2 | 140.9 | | 129.4 | 51.5 | 8.9 | 65.3 | 125.7 | | 112.0 | 163.3 | |
| LOS | D | F | | F | D | A | E | F | | F | F | |
| Approach Delay | | 105.7 | | | 78.4 | | | 118.0 | | | 155.5 | |
| Approach LOS | | F | | | E | | | F | | | F | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 120
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.25
 Intersection Signal Delay: 117.0 Intersection LOS: F
 Intersection Capacity Utilization 123.1% ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Total Opening Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|--------|--------|-------|------|-------|--------|--------|--------|
| Lane Group Flow (vph) | 313 | 608 | 484 | 493 | 165 | 149 | 1013 | 212 | 1177 |
| v/c Ratio | 0.73 | 1.16 | 1.15 | 0.53 | 0.37 | 0.80 | 1.15 | 1.02 | 1.25 |
| Control Delay | 37.2 | 140.9 | 129.4 | 51.5 | 8.9 | 65.3 | 125.7 | 112.0 | 163.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 37.2 | 140.9 | 129.4 | 51.5 | 8.9 | 65.3 | 125.7 | 112.0 | 163.3 |
| Queue Length 50th (m) | 64.7 | ~120.7 | ~160.5 | 72.4 | 0.0 | 32.2 | ~198.3 | ~58.9 | ~254.5 |
| Queue Length 95th (m) | 91.1 | #162.2 | #238.3 | 100.0 | 21.3 | #61.9 | #243.4 | #115.8 | #304.8 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 521 | 525 | 420 | 938 | 452 | 214 | 879 | 207 | 941 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.60 | 1.16 | 1.15 | 0.53 | 0.37 | 0.70 | 1.15 | 1.02 | 1.25 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Niagara Street & Woodlawn Road

Total Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|--|---|---|--|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |   | |  |   |  |  |   | |  |   | |
| Traffic Volume (vph) | 304 | 442 | 147 | 469 | 478 | 160 | 145 | 635 | 347 | 206 | 833 | 308 |
| Future Volume (vph) | 304 | 442 | 147 | 469 | 478 | 160 | 145 | 635 | 347 | 206 | 833 | 308 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.97 | | 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 | |
| Frt | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1542 | 2274 | | 1551 | 3341 | 1188 | 1568 | 2626 | | 1523 | 2748 | |
| Flt Permitted | 0.44 | 1.00 | | 0.18 | 1.00 | 1.00 | 0.08 | 1.00 | | 0.08 | 1.00 | |
| Satd. Flow (perm) | 713 | 2274 | | 288 | 3341 | 1188 | 132 | 2626 | | 122 | 2748 | |
| 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) | 313 | 456 | 152 | 484 | 493 | 165 | 149 | 655 | 358 | 212 | 859 | 318 |
| RTOR Reduction (vph) | 0 | 21 | 0 | 0 | 0 | 119 | 0 | 46 | 0 | 0 | 23 | 0 |
| Lane Group Flow (vph) | 313 | 587 | 0 | 484 | 493 | 46 | 149 | 967 | 0 | 212 | 1154 | 0 |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| Heavy Vehicles (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 60.7 | 35.0 | | 73.0 | 44.3 | 44.3 | 64.3 | 50.0 | | 69.7 | 52.7 | |
| Effective Green, g (s) | 60.7 | 35.0 | | 73.0 | 44.3 | 44.3 | 64.3 | 50.0 | | 69.7 | 52.7 | |
| Actuated g/C Ratio | 0.38 | 0.22 | | 0.46 | 0.28 | 0.28 | 0.41 | 0.32 | | 0.44 | 0.33 | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Lane Grp Cap (vph) | 409 | 504 | | 413 | 938 | 333 | 184 | 832 | | 204 | 918 | |
| v/s Ratio Prot | 0.12 | 0.26 | | c0.26 | 0.15 | | 0.07 | 0.37 | | c0.11 | c0.42 | |
| v/s Ratio Perm | 0.17 | | | c0.28 | | 0.04 | 0.26 | | | 0.35 | | |
| v/c Ratio | 0.77 | 1.16 | | 1.17 | 0.53 | 0.14 | 0.81 | 1.16 | | 1.04 | 1.26 | |
| Uniform Delay, d1 | 37.5 | 61.3 | | 42.8 | 47.8 | 42.4 | 41.5 | 53.8 | | 49.9 | 52.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 8.0 | 94.0 | | 100.3 | 0.4 | 0.1 | 22.0 | 85.9 | | 73.7 | 124.4 | |
| Delay (s) | 45.5 | 155.4 | | 143.1 | 48.2 | 42.6 | 63.5 | 139.8 | | 123.6 | 176.9 | |
| Level of Service | D | F | | F | D | D | E | F | | F | F | |
| Approach Delay (s) | | 118.0 | | | 87.6 | | | 130.0 | | | 168.8 | |
| Approach LOS | | F | | | F | | | F | | | F | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 128.8 | HCM 2000 Level of Service | | | | F | | | | |
| HCM 2000 Volume to Capacity ratio | | | 1.23 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | Sum of lost time (s) | | | | 20.7 | | | | |
| Intersection Capacity Utilization | | | 123.1% | ICU Level of Service | | | | H | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Total Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  |  |
| Traffic Volume (vph) | 10 | 0 | 26 | 17 | 0 | 98 | 10 | 986 | 26 | 145 | 1203 | 30 |
| Future Volume (vph) | 10 | 0 | 26 | 17 | 0 | 98 | 10 | 986 | 26 | 145 | 1203 | 30 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.904 | | | 0.884 | | | 0.996 | | | 0.996 | |
| Flt Protected | | 0.986 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1453 | 0 | 0 | 1403 | 0 | 1568 | 2848 | 0 | 1538 | 2877 | 0 |
| Flt Permitted | | 0.986 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1453 | 0 | 0 | 1403 | 0 | 1568 | 2848 | 0 | 1538 | 2877 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 19 | | | | | 19 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 2% | 2% | 2% | 1% | 0% |
| Adj. Flow (vph) | 11 | 0 | 27 | 18 | 0 | 107 | 11 | 1038 | 28 | 158 | 1266 | 32 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 38 | 0 | 0 | 125 | 0 | 11 | 1066 | 0 | 158 | 1298 | 0 |
| Enter Blocked Intersection | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 100 | | 100 | 25 | | 100 | 100 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 65.0% |
| ICU Level of Service | C |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Total Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  | |
| Traffic Volume (veh/h) | 10 | 0 | 26 | 17 | 0 | 98 | 10 | 986 | 26 | 145 | 1203 | 30 |
| Future Volume (Veh/h) | 10 | 0 | 26 | 17 | 0 | 98 | 10 | 986 | 26 | 145 | 1203 | 30 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 11 | 0 | 27 | 18 | 0 | 107 | 11 | 1038 | 28 | 158 | 1266 | 32 |
| Pedestrians | | 19 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 2 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage veh | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.84 | 0.84 | 0.79 | 0.84 | 0.84 | 0.90 | 0.79 | | | 0.90 | | |
| vC, conflicting volume | 2265 | 2705 | 668 | 2050 | 2707 | 533 | 1317 | | | 1066 | | |
| vC1, stage 1 conf vol | 1617 | 1617 | | 1074 | 1074 | | | | | | | |
| vC2, stage 2 conf vol | 648 | 1088 | | 976 | 1633 | | | | | | | |
| vCu, unblocked vol | 1570 | 2091 | 55 | 1315 | 2093 | 244 | 874 | | | 839 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 90 | 100 | 97 | 92 | 100 | 84 | 98 | | | 78 | | |
| cM capacity (veh/h) | 106 | 112 | 785 | 221 | 122 | 677 | 608 | | | 708 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 38 | 125 | 11 | 692 | 374 | 158 | 844 | 454 | | | | |
| Volume Left | 11 | 18 | 11 | 0 | 0 | 158 | 0 | 0 | | | | |
| Volume Right | 27 | 107 | 0 | 0 | 28 | 0 | 0 | 32 | | | | |
| cSH | 275 | 522 | 608 | 1700 | 1700 | 708 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.14 | 0.24 | 0.02 | 0.41 | 0.22 | 0.22 | 0.50 | 0.27 | | | | |
| Queue Length 95th (m) | 3.8 | 7.4 | 0.4 | 0.0 | 0.0 | 6.8 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 20.2 | 14.1 | 11.0 | 0.0 | 0.0 | 11.5 | 0.0 | 0.0 | | | | |
| Lane LOS | C | B | B | | | B | | | | | | |
| Approach Delay (s) | 20.2 | 14.1 | 0.1 | | | 1.3 | | | | | | |
| Approach LOS | C | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.7 | | | | | | | | | |
| Intersection Capacity Utilization | | | 65.0% | | ICU Level of Service | | | | | C | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

Total Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 41 | 1 | 39 | 13 | 2 | 71 | 37 | 912 | 21 | 92 | 1100 | 50 |
| Future Volume (vph) | 41 | 1 | 39 | 13 | 2 | 71 | 37 | 912 | 21 | 92 | 1100 | 50 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.98 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.854 | | | 0.854 | | | 0.997 | | | 0.993 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1289 | 0 | 1568 | 1293 | 0 | 1568 | 2822 | 0 | 1568 | 2837 | 0 |
| Flt Permitted | 0.709 | | | 0.730 | | | 0.223 | | | 0.293 | | |
| Satd. Flow (perm) | 1169 | 1289 | 0 | 1199 | 1293 | 0 | 367 | 2822 | 0 | 482 | 2837 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 40 | | | 72 | | | 4 | | | 8 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| Adj. Flow (vph) | 42 | 1 | 40 | 13 | 2 | 72 | 38 | 931 | 21 | 94 | 1122 | 51 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 42 | 41 | 0 | 13 | 74 | 0 | 38 | 952 | 0 | 94 | 1173 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

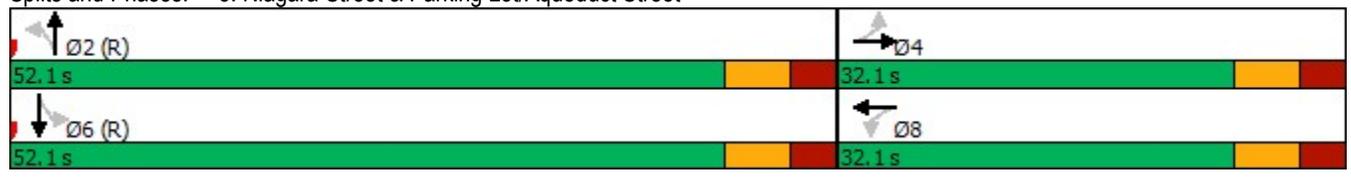
Total Opening Year
 PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effct Green (s) | 9.9 | 9.9 | | 9.9 | 9.9 | | 64.6 | 64.6 | | 64.6 | 64.6 | |
| Actuated g/C Ratio | 0.12 | 0.12 | | 0.12 | 0.12 | | 0.77 | 0.77 | | 0.77 | 0.77 | |
| v/c Ratio | 0.31 | 0.22 | | 0.09 | 0.34 | | 0.14 | 0.44 | | 0.25 | 0.54 | |
| Control Delay | 39.2 | 14.2 | | 33.3 | 13.7 | | 5.8 | 5.7 | | 6.9 | 6.7 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 39.2 | 14.2 | | 33.3 | 13.7 | | 5.8 | 5.7 | | 6.9 | 6.7 | |
| LOS | D | B | | C | B | | A | A | | A | A | |
| Approach Delay | | 26.9 | | | 16.7 | | | 5.7 | | | 6.7 | |
| Approach LOS | | C | | | B | | | A | | | A | |

Intersection Summary

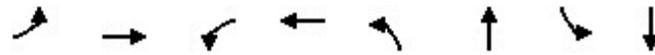
Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 50
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.54
 Intersection Signal Delay: 7.3
 Intersection Capacity Utilization 77.9%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service D

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Total Opening Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 42 | 41 | 13 | 74 | 38 | 952 | 94 | 1173 |
| v/c Ratio | 0.31 | 0.22 | 0.09 | 0.34 | 0.14 | 0.44 | 0.25 | 0.54 |
| Control Delay | 39.2 | 14.2 | 33.3 | 13.7 | 5.8 | 5.7 | 6.9 | 6.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 39.2 | 14.2 | 33.3 | 13.7 | 5.8 | 5.7 | 6.9 | 6.7 |
| Queue Length 50th (m) | 6.7 | 0.2 | 2.0 | 0.3 | 1.7 | 29.4 | 4.6 | 40.8 |
| Queue Length 95th (m) | 16.0 | 9.0 | 7.1 | 12.0 | 6.0 | 48.6 | 13.4 | 67.1 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 347 | 410 | 355 | 434 | 281 | 2164 | 369 | 2177 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.12 | 0.10 | 0.04 | 0.17 | 0.14 | 0.44 | 0.25 | 0.54 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
 3: Niagara Street & Parking Lot/Aqueduct Street

Total Opening Year
 PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 41 | 1 | 39 | 13 | 2 | 71 | 37 | 912 | 21 | 92 | 1100 | 50 |
| Future Volume (vph) | 41 | 1 | 39 | 13 | 2 | 71 | 37 | 912 | 21 | 92 | 1100 | 50 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.98 | | 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 | | 0.99 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.85 | | 1.00 | 1.00 | | 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) | 1566 | 1289 | | 1561 | 1294 | | 1564 | 2822 | | 1560 | 2839 | |
| Flt Permitted | 0.71 | 1.00 | | 0.73 | 1.00 | | 0.22 | 1.00 | | 0.29 | 1.00 | |
| Satd. Flow (perm) | 1169 | 1289 | | 1200 | 1294 | | 367 | 2822 | | 481 | 2839 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 42 | 1 | 40 | 13 | 2 | 72 | 38 | 931 | 21 | 94 | 1122 | 51 |
| RTOR Reduction (vph) | 0 | 36 | 0 | 0 | 65 | 0 | 0 | 1 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 42 | 5 | 0 | 13 | 9 | 0 | 38 | 951 | 0 | 94 | 1171 | 0 |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| 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) | 8.3 | 8.3 | | 8.3 | 8.3 | | 61.7 | 61.7 | | 61.7 | 61.7 | |
| Effective Green, g (s) | 8.3 | 8.3 | | 8.3 | 8.3 | | 61.7 | 61.7 | | 61.7 | 61.7 | |
| Actuated g/C Ratio | 0.10 | 0.10 | | 0.10 | 0.10 | | 0.73 | 0.73 | | 0.73 | 0.73 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 115 | 127 | | 118 | 127 | | 268 | 2067 | | 352 | 2080 | |
| v/s Ratio Prot | | 0.00 | | | 0.01 | | | 0.34 | | | c0.41 | |
| v/s Ratio Perm | c0.04 | | | 0.01 | | | 0.10 | | | 0.20 | | |
| v/c Ratio | 0.37 | 0.04 | | 0.11 | 0.07 | | 0.14 | 0.46 | | 0.27 | 0.56 | |
| Uniform Delay, d1 | 35.5 | 34.3 | | 34.6 | 34.5 | | 3.4 | 4.5 | | 3.7 | 5.1 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.7 | 0.2 | | 0.6 | 0.3 | | 1.1 | 0.7 | | 1.9 | 1.1 | |
| Delay (s) | 38.2 | 34.5 | | 35.2 | 34.8 | | 4.5 | 5.3 | | 5.6 | 6.2 | |
| Level of Service | D | C | | D | C | | A | A | | A | A | |
| Approach Delay (s) | | 36.4 | | | 34.8 | | | 5.2 | | | 6.2 | |
| Approach LOS | | D | | | C | | | A | | | A | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 7.9 | | | | HCM 2000 Level of Service | | | A | | |
| HCM 2000 Volume to Capacity ratio | | | 0.54 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | | | | Sum of lost time (s) | | | 14.2 | | |
| Intersection Capacity Utilization | | | 77.9% | | | | ICU Level of Service | | | D | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Total Opening Year
PM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 23 | 40 | 42 | 866 | 1012 | 75 |
| Future Volume (vph) | 23 | 40 | 42 | 866 | 1012 | 75 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.915 | | | | 0.990 | |
| Flt Protected | 0.982 | | 0.950 | | | |
| Satd. Flow (prot) | 1465 | 0 | 1568 | 3308 | 2861 | 0 |
| Flt Permitted | 0.982 | | 0.950 | | | |
| Satd. Flow (perm) | 1465 | 0 | 1568 | 3308 | 2861 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 2 | 1 | 8 | | | 8 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 1% | 0% |
| Adj. Flow (vph) | 25 | 43 | 46 | 941 | 1100 | 82 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 68 | 0 | 46 | 941 | 1182 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 51.5% |
| Analysis Period (min) | 15 |
| | ICU Level of Service A |

HCM Unsignalized Intersection Capacity Analysis
4: Niagara Street & Roger Drive

Total Opening Year
PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|-------|------|------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 23 | 40 | 42 | 866 | 1012 | 75 |
| Future Volume (Veh/h) | 23 | 40 | 42 | 866 | 1012 | 75 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 25 | 43 | 46 | 941 | 1100 | 82 |
| Pedestrians | 8 | | | 1 | 2 | |
| Lane Width (m) | 3.6 | | | 3.6 | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | 1.2 | 1.2 | |
| Percent Blockage | 1 | | | 0 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | 0.89 | 0.86 | 0.86 | | | |
| vC, conflicting volume | 1714 | 600 | 1190 | | | |
| vC1, stage 1 conf vol | 1149 | | | | | |
| vC2, stage 2 conf vol | 564 | | | | | |
| vCu, unblocked vol | 1328 | 225 | 907 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 91 | 94 | 93 | | | |
| cM capacity (veh/h) | 291 | 673 | 652 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 68 | 46 | 470 | 470 | 733 | 449 |
| Volume Left | 25 | 46 | 0 | 0 | 0 | 0 |
| Volume Right | 43 | 0 | 0 | 0 | 0 | 82 |
| cSH | 454 | 652 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.15 | 0.07 | 0.28 | 0.28 | 0.43 | 0.26 |
| Queue Length 95th (m) | 4.2 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 14.3 | 10.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | B | | | | |
| Approach Delay (s) | 14.3 | 0.5 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 0.7 | | | | | |
| Intersection Capacity Utilization | 51.5% | | | ICU Level of Service | A | |
| Analysis Period (min) | 15 | | | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 348 | 152 | 82 | 100 | 157 | 100 | 143 | 514 | 62 | 102 | 577 | 460 |
| Future Volume (vph) | 348 | 152 | 82 | 100 | 157 | 100 | 143 | 514 | 62 | 102 | 577 | 460 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 0.99 | | | 1.00 | | 0.99 | 0.98 | |
| Frt | | 0.948 | | | 0.942 | | | 0.984 | | | 0.933 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1391 | 0 | 1568 | 1391 | 0 | 1452 | 2825 | 0 | 1466 | 2640 | 0 |
| Flt Permitted | 0.337 | | | 0.517 | | | 0.117 | | | 0.369 | | |
| Satd. Flow (perm) | 541 | 1391 | 0 | 842 | 1391 | 0 | 179 | 2825 | 0 | 564 | 2640 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 25 | | | 29 | | | 13 | | | 206 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Adj. Flow (vph) | 363 | 158 | 85 | 104 | 164 | 104 | 149 | 535 | 65 | 106 | 601 | 479 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 363 | 243 | 0 | 104 | 268 | 0 | 149 | 600 | 0 | 106 | 1080 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total Opening Year
PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 39.4 | 24.6 | | 34.8 | 22.0 | | 56.6 | 43.2 | | 54.1 | 42.0 | |
| Actuated g/C Ratio | 0.38 | 0.23 | | 0.33 | 0.21 | | 0.54 | 0.41 | | 0.52 | 0.40 | |
| v/c Ratio | 1.15 | 0.70 | | 0.30 | 0.85 | | 0.68 | 0.51 | | 0.29 | 0.92 | |
| Control Delay | 123.1 | 44.1 | | 22.4 | 59.4 | | 32.9 | 25.9 | | 14.7 | 38.6 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 123.1 | 44.1 | | 22.4 | 59.4 | | 32.9 | 25.9 | | 14.7 | 38.6 | |
| LOS | F | D | | C | E | | C | C | | B | D | |
| Approach Delay | | 91.4 | | | 49.1 | | | 27.3 | | | 36.5 | |
| Approach LOS | | F | | | D | | | C | | | D | |

Intersection Summary

Area Type: Other
 Cycle Length: 104.8
 Actuated Cycle Length: 104.8
 Offset: 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.15
 Intersection Signal Delay: 47.2 Intersection LOS: D
 Intersection Capacity Utilization 106.7% ICU Level of Service G
 Analysis Period (min) 15

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Total Opening Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|--------|-------|------|-------|-------|-------|------|--------|
| Lane Group Flow (vph) | 363 | 243 | 104 | 268 | 149 | 600 | 106 | 1080 |
| v/c Ratio | 1.15 | 0.70 | 0.30 | 0.85 | 0.68 | 0.51 | 0.29 | 0.92 |
| Control Delay | 123.1 | 44.1 | 22.4 | 59.4 | 32.9 | 25.9 | 14.7 | 38.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 123.1 | 44.1 | 22.4 | 59.4 | 32.9 | 25.9 | 14.7 | 38.6 |
| Queue Length 50th (m) | ~70.5 | 42.6 | 14.2 | 49.3 | 15.3 | 49.2 | 10.6 | 98.8 |
| Queue Length 95th (m) | #108.5 | 70.0 | 24.4 | #78.5 | #40.5 | 75.0 | 21.5 | #160.6 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 317 | 379 | 384 | 379 | 244 | 1173 | 408 | 1180 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.15 | 0.64 | 0.27 | 0.71 | 0.61 | 0.51 | 0.26 | 0.92 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Total Opening Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |   | |  |   | |
| Traffic Volume (vph) | 348 | 152 | 82 | 100 | 157 | 100 | 143 | 514 | 62 | 102 | 577 | 460 |
| Future Volume (vph) | 348 | 152 | 82 | 100 | 157 | 100 | 143 | 514 | 62 | 102 | 577 | 460 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 0.99 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.95 | | 1.00 | 0.94 | | 1.00 | 0.98 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1534 | 1390 | | 1558 | 1391 | | 1452 | 2824 | | 1461 | 2641 | |
| Flt Permitted | 0.34 | 1.00 | | 0.52 | 1.00 | | 0.12 | 1.00 | | 0.37 | 1.00 | |
| Satd. Flow (perm) | 545 | 1390 | | 847 | 1391 | | 180 | 2824 | | 568 | 2641 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 362 | 158 | 85 | 104 | 164 | 104 | 149 | 535 | 65 | 106 | 601 | 479 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 23 | 0 | 0 | 8 | 0 | 0 | 124 | 0 |
| Lane Group Flow (vph) | 363 | 224 | 0 | 104 | 245 | 0 | 149 | 592 | 0 | 106 | 956 | 0 |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 36.7 | 24.7 | | 31.3 | 22.0 | | 53.3 | 43.2 | | 50.7 | 41.9 | |
| Effective Green, g (s) | 36.7 | 24.7 | | 31.3 | 22.0 | | 53.3 | 43.2 | | 50.7 | 41.9 | |
| Actuated g/C Ratio | 0.35 | 0.24 | | 0.30 | 0.21 | | 0.51 | 0.41 | | 0.48 | 0.40 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 304 | 327 | | 316 | 292 | | 214 | 1164 | | 349 | 1055 | |
| v/s Ratio Prot | c0.14 | 0.16 | | 0.03 | 0.18 | | c0.07 | 0.21 | | 0.03 | c0.36 | |
| v/s Ratio Perm | c0.28 | | | 0.07 | | | 0.29 | | | 0.12 | | |
| v/c Ratio | 1.19 | 0.68 | | 0.33 | 0.84 | | 0.70 | 0.51 | | 0.30 | 0.91 | |
| Uniform Delay, d1 | 31.7 | 36.5 | | 27.7 | 39.7 | | 18.5 | 22.9 | | 15.2 | 29.6 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 115.0 | 4.9 | | 0.4 | 18.1 | | 8.7 | 1.6 | | 0.4 | 12.7 | |
| Delay (s) | 146.7 | 41.4 | | 28.1 | 57.8 | | 27.2 | 24.5 | | 15.6 | 42.3 | |
| Level of Service | F | D | | C | E | | C | C | | B | D | |
| Approach Delay (s) | | 104.5 | | | 49.5 | | | 25.0 | | | 39.9 | |
| Approach LOS | | F | | | D | | | C | | | D | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 50.8 | | | | HCM 2000 Level of Service | | | | D | |
| HCM 2000 Volume to Capacity ratio | | | 1.03 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | | Sum of lost time (s) | | | | 18.8 | |
| Intersection Capacity Utilization | | | 106.7% | | | | ICU Level of Service | | | | G | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Total Opening Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 16 | 17 | 1110 | 20 | 32 | 1417 |
| Future Volume (vph) | 16 | 17 | 1110 | 20 | 32 | 1417 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | 0.931 | | 0.997 | | | |
| Flt Protected | 0.976 | | | | 0.950 | |
| Satd. Flow (prot) | 1452 | 0 | 2851 | 0 | 1538 | 2888 |
| Flt Permitted | 0.976 | | | | 0.950 | |
| Satd. Flow (perm) | 1452 | 0 | 2851 | 0 | 1538 | 2888 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 17 | 18 | 1207 | 22 | 35 | 1540 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 35 | 0 | 1229 | 0 | 35 | 1540 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 58.5% | | | ICU Level of Service B | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis
6: Niagara Street & Site Access

Total Opening Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (veh/h) | 16 | 17 | 1110 | 20 | 32 | 1417 |
| Future Volume (Veh/h) | 16 | 17 | 1110 | 20 | 32 | 1417 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 17 | 18 | 1207 | 22 | 35 | 1540 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | | | TWLTL |
| Median storage veh | | | 2 | | | 2 |
| Upstream signal (m) | | | 300 | | | 165 |
| pX, platoon unblocked | 0.72 | 0.95 | | | 0.95 | |
| vC, conflicting volume | 2058 | 614 | | | 1229 | |
| vC1, stage 1 conf vol | 1218 | | | | | |
| vC2, stage 2 conf vol | 840 | | | | | |
| vCu, unblocked vol | 1381 | 488 | | | 1135 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 93 | 96 | | | 94 | |
| cM capacity (veh/h) | 243 | 499 | | | 580 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 35 | 805 | 424 | 35 | 770 | 770 |
| Volume Left | 17 | 0 | 0 | 35 | 0 | 0 |
| Volume Right | 18 | 0 | 22 | 0 | 0 | 0 |
| cSH | 330 | 1700 | 1700 | 580 | 1700 | 1700 |
| Volume to Capacity | 0.11 | 0.47 | 0.25 | 0.06 | 0.45 | 0.45 |
| Queue Length 95th (m) | 2.8 | 0.0 | 0.0 | 1.5 | 0.0 | 0.0 |
| Control Delay (s) | 17.2 | 0.0 | 0.0 | 11.6 | 0.0 | 0.0 |
| Lane LOS | C | | | B | | |
| Approach Delay (s) | 17.2 | 0.0 | | 0.3 | | |
| Approach LOS | C | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.4 | | | |
| Intersection Capacity Utilization | | | 58.5% | ICU Level of Service | B | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Total 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 261 | 415 | 102 | 216 | 368 | 133 | 102 | 629 | 385 | 105 | 393 | 164 |
| Future Volume (vph) | 261 | 415 | 102 | 216 | 368 | 133 | 102 | 629 | 385 | 105 | 393 | 164 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 1.00 | | 1.00 | | 0.97 | 1.00 | 0.99 | | | 1.00 | |
| Frt | | 0.970 | | | | 0.850 | | 0.943 | | | 0.956 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 2715 | 0 | 1508 | 3276 | 1224 | 1553 | 2660 | 0 | 1452 | 2664 | 0 |
| Flt Permitted | 0.356 | | | 0.289 | | | 0.387 | | | 0.147 | | |
| Satd. Flow (perm) | 572 | 2715 | 0 | 458 | 3276 | 1194 | 632 | 2660 | 0 | 225 | 2664 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 18 | | | | 136 | | 86 | | | 42 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Adj. Flow (vph) | 266 | 423 | 104 | 220 | 376 | 136 | 104 | 642 | 393 | 107 | 401 | 167 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 266 | 527 | 0 | 220 | 376 | 136 | 104 | 1035 | 0 | 107 | 568 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

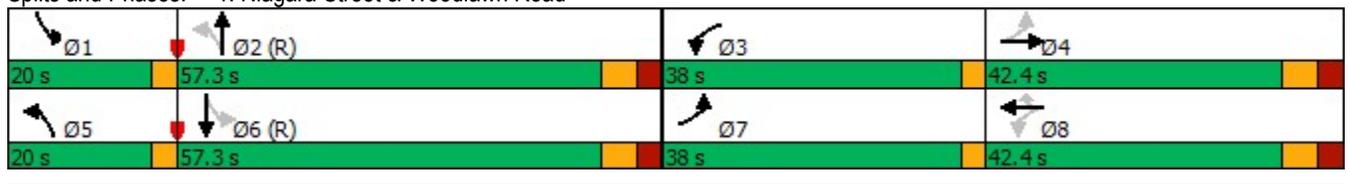
Total 5 Year
AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 63.2 | 34.8 | | 56.9 | 31.3 | 31.3 | 83.5 | 68.8 | | 87.1 | 70.7 | |
| Actuated g/C Ratio | 0.40 | 0.22 | | 0.36 | 0.20 | 0.20 | 0.53 | 0.44 | | 0.55 | 0.45 | |
| v/c Ratio | 0.70 | 0.86 | | 0.72 | 0.58 | 0.39 | 0.26 | 0.86 | | 0.49 | 0.47 | |
| Control Delay | 43.4 | 71.4 | | 45.9 | 60.4 | 10.6 | 20.3 | 45.7 | | 26.2 | 31.6 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 43.4 | 71.4 | | 45.9 | 60.4 | 10.6 | 20.3 | 45.7 | | 26.2 | 31.6 | |
| LOS | D | E | | D | E | B | C | D | | C | C | |
| Approach Delay | | 62.0 | | | 46.8 | | | 43.4 | | | 30.7 | |
| Approach LOS | | E | | | D | | | D | | | C | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 80
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.86
 Intersection Signal Delay: 46.0 Intersection LOS: D
 Intersection Capacity Utilization 96.0% ICU Level of Service F
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Total 5 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|-------|------|-------|------|------|--------|-------|-------|
| Lane Group Flow (vph) | 266 | 527 | 220 | 376 | 136 | 104 | 1035 | 107 | 568 |
| v/c Ratio | 0.70 | 0.86 | 0.72 | 0.58 | 0.39 | 0.26 | 0.86 | 0.49 | 0.47 |
| Control Delay | 43.4 | 71.4 | 45.9 | 60.4 | 10.6 | 20.3 | 45.7 | 26.2 | 31.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 43.4 | 71.4 | 45.9 | 60.4 | 10.6 | 20.3 | 45.7 | 26.2 | 31.6 |
| Queue Length 50th (m) | 62.8 | 86.1 | 50.3 | 59.5 | 0.0 | 15.8 | 150.1 | 16.4 | 63.2 |
| Queue Length 95th (m) | 78.5 | 103.6 | 64.6 | 74.5 | 19.1 | 31.0 | #243.7 | 31.9 | 97.0 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 443 | 650 | 416 | 735 | 373 | 448 | 1208 | 261 | 1217 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.60 | 0.81 | 0.53 | 0.51 | 0.36 | 0.23 | 0.86 | 0.41 | 0.47 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Niagara Street & Woodlawn Road

Total 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 261 | 415 | 102 | 216 | 368 | 133 | 102 | 629 | 385 | 105 | 393 | 164 |
| Future Volume (vph) | 261 | 415 | 102 | 216 | 368 | 133 | 102 | 629 | 385 | 105 | 393 | 164 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 | 1.00 | 0.99 | | 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 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1534 | 2716 | | 1507 | 3276 | 1194 | 1552 | 2661 | | 1452 | 2663 | |
| Flt Permitted | 0.36 | 1.00 | | 0.29 | 1.00 | 1.00 | 0.39 | 1.00 | | 0.15 | 1.00 | |
| Satd. Flow (perm) | 575 | 2716 | | 458 | 3276 | 1194 | 632 | 2661 | | 225 | 2663 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 266 | 423 | 104 | 220 | 376 | 136 | 104 | 642 | 393 | 107 | 401 | 167 |
| RTOR Reduction (vph) | 0 | 14 | 0 | 0 | 0 | 109 | 0 | 48 | 0 | 0 | 23 | 0 |
| Lane Group Flow (vph) | 266 | 513 | 0 | 220 | 376 | 27 | 104 | 987 | 0 | 107 | 545 | 0 |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 58.9 | 34.8 | | 52.4 | 31.3 | 31.3 | 79.2 | 68.8 | | 83.0 | 70.7 | |
| Effective Green, g (s) | 58.9 | 34.8 | | 52.4 | 31.3 | 31.3 | 79.2 | 68.8 | | 83.0 | 70.7 | |
| Actuated g/C Ratio | 0.37 | 0.22 | | 0.33 | 0.20 | 0.20 | 0.50 | 0.44 | | 0.53 | 0.45 | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Lane Grp Cap (vph) | 364 | 599 | | 292 | 650 | 236 | 378 | 1160 | | 214 | 1193 | |
| v/s Ratio Prot | c0.11 | c0.19 | | c0.10 | 0.11 | | 0.02 | c0.37 | | c0.04 | 0.20 | |
| v/s Ratio Perm | 0.16 | | | 0.15 | | 0.02 | 0.12 | | | 0.22 | | |
| v/c Ratio | 0.73 | 0.86 | | 0.75 | 0.58 | 0.11 | 0.28 | 0.85 | | 0.50 | 0.46 | |
| Uniform Delay, d1 | 38.0 | 59.0 | | 41.8 | 57.2 | 51.8 | 21.2 | 39.8 | | 23.8 | 30.2 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 7.0 | 11.4 | | 10.1 | 1.0 | 0.2 | 0.3 | 7.9 | | 1.4 | 1.3 | |
| Delay (s) | 45.1 | 70.5 | | 51.9 | 58.3 | 52.0 | 21.5 | 47.7 | | 25.2 | 31.4 | |
| Level of Service | D | E | | D | E | D | C | D | | C | C | |
| Approach Delay (s) | | 61.9 | | | 55.2 | | | 45.3 | | | 30.5 | |
| Approach LOS | | E | | | E | | | D | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 48.4 | | | HCM 2000 Level of Service | | | | D | | |
| HCM 2000 Volume to Capacity ratio | | | 0.82 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | Sum of lost time (s) | | | | 20.7 | | | | |
| Intersection Capacity Utilization | | | 96.0% | ICU Level of Service | | | | F | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Total 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  | |
| Traffic Volume (vph) | 4 | 0 | 22 | 23 | 0 | 130 | 12 | 882 | 10 | 52 | 742 | 4 |
| Future Volume (vph) | 4 | 0 | 22 | 23 | 0 | 130 | 12 | 882 | 10 | 52 | 742 | 4 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.885 | | | 0.885 | | | 0.998 | | | 0.999 | |
| Flt Protected | | 0.993 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1432 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Flt Permitted | | 0.993 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1432 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 5 | | | | | 5 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 3% | 2% | 2% | 4% | 0% |
| Adj. Flow (vph) | 4 | 0 | 23 | 25 | 0 | 141 | 13 | 928 | 11 | 57 | 781 | 4 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 27 | 0 | 0 | 166 | 0 | 13 | 939 | 0 | 57 | 785 | 0 |
| Enter Blocked Intersection | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 58.3% |
| ICU Level of Service | B |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Total 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  |  |
| Traffic Volume (veh/h) | 4 | 0 | 22 | 23 | 0 | 130 | 12 | 882 | 10 | 52 | 742 | 4 |
| Future Volume (Veh/h) | 4 | 0 | 22 | 23 | 0 | 130 | 12 | 882 | 10 | 52 | 742 | 4 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 4 | 0 | 23 | 25 | 0 | 141 | 13 | 928 | 11 | 57 | 781 | 4 |
| Pedestrians | | 5 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 0 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage veh | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.93 | 0.93 | | 0.93 | 0.93 | 0.93 | | | | 0.93 | | |
| vC, conflicting volume | 1533 | 1867 | 398 | 1487 | 1864 | 470 | 790 | | | 939 | | |
| vC1, stage 1 conf vol | 902 | 902 | | 960 | 960 | | | | | | | |
| vC2, stage 2 conf vol | 631 | 965 | | 528 | 904 | | | | | | | |
| vCu, unblocked vol | 1416 | 1777 | 398 | 1366 | 1773 | 268 | 790 | | | 775 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 98 | 100 | 96 | 90 | 100 | 79 | 98 | | | 93 | | |
| cM capacity (veh/h) | 223 | 227 | 605 | 262 | 240 | 676 | 836 | | | 775 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 27 | 166 | 13 | 619 | 320 | 57 | 521 | 264 | | | | |
| Volume Left | 4 | 25 | 13 | 0 | 0 | 57 | 0 | 0 | | | | |
| Volume Right | 23 | 141 | 0 | 0 | 11 | 0 | 0 | 4 | | | | |
| cSH | 483 | 546 | 836 | 1700 | 1700 | 775 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.06 | 0.30 | 0.02 | 0.36 | 0.19 | 0.07 | 0.31 | 0.16 | | | | |
| Queue Length 95th (m) | 1.4 | 10.2 | 0.4 | 0.0 | 0.0 | 1.9 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 12.9 | 14.4 | 9.4 | 0.0 | 0.0 | 10.0 | 0.0 | 0.0 | | | | |
| Lane LOS | B | B | A | | | B | | | | | | |
| Approach Delay (s) | 12.9 | 14.4 | 0.1 | | | 0.7 | | | | | | |
| Approach LOS | B | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.7 | | | | | | | | | |
| Intersection Capacity Utilization | | | 58.3% | | ICU Level of Service | | | | | B | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

Total 5 Year
AM Peak Hour



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 63 | 4 | 51 | 11 | 11 | 164 | 39 | 691 | 10 | 121 | 576 | 72 |
| Future Volume (vph) | 63 | 4 | 51 | 11 | 11 | 164 | 39 | 691 | 10 | 121 | 576 | 72 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.860 | | | 0.860 | | | 0.998 | | | 0.983 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1303 | 0 | 1568 | 1279 | 0 | 1568 | 2799 | 0 | 1553 | 2714 | 0 |
| Flt Permitted | 0.575 | | | 0.719 | | | 0.389 | | | 0.367 | | |
| Satd. Flow (perm) | 948 | 1303 | 0 | 1185 | 1279 | 0 | 641 | 2799 | 0 | 599 | 2714 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 54 | | | 174 | | | 3 | | | 25 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| Adj. Flow (vph) | 67 | 4 | 54 | 12 | 12 | 174 | 41 | 735 | 11 | 129 | 613 | 77 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 67 | 58 | 0 | 12 | 186 | 0 | 41 | 746 | 0 | 129 | 690 | 0 |
| Enter Blocked Intersection | No |
| Lane Alignment | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

Total 5 Year
 AM Peak Hour

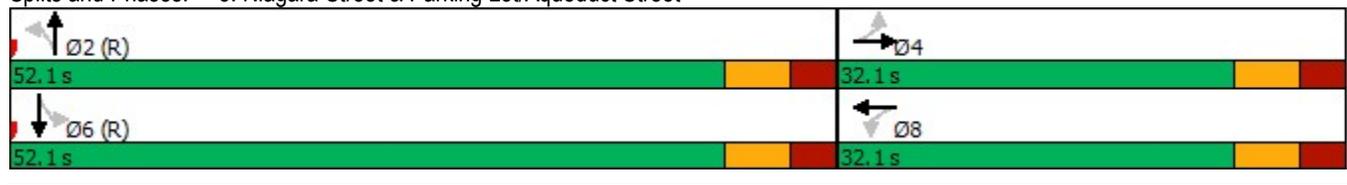


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effct Green (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 58.0 | 58.0 | | 58.0 | 58.0 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | 0.14 | 0.14 | | 0.69 | 0.69 | | 0.69 | 0.69 | |
| v/c Ratio | 0.50 | 0.25 | | 0.07 | 0.56 | | 0.09 | 0.39 | | 0.31 | 0.37 | |
| Control Delay | 45.2 | 12.6 | | 29.9 | 13.2 | | 5.9 | 6.7 | | 8.6 | 6.3 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 45.2 | 12.6 | | 29.9 | 13.2 | | 5.9 | 6.7 | | 8.6 | 6.3 | |
| LOS | D | B | | C | B | | A | A | | A | A | |
| Approach Delay | | 30.1 | | | 14.3 | | | 6.7 | | | 6.7 | |
| Approach LOS | | C | | | B | | | A | | | A | |

Intersection Summary

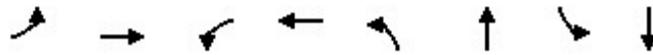
Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 45
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.56
 Intersection Signal Delay: 9.0
 Intersection Capacity Utilization 77.9%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service D

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Total 5 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 67 | 58 | 12 | 186 | 41 | 746 | 129 | 690 |
| v/c Ratio | 0.50 | 0.25 | 0.07 | 0.56 | 0.09 | 0.39 | 0.31 | 0.37 |
| Control Delay | 45.2 | 12.6 | 29.9 | 13.2 | 5.9 | 6.7 | 8.6 | 6.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 45.2 | 12.6 | 29.9 | 13.2 | 5.9 | 6.7 | 8.6 | 6.3 |
| Queue Length 50th (m) | 10.7 | 0.6 | 1.8 | 1.8 | 1.9 | 23.4 | 7.2 | 20.4 |
| Queue Length 95th (m) | 22.4 | 10.4 | 6.2 | 19.4 | 6.6 | 41.3 | 20.4 | 36.8 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 281 | 424 | 351 | 502 | 441 | 1930 | 413 | 1878 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.24 | 0.14 | 0.03 | 0.37 | 0.09 | 0.39 | 0.31 | 0.37 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis

3: Niagara Street & Parking Lot/Aqueduct Street

Total 5 Year
AM Peak Hour



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|------|-------|------|------|----------------------|---------------------------|-------|------|------|------|------|
| Lane Configurations | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↕ | | ↖ | ↗ | |
| Traffic Volume (vph) | 63 | 4 | 51 | 11 | 11 | 164 | 39 | 691 | 10 | 121 | 576 | 72 |
| Future Volume (vph) | 63 | 4 | 51 | 11 | 11 | 164 | 39 | 691 | 10 | 121 | 576 | 72 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 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 | 0.86 | | 1.00 | 0.86 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1566 | 1304 | | 1566 | 1279 | | 1565 | 2799 | | 1551 | 2715 | |
| Flt Permitted | 0.58 | 1.00 | | 0.72 | 1.00 | | 0.39 | 1.00 | | 0.37 | 1.00 | |
| Satd. Flow (perm) | 948 | 1304 | | 1186 | 1279 | | 641 | 2799 | | 599 | 2715 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 67 | 4 | 54 | 12 | 12 | 174 | 41 | 735 | 11 | 129 | 613 | 77 |
| RTOR Reduction (vph) | 0 | 46 | 0 | 0 | 149 | 0 | 0 | 1 | 0 | 0 | 8 | 0 |
| Lane Group Flow (vph) | 67 | 12 | 0 | 12 | 37 | 0 | 41 | 745 | 0 | 129 | 682 | 0 |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| 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) | 12.0 | 12.0 | | 12.0 | 12.0 | | 58.0 | 58.0 | | 58.0 | 58.0 | |
| Effective Green, g (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 58.0 | 58.0 | | 58.0 | 58.0 | |
| Actuated g/C Ratio | 0.14 | 0.14 | | 0.14 | 0.14 | | 0.69 | 0.69 | | 0.69 | 0.69 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 135 | 185 | | 169 | 182 | | 441 | 1928 | | 412 | 1870 | |
| v/s Ratio Prot | | 0.01 | | | 0.03 | | | c0.27 | | | 0.25 | |
| v/s Ratio Perm | c0.07 | | | 0.01 | | | 0.06 | | | 0.22 | | |
| v/c Ratio | 0.50 | 0.06 | | 0.07 | 0.20 | | 0.09 | 0.39 | | 0.31 | 0.36 | |
| Uniform Delay, d1 | 33.3 | 31.2 | | 31.3 | 31.9 | | 4.4 | 5.6 | | 5.2 | 5.4 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.9 | 0.2 | | 0.2 | 0.8 | | 0.4 | 0.6 | | 2.0 | 0.6 | |
| Delay (s) | 37.2 | 31.4 | | 31.5 | 32.6 | | 4.8 | 6.1 | | 7.2 | 6.0 | |
| Level of Service | D | C | | C | C | | A | A | | A | A | |
| Approach Delay (s) | | 34.5 | | | 32.6 | | | 6.1 | | | 6.2 | |
| Approach LOS | | C | | | C | | | A | | | A | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 10.7 | | | | HCM 2000 Level of Service | | | | B | |
| HCM 2000 Volume to Capacity ratio | | | 0.41 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | | | Sum of lost time (s) | | | 14.2 | | | |
| Intersection Capacity Utilization | | | 77.9% | | | ICU Level of Service | | | | | D | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Total 5 Year
AM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 19 | 38 | 43 | 767 | 544 | 76 |
| Future Volume (vph) | 19 | 38 | 43 | 767 | 544 | 76 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Fr _t | 0.911 | | | | 0.982 | |
| Fl _t Protected | 0.983 | | 0.950 | | | |
| Satd. Flow (prot) | 1431 | 0 | 1568 | 3308 | 2734 | 0 |
| Fl _t Permitted | 0.983 | | 0.950 | | | |
| Satd. Flow (perm) | 1431 | 0 | 1568 | 3308 | 2734 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 1 | | 6 | | | 6 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 2% | 5% | 3% |
| Adj. Flow (vph) | 21 | 41 | 47 | 834 | 591 | 83 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 62 | 0 | 47 | 834 | 674 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 39.0% |
| Analysis Period (min) | 15 |
| | ICU Level of Service A |

HCM Unsignalized Intersection Capacity Analysis

4: Niagara Street & Roger Drive

Total 5 Year
AM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 19 | 38 | 43 | 767 | 544 | 76 |
| Future Volume (Veh/h) | 19 | 38 | 43 | 767 | 544 | 76 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 21 | 41 | 47 | 834 | 591 | 83 |
| Pedestrians | 6 | | | | 1 | |
| Lane Width (m) | 3.6 | | | | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | | 1.2 | |
| Percent Blockage | 1 | | | | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1150 | 343 | 680 | | | |
| vC1, stage 1 conf vol | 638 | | | | | |
| vC2, stage 2 conf vol | 512 | | | | | |
| vCu, unblocked vol | 1150 | 343 | 680 | | | |
| tC, single (s) | 6.8 | 7.0 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 95 | 94 | 95 | | | |
| cM capacity (veh/h) | 394 | 647 | 917 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 62 | 47 | 417 | 417 | 394 | 280 |
| Volume Left | 21 | 47 | 0 | 0 | 0 | 0 |
| Volume Right | 41 | 0 | 0 | 0 | 0 | 83 |
| cSH | 532 | 917 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.12 | 0.05 | 0.25 | 0.25 | 0.23 | 0.16 |
| Queue Length 95th (m) | 3.1 | 1.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 12.7 | 9.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | | | | |
| Approach Delay (s) | 12.7 | 0.5 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.8 | | | |
| Intersection Capacity Utilization | | | 39.0% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 319 | 180 | 103 | 43 | 145 | 118 | 103 | 380 | 50 | 82 | 342 | 231 |
| Future Volume (vph) | 319 | 180 | 103 | 43 | 145 | 118 | 103 | 380 | 50 | 82 | 342 | 231 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 1.00 | 0.99 | | 0.99 | 1.00 | | 0.99 | 0.99 | |
| Frt | | 0.945 | | | 0.933 | | | 0.983 | | | 0.940 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1289 | 0 | 1413 | 1322 | 0 | 1376 | 2683 | 0 | 1376 | 2612 | 0 |
| Flt Permitted | 0.323 | | | 0.493 | | | 0.317 | | | 0.459 | | |
| Satd. Flow (perm) | 518 | 1289 | 0 | 730 | 1322 | 0 | 456 | 2683 | 0 | 661 | 2612 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 26 | | | 38 | | | 15 | | | 168 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Peak Hour Factor | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Adj. Flow (vph) | 351 | 198 | 113 | 47 | 159 | 130 | 113 | 418 | 55 | 90 | 376 | 254 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 351 | 311 | 0 | 47 | 289 | 0 | 113 | 473 | 0 | 90 | 630 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total 5 Year
AM Peak Hour

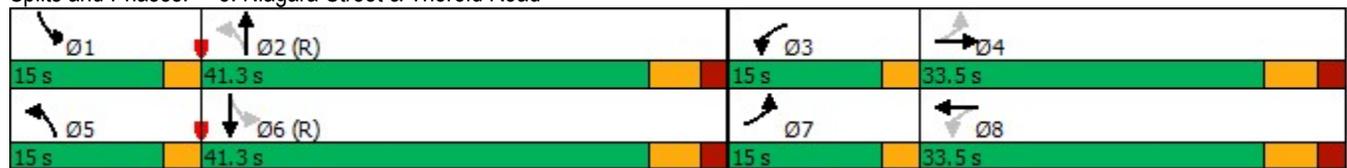


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 41.8 | 29.8 | | 33.9 | 23.3 | | 55.2 | 43.8 | | 53.2 | 41.4 | |
| Actuated g/C Ratio | 0.40 | 0.28 | | 0.32 | 0.22 | | 0.53 | 0.42 | | 0.51 | 0.40 | |
| v/c Ratio | 1.09 | 0.81 | | 0.17 | 0.89 | | 0.35 | 0.42 | | 0.23 | 0.56 | |
| Control Delay | 103.0 | 49.6 | | 19.7 | 63.3 | | 16.3 | 24.3 | | 14.5 | 21.0 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 103.0 | 49.6 | | 19.7 | 63.3 | | 16.3 | 24.3 | | 14.5 | 21.0 | |
| LOS | F | D | | B | E | | B | C | | B | C | |
| Approach Delay | | 77.9 | | | 57.2 | | | 22.7 | | | 20.2 | |
| Approach LOS | | E | | | E | | | C | | | C | |

Intersection Summary

| | |
|-----------------------------------|---|
| Area Type: | Other |
| Cycle Length: | 104.8 |
| Actuated Cycle Length: | 104.8 |
| Offset: | 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green |
| Natural Cycle: | 65 |
| Control Type: | Actuated-Coordinated |
| Maximum v/c Ratio: | 1.09 |
| Intersection Signal Delay: | 42.8 |
| Intersection LOS: | D |
| Intersection Capacity Utilization | 85.6% |
| ICU Level of Service | E |
| Analysis Period (min) | 15 |

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Total 5 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|--------|--------|------|-------|------|-------|------|-------|
| Lane Group Flow (vph) | 351 | 311 | 47 | 289 | 113 | 473 | 90 | 630 |
| v/c Ratio | 1.09 | 0.81 | 0.17 | 0.89 | 0.35 | 0.42 | 0.23 | 0.56 |
| Control Delay | 103.0 | 49.6 | 19.7 | 63.3 | 16.3 | 24.3 | 14.5 | 21.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 103.0 | 49.6 | 19.7 | 63.3 | 16.3 | 24.3 | 14.5 | 21.0 |
| Queue Length 50th (m) | ~60.2 | 56.6 | 5.9 | 51.7 | 12.0 | 37.9 | 9.4 | 40.8 |
| Queue Length 95th (m) | #100.0 | #104.4 | 13.0 | #94.0 | 22.8 | 57.7 | 18.7 | 64.2 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 323 | 385 | 348 | 368 | 350 | 1131 | 434 | 1134 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.09 | 0.81 | 0.14 | 0.79 | 0.32 | 0.42 | 0.21 | 0.56 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
5: Niagara Street & Thorold Road

Total 5 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |   | |  |   | |
| Traffic Volume (vph) | 319 | 180 | 103 | 43 | 145 | 118 | 103 | 380 | 50 | 82 | 342 | 231 |
| Future Volume (vph) | 319 | 180 | 103 | 43 | 145 | 118 | 103 | 380 | 50 | 82 | 342 | 231 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 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 | 0.95 | | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1534 | 1290 | | 1409 | 1322 | | 1374 | 2681 | | 1373 | 2610 | |
| Flt Permitted | 0.32 | 1.00 | | 0.49 | 1.00 | | 0.32 | 1.00 | | 0.46 | 1.00 | |
| Satd. Flow (perm) | 522 | 1290 | | 732 | 1322 | | 458 | 2681 | | 663 | 2610 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 351 | 198 | 113 | 47 | 159 | 130 | 113 | 418 | 55 | 90 | 376 | 254 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 29 | 0 | 0 | 9 | 0 | 0 | 102 | 0 |
| Lane Group Flow (vph) | 351 | 292 | 0 | 47 | 260 | 0 | 113 | 464 | 0 | 90 | 528 | 0 |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 38.9 | 29.8 | | 30.0 | 23.9 | | 51.9 | 42.7 | | 48.3 | 40.9 | |
| Effective Green, g (s) | 38.9 | 29.8 | | 30.0 | 23.9 | | 51.9 | 42.7 | | 48.3 | 40.9 | |
| Actuated g/C Ratio | 0.37 | 0.28 | | 0.29 | 0.23 | | 0.50 | 0.41 | | 0.46 | 0.39 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 309 | 366 | | 248 | 301 | | 307 | 1092 | | 355 | 1018 | |
| v/s Ratio Prot | c0.13 | 0.23 | | 0.01 | 0.20 | | c0.03 | 0.17 | | 0.02 | c0.20 | |
| v/s Ratio Perm | c0.29 | | | 0.04 | | | 0.15 | | | 0.10 | | |
| v/c Ratio | 1.14 | 0.80 | | 0.19 | 0.86 | | 0.37 | 0.43 | | 0.25 | 0.52 | |
| Uniform Delay, d1 | 30.5 | 34.7 | | 27.7 | 38.9 | | 15.1 | 22.3 | | 16.3 | 24.4 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 93.1 | 11.0 | | 0.3 | 21.2 | | 0.5 | 1.2 | | 0.3 | 1.9 | |
| Delay (s) | 123.6 | 45.7 | | 27.9 | 60.0 | | 15.7 | 23.5 | | 16.6 | 26.3 | |
| Level of Service | F | D | | C | E | | B | C | | B | C | |
| Approach Delay (s) | | 87.0 | | | 55.5 | | | 22.0 | | | 25.1 | |
| Approach LOS | | F | | | E | | | C | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 46.5 | | | | HCM 2000 Level of Service | | | D | | |
| HCM 2000 Volume to Capacity ratio | | | 0.79 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | Sum of lost time (s) | | | 18.8 | | | |
| Intersection Capacity Utilization | | | 85.6% | | | ICU Level of Service | | | E | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |
| c Critical Lane Group | | | | | | | | | | | | |

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Total 5 Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 23 | 42 | 1074 | 7 | 12 | 699 |
| Future Volume (vph) | 23 | 42 | 1074 | 7 | 12 | 699 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | 0.913 | | 0.999 | | | |
| Flt Protected | 0.983 | | | | 0.950 | |
| Satd. Flow (prot) | 1434 | 0 | 2829 | 0 | 1538 | 2804 |
| Flt Permitted | 0.983 | | | | 0.950 | |
| Satd. Flow (perm) | 1434 | 0 | 2829 | 0 | 1538 | 2804 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 3% | 2% | 2% | 4% |
| Adj. Flow (vph) | 25 | 46 | 1167 | 8 | 13 | 760 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 71 | 0 | 1175 | 0 | 13 | 760 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 48.2% | | | ICU Level of Service A | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis

6: Niagara Street & Site Access

Total 5 Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |  | |  |  |
| Traffic Volume (veh/h) | 23 | 42 | 1074 | 7 | 12 | 699 |
| Future Volume (Veh/h) | 23 | 42 | 1074 | 7 | 12 | 699 |
| Sign Control | Stop | | Free | | Free | |
| Grade | 0% | | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 25 | 46 | 1167 | 8 | 13 | 760 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | | TWLTL | |
| Median storage veh | | | 2 | | 2 | |
| Upstream signal (m) | | | 300 | | 165 | |
| pX, platoon unblocked | 0.99 | 0.99 | | | 0.99 | |
| vC, conflicting volume | 1577 | 588 | | | 1175 | |
| vC1, stage 1 conf vol | 1171 | | | | | |
| vC2, stage 2 conf vol | 406 | | | | | |
| vCu, unblocked vol | 1558 | 556 | | | 1151 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 90 | 90 | | | 98 | |
| cM capacity (veh/h) | 244 | 469 | | | 595 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 71 | 778 | 397 | 13 | 380 | 380 |
| Volume Left | 25 | 0 | 0 | 13 | 0 | 0 |
| Volume Right | 46 | 0 | 8 | 0 | 0 | 0 |
| cSH | 354 | 1700 | 1700 | 595 | 1700 | 1700 |
| Volume to Capacity | 0.20 | 0.46 | 0.23 | 0.02 | 0.22 | 0.22 |
| Queue Length 95th (m) | 5.9 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 |
| Control Delay (s) | 17.7 | 0.0 | 0.0 | 11.2 | 0.0 | 0.0 |
| Lane LOS | C | | | B | | |
| Approach Delay (s) | 17.7 | 0.0 | | | 0.2 | |
| Approach LOS | C | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.7 | | | |
| Intersection Capacity Utilization | | | 48.2% | | ICU Level of Service | A |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Total 5 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 336 | 488 | 159 | 504 | 528 | 177 | 158 | 695 | 375 | 227 | 912 | 341 |
| Future Volume (vph) | 336 | 488 | 159 | 504 | 528 | 177 | 158 | 695 | 375 | 227 | 912 | 341 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | | 0.95 | | 0.97 | | | 0.99 | |
| Frt | | 0.963 | | | | 0.850 | | 0.947 | | | 0.959 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1553 | 2273 | 0 | 1553 | 3341 | 1248 | 1568 | 2627 | 0 | 1523 | 2747 | 0 |
| Flt Permitted | 0.338 | | | 0.133 | | | 0.080 | | | 0.077 | | |
| Satd. Flow (perm) | 545 | 2273 | 0 | 216 | 3341 | 1188 | 132 | 2627 | 0 | 123 | 2747 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 26 | | | | 182 | | 67 | | | 36 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| 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 (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Adj. Flow (vph) | 346 | 503 | 164 | 520 | 544 | 182 | 163 | 716 | 387 | 234 | 940 | 352 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 346 | 667 | 0 | 520 | 544 | 182 | 163 | 1103 | 0 | 234 | 1292 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

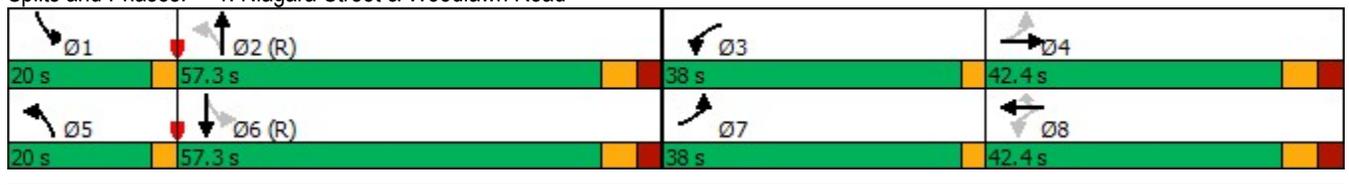
Total 5 Year
PM Peak Hour

| | ↖ | → | ↘ | ↙ | ← | ↖ | ↙ | ↑ | ↘ | ↘ | ↓ | ↙ |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 68.4 | 35.0 | | 76.3 | 41.0 | 41.0 | 69.4 | 50.0 | | 72.5 | 51.9 | |
| Actuated g/C Ratio | 0.43 | 0.22 | | 0.48 | 0.26 | 0.26 | 0.44 | 0.32 | | 0.46 | 0.33 | |
| v/c Ratio | 0.82 | 1.27 | | 1.30 | 0.63 | 0.41 | 0.84 | 1.26 | | 1.13 | 1.39 | |
| Control Delay | 43.7 | 183.2 | | 188.4 | 56.6 | 9.4 | 70.6 | 165.9 | | 143.0 | 221.9 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 43.7 | 183.2 | | 188.4 | 56.6 | 9.4 | 70.6 | 165.9 | | 143.0 | 221.9 | |
| LOS | D | F | | F | E | A | E | F | | F | F | |
| Approach Delay | | 135.5 | | | 104.7 | | | 153.6 | | | 209.8 | |
| Approach LOS | | F | | | F | | | F | | | F | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 100
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.39
 Intersection Signal Delay: 154.9
 Intersection LOS: F
 Intersection Capacity Utilization 131.3%
 ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Total 5 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|--------|--------|-------|------|-------|--------|--------|--------|
| Lane Group Flow (vph) | 346 | 667 | 520 | 544 | 182 | 163 | 1103 | 234 | 1292 |
| v/c Ratio | 0.82 | 1.27 | 1.30 | 0.63 | 0.41 | 0.84 | 1.26 | 1.13 | 1.39 |
| Control Delay | 43.7 | 183.2 | 188.4 | 56.6 | 9.4 | 70.6 | 165.9 | 143.0 | 221.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 43.7 | 183.2 | 188.4 | 56.6 | 9.4 | 70.6 | 165.9 | 143.0 | 221.9 |
| Queue Length 50th (m) | 73.6 | ~142.4 | ~198.4 | 85.2 | 0.0 | 36.7 | ~231.3 | ~74.7 | ~300.9 |
| Queue Length 95th (m) | 102.4 | #184.7 | #276.7 | 111.0 | 22.5 | #72.9 | #276.8 | #133.6 | #346.8 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 480 | 524 | 401 | 867 | 443 | 214 | 878 | 207 | 927 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.72 | 1.27 | 1.30 | 0.63 | 0.41 | 0.76 | 1.26 | 1.13 | 1.39 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Niagara Street & Woodlawn Road

Total 5 Year
PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|-------|--------|---------------------------|-------|------|-------|-------|------|-------|-------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 336 | 488 | 159 | 504 | 528 | 177 | 158 | 695 | 375 | 227 | 912 | 341 |
| Future Volume (vph) | 336 | 488 | 159 | 504 | 528 | 177 | 158 | 695 | 375 | 227 | 912 | 341 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.97 | | 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 | |
| Frt | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1546 | 2274 | | 1552 | 3341 | 1188 | 1568 | 2628 | | 1523 | 2747 | |
| Flt Permitted | 0.34 | 1.00 | | 0.13 | 1.00 | 1.00 | 0.08 | 1.00 | | 0.08 | 1.00 | |
| Satd. Flow (perm) | 550 | 2274 | | 217 | 3341 | 1188 | 132 | 2628 | | 124 | 2747 | |
| 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) | 346 | 503 | 164 | 520 | 544 | 182 | 163 | 716 | 387 | 234 | 940 | 352 |
| RTOR Reduction (vph) | 0 | 20 | 0 | 0 | 0 | 135 | 0 | 46 | 0 | 0 | 24 | 0 |
| Lane Group Flow (vph) | 346 | 647 | 0 | 520 | 544 | 47 | 163 | 1057 | 0 | 234 | 1268 | 0 |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| Heavy Vehicles (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 64.0 | 35.0 | | 73.0 | 41.0 | 41.0 | 65.1 | 50.0 | | 68.9 | 51.9 | |
| Effective Green, g (s) | 64.0 | 35.0 | | 73.0 | 41.0 | 41.0 | 65.1 | 50.0 | | 68.9 | 51.9 | |
| Actuated g/C Ratio | 0.41 | 0.22 | | 0.46 | 0.26 | 0.26 | 0.41 | 0.32 | | 0.44 | 0.33 | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Lane Grp Cap (vph) | 406 | 504 | | 396 | 868 | 308 | 191 | 833 | | 204 | 904 | |
| v/s Ratio Prot | 0.16 | 0.28 | | c0.29 | 0.16 | | 0.08 | 0.40 | | c0.12 | c0.46 | |
| v/s Ratio Perm | 0.19 | | | c0.32 | | 0.04 | 0.27 | | | 0.38 | | |
| v/c Ratio | 0.85 | 1.28 | | 1.31 | 0.63 | 0.15 | 0.85 | 1.27 | | 1.15 | 1.40 | |
| Uniform Delay, d1 | 36.3 | 61.3 | | 47.0 | 51.6 | 45.0 | 44.0 | 53.8 | | 50.3 | 52.9 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 15.6 | 142.0 | | 157.9 | 1.2 | 0.2 | 28.7 | 130.6 | | 108.3 | 187.8 | |
| Delay (s) | 51.9 | 203.3 | | 204.9 | 52.8 | 45.1 | 72.7 | 184.4 | | 158.6 | 240.7 | |
| Level of Service | D | F | | F | D | D | E | F | | F | F | |
| Approach Delay (s) | | 151.6 | | | 115.2 | | | 170.1 | | | 228.1 | |
| Approach LOS | | F | | | F | | | F | | | F | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 170.4 | HCM 2000 Level of Service | | | | F | | | | |
| HCM 2000 Volume to Capacity ratio | | | 1.37 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | Sum of lost time (s) | | | | 20.7 | | | | |
| Intersection Capacity Utilization | | | 131.3% | ICU Level of Service | | | | H | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Total 5 Year
PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 0 | 29 | 17 | 0 | 98 | 11 | 1085 | 26 | 145 | 1325 | 33 |
| Future Volume (vph) | 11 | 0 | 29 | 17 | 0 | 98 | 11 | 1085 | 26 | 145 | 1325 | 33 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.903 | | | 0.884 | | | 0.996 | | | 0.996 | |
| Flt Protected | | 0.986 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1451 | 0 | 0 | 1403 | 0 | 1568 | 2848 | 0 | 1538 | 2877 | 0 |
| Flt Permitted | | 0.986 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1451 | 0 | 0 | 1403 | 0 | 1568 | 2848 | 0 | 1538 | 2877 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 19 | | | | | 19 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 2% | 2% | 2% | 1% | 0% |
| Adj. Flow (vph) | 12 | 0 | 31 | 18 | 0 | 107 | 12 | 1142 | 28 | 158 | 1395 | 35 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 43 | 0 | 0 | 125 | 0 | 12 | 1170 | 0 | 158 | 1430 | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 100 | | 100 | 25 | | 100 | 100 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 69.3% |
| ICU Level of Service | C |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Total 5 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  | |
| Traffic Volume (veh/h) | 11 | 0 | 29 | 17 | 0 | 98 | 11 | 1085 | 26 | 145 | 1325 | 33 |
| Future Volume (Veh/h) | 11 | 0 | 29 | 17 | 0 | 98 | 11 | 1085 | 26 | 145 | 1325 | 33 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 12 | 0 | 31 | 18 | 0 | 107 | 12 | 1142 | 28 | 158 | 1395 | 35 |
| Pedestrians | | 19 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 2 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage veh | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.81 | 0.81 | 0.74 | 0.81 | 0.81 | 0.87 | 0.74 | | | 0.87 | | |
| vC, conflicting volume | 2450 | 2942 | 734 | 2224 | 2945 | 585 | 1449 | | | 1170 | | |
| vC1, stage 1 conf vol | 1748 | 1748 | | 1180 | 1180 | | | | | | | |
| vC2, stage 2 conf vol | 702 | 1194 | | 1044 | 1765 | | | | | | | |
| vCu, unblocked vol | 1596 | 2206 | 0 | 1317 | 2211 | 227 | 909 | | | 898 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 87 | 100 | 96 | 91 | 100 | 84 | 98 | | | 76 | | |
| cM capacity (veh/h) | 90 | 93 | 796 | 206 | 102 | 676 | 553 | | | 654 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 43 | 125 | 12 | 761 | 409 | 158 | 930 | 500 | | | | |
| Volume Left | 12 | 18 | 12 | 0 | 0 | 158 | 0 | 0 | | | | |
| Volume Right | 31 | 107 | 0 | 0 | 28 | 0 | 0 | 35 | | | | |
| cSH | 250 | 509 | 553 | 1700 | 1700 | 654 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.17 | 0.25 | 0.02 | 0.45 | 0.24 | 0.24 | 0.55 | 0.29 | | | | |
| Queue Length 95th (m) | 4.9 | 7.7 | 0.5 | 0.0 | 0.0 | 7.5 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 22.4 | 14.4 | 11.7 | 0.0 | 0.0 | 12.2 | 0.0 | 0.0 | | | | |
| Lane LOS | C | B | B | | | B | | | | | | |
| Approach Delay (s) | 22.4 | 14.4 | 0.1 | | | 1.2 | | | | | | |
| Approach LOS | C | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.6 | | | | | | | | | |
| Intersection Capacity Utilization | | | 69.3% | | ICU Level of Service | | | | | C | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

Total 5 Year
 PM Peak Hour



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 45 | 1 | 43 | 14 | 2 | 79 | 41 | 1001 | 23 | 102 | 1210 | 55 |
| Future Volume (vph) | 45 | 1 | 43 | 14 | 2 | 79 | 41 | 1001 | 23 | 102 | 1210 | 55 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.98 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.853 | | | 0.854 | | | 0.997 | | | 0.993 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1288 | 0 | 1568 | 1293 | 0 | 1568 | 2822 | 0 | 1568 | 2837 | 0 |
| Flt Permitted | 0.703 | | | 0.728 | | | 0.191 | | | 0.261 | | |
| Satd. Flow (perm) | 1159 | 1288 | 0 | 1196 | 1293 | 0 | 315 | 2822 | 0 | 429 | 2837 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 44 | | | 80 | | | 4 | | | 8 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| Adj. Flow (vph) | 46 | 1 | 44 | 14 | 2 | 81 | 42 | 1021 | 23 | 104 | 1235 | 56 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 46 | 45 | 0 | 14 | 83 | 0 | 42 | 1044 | 0 | 104 | 1291 | 0 |
| Enter Blocked Intersection | No |
| Lane Alignment | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

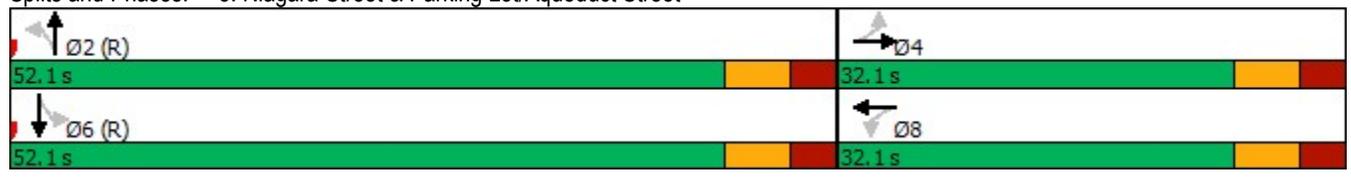
Total 5 Year
 PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effect Green (s) | 10.1 | 10.1 | | 10.1 | 10.1 | | 64.3 | 64.3 | | 64.3 | 64.3 | |
| Actuated g/C Ratio | 0.12 | 0.12 | | 0.12 | 0.12 | | 0.76 | 0.76 | | 0.76 | 0.76 | |
| v/c Ratio | 0.33 | 0.23 | | 0.10 | 0.37 | | 0.17 | 0.48 | | 0.32 | 0.60 | |
| Control Delay | 39.6 | 13.7 | | 32.9 | 13.5 | | 6.9 | 6.2 | | 8.4 | 7.6 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 39.6 | 13.7 | | 32.9 | 13.5 | | 6.9 | 6.2 | | 8.4 | 7.6 | |
| LOS | D | B | | C | B | | A | A | | A | A | |
| Approach Delay | | 26.8 | | | 16.3 | | | 6.3 | | | 7.6 | |
| Approach LOS | | C | | | B | | | A | | | A | |

Intersection Summary

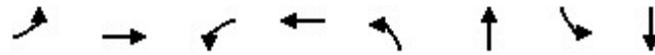
Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.60
 Intersection Signal Delay: 8.0
 Intersection LOS: A
 Intersection Capacity Utilization 82.0%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Total 5 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 46 | 45 | 14 | 83 | 42 | 1044 | 104 | 1291 |
| v/c Ratio | 0.33 | 0.23 | 0.10 | 0.37 | 0.17 | 0.48 | 0.32 | 0.60 |
| Control Delay | 39.6 | 13.7 | 32.9 | 13.5 | 6.9 | 6.2 | 8.4 | 7.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 39.6 | 13.7 | 32.9 | 13.5 | 6.9 | 6.2 | 8.4 | 7.6 |
| Queue Length 50th (m) | 7.3 | 0.2 | 2.2 | 0.5 | 1.9 | 34.5 | 5.5 | 49.3 |
| Queue Length 95th (m) | 16.9 | 9.2 | 7.3 | 12.7 | 7.2 | 57.6 | 17.1 | 82.1 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 344 | 413 | 355 | 440 | 240 | 2156 | 327 | 2168 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.13 | 0.11 | 0.04 | 0.19 | 0.17 | 0.48 | 0.32 | 0.60 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis

3: Niagara Street & Parking Lot/Aqueduct Street

Total 5 Year
PM Peak Hour



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|------|------|------|------|------|------|------|------|------|-------|------|
| Lane Configurations | ↖ | ↗ | | ↖ | ↗ | | ↖ | ↕ | | ↖ | ↗ | |
| Traffic Volume (vph) | 45 | 1 | 43 | 14 | 2 | 79 | 41 | 1001 | 23 | 102 | 1210 | 55 |
| Future Volume (vph) | 45 | 1 | 43 | 14 | 2 | 79 | 41 | 1001 | 23 | 102 | 1210 | 55 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.98 | | 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 | 0.85 | | 1.00 | 0.85 | | 1.00 | 1.00 | | 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) | 1566 | 1288 | | 1561 | 1293 | | 1565 | 2822 | | 1562 | 2839 | |
| Flt Permitted | 0.70 | 1.00 | | 0.73 | 1.00 | | 0.19 | 1.00 | | 0.26 | 1.00 | |
| Satd. Flow (perm) | 1159 | 1288 | | 1196 | 1293 | | 315 | 2822 | | 430 | 2839 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 46 | 1 | 44 | 14 | 2 | 81 | 42 | 1021 | 23 | 104 | 1235 | 56 |
| RTOR Reduction (vph) | 0 | 40 | 0 | 0 | 72 | 0 | 0 | 1 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 46 | 5 | 0 | 14 | 11 | 0 | 42 | 1043 | 0 | 104 | 1289 | 0 |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| 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) | 8.5 | 8.5 | | 8.5 | 8.5 | | 61.5 | 61.5 | | 61.5 | 61.5 | |
| Effective Green, g (s) | 8.5 | 8.5 | | 8.5 | 8.5 | | 61.5 | 61.5 | | 61.5 | 61.5 | |
| Actuated g/C Ratio | 0.10 | 0.10 | | 0.10 | 0.10 | | 0.73 | 0.73 | | 0.73 | 0.73 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 117 | 130 | | 120 | 130 | | 230 | 2061 | | 314 | 2073 | |
| v/s Ratio Prot | | 0.00 | | | 0.01 | | | 0.37 | | | c0.45 | |
| v/s Ratio Perm | c0.04 | | | 0.01 | | | 0.13 | | | 0.24 | | |
| v/c Ratio | 0.39 | 0.04 | | 0.12 | 0.09 | | 0.18 | 0.51 | | 0.33 | 0.62 | |
| Uniform Delay, d1 | 35.4 | 34.2 | | 34.4 | 34.3 | | 3.5 | 4.9 | | 4.0 | 5.6 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.0 | 0.2 | | 0.6 | 0.4 | | 1.7 | 0.9 | | 2.8 | 1.4 | |
| Delay (s) | 38.4 | 34.4 | | 35.0 | 34.7 | | 5.3 | 5.7 | | 6.8 | 7.0 | |
| Level of Service | D | C | | D | C | | A | A | | A | A | |
| Approach Delay (s) | | 36.4 | | | 34.8 | | | 5.7 | | | 7.0 | |
| Approach LOS | | D | | | C | | | A | | | A | |

Intersection Summary

| | | | |
|-----------------------------------|-------|---------------------------|------|
| HCM 2000 Control Delay | 8.5 | HCM 2000 Level of Service | A |
| HCM 2000 Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 84.2 | Sum of lost time (s) | 14.2 |
| Intersection Capacity Utilization | 82.0% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Total 5 Year
PM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 25 | 44 | 47 | 950 | 1113 | 82 |
| Future Volume (vph) | 25 | 44 | 47 | 950 | 1113 | 82 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.914 | | | | 0.990 | |
| Flt Protected | 0.982 | | 0.950 | | | |
| Satd. Flow (prot) | 1463 | 0 | 1568 | 3308 | 2861 | 0 |
| Flt Permitted | 0.982 | | 0.950 | | | |
| Satd. Flow (perm) | 1463 | 0 | 1568 | 3308 | 2861 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 2 | 1 | 8 | | | 8 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 1% | 0% |
| Adj. Flow (vph) | 27 | 48 | 51 | 1033 | 1210 | 89 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 75 | 0 | 51 | 1033 | 1299 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 56.7% |
| ICU Level of Service | B |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

4: Niagara Street & Roger Drive

Total 5 Year
PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 25 | 44 | 47 | 950 | 1113 | 82 |
| Future Volume (Veh/h) | 25 | 44 | 47 | 950 | 1113 | 82 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 27 | 48 | 51 | 1033 | 1210 | 89 |
| Pedestrians | 8 | | | 1 | 2 | |
| Lane Width (m) | 3.6 | | | 3.6 | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | 1.2 | 1.2 | |
| Percent Blockage | 1 | | | 0 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | 0.86 | 0.82 | 0.82 | | | |
| vC, conflicting volume | 1883 | 658 | 1307 | | | |
| vC1, stage 1 conf vol | 1262 | | | | | |
| vC2, stage 2 conf vol | 620 | | | | | |
| vCu, unblocked vol | 1325 | 150 | 940 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 90 | 93 | 92 | | | |
| cM capacity (veh/h) | 272 | 714 | 602 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 75 | 51 | 516 | 516 | 807 | 492 |
| Volume Left | 27 | 51 | 0 | 0 | 0 | 0 |
| Volume Right | 48 | 0 | 0 | 0 | 0 | 89 |
| cSH | 450 | 602 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.17 | 0.08 | 0.30 | 0.30 | 0.47 | 0.29 |
| Queue Length 95th (m) | 4.7 | 2.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 14.6 | 11.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | B | | | | |
| Approach Delay (s) | 14.6 | 0.5 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.7 | | | |
| Intersection Capacity Utilization | | | 56.7% | ICU Level of Service | B | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total 5 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 383 | 167 | 91 | 110 | 173 | 110 | 158 | 562 | 68 | 112 | 634 | 508 |
| Future Volume (vph) | 383 | 167 | 91 | 110 | 173 | 110 | 158 | 562 | 68 | 112 | 634 | 508 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 0.99 | | | 1.00 | | 0.99 | 0.98 | |
| Frt | | 0.947 | | | 0.942 | | | 0.984 | | | 0.933 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1389 | 0 | 1568 | 1391 | 0 | 1452 | 2825 | 0 | 1466 | 2639 | 0 |
| Flt Permitted | 0.313 | | | 0.467 | | | 0.097 | | | 0.329 | | |
| Satd. Flow (perm) | 503 | 1389 | 0 | 761 | 1391 | 0 | 148 | 2825 | 0 | 504 | 2639 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 25 | | | 30 | | | 13 | | | 207 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Adj. Flow (vph) | 399 | 174 | 95 | 115 | 180 | 115 | 165 | 585 | 71 | 117 | 660 | 529 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 399 | 269 | 0 | 115 | 295 | 0 | 165 | 656 | 0 | 117 | 1189 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total 5 Year
PM Peak Hour

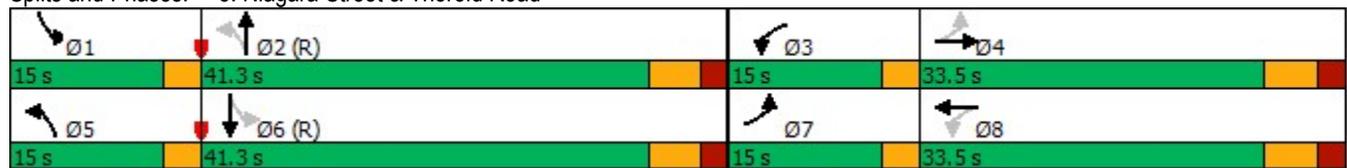


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 40.8 | 25.8 | | 36.5 | 23.4 | | 55.4 | 41.4 | | 52.3 | 39.8 | |
| Actuated g/C Ratio | 0.39 | 0.25 | | 0.35 | 0.22 | | 0.53 | 0.40 | | 0.50 | 0.38 | |
| v/c Ratio | 1.27 | 0.75 | | 0.34 | 0.88 | | 0.78 | 0.58 | | 0.35 | 1.05 | |
| Control Delay | 171.4 | 46.4 | | 22.3 | 62.3 | | 46.7 | 28.4 | | 16.2 | 69.5 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 171.4 | 46.4 | | 22.3 | 62.3 | | 46.7 | 28.4 | | 16.2 | 69.5 | |
| LOS | F | D | | C | E | | D | C | | B | E | |
| Approach Delay | | 121.1 | | | 51.1 | | | 32.1 | | | 64.7 | |
| Approach LOS | | F | | | D | | | C | | | E | |

Intersection Summary

Area Type: Other
 Cycle Length: 104.8
 Actuated Cycle Length: 104.8
 Offset: 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 80
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.27
 Intersection Signal Delay: 66.4
 Intersection LOS: E
 Intersection Capacity Utilization 115.0%
 ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Total 5 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|--------|-------|------|-------|-------|-------|------|--------|
| Lane Group Flow (vph) | 399 | 269 | 115 | 295 | 165 | 656 | 117 | 1189 |
| v/c Ratio | 1.27 | 0.75 | 0.34 | 0.88 | 0.78 | 0.58 | 0.35 | 1.05 |
| Control Delay | 171.4 | 46.4 | 22.3 | 62.3 | 46.7 | 28.4 | 16.2 | 69.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 171.4 | 46.4 | 22.3 | 62.3 | 46.7 | 28.4 | 16.2 | 69.5 |
| Queue Length 50th (m) | ~70.8 | 47.4 | 15.1 | 54.2 | 20.2 | 58.3 | 12.5 | ~140.5 |
| Queue Length 95th (m) | #134.4 | #81.2 | 26.6 | #95.8 | #54.9 | 83.7 | 23.3 | #187.4 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 314 | 380 | 375 | 380 | 228 | 1123 | 374 | 1131 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.27 | 0.71 | 0.31 | 0.78 | 0.72 | 0.58 | 0.31 | 1.05 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Total 5 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |   | |  |   | |
| Traffic Volume (vph) | 383 | 167 | 91 | 110 | 173 | 110 | 158 | 562 | 68 | 112 | 634 | 508 |
| Future Volume (vph) | 383 | 167 | 91 | 110 | 173 | 110 | 158 | 562 | 68 | 112 | 634 | 508 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 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 | 0.98 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 0.99 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.95 | | 1.00 | 0.94 | | 1.00 | 0.98 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1535 | 1389 | | 1559 | 1390 | | 1452 | 2824 | | 1462 | 2640 | |
| Flt Permitted | 0.31 | 1.00 | | 0.47 | 1.00 | | 0.10 | 1.00 | | 0.33 | 1.00 | |
| Satd. Flow (perm) | 506 | 1389 | | 767 | 1390 | | 148 | 2824 | | 507 | 2640 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 399 | 174 | 95 | 115 | 180 | 115 | 165 | 585 | 71 | 117 | 660 | 529 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 23 | 0 | 0 | 8 | 0 | 0 | 128 | 0 |
| Lane Group Flow (vph) | 399 | 250 | 0 | 115 | 272 | 0 | 165 | 648 | 0 | 117 | 1061 | 0 |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 37.8 | 25.8 | | 33.0 | 23.4 | | 52.1 | 41.4 | | 49.1 | 39.9 | |
| Effective Green, g (s) | 37.8 | 25.8 | | 33.0 | 23.4 | | 52.1 | 41.4 | | 49.1 | 39.9 | |
| Actuated g/C Ratio | 0.36 | 0.25 | | 0.31 | 0.22 | | 0.50 | 0.40 | | 0.47 | 0.38 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 300 | 341 | | 314 | 310 | | 206 | 1115 | | 321 | 1005 | |
| v/s Ratio Prot | c0.15 | 0.18 | | 0.03 | 0.20 | | c0.08 | 0.23 | | 0.03 | c0.40 | |
| v/s Ratio Perm | c0.33 | | | 0.08 | | | 0.32 | | | 0.14 | | |
| v/c Ratio | 1.33 | 0.73 | | 0.37 | 0.88 | | 0.80 | 0.58 | | 0.36 | 1.06 | |
| Uniform Delay, d1 | 30.9 | 36.3 | | 26.7 | 39.3 | | 23.5 | 24.9 | | 16.4 | 32.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 169.7 | 7.1 | | 0.5 | 22.7 | | 19.1 | 2.2 | | 0.5 | 44.2 | |
| Delay (s) | 200.5 | 43.5 | | 27.2 | 62.0 | | 42.7 | 27.1 | | 16.9 | 76.7 | |
| Level of Service | F | D | | C | E | | D | C | | B | E | |
| Approach Delay (s) | | 137.3 | | | 52.2 | | | 30.2 | | | 71.3 | |
| Approach LOS | | F | | | D | | | C | | | E | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 72.1 | | | | HCM 2000 Level of Service | | | E | | |
| HCM 2000 Volume to Capacity ratio | | | 1.17 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | | Sum of lost time (s) | | | 18.8 | | |
| Intersection Capacity Utilization | | | 115.0% | | | | ICU Level of Service | | | H | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Total 5 Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 16 | 17 | 1211 | 20 | 32 | 1543 |
| Future Volume (vph) | 16 | 17 | 1211 | 20 | 32 | 1543 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | 0.931 | | 0.998 | | | |
| Flt Protected | 0.976 | | | | 0.950 | |
| Satd. Flow (prot) | 1452 | 0 | 2854 | 0 | 1538 | 2888 |
| Flt Permitted | 0.976 | | | | 0.950 | |
| Satd. Flow (perm) | 1452 | 0 | 2854 | 0 | 1538 | 2888 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 17 | 18 | 1316 | 22 | 35 | 1677 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 35 | 0 | 1338 | 0 | 35 | 1677 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 62.8% | | | ICU Level of Service B | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis

6: Niagara Street & Site Access

Total 5 Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (veh/h) | 16 | 17 | 1211 | 20 | 32 | 1543 |
| Future Volume (Veh/h) | 16 | 17 | 1211 | 20 | 32 | 1543 |
| Sign Control | Stop | | Free | | Free | |
| Grade | 0% | | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 17 | 18 | 1316 | 22 | 35 | 1677 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | | TWLTL | |
| Median storage veh) | | | 2 | | 2 | |
| Upstream signal (m) | | | 300 | | 165 | |
| pX, platoon unblocked | 0.73 | 0.92 | | | 0.92 | |
| vC, conflicting volume | 2236 | 669 | | | 1338 | |
| vC1, stage 1 conf vol | 1327 | | | | | |
| vC2, stage 2 conf vol | 908 | | | | | |
| vCu, unblocked vol | 1464 | 465 | | | 1193 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 92 | 96 | | | 93 | |
| cM capacity (veh/h) | 220 | 500 | | | 534 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 35 | 877 | 461 | 35 | 838 | 838 |
| Volume Left | 17 | 0 | 0 | 35 | 0 | 0 |
| Volume Right | 18 | 0 | 22 | 0 | 0 | 0 |
| cSH | 309 | 1700 | 1700 | 534 | 1700 | 1700 |
| Volume to Capacity | 0.11 | 0.52 | 0.27 | 0.07 | 0.49 | 0.49 |
| Queue Length 95th (m) | 3.0 | 0.0 | 0.0 | 1.7 | 0.0 | 0.0 |
| Control Delay (s) | 18.1 | 0.0 | 0.0 | 12.2 | 0.0 | 0.0 |
| Lane LOS | C | | B | | | |
| Approach Delay (s) | 18.1 | 0.0 | | 0.2 | | |
| Approach LOS | C | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.3 | | | |
| Intersection Capacity Utilization | | | 62.8% | | ICU Level of Service B | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Total 10 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 288 | 458 | 112 | 233 | 406 | 146 | 109 | 687 | 413 | 116 | 431 | 181 |
| Future Volume (vph) | 288 | 458 | 112 | 233 | 406 | 146 | 109 | 687 | 413 | 116 | 431 | 181 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 1.00 | | 1.00 | | 0.97 | 1.00 | 0.99 | | | 1.00 | |
| Fr _t | | 0.971 | | | | 0.850 | | 0.944 | | | 0.956 | |
| Fl _t Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 2718 | 0 | 1508 | 3276 | 1224 | 1553 | 2663 | 0 | 1452 | 2663 | 0 |
| Fl _t Permitted | 0.336 | | | 0.265 | | | 0.340 | | | 0.099 | | |
| Satd. Flow (perm) | 540 | 2718 | 0 | 420 | 3276 | 1194 | 555 | 2663 | 0 | 151 | 2663 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 17 | | | | 149 | | 83 | | | 43 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Adj. Flow (vph) | 294 | 467 | 114 | 238 | 414 | 149 | 111 | 701 | 421 | 118 | 440 | 185 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 294 | 581 | 0 | 238 | 414 | 149 | 111 | 1122 | 0 | 118 | 625 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

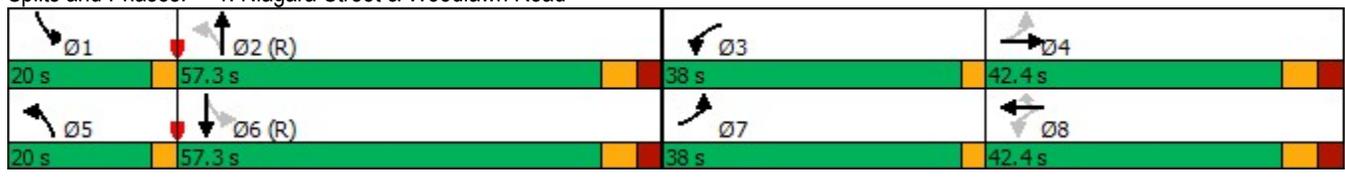
Total 10 Year
AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 67.7 | 38.0 | | 60.7 | 34.1 | 34.1 | 79.3 | 64.0 | | 82.6 | 65.7 | |
| Actuated g/C Ratio | 0.43 | 0.24 | | 0.38 | 0.22 | 0.22 | 0.50 | 0.41 | | 0.52 | 0.42 | |
| v/c Ratio | 0.74 | 0.87 | | 0.76 | 0.58 | 0.40 | 0.32 | 0.99 | | 0.64 | 0.55 | |
| Control Delay | 42.7 | 70.0 | | 45.5 | 58.8 | 10.2 | 23.1 | 67.6 | | 39.9 | 36.5 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 42.7 | 70.0 | | 45.5 | 58.8 | 10.2 | 23.1 | 67.6 | | 39.9 | 36.5 | |
| LOS | D | E | | D | E | B | C | E | | D | D | |
| Approach Delay | | 60.8 | | | 45.8 | | | 63.6 | | | 37.1 | |
| Approach LOS | | E | | | D | | | E | | | D | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.99
 Intersection Signal Delay: 53.6 Intersection LOS: D
 Intersection Capacity Utilization 102.4% ICU Level of Service G
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Total 10 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|-------|-------|------|-------|------|------|--------|-------|-------|
| Lane Group Flow (vph) | 294 | 581 | 238 | 414 | 149 | 111 | 1122 | 118 | 625 |
| v/c Ratio | 0.74 | 0.87 | 0.76 | 0.58 | 0.40 | 0.32 | 0.99 | 0.64 | 0.55 |
| Control Delay | 42.7 | 70.0 | 45.5 | 58.8 | 10.2 | 23.1 | 67.6 | 39.9 | 36.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 42.7 | 70.0 | 45.5 | 58.8 | 10.2 | 23.1 | 67.6 | 39.9 | 36.5 |
| Queue Length 50th (m) | 67.0 | 93.8 | 52.1 | 64.5 | 0.0 | 18.3 | ~195.5 | 19.7 | 76.9 |
| Queue Length 95th (m) | 85.2 | 118.6 | 67.9 | 82.5 | 20.2 | 33.9 | #277.6 | 41.3 | 112.6 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 453 | 678 | 421 | 742 | 385 | 399 | 1130 | 220 | 1134 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.65 | 0.86 | 0.57 | 0.56 | 0.39 | 0.28 | 0.99 | 0.54 | 0.55 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Niagara Street & Woodlawn Road

Total 10 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  | |
| Traffic Volume (vph) | 288 | 458 | 112 | 233 | 406 | 146 | 109 | 687 | 413 | 116 | 431 | 181 |
| Future Volume (vph) | 288 | 458 | 112 | 233 | 406 | 146 | 109 | 687 | 413 | 116 | 431 | 181 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 | 1.00 | 0.99 | | 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 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.94 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1535 | 2717 | | 1507 | 3276 | 1194 | 1552 | 2663 | | 1452 | 2662 | |
| Flt Permitted | 0.34 | 1.00 | | 0.27 | 1.00 | 1.00 | 0.34 | 1.00 | | 0.10 | 1.00 | |
| Satd. Flow (perm) | 543 | 2717 | | 421 | 3276 | 1194 | 555 | 2663 | | 151 | 2662 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 294 | 467 | 114 | 238 | 414 | 149 | 111 | 701 | 421 | 118 | 440 | 185 |
| RTOR Reduction (vph) | 0 | 13 | 0 | 0 | 0 | 117 | 0 | 49 | 0 | 0 | 25 | 0 |
| Lane Group Flow (vph) | 294 | 568 | 0 | 238 | 414 | 32 | 111 | 1073 | 0 | 118 | 600 | 0 |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 63.3 | 38.0 | | 56.4 | 34.1 | 34.1 | 75.0 | 64.0 | | 78.4 | 65.7 | |
| Effective Green, g (s) | 63.3 | 38.0 | | 56.4 | 34.1 | 34.1 | 75.0 | 64.0 | | 78.4 | 65.7 | |
| Actuated g/C Ratio | 0.40 | 0.24 | | 0.36 | 0.22 | 0.22 | 0.48 | 0.41 | | 0.50 | 0.42 | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Lane Grp Cap (vph) | 382 | 654 | | 304 | 708 | 258 | 333 | 1080 | | 179 | 1109 | |
| v/s Ratio Prot | c0.13 | c0.21 | | 0.11 | 0.13 | | 0.02 | c0.40 | | c0.05 | 0.23 | |
| v/s Ratio Perm | 0.18 | | | 0.17 | | 0.03 | 0.14 | | | 0.27 | | |
| v/c Ratio | 0.77 | 0.87 | | 0.78 | 0.58 | 0.12 | 0.33 | 0.99 | | 0.66 | 0.54 | |
| Uniform Delay, d1 | 35.7 | 57.5 | | 39.5 | 55.4 | 49.8 | 23.9 | 46.6 | | 29.0 | 34.6 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 8.7 | 11.7 | | 12.0 | 1.0 | 0.2 | 0.5 | 25.8 | | 7.8 | 1.9 | |
| Delay (s) | 44.5 | 69.1 | | 51.5 | 56.5 | 49.9 | 24.3 | 72.4 | | 36.8 | 36.5 | |
| Level of Service | D | E | | D | E | D | C | E | | D | D | |
| Approach Delay (s) | | 60.8 | | | 53.8 | | | 68.1 | | | 36.6 | |
| Approach LOS | | E | | | D | | | E | | | D | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 56.8 | | HCM 2000 Level of Service | | | | | E | | |
| HCM 2000 Volume to Capacity ratio | | | 0.90 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | | Sum of lost time (s) | | | | | 20.7 | | |
| Intersection Capacity Utilization | | | 102.4% | | ICU Level of Service | | | | | G | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Total 10 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  | |
| Traffic Volume (vph) | 4 | 0 | 24 | 23 | 0 | 130 | 13 | 973 | 10 | 52 | 815 | 4 |
| Future Volume (vph) | 4 | 0 | 24 | 23 | 0 | 130 | 13 | 973 | 10 | 52 | 815 | 4 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.884 | | | 0.885 | | | 0.998 | | | 0.999 | |
| Flt Protected | | 0.993 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1431 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Flt Permitted | | 0.993 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1431 | 0 | 0 | 1404 | 0 | 1568 | 2826 | 0 | 1538 | 2802 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 5 | | | | | 5 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 3% | 2% | 2% | 4% | 0% |
| Adj. Flow (vph) | 4 | 0 | 25 | 25 | 0 | 141 | 14 | 1024 | 11 | 57 | 858 | 4 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 29 | 0 | 0 | 166 | 0 | 14 | 1035 | 0 | 57 | 862 | 0 |
| Enter Blocked Intersection | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 61.7% |
| Analysis Period (min) | 15 |
| | ICU Level of Service B |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Total 10 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  |  |
| Traffic Volume (veh/h) | 4 | 0 | 24 | 23 | 0 | 130 | 13 | 973 | 10 | 52 | 815 | 4 |
| Future Volume (Veh/h) | 4 | 0 | 24 | 23 | 0 | 130 | 13 | 973 | 10 | 52 | 815 | 4 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 4 | 0 | 25 | 25 | 0 | 141 | 14 | 1024 | 11 | 57 | 858 | 4 |
| Pedestrians | | 5 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 0 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage veh | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.90 | 0.90 | | 0.90 | 0.90 | 0.90 | | | | 0.90 | | |
| vC, conflicting volume | 1660 | 2042 | 436 | 1626 | 2038 | 518 | 867 | | | 1035 | | |
| vC1, stage 1 conf vol | 979 | 979 | | 1058 | 1058 | | | | | | | |
| vC2, stage 2 conf vol | 681 | 1063 | | 568 | 981 | | | | | | | |
| vCu, unblocked vol | 1517 | 1940 | 436 | 1479 | 1936 | 253 | 867 | | | 826 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 98 | 100 | 96 | 89 | 100 | 79 | 98 | | | 92 | | |
| cM capacity (veh/h) | 204 | 203 | 571 | 236 | 216 | 674 | 782 | | | 724 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 29 | 166 | 14 | 683 | 352 | 57 | 572 | 290 | | | | |
| Volume Left | 4 | 25 | 14 | 0 | 0 | 57 | 0 | 0 | | | | |
| Volume Right | 25 | 141 | 0 | 0 | 11 | 0 | 0 | 4 | | | | |
| cSH | 458 | 527 | 782 | 1700 | 1700 | 724 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.06 | 0.32 | 0.02 | 0.40 | 0.21 | 0.08 | 0.34 | 0.17 | | | | |
| Queue Length 95th (m) | 1.6 | 10.7 | 0.4 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 13.4 | 14.9 | 9.7 | 0.0 | 0.0 | 10.4 | 0.0 | 0.0 | | | | |
| Lane LOS | B | B | A | | | B | | | | | | |
| Approach Delay (s) | 13.4 | 14.9 | 0.1 | | | 0.6 | | | | | | |
| Approach LOS | B | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.7 | | | | | | | | | |
| Intersection Capacity Utilization | | | 61.7% | | ICU Level of Service | | | | B | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

Total 10 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 70 | 4 | 57 | 12 | 12 | 181 | 44 | 761 | 11 | 133 | 630 | 79 |
| Future Volume (vph) | 70 | 4 | 57 | 12 | 12 | 181 | 44 | 761 | 11 | 133 | 630 | 79 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.859 | | | 0.859 | | | 0.998 | | | 0.983 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1302 | 0 | 1568 | 1278 | 0 | 1568 | 2799 | 0 | 1553 | 2714 | 0 |
| Flt Permitted | 0.526 | | | 0.715 | | | 0.362 | | | 0.333 | | |
| Satd. Flow (perm) | 867 | 1302 | 0 | 1179 | 1278 | 0 | 597 | 2799 | 0 | 544 | 2714 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 61 | | | 147 | | | 3 | | | 25 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| Adj. Flow (vph) | 74 | 4 | 61 | 13 | 13 | 193 | 47 | 810 | 12 | 141 | 670 | 84 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 74 | 65 | 0 | 13 | 206 | 0 | 47 | 822 | 0 | 141 | 754 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

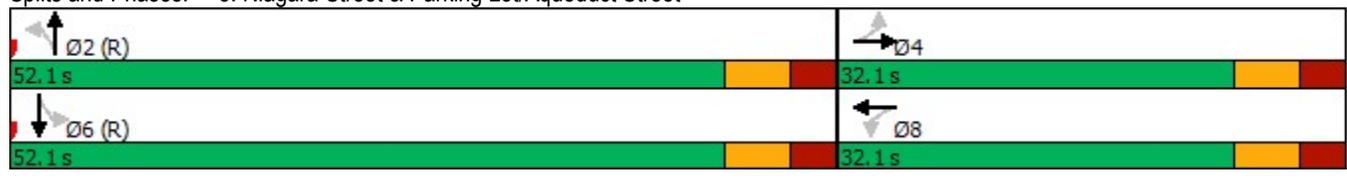
Total 10 Year
 AM Peak Hour

| | ↖ | | → | | ↗ | | ↖ | | ↗ | | ↘ | |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effct Green (s) | 12.9 | 12.9 | | 12.9 | 12.9 | | 57.1 | 57.1 | | 57.1 | 57.1 | |
| Actuated g/C Ratio | 0.15 | 0.15 | | 0.15 | 0.15 | | 0.68 | 0.68 | | 0.68 | 0.68 | |
| v/c Ratio | 0.56 | 0.26 | | 0.07 | 0.64 | | 0.12 | 0.43 | | 0.38 | 0.41 | |
| Control Delay | 48.0 | 11.6 | | 28.6 | 20.3 | | 6.9 | 7.7 | | 10.9 | 7.2 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 48.0 | 11.6 | | 28.6 | 20.3 | | 6.9 | 7.7 | | 10.9 | 7.2 | |
| LOS | D | B | | C | C | | A | A | | B | A | |
| Approach Delay | | 31.0 | | | 20.8 | | | 7.6 | | | 7.8 | |
| Approach LOS | | C | | | C | | | A | | | A | |

Intersection Summary

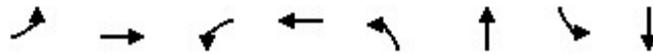
Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 55
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.64
 Intersection Signal Delay: 10.6
 Intersection LOS: B
 Intersection Capacity Utilization 80.8%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Total 10 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|------|------|------|------|------|-------|------|------|
| Lane Group Flow (vph) | 74 | 65 | 13 | 206 | 47 | 822 | 141 | 754 |
| v/c Ratio | 0.56 | 0.26 | 0.07 | 0.64 | 0.12 | 0.43 | 0.38 | 0.41 |
| Control Delay | 48.0 | 11.6 | 28.6 | 20.3 | 6.9 | 7.7 | 10.9 | 7.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 48.0 | 11.6 | 28.6 | 20.3 | 6.9 | 7.7 | 10.9 | 7.2 |
| Queue Length 50th (m) | 11.8 | 0.6 | 1.9 | 9.0 | 2.3 | 27.9 | 8.7 | 24.0 |
| Queue Length 95th (m) | 23.8 | 10.6 | 6.4 | 28.5 | 8.1 | 51.2 | 26.6 | 45.0 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 257 | 429 | 350 | 482 | 404 | 1899 | 368 | 1848 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.29 | 0.15 | 0.04 | 0.43 | 0.12 | 0.43 | 0.38 | 0.41 |
| Intersection Summary | | | | | | | | |

HCM Signalized Intersection Capacity Analysis

3: Niagara Street & Parking Lot/Aqueduct Street

Total 10 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 70 | 4 | 57 | 12 | 12 | 181 | 44 | 761 | 11 | 133 | 630 | 79 |
| Future Volume (vph) | 70 | 4 | 57 | 12 | 12 | 181 | 44 | 761 | 11 | 133 | 630 | 79 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 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 | 0.86 | | 1.00 | 0.86 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1567 | 1302 | | 1566 | 1278 | | 1565 | 2799 | | 1552 | 2715 | |
| Flt Permitted | 0.53 | 1.00 | | 0.71 | 1.00 | | 0.36 | 1.00 | | 0.33 | 1.00 | |
| Satd. Flow (perm) | 867 | 1302 | | 1178 | 1278 | | 596 | 2799 | | 544 | 2715 | |
| Peak-hour factor, PHF | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Adj. Flow (vph) | 74 | 4 | 61 | 13 | 13 | 193 | 47 | 810 | 12 | 141 | 670 | 84 |
| RTOR Reduction (vph) | 0 | 52 | 0 | 0 | 124 | 0 | 0 | 1 | 0 | 0 | 8 | 0 |
| Lane Group Flow (vph) | 74 | 13 | 0 | 13 | 82 | 0 | 47 | 821 | 0 | 141 | 746 | 0 |
| Confl. Peds. (#/hr) | 2 | | 2 | 2 | | 2 | 4 | | 2 | 2 | | 4 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 2% | 0% | 4% | 0% | 1% | 6% | 0% |
| 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) | 12.9 | 12.9 | | 12.9 | 12.9 | | 57.1 | 57.1 | | 57.1 | 57.1 | |
| Effective Green, g (s) | 12.9 | 12.9 | | 12.9 | 12.9 | | 57.1 | 57.1 | | 57.1 | 57.1 | |
| Actuated g/C Ratio | 0.15 | 0.15 | | 0.15 | 0.15 | | 0.68 | 0.68 | | 0.68 | 0.68 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 132 | 199 | | 180 | 195 | | 404 | 1898 | | 368 | 1841 | |
| v/s Ratio Prot | | 0.01 | | | 0.06 | | | c0.29 | | | 0.27 | |
| v/s Ratio Perm | c0.09 | | | 0.01 | | | 0.08 | | | 0.26 | | |
| v/c Ratio | 0.56 | 0.07 | | 0.07 | 0.42 | | 0.12 | 0.43 | | 0.38 | 0.41 | |
| Uniform Delay, d1 | 33.0 | 30.5 | | 30.5 | 32.3 | | 4.7 | 6.2 | | 5.9 | 6.0 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 6.5 | 0.2 | | 0.2 | 2.0 | | 0.6 | 0.7 | | 3.0 | 0.7 | |
| Delay (s) | 39.5 | 30.7 | | 30.8 | 34.2 | | 5.3 | 6.9 | | 8.9 | 6.7 | |
| Level of Service | D | C | | C | C | | A | A | | A | A | |
| Approach Delay (s) | | 35.4 | | | 34.0 | | | 6.8 | | | 7.0 | |
| Approach LOS | | D | | | C | | | A | | | A | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 11.6 | | | | HCM 2000 Level of Service | | | | B | |
| HCM 2000 Volume to Capacity ratio | | | 0.46 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | | | | Sum of lost time (s) | | | 14.2 | | |
| Intersection Capacity Utilization | | | 80.8% | | | | ICU Level of Service | | | D | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Total 10 Year
AM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 21 | 42 | 48 | 844 | 594 | 84 |
| Future Volume (vph) | 21 | 42 | 48 | 844 | 594 | 84 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.910 | | | | 0.981 | |
| Flt Protected | 0.984 | | 0.950 | | | |
| Satd. Flow (prot) | 1431 | 0 | 1568 | 3308 | 2731 | 0 |
| Flt Permitted | 0.984 | | 0.950 | | | |
| Satd. Flow (perm) | 1431 | 0 | 1568 | 3308 | 2731 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 1 | | 6 | | | 6 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 2% | 5% | 3% |
| Adj. Flow (vph) | 23 | 46 | 52 | 917 | 646 | 91 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 69 | 0 | 52 | 917 | 737 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 41.4% |
| Analysis Period (min) | 15 |
| | ICU Level of Service A |

HCM Unsignalized Intersection Capacity Analysis

4: Niagara Street & Roger Drive

Total 10 Year
AM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 21 | 42 | 48 | 844 | 594 | 84 |
| Future Volume (Veh/h) | 21 | 42 | 48 | 844 | 594 | 84 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 23 | 46 | 52 | 917 | 646 | 91 |
| Pedestrians | 6 | | | | 1 | |
| Lane Width (m) | 3.6 | | | | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | | 1.2 | |
| Percent Blockage | 1 | | | | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | 0.99 | 0.99 | 0.99 | | | |
| vC, conflicting volume | 1261 | 374 | 743 | | | |
| vC1, stage 1 conf vol | 698 | | | | | |
| vC2, stage 2 conf vol | 564 | | | | | |
| vCu, unblocked vol | 1244 | 348 | 721 | | | |
| tC, single (s) | 6.8 | 7.0 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 94 | 93 | 94 | | | |
| cM capacity (veh/h) | 366 | 635 | 877 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 69 | 52 | 458 | 458 | 431 | 306 |
| Volume Left | 23 | 52 | 0 | 0 | 0 | 0 |
| Volume Right | 46 | 0 | 0 | 0 | 0 | 91 |
| cSH | 510 | 877 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.14 | 0.06 | 0.27 | 0.27 | 0.25 | 0.18 |
| Queue Length 95th (m) | 3.7 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 13.2 | 9.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | A | | | | |
| Approach Delay (s) | 13.2 | 0.5 | | | 0.0 | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.8 | | | |
| Intersection Capacity Utilization | | | 41.4% | ICU Level of Service | A | |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total 10 Year
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 351 | 199 | 113 | 48 | 160 | 131 | 113 | 418 | 55 | 91 | 373 | 254 |
| Future Volume (vph) | 351 | 199 | 113 | 48 | 160 | 131 | 113 | 418 | 55 | 91 | 373 | 254 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 1.00 | 0.99 | | 0.99 | 1.00 | | 1.00 | 0.98 | |
| Frt | | 0.946 | | | 0.932 | | | 0.983 | | | 0.939 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1291 | 0 | 1413 | 1321 | 0 | 1376 | 2683 | 0 | 1376 | 2609 | 0 |
| Flt Permitted | 0.303 | | | 0.446 | | | 0.269 | | | 0.419 | | |
| Satd. Flow (perm) | 487 | 1291 | 0 | 660 | 1321 | 0 | 388 | 2683 | 0 | 604 | 2609 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 26 | | | 38 | | | 15 | | | 171 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Peak Hour Factor | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Adj. Flow (vph) | 386 | 219 | 124 | 53 | 176 | 144 | 124 | 459 | 60 | 100 | 410 | 279 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 386 | 343 | 0 | 53 | 320 | 0 | 124 | 519 | 0 | 100 | 689 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total 10 Year
AM Peak Hour



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 43.8 | 31.7 | | 36.3 | 25.4 | | 53.1 | 41.3 | | 51.1 | 38.8 | |
| Actuated g/C Ratio | 0.42 | 0.30 | | 0.35 | 0.24 | | 0.51 | 0.39 | | 0.49 | 0.37 | |
| v/c Ratio | 1.20 | 0.84 | | 0.19 | 0.92 | | 0.43 | 0.49 | | 0.28 | 0.64 | |
| Control Delay | 139.8 | 52.0 | | 19.5 | 65.7 | | 18.7 | 26.7 | | 15.8 | 24.1 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 139.8 | 52.0 | | 19.5 | 65.7 | | 18.7 | 26.7 | | 15.8 | 24.1 | |
| LOS | F | D | | B | E | | B | C | | B | C | |
| Approach Delay | | 98.5 | | | 59.2 | | | 25.1 | | | 23.1 | |
| Approach LOS | | F | | | E | | | C | | | C | |

Intersection Summary

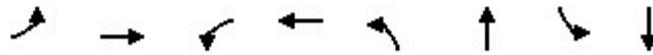
Area Type: Other
 Cycle Length: 104.8
 Actuated Cycle Length: 104.8
 Offset: 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 80
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.20
 Intersection Signal Delay: 50.6
 Intersection Capacity Utilization 91.6%
 Analysis Period (min) 15

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Total 10 Year
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|--------|--------|------|--------|------|-------|------|-------|
| Lane Group Flow (vph) | 386 | 343 | 53 | 320 | 124 | 519 | 100 | 689 |
| v/c Ratio | 1.20 | 0.84 | 0.19 | 0.92 | 0.43 | 0.49 | 0.28 | 0.64 |
| Control Delay | 139.8 | 52.0 | 19.5 | 65.7 | 18.7 | 26.7 | 15.8 | 24.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 139.8 | 52.0 | 19.5 | 65.7 | 18.7 | 26.7 | 15.8 | 24.1 |
| Queue Length 50th (m) | ~76.3 | 64.0 | 6.5 | 58.7 | 13.8 | 44.3 | 10.9 | 49.4 |
| Queue Length 95th (m) | #125.2 | #122.6 | 14.3 | #110.1 | 24.8 | 64.3 | 20.4 | 73.0 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 323 | 408 | 343 | 368 | 313 | 1067 | 396 | 1074 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.20 | 0.84 | 0.15 | 0.87 | 0.40 | 0.49 | 0.25 | 0.64 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Total 10 Year
AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|-------|-------|-------|------|------|---------------------------|------|------|-------|-------|------|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 351 | 199 | 113 | 48 | 160 | 131 | 113 | 418 | 55 | 91 | 373 | 254 |
| Future Volume (vph) | 351 | 199 | 113 | 48 | 160 | 131 | 113 | 418 | 55 | 91 | 373 | 254 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 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 | |
| Frt | 1.00 | 0.95 | | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 0.94 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1535 | 1290 | | 1410 | 1322 | | 1374 | 2682 | | 1373 | 2609 | |
| Flt Permitted | 0.30 | 1.00 | | 0.45 | 1.00 | | 0.27 | 1.00 | | 0.42 | 1.00 | |
| Satd. Flow (perm) | 490 | 1290 | | 662 | 1322 | | 389 | 2682 | | 606 | 2609 | |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 386 | 219 | 124 | 53 | 176 | 144 | 124 | 459 | 60 | 100 | 410 | 279 |
| RTOR Reduction (vph) | 0 | 18 | 0 | 0 | 29 | 0 | 0 | 9 | 0 | 0 | 109 | 0 |
| Lane Group Flow (vph) | 386 | 325 | 0 | 53 | 291 | 0 | 124 | 510 | 0 | 100 | 580 | 0 |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 41.1 | 31.7 | | 32.5 | 26.1 | | 49.8 | 40.1 | | 46.0 | 38.2 | |
| Effective Green, g (s) | 41.1 | 31.7 | | 32.5 | 26.1 | | 49.8 | 40.1 | | 46.0 | 38.2 | |
| Actuated g/C Ratio | 0.39 | 0.30 | | 0.31 | 0.25 | | 0.48 | 0.38 | | 0.44 | 0.36 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 311 | 390 | | 250 | 329 | | 276 | 1026 | | 323 | 950 | |
| v/s Ratio Prot | c0.14 | 0.25 | | 0.01 | 0.22 | | c0.04 | 0.19 | | 0.02 | c0.22 | |
| v/s Ratio Perm | c0.34 | | | 0.05 | | | 0.17 | | | 0.11 | | |
| v/c Ratio | 1.24 | 0.83 | | 0.21 | 0.89 | | 0.45 | 0.50 | | 0.31 | 0.61 | |
| Uniform Delay, d1 | 29.2 | 34.1 | | 26.0 | 37.9 | | 16.8 | 24.7 | | 17.9 | 27.2 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 132.9 | 13.7 | | 0.3 | 23.2 | | 0.8 | 1.7 | | 0.4 | 2.9 | |
| Delay (s) | 162.0 | 47.8 | | 26.4 | 61.1 | | 17.7 | 26.4 | | 18.3 | 30.1 | |
| Level of Service | F | D | | C | E | | B | C | | B | C | |
| Approach Delay (s) | | 108.3 | | | 56.2 | | | 24.7 | | | 28.6 | |
| Approach LOS | | F | | | E | | | C | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 54.6 | | | | HCM 2000 Level of Service | | | | D | |
| HCM 2000 Volume to Capacity ratio | | | 0.91 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | | Sum of lost time (s) | | | | 18.8 | |
| Intersection Capacity Utilization | | | 91.6% | | | | ICU Level of Service | | | | F | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Total 10 Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |  |  |  |  |
| Traffic Volume (vph) | 23 | 42 | 1167 | 7 | 12 | 764 |
| Future Volume (vph) | 23 | 42 | 1167 | 7 | 12 | 764 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | 0.913 | | 0.999 | | | |
| Flt Protected | 0.983 | | | | 0.950 | |
| Satd. Flow (prot) | 1434 | 0 | 2829 | 0 | 1538 | 2804 |
| Flt Permitted | 0.983 | | | | 0.950 | |
| Satd. Flow (perm) | 1434 | 0 | 2829 | 0 | 1538 | 2804 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 3% | 2% | 2% | 4% |
| Adj. Flow (vph) | 25 | 46 | 1268 | 8 | 13 | 830 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 71 | 0 | 1276 | 0 | 13 | 830 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 51.4% | | ICU Level of Service A | | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis
6: Niagara Street & Site Access

Total 10 Year
AM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (veh/h) | 23 | 42 | 1167 | 7 | 12 | 764 |
| Future Volume (Veh/h) | 23 | 42 | 1167 | 7 | 12 | 764 |
| Sign Control | Stop | | Free | | Free | |
| Grade | 0% | | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 25 | 46 | 1268 | 8 | 13 | 830 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | | TWLTL | |
| Median storage veh) | | | 2 | | 2 | |
| Upstream signal (m) | | | 300 | | 165 | |
| pX, platoon unblocked | 0.96 | 0.96 | | | 0.96 | |
| vC, conflicting volume | 1713 | 638 | | | 1276 | |
| vC1, stage 1 conf vol | 1272 | | | | | |
| vC2, stage 2 conf vol | 441 | | | | | |
| vCu, unblocked vol | 1658 | 536 | | | 1202 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 89 | 90 | | | 98 | |
| cM capacity (veh/h) | 223 | 469 | | | 553 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 71 | 845 | 431 | 13 | 415 | 415 |
| Volume Left | 25 | 0 | 0 | 13 | 0 | 0 |
| Volume Right | 46 | 0 | 8 | 0 | 0 | 0 |
| cSH | 338 | 1700 | 1700 | 553 | 1700 | 1700 |
| Volume to Capacity | 0.21 | 0.50 | 0.25 | 0.02 | 0.24 | 0.24 |
| Queue Length 95th (m) | 6.2 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 |
| Control Delay (s) | 18.5 | 0.0 | 0.0 | 11.7 | 0.0 | 0.0 |
| Lane LOS | C | | | B | | |
| Approach Delay (s) | 18.5 | 0.0 | | 0.2 | | |
| Approach LOS | C | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.7 | | | |
| Intersection Capacity Utilization | | | 51.4% | | ICU Level of Service | A |
| Analysis Period (min) | | | 15 | | | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Total 10 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  | |  |  |  |
| Traffic Volume (vph) | 371 | 538 | 171 | 543 | 583 | 195 | 171 | 763 | 406 | 251 | 1000 | 376 |
| Future Volume (vph) | 371 | 538 | 171 | 543 | 583 | 195 | 171 | 763 | 406 | 251 | 1000 | 376 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 0.0 | 105.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | | 0.95 | | 0.97 | | | 0.99 | |
| Frt | | 0.964 | | | | 0.850 | | 0.948 | | | 0.959 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1553 | 2274 | 0 | 1553 | 3341 | 1248 | 1568 | 2630 | 0 | 1523 | 2747 | 0 |
| Flt Permitted | 0.228 | | | 0.108 | | | 0.080 | | | 0.078 | | |
| Satd. Flow (perm) | 368 | 2274 | 0 | 175 | 3341 | 1188 | 132 | 2630 | 0 | 125 | 2747 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 25 | | | | 201 | | 65 | | | 36 | |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | 50 | |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | 265.2 | |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | 19.1 | |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| 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 (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Adj. Flow (vph) | 382 | 555 | 176 | 560 | 601 | 201 | 176 | 787 | 419 | 259 | 1031 | 388 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 382 | 731 | 0 | 560 | 601 | 201 | 176 | 1206 | 0 | 259 | 1419 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

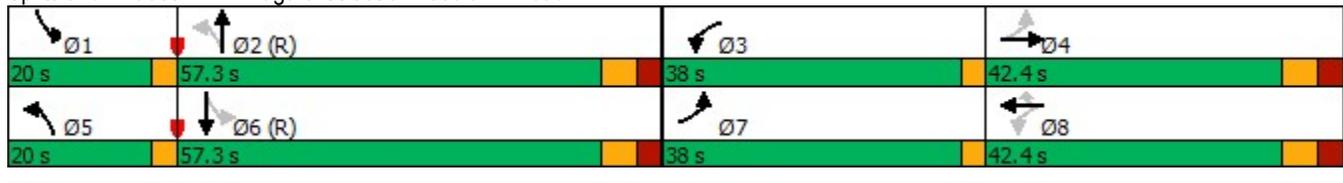
Total 10 Year
PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | | 6.0 | 10.0 | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | | 9.0 | 17.3 | |
| Total Split (s) | 38.0 | 42.4 | | 38.0 | 42.4 | 42.4 | 20.0 | 57.3 | | 20.0 | 57.3 | |
| Total Split (%) | 24.1% | 26.9% | | 24.1% | 26.9% | 26.9% | 12.7% | 36.3% | | 12.7% | 36.3% | |
| Maximum Green (s) | 35.0 | 35.0 | | 35.0 | 35.0 | 35.0 | 17.0 | 50.0 | | 17.0 | 50.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | | 0.0 | 3.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | Yes | Yes | Yes | Yes | | Yes | Yes | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Recall Mode | None | None | | None | None | None | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | | | 12.0 | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | | | 20.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | | | 0 | |
| Act Effct Green (s) | 72.3 | 35.0 | | 75.3 | 37.1 | 37.1 | 70.0 | 50.0 | | 72.1 | 51.3 | |
| Actuated g/C Ratio | 0.46 | 0.22 | | 0.48 | 0.24 | 0.24 | 0.44 | 0.32 | | 0.46 | 0.33 | |
| v/c Ratio | 0.92 | 1.40 | | 1.44 | 0.77 | 0.46 | 0.88 | 1.37 | | 1.25 | 1.55 | |
| Control Delay | 61.0 | 231.3 | | 247.7 | 64.2 | 9.9 | 77.1 | 213.6 | | 183.1 | 287.1 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 61.0 | 231.3 | | 247.7 | 64.2 | 9.9 | 77.1 | 213.6 | | 183.1 | 287.1 | |
| LOS | E | F | | F | E | A | E | F | | F | F | |
| Approach Delay | | 172.9 | | | 131.6 | | | 196.2 | | | 271.0 | |
| Approach LOS | | F | | | F | | | F | | | F | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 130
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.55
 Intersection Signal Delay: 198.3 Intersection LOS: F
 Intersection Capacity Utilization 140.1% ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Total 10 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | SBL | SBT |
|------------------------|--------|--------|--------|-------|------|-------|--------|--------|--------|
| Lane Group Flow (vph) | 382 | 731 | 560 | 601 | 201 | 176 | 1206 | 259 | 1419 |
| v/c Ratio | 0.92 | 1.40 | 1.44 | 0.77 | 0.46 | 0.88 | 1.37 | 1.25 | 1.55 |
| Control Delay | 61.0 | 231.3 | 247.7 | 64.2 | 9.9 | 77.1 | 213.6 | 183.1 | 287.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 61.0 | 231.3 | 247.7 | 64.2 | 9.9 | 77.1 | 213.6 | 183.1 | 287.1 |
| Queue Length 50th (m) | 88.7 | ~166.0 | ~236.2 | 100.0 | 0.0 | 41.4 | ~269.1 | ~91.6 | ~347.2 |
| Queue Length 95th (m) | #148.4 | #209.3 | #313.0 | 124.2 | 23.7 | #83.3 | #314.6 | #152.5 | #392.7 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | 241.2 |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 105.0 | |
| Base Capacity (vph) | 436 | 524 | 389 | 785 | 433 | 214 | 878 | 208 | 917 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.88 | 1.40 | 1.44 | 0.77 | 0.46 | 0.82 | 1.37 | 1.25 | 1.55 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Niagara Street & Woodlawn Road

Total 10 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|--|---|---|--|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |   | |  |   |  |  |   | |  |   | |
| Traffic Volume (vph) | 371 | 538 | 171 | 543 | 583 | 195 | 171 | 763 | 406 | 251 | 1000 | 376 |
| Future Volume (vph) | 371 | 538 | 171 | 543 | 583 | 195 | 171 | 763 | 406 | 251 | 1000 | 376 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.95 | 1.00 | 0.97 | | 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 | |
| Frt | 1.00 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 0.95 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1549 | 2274 | | 1552 | 3341 | 1188 | 1568 | 2630 | | 1523 | 2747 | |
| Flt Permitted | 0.23 | 1.00 | | 0.11 | 1.00 | 1.00 | 0.08 | 1.00 | | 0.08 | 1.00 | |
| Satd. Flow (perm) | 372 | 2274 | | 176 | 3341 | 1188 | 132 | 2630 | | 125 | 2747 | |
| 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) | 382 | 555 | 176 | 560 | 601 | 201 | 176 | 787 | 419 | 259 | 1031 | 388 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 0 | 154 | 0 | 44 | 0 | 0 | 24 | 0 |
| Lane Group Flow (vph) | 382 | 712 | 0 | 560 | 601 | 47 | 176 | 1162 | 0 | 259 | 1395 | 0 |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| Heavy Vehicles (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 67.9 | 35.0 | | 72.1 | 37.1 | 37.1 | 65.7 | 50.0 | | 68.3 | 51.3 | |
| Effective Green, g (s) | 67.9 | 35.0 | | 72.1 | 37.1 | 37.1 | 65.7 | 50.0 | | 68.3 | 51.3 | |
| Actuated g/C Ratio | 0.43 | 0.22 | | 0.46 | 0.24 | 0.24 | 0.42 | 0.32 | | 0.43 | 0.33 | |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | | 3.0 | 7.3 | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | | 2.6 | 2.5 | |
| Lane Grp Cap (vph) | 405 | 504 | | 385 | 785 | 279 | 197 | 833 | | 204 | 893 | |
| v/s Ratio Prot | 0.20 | 0.31 | | c0.32 | 0.18 | | 0.09 | 0.44 | | c0.14 | c0.51 | |
| v/s Ratio Perm | 0.21 | | | c0.34 | | 0.04 | 0.28 | | | 0.41 | | |
| v/c Ratio | 0.94 | 1.41 | | 1.45 | 0.77 | 0.17 | 0.89 | 1.39 | | 1.27 | 1.56 | |
| Uniform Delay, d1 | 36.5 | 61.3 | | 49.7 | 56.2 | 48.0 | 45.9 | 53.8 | | 50.4 | 53.2 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 30.4 | 196.8 | | 218.5 | 4.3 | 0.2 | 36.0 | 184.9 | | 154.0 | 258.3 | |
| Delay (s) | 66.9 | 258.2 | | 268.3 | 60.5 | 48.2 | 81.9 | 238.7 | | 204.5 | 311.5 | |
| Level of Service | E | F | | F | E | D | F | F | | F | F | |
| Approach Delay (s) | | 192.5 | | | 144.1 | | | 218.7 | | | 295.0 | |
| Approach LOS | | F | | | F | | | F | | | F | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 218.2 | | | HCM 2000 Level of Service | | | F | | | |
| HCM 2000 Volume to Capacity ratio | | | 1.51 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | | | Sum of lost time (s) | | | 20.7 | | | |
| Intersection Capacity Utilization | | | 140.1% | | | ICU Level of Service | | | H | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
2: Niagara Street & Abbey Road

Total 10 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  | |
| Traffic Volume (vph) | 12 | 0 | 32 | 17 | 0 | 98 | 12 | 1195 | 26 | 145 | 1461 | 37 |
| Future Volume (vph) | 12 | 0 | 32 | 17 | 0 | 98 | 12 | 1195 | 26 | 145 | 1461 | 37 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1630 | 1630 | 1630 | 1630 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 15.0 | | 0.0 | 15.0 | | 0.0 |
| Storage Lanes | 0 | | 0 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | 0.902 | | | 0.884 | | | 0.997 | | | 0.996 | |
| Flt Protected | | 0.986 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1450 | 0 | 0 | 1403 | 0 | 1568 | 2851 | 0 | 1538 | 2877 | 0 |
| Flt Permitted | | 0.986 | | | 0.993 | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1450 | 0 | 0 | 1403 | 0 | 1568 | 2851 | 0 | 1538 | 2877 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 169.8 | | | 101.4 | | | 77.8 | | | 158.1 | |
| Travel Time (s) | | 12.2 | | | 7.3 | | | 5.6 | | | 11.4 | |
| Confl. Peds. (#/hr) | | | | | | | 19 | | | | | 19 |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 2% | 2% | 2% | 0% | 2% | 2% | 2% | 1% | 0% |
| Adj. Flow (vph) | 13 | 0 | 34 | 18 | 0 | 107 | 13 | 1258 | 28 | 158 | 1538 | 39 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 47 | 0 | 0 | 125 | 0 | 13 | 1286 | 0 | 158 | 1577 | 0 |
| Enter Blocked Intersection | 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 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 100 | | 100 | 25 | | 100 | 100 | | 15 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

Intersection Summary

| | |
|-----------------------------------|--------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 74.1% |
| ICU Level of Service | D |
| Analysis Period (min) | 15 |

HCM Unsignalized Intersection Capacity Analysis

2: Niagara Street & Abbey Road

Total 10 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations | |  | | |  | |  |  | |  |  |  |
| Traffic Volume (veh/h) | 12 | 0 | 32 | 17 | 0 | 98 | 12 | 1195 | 26 | 145 | 1461 | 37 |
| Future Volume (Veh/h) | 12 | 0 | 32 | 17 | 0 | 98 | 12 | 1195 | 26 | 145 | 1461 | 37 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.92 | 0.95 | 0.92 | 0.92 | 0.92 | 0.95 | 0.95 | 0.92 | 0.92 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 13 | 0 | 34 | 18 | 0 | 107 | 13 | 1258 | 28 | 158 | 1538 | 39 |
| Pedestrians | | 19 | | | | | | | | | | |
| Lane Width (m) | | 3.6 | | | | | | | | | | |
| Walking Speed (m/s) | | 1.2 | | | | | | | | | | |
| Percent Blockage | | 2 | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | TWLTL | | | TWLTL | |
| Median storage veh | | | | | | | | 2 | | | 2 | |
| Upstream signal (m) | | | | | | | | 142 | | | 323 | |
| pX, platoon unblocked | 0.80 | 0.80 | 0.72 | 0.80 | 0.80 | 0.84 | 0.72 | | | 0.84 | | |
| vC, conflicting volume | 2654 | 3204 | 808 | 2417 | 3210 | 643 | 1596 | | | 1286 | | |
| vC1, stage 1 conf vol | 1892 | 1892 | | 1298 | 1298 | | | | | | | |
| vC2, stage 2 conf vol | 762 | 1312 | | 1119 | 1912 | | | | | | | |
| vCu, unblocked vol | 1665 | 2352 | 0 | 1369 | 2359 | 191 | 1052 | | | 958 | | |
| tC, single (s) | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | 6.5 | 5.5 | | 6.5 | 5.5 | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 81 | 100 | 96 | 90 | 100 | 84 | 97 | | | 74 | | |
| cM capacity (veh/h) | 69 | 73 | 774 | 182 | 79 | 686 | 475 | | | 599 | | |
| Direction, Lane # | EB 1 | WB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 | | | | |
| Volume Total | 47 | 125 | 13 | 839 | 447 | 158 | 1025 | 552 | | | | |
| Volume Left | 13 | 18 | 13 | 0 | 0 | 158 | 0 | 0 | | | | |
| Volume Right | 34 | 107 | 0 | 0 | 28 | 0 | 0 | 39 | | | | |
| cSH | 203 | 491 | 475 | 1700 | 1700 | 599 | 1700 | 1700 | | | | |
| Volume to Capacity | 0.23 | 0.25 | 0.03 | 0.49 | 0.26 | 0.26 | 0.60 | 0.32 | | | | |
| Queue Length 95th (m) | 6.9 | 8.0 | 0.7 | 0.0 | 0.0 | 8.4 | 0.0 | 0.0 | | | | |
| Control Delay (s) | 28.0 | 14.8 | 12.8 | 0.0 | 0.0 | 13.1 | 0.0 | 0.0 | | | | |
| Lane LOS | D | B | B | | | B | | | | | | |
| Approach Delay (s) | 28.0 | 14.8 | 0.1 | | | 1.2 | | | | | | |
| Approach LOS | D | B | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.7 | | | | | | | | | |
| Intersection Capacity Utilization | | | 74.1% | ICU Level of Service | D | | | | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

Lanes, Volumes, Timings
3: Niagara Street & Parking Lot/Aqueduct Street

Total 10 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 50 | 1 | 48 | 16 | 3 | 87 | 45 | 1099 | 25 | 112 | 1331 | 61 |
| Future Volume (vph) | 50 | 1 | 48 | 16 | 3 | 87 | 45 | 1099 | 25 | 112 | 1331 | 61 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 10.0 | | 0.0 | 10.0 | | 0.0 | 70.0 | | 0.0 | 60.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 1.00 | 0.98 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.853 | | | 0.855 | | | 0.997 | | | 0.993 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1568 | 1288 | 0 | 1568 | 1295 | 0 | 1568 | 2822 | 0 | 1568 | 2837 | 0 |
| Flt Permitted | 0.697 | | | 0.724 | | | 0.159 | | | 0.229 | | |
| Satd. Flow (perm) | 1149 | 1288 | 0 | 1190 | 1295 | 0 | 262 | 2822 | 0 | 377 | 2837 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 33 | | | 62 | | | 4 | | | 8 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 64.5 | | | 107.2 | | | 262.1 | | | 63.8 | |
| Travel Time (s) | | 4.6 | | | 7.7 | | | 18.9 | | | 4.6 | |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| Adj. Flow (vph) | 51 | 1 | 49 | 16 | 3 | 89 | 46 | 1121 | 26 | 114 | 1358 | 62 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 51 | 50 | 0 | 16 | 92 | 0 | 46 | 1147 | 0 | 114 | 1420 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | | | | | | | Yes | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
 3: Niagara Street & Parking Lot/Aqueduct Street

Total 10 Year
 PM Peak Hour

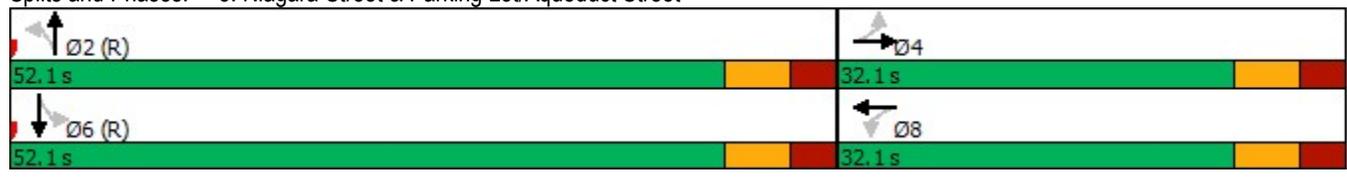


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | | 8.0 | 8.0 | | 10.0 | 10.0 | | 10.0 | 10.0 | |
| Minimum Split (s) | 15.1 | 15.1 | | 15.1 | 15.1 | | 17.1 | 17.1 | | 17.1 | 17.1 | |
| Total Split (s) | 32.1 | 32.1 | | 32.1 | 32.1 | | 52.1 | 52.1 | | 52.1 | 52.1 | |
| Total Split (%) | 38.1% | 38.1% | | 38.1% | 38.1% | | 61.9% | 61.9% | | 61.9% | 61.9% | |
| Maximum Green (s) | 25.0 | 25.0 | | 25.0 | 25.0 | | 45.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | | 4.1 | 4.1 | |
| All-Red Time (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Recall Mode | None | None | | None | None | | C-Max | C-Max | | C-Max | C-Max | |
| Walk Time (s) | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | | 18.0 | 18.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | |
| Act Effect Green (s) | 10.5 | 10.5 | | 10.5 | 10.5 | | 64.0 | 64.0 | | 64.0 | 64.0 | |
| Actuated g/C Ratio | 0.12 | 0.12 | | 0.12 | 0.12 | | 0.76 | 0.76 | | 0.76 | 0.76 | |
| v/c Ratio | 0.36 | 0.26 | | 0.11 | 0.43 | | 0.23 | 0.53 | | 0.40 | 0.66 | |
| Control Delay | 40.0 | 19.7 | | 32.8 | 20.4 | | 8.8 | 7.0 | | 11.1 | 8.9 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 40.0 | 19.7 | | 32.8 | 20.4 | | 8.8 | 7.0 | | 11.1 | 8.9 | |
| LOS | D | B | | C | C | | A | A | | B | A | |
| Approach Delay | | 30.0 | | | 22.2 | | | 7.1 | | | 9.1 | |
| Approach LOS | | C | | | C | | | A | | | A | |

Intersection Summary

Area Type: Other
 Cycle Length: 84.2
 Actuated Cycle Length: 84.2
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.66
 Intersection Signal Delay: 9.5
 Intersection Capacity Utilization 86.7%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service E

Splits and Phases: 3: Niagara Street & Parking Lot/Aqueduct Street



Queues
3: Niagara Street & Parking Lot/Aqueduct Street

Total 10 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|------|------|------|------|------|-------|------|-------|
| Lane Group Flow (vph) | 51 | 50 | 16 | 92 | 46 | 1147 | 114 | 1420 |
| v/c Ratio | 0.36 | 0.26 | 0.11 | 0.43 | 0.23 | 0.53 | 0.40 | 0.66 |
| Control Delay | 40.0 | 19.7 | 32.8 | 20.4 | 8.8 | 7.0 | 11.1 | 8.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 40.0 | 19.7 | 32.8 | 20.4 | 8.8 | 7.0 | 11.1 | 8.9 |
| Queue Length 50th (m) | 8.1 | 2.6 | 2.5 | 4.7 | 2.3 | 41.0 | 6.6 | 60.3 |
| Queue Length 95th (m) | 18.1 | 12.1 | 7.9 | 17.8 | 9.1 | 69.0 | 22.7 | 102.2 |
| Internal Link Dist (m) | | 40.5 | | 83.2 | | 238.1 | | 39.8 |
| Turn Bay Length (m) | 10.0 | | 10.0 | | 70.0 | | 60.0 | |
| Base Capacity (vph) | 341 | 405 | 353 | 428 | 199 | 2144 | 286 | 2157 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.15 | 0.12 | 0.05 | 0.21 | 0.23 | 0.53 | 0.40 | 0.66 |

Intersection Summary

HCM Signalized Intersection Capacity Analysis
 3: Niagara Street & Parking Lot/Aqueduct Street

Total 10 Year
 PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |   | |  |   | |
| Traffic Volume (vph) | 50 | 1 | 48 | 16 | 3 | 87 | 45 | 1099 | 25 | 112 | 1331 | 61 |
| Future Volume (vph) | 50 | 1 | 48 | 16 | 3 | 87 | 45 | 1099 | 25 | 112 | 1331 | 61 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.98 | | 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 | 0.85 | | 1.00 | 0.85 | | 1.00 | 1.00 | | 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) | 1566 | 1288 | | 1561 | 1295 | | 1565 | 2821 | | 1563 | 2838 | |
| Flt Permitted | 0.70 | 1.00 | | 0.72 | 1.00 | | 0.16 | 1.00 | | 0.23 | 1.00 | |
| Satd. Flow (perm) | 1150 | 1288 | | 1190 | 1295 | | 263 | 2821 | | 377 | 2838 | |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 51 | 1 | 49 | 16 | 3 | 89 | 46 | 1121 | 26 | 114 | 1358 | 62 |
| RTOR Reduction (vph) | 0 | 30 | 0 | 0 | 55 | 0 | 0 | 1 | 0 | 0 | 2 | 0 |
| Lane Group Flow (vph) | 51 | 20 | 0 | 16 | 37 | 0 | 46 | 1146 | 0 | 114 | 1418 | 0 |
| Confl. Peds. (#/hr) | 2 | | 6 | 6 | | 2 | 12 | | 14 | 14 | | 12 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 2% | 0% |
| 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) | 8.9 | 8.9 | | 8.9 | 8.9 | | 61.1 | 61.1 | | 61.1 | 61.1 | |
| Effective Green, g (s) | 8.9 | 8.9 | | 8.9 | 8.9 | | 61.1 | 61.1 | | 61.1 | 61.1 | |
| Actuated g/C Ratio | 0.11 | 0.11 | | 0.11 | 0.11 | | 0.73 | 0.73 | | 0.73 | 0.73 | |
| Clearance Time (s) | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | | 7.1 | 7.1 | |
| Vehicle Extension (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 121 | 136 | | 125 | 136 | | 190 | 2047 | | 273 | 2059 | |
| v/s Ratio Prot | | 0.02 | | | 0.03 | | | 0.41 | | | c0.50 | |
| v/s Ratio Perm | c0.04 | | | 0.01 | | | 0.18 | | | 0.30 | | |
| v/c Ratio | 0.42 | 0.15 | | 0.13 | 0.27 | | 0.24 | 0.56 | | 0.42 | 0.69 | |
| Uniform Delay, d1 | 35.2 | 34.2 | | 34.1 | 34.7 | | 3.8 | 5.3 | | 4.5 | 6.3 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 3.2 | 0.7 | | 0.6 | 1.5 | | 3.0 | 1.1 | | 4.6 | 1.9 | |
| Delay (s) | 38.5 | 34.9 | | 34.8 | 36.1 | | 6.8 | 6.4 | | 9.2 | 8.2 | |
| Level of Service | D | C | | C | D | | A | A | | A | A | |
| Approach Delay (s) | | 36.7 | | | 35.9 | | | 6.5 | | | 8.3 | |
| Approach LOS | | D | | | D | | | A | | | A | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 9.6 | HCM 2000 Level of Service | | | | | | A | | |
| HCM 2000 Volume to Capacity ratio | | | 0.65 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 84.2 | Sum of lost time (s) | | | | | | 14.2 | | |
| Intersection Capacity Utilization | | | 86.7% | ICU Level of Service | | | | | | E | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
4: Niagara Street & Roger Drive

Total 10 Year
PM Peak Hour



| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|----------------------------|-------|-------|-------|------|-------|-------|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 28 | 49 | 51 | 1043 | 1225 | 91 |
| Future Volume (vph) | 28 | 49 | 51 | 1043 | 1225 | 91 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1651 | 1776 | 1535 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | 15.0 | | | 0.0 |
| Storage Lanes | 1 | 0 | 1 | | | 0 |
| Taper Length (m) | 7.5 | | 7.5 | | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 0.95 |
| Ped Bike Factor | | | | | | |
| Frt | 0.914 | | | | 0.990 | |
| Flt Protected | 0.982 | | 0.950 | | | |
| Satd. Flow (prot) | 1463 | 0 | 1568 | 3308 | 2861 | 0 |
| Flt Permitted | 0.982 | | 0.950 | | | |
| Satd. Flow (perm) | 1463 | 0 | 1568 | 3308 | 2861 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 93.6 | | | 92.0 | 262.1 | |
| Travel Time (s) | 6.7 | | | 6.6 | 18.9 | |
| Confl. Peds. (#/hr) | 2 | 1 | 8 | | | 8 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 2% | 1% | 0% |
| Adj. Flow (vph) | 30 | 53 | 55 | 1134 | 1332 | 99 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 83 | 0 | 55 | 1134 | 1431 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 3.6 | 3.6 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | Yes | Yes | |
| Headway Factor | 1.22 | 1.22 | 1.20 | 1.09 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Free | Free | |

Intersection Summary

| | |
|-----------------------------------|------------------------|
| Area Type: | Other |
| Control Type: | Unsignalized |
| Intersection Capacity Utilization | 61.1% |
| Analysis Period (min) | 15 |
| | ICU Level of Service B |

HCM Unsignalized Intersection Capacity Analysis

4: Niagara Street & Roger Drive

Total 10 Year
PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|-------|------|------|----------------------|-------|------|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 28 | 49 | 51 | 1043 | 1225 | 91 |
| Future Volume (Veh/h) | 28 | 49 | 51 | 1043 | 1225 | 91 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 30 | 53 | 55 | 1134 | 1332 | 99 |
| Pedestrians | 8 | | | 1 | 2 | |
| Lane Width (m) | 3.6 | | | 3.6 | 3.6 | |
| Walking Speed (m/s) | 1.2 | | | 1.2 | 1.2 | |
| Percent Blockage | 1 | | | 0 | 0 | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | TWLTL | TWLTL | |
| Median storage veh | | | | 2 | 2 | |
| Upstream signal (m) | | | | 341 | 262 | |
| pX, platoon unblocked | 0.82 | 0.76 | 0.76 | | | |
| vC, conflicting volume | 2068 | 724 | 1439 | | | |
| vC1, stage 1 conf vol | 1390 | | | | | |
| vC2, stage 2 conf vol | 679 | | | | | |
| vCu, unblocked vol | 1290 | 24 | 958 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 88 | 93 | 90 | | | |
| cM capacity (veh/h) | 254 | 800 | 551 | | | |
| Direction, Lane # | EB 1 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 |
| Volume Total | 83 | 55 | 567 | 567 | 888 | 543 |
| Volume Left | 30 | 55 | 0 | 0 | 0 | 0 |
| Volume Right | 53 | 0 | 0 | 0 | 0 | 99 |
| cSH | 450 | 551 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.18 | 0.10 | 0.33 | 0.33 | 0.52 | 0.32 |
| Queue Length 95th (m) | 5.3 | 2.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| Control Delay (s) | 14.8 | 12.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | B | B | | | | |
| Approach Delay (s) | 14.8 | 0.6 | 0.0 | | | |
| Approach LOS | B | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 0.7 | | | | | |
| Intersection Capacity Utilization | 61.1% | | | ICU Level of Service | B | |
| Analysis Period (min) | 15 | | | | | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total 10 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 422 | 185 | 100 | 121 | 191 | 121 | 174 | 616 | 75 | 124 | 697 | 560 |
| Future Volume (vph) | 422 | 185 | 100 | 121 | 191 | 121 | 174 | 616 | 75 | 124 | 697 | 560 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 0.99 | | | 1.00 | | 0.99 | 0.98 | |
| Frt | | 0.947 | | | 0.942 | | | 0.984 | | | 0.933 | |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1538 | 1389 | 0 | 1568 | 1391 | 0 | 1452 | 2825 | 0 | 1466 | 2639 | 0 |
| Flt Permitted | 0.290 | | | 0.422 | | | 0.102 | | | 0.283 | | |
| Satd. Flow (perm) | 466 | 1389 | 0 | 689 | 1391 | 0 | 156 | 2825 | 0 | 434 | 2639 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 25 | | | 29 | | | 13 | | | 207 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | 249.0 | |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | 17.9 | |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Adj. Flow (vph) | 440 | 193 | 104 | 126 | 199 | 126 | 181 | 642 | 78 | 129 | 726 | 583 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 440 | 297 | 0 | 126 | 325 | 0 | 181 | 720 | 0 | 129 | 1309 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| 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 | | Yes | | | | | | | | | Yes | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total 10 Year
PM Peak Hour

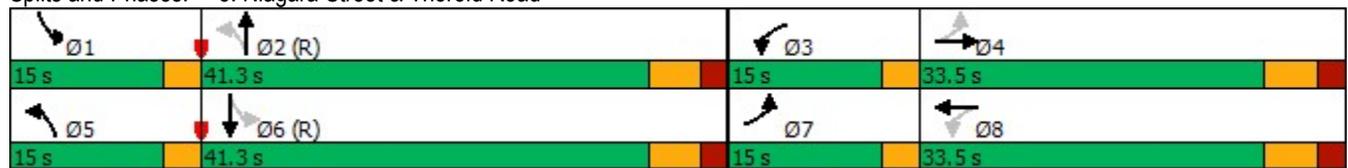


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-----|-------|-------|-----|-------|-------|-----|
| Turn Type | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Detector Phase | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | | 5.0 | 8.0 | |
| Minimum Split (s) | 8.0 | 14.5 | | 8.0 | 14.5 | | 8.0 | 14.3 | | 8.0 | 14.3 | |
| Total Split (s) | 15.0 | 33.5 | | 15.0 | 33.5 | | 15.0 | 41.3 | | 15.0 | 41.3 | |
| Total Split (%) | 14.3% | 32.0% | | 14.3% | 32.0% | | 14.3% | 39.4% | | 14.3% | 39.4% | |
| Maximum Green (s) | 12.0 | 27.0 | | 12.0 | 27.0 | | 12.0 | 35.0 | | 12.0 | 35.0 | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | | 3.0 | 4.1 | |
| All-Red Time (s) | 0.0 | 2.4 | | 0.0 | 2.4 | | 0.0 | 2.2 | | 0.0 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lead/Lag | Lead | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Recall Mode | None | None | | None | None | | None | C-Max | | None | C-Max | |
| Walk Time (s) | | 10.0 | | | 10.0 | | | 9.0 | | | 9.0 | |
| Flash Dont Walk (s) | | 17.0 | | | 17.0 | | | 15.0 | | | 15.0 | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | | | 0 | | | 0 | |
| Act Effct Green (s) | 42.1 | 27.1 | | 38.4 | 25.0 | | 53.9 | 39.4 | | 50.6 | 37.8 | |
| Actuated g/C Ratio | 0.40 | 0.26 | | 0.37 | 0.24 | | 0.51 | 0.38 | | 0.48 | 0.36 | |
| v/c Ratio | 1.42 | 0.79 | | 0.38 | 0.92 | | 0.83 | 0.67 | | 0.42 | 1.21 | |
| Control Delay | 231.7 | 49.1 | | 22.4 | 67.4 | | 52.5 | 31.7 | | 18.2 | 130.2 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 231.7 | 49.1 | | 22.4 | 67.4 | | 52.5 | 31.7 | | 18.2 | 130.2 | |
| LOS | F | D | | C | E | | D | C | | B | F | |
| Approach Delay | | 158.2 | | | 54.8 | | | 35.9 | | | 120.1 | |
| Approach LOS | | F | | | D | | | D | | | F | |

Intersection Summary

Area Type: Other
 Cycle Length: 104.8
 Actuated Cycle Length: 104.8
 Offset: 54.5 (52%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.42
 Intersection Signal Delay: 98.2
 Intersection LOS: F
 Intersection Capacity Utilization 124.1%
 ICU Level of Service H
 Analysis Period (min) 15

Splits and Phases: 5: Niagara Street & Thorold Road



Queues
5: Niagara Street & Thorold Road

Total 10 Year
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT |
|------------------------|--------|-------|------|--------|-------|-------|------|--------|
| Lane Group Flow (vph) | 440 | 297 | 126 | 325 | 181 | 720 | 129 | 1309 |
| v/c Ratio | 1.42 | 0.79 | 0.38 | 0.92 | 0.83 | 0.67 | 0.42 | 1.21 |
| Control Delay | 231.7 | 49.1 | 22.4 | 67.4 | 52.5 | 31.7 | 18.2 | 130.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 231.7 | 49.1 | 22.4 | 67.4 | 52.5 | 31.7 | 18.2 | 130.2 |
| Queue Length 50th (m) | ~91.5 | 53.4 | 16.2 | 61.2 | 23.9 | 68.4 | 14.3 | ~173.0 |
| Queue Length 95th (m) | #160.0 | #98.6 | 28.9 | #111.7 | #62.7 | 94.0 | 25.5 | #217.0 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | |
| Base Capacity (vph) | 310 | 385 | 367 | 379 | 228 | 1070 | 337 | 1083 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.42 | 0.77 | 0.34 | 0.86 | 0.79 | 0.67 | 0.38 | 1.21 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Total 10 Year
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|--|---|---|--|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |   | |  |   | |
| Traffic Volume (vph) | 422 | 185 | 100 | 121 | 191 | 121 | 174 | 616 | 75 | 124 | 697 | 560 |
| Future Volume (vph) | 422 | 185 | 100 | 121 | 191 | 121 | 174 | 616 | 75 | 124 | 697 | 560 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 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 | |
| Frt | 1.00 | 0.95 | | 1.00 | 0.94 | | 1.00 | 0.98 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1535 | 1390 | | 1561 | 1391 | | 1452 | 2824 | | 1463 | 2640 | |
| Flt Permitted | 0.29 | 1.00 | | 0.42 | 1.00 | | 0.10 | 1.00 | | 0.28 | 1.00 | |
| Satd. Flow (perm) | 468 | 1390 | | 694 | 1391 | | 155 | 2824 | | 435 | 2640 | |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 440 | 193 | 104 | 126 | 199 | 126 | 181 | 642 | 78 | 129 | 726 | 583 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 22 | 0 | 0 | 8 | 0 | 0 | 132 | 0 |
| Lane Group Flow (vph) | 440 | 278 | 0 | 126 | 303 | 0 | 181 | 712 | 0 | 129 | 1177 | 0 |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Turn Type | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 39.1 | 27.1 | | 34.9 | 25.0 | | 50.6 | 39.4 | | 47.4 | 37.8 | |
| Effective Green, g (s) | 39.1 | 27.1 | | 34.9 | 25.0 | | 50.6 | 39.4 | | 47.4 | 37.8 | |
| Actuated g/C Ratio | 0.37 | 0.26 | | 0.33 | 0.24 | | 0.48 | 0.38 | | 0.45 | 0.36 | |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | |
| Lane Grp Cap (vph) | 296 | 359 | | 313 | 331 | | 213 | 1061 | | 290 | 952 | |
| v/s Ratio Prot | c0.17 | 0.20 | | 0.04 | 0.22 | | c0.09 | 0.25 | | 0.04 | c0.45 | |
| v/s Ratio Perm | c0.38 | | | 0.10 | | | 0.32 | | | 0.16 | | |
| v/c Ratio | 1.49 | 0.78 | | 0.40 | 0.92 | | 0.85 | 0.67 | | 0.44 | 1.24 | |
| Uniform Delay, d1 | 29.9 | 36.0 | | 25.6 | 38.9 | | 26.1 | 27.3 | | 17.8 | 33.5 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 236.1 | 9.4 | | 0.6 | 28.4 | | 25.4 | 3.4 | | 0.8 | 115.3 | |
| Delay (s) | 266.0 | 45.4 | | 26.2 | 67.3 | | 51.5 | 30.7 | | 18.6 | 148.8 | |
| Level of Service | F | D | | C | E | | D | C | | B | F | |
| Approach Delay (s) | | 177.1 | | | 55.8 | | | 34.9 | | | 137.1 | |
| Approach LOS | | F | | | E | | | C | | | F | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 109.0 | | | | HCM 2000 Level of Service | | | | F | |
| HCM 2000 Volume to Capacity ratio | | | 1.33 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | Sum of lost time (s) | | | | 18.8 | | |
| Intersection Capacity Utilization | | | 124.1% | | | ICU Level of Service | | | | H | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: Niagara Street & Site Access

Total 10 Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|--|---|---|--|
| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |   | |  |   |
| Traffic Volume (vph) | 16 | 17 | 1323 | 20 | 32 | 1682 |
| Future Volume (vph) | 16 | 17 | 1323 | 20 | 32 | 1682 |
| Ideal Flow (vphpl) | 1630 | 1630 | 1535 | 1535 | 1651 | 1535 |
| Storage Length (m) | 0.0 | 0.0 | | 0.0 | 15.0 | |
| Storage Lanes | 1 | 0 | | 0 | 1 | |
| Taper Length (m) | 7.5 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 |
| Frt | 0.931 | | 0.998 | | | |
| Flt Protected | 0.976 | | | | 0.950 | |
| Satd. Flow (prot) | 1452 | 0 | 2854 | 0 | 1538 | 2888 |
| Flt Permitted | 0.976 | | | | 0.950 | |
| Satd. Flow (perm) | 1452 | 0 | 2854 | 0 | 1538 | 2888 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 158.9 | | 158.1 | | | 164.9 |
| Travel Time (s) | 11.4 | | 11.4 | | | 11.9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 2% | 2% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 17 | 18 | 1438 | 22 | 35 | 1828 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 35 | 0 | 1460 | 0 | 35 | 1828 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 3.6 | | | 3.6 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | Yes | | | Yes |
| Headway Factor | 1.22 | 1.22 | 1.31 | 1.31 | 1.20 | 1.31 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |
| Intersection Summary | | | | | | |
| Area Type: | Other | | | | | |
| Control Type: | Unsignalized | | | | | |
| Intersection Capacity Utilization | 67.6% | | | ICU Level of Service C | | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis

6: Niagara Street & Site Access

Total 10 Year
PM Peak Hour

| |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|
| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
| Lane Configurations |  | |  | |  |  |
| Traffic Volume (veh/h) | 16 | 17 | 1323 | 20 | 32 | 1682 |
| Future Volume (Veh/h) | 16 | 17 | 1323 | 20 | 32 | 1682 |
| Sign Control | Stop | | Free | | Free | |
| Grade | 0% | | 0% | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 17 | 18 | 1438 | 22 | 35 | 1828 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | TWLTL | | | TWLTL |
| Median storage veh | | | 2 | | | 2 |
| Upstream signal (m) | | | 300 | | | 165 |
| pX, platoon unblocked | 0.76 | 0.88 | | | 0.88 | |
| vC, conflicting volume | 2433 | 730 | | | 1460 | |
| vC1, stage 1 conf vol | 1449 | | | | | |
| vC2, stage 2 conf vol | 984 | | | | | |
| vCu, unblocked vol | 1547 | 426 | | | 1254 | |
| tC, single (s) | 6.8 | 6.9 | | | 4.1 | |
| tC, 2 stage (s) | 5.8 | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 91 | 96 | | | 93 | |
| cM capacity (veh/h) | 196 | 509 | | | 486 | |
| Direction, Lane # | WB 1 | NB 1 | NB 2 | SB 1 | SB 2 | SB 3 |
| Volume Total | 35 | 959 | 501 | 35 | 914 | 914 |
| Volume Left | 17 | 0 | 0 | 35 | 0 | 0 |
| Volume Right | 18 | 0 | 22 | 0 | 0 | 0 |
| cSH | 287 | 1700 | 1700 | 486 | 1700 | 1700 |
| Volume to Capacity | 0.12 | 0.56 | 0.29 | 0.07 | 0.54 | 0.54 |
| Queue Length 95th (m) | 3.3 | 0.0 | 0.0 | 1.9 | 0.0 | 0.0 |
| Control Delay (s) | 19.3 | 0.0 | 0.0 | 13.0 | 0.0 | 0.0 |
| Lane LOS | C | | B | | | |
| Approach Delay (s) | 19.3 | 0.0 | 0.2 | | | |
| Approach LOS | C | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 0.3 | | | |
| Intersection Capacity Utilization | | | 67.6% | ICU Level of Service | C | |
| Analysis Period (min) | | | 15 | | | |

Appendix E

Synchro Reports – Sensitivity



Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Total 10 Year Sensitivity
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |   |   | |   |   |  |  |   |  |  |   |  |
| Traffic Volume (vph) | 288 | 458 | 112 | 233 | 406 | 146 | 109 | 687 | 413 | 116 | 431 | 181 |
| Future Volume (vph) | 288 | 458 | 112 | 233 | 406 | 146 | 109 | 687 | 413 | 116 | 431 | 181 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 30.0 | 105.0 | | 20.0 |
| Storage Lanes | 2 | | 0 | 2 | | 1 | 1 | | 1 | 1 | | 1 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 0.97 | 0.95 | 0.95 | 0.97 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 1.00 | | 0.99 | | 0.97 | 1.00 | | 0.98 | 1.00 | | 0.98 |
| Frt | | 0.971 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 2983 | 2718 | 0 | 2926 | 3276 | 1224 | 1553 | 2832 | 1279 | 1452 | 2832 | 1219 |
| Flt Permitted | 0.950 | | | 0.950 | | | 0.473 | | | 0.298 | | |
| Satd. Flow (perm) | 2946 | 2718 | 0 | 2910 | 3276 | 1194 | 771 | 2832 | 1255 | 455 | 2832 | 1199 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 19 | | | | 149 | | | 198 | | | 108 |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | | 50 |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | | 265.2 |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | | 19.1 |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Peak Hour Factor | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Adj. Flow (vph) | 294 | 467 | 114 | 238 | 414 | 149 | 111 | 701 | 421 | 118 | 440 | 185 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 294 | 581 | 0 | 238 | 414 | 149 | 111 | 701 | 421 | 118 | 440 | 185 |
| 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) | | 7.2 | | | 7.2 | | | 3.6 | | | | 3.6 |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | | 9.4 |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | | 0.6 |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | | Cl+Ex |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | | 0.0 |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

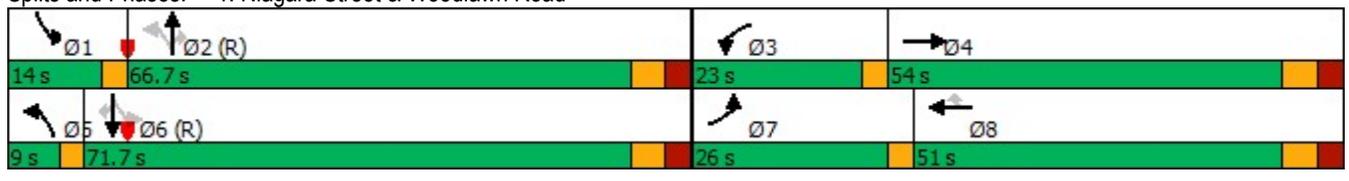
Total 10 Year Sensitivity
AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Turn Type | Prot | NA | | Prot | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | 8 | 2 | | 2 | 6 | | 6 |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | 2 | 1 | 6 | 6 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | 10.0 | 6.0 | 10.0 | 10.0 |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | 17.3 | 9.0 | 17.3 | 17.3 |
| Total Split (s) | 26.0 | 54.0 | | 23.0 | 51.0 | 51.0 | 9.0 | 66.7 | 66.7 | 14.0 | 71.7 | 71.7 |
| Total Split (%) | 16.5% | 34.2% | | 14.6% | 32.3% | 32.3% | 5.7% | 42.3% | 42.3% | 8.9% | 45.5% | 45.5% |
| Maximum Green (s) | 23.0 | 46.6 | | 20.0 | 43.6 | 43.6 | 6.0 | 59.4 | 59.4 | 11.0 | 64.4 | 64.4 |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | 4.1 |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | 3.2 | 0.0 | 3.2 | 3.2 |
| 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 |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | 7.3 | 3.0 | 7.3 | 7.3 |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag |
| Lead-Lag Optimize? | Yes | Yes | | Yes |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 |
| Recall Mode | None | None | | None | None | None | None | C-Max | C-Max | None | C-Max | C-Max |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | 20.0 | | 20.0 | 20.0 |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Act Effct Green (s) | 19.8 | 37.8 | | 17.1 | 35.1 | 35.1 | 84.7 | 71.6 | 71.6 | 87.7 | 73.2 | 73.2 |
| Actuated g/C Ratio | 0.13 | 0.24 | | 0.11 | 0.22 | 0.22 | 0.54 | 0.45 | 0.45 | 0.56 | 0.46 | 0.46 |
| v/c Ratio | 0.79 | 0.87 | | 0.75 | 0.57 | 0.39 | 0.24 | 0.55 | 0.62 | 0.37 | 0.33 | 0.30 |
| Control Delay | 81.9 | 70.0 | | 82.9 | 57.1 | 9.5 | 20.1 | 35.2 | 22.9 | 21.5 | 29.2 | 13.6 |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 81.9 | 70.0 | | 82.9 | 57.1 | 9.5 | 20.1 | 35.2 | 22.9 | 21.5 | 29.2 | 13.6 |
| LOS | F | E | | F | E | A | C | D | C | C | C | B |
| Approach Delay | | 74.0 | | | 55.9 | | | 29.6 | | | 24.1 | |
| Approach LOS | | E | | | E | | | C | | | C | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.87
 Intersection Signal Delay: 44.9 Intersection LOS: D
 Intersection Capacity Utilization 81.8% ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Total 10 Year Sensitivity
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|-------|------|-------|------|------|-------|-------|-------|-------|------|
| Lane Group Flow (vph) | 294 | 581 | 238 | 414 | 149 | 111 | 701 | 421 | 118 | 440 | 185 |
| v/c Ratio | 0.79 | 0.87 | 0.75 | 0.57 | 0.39 | 0.24 | 0.55 | 0.62 | 0.37 | 0.33 | 0.30 |
| Control Delay | 81.9 | 70.0 | 82.9 | 57.1 | 9.5 | 20.1 | 35.2 | 22.9 | 21.5 | 29.2 | 13.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 81.9 | 70.0 | 82.9 | 57.1 | 9.5 | 20.1 | 35.2 | 22.9 | 21.5 | 29.2 | 13.6 |
| Queue Length 50th (m) | 49.0 | 95.0 | 39.7 | 64.5 | 0.0 | 16.7 | 88.7 | 56.8 | 18.0 | 49.1 | 14.8 |
| Queue Length 95th (m) | 65.3 | 111.8 | 54.7 | 78.1 | 18.9 | 32.1 | 124.2 | 110.3 | 34.1 | 68.9 | 36.7 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | | 241.2 | |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 30.0 | 105.0 | | 20.0 |
| Base Capacity (vph) | 435 | 816 | 371 | 905 | 437 | 458 | 1284 | 677 | 329 | 1315 | 614 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.68 | 0.71 | 0.64 | 0.46 | 0.34 | 0.24 | 0.55 | 0.62 | 0.36 | 0.33 | 0.30 |

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Niagara Street & Woodlawn Road

Total 10 Year Sensitivity
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |   |   | |   |   |  |  |   |  |  |   |  |
| Traffic Volume (vph) | 288 | 458 | 112 | 233 | 406 | 146 | 109 | 687 | 413 | 116 | 431 | 181 |
| Future Volume (vph) | 288 | 458 | 112 | 233 | 406 | 146 | 109 | 687 | 413 | 116 | 431 | 181 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | 7.3 | 3.0 | 7.3 | 7.3 |
| Lane Util. Factor | 0.97 | 0.95 | | 0.97 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frbp, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | 0.98 | 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 | 0.97 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 2983 | 2717 | | 2926 | 3276 | 1194 | 1551 | 2832 | 1255 | 1451 | 2832 | 1199 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.47 | 1.00 | 1.00 | 0.30 | 1.00 | 1.00 |
| Satd. Flow (perm) | 2983 | 2717 | | 2926 | 3276 | 1194 | 772 | 2832 | 1255 | 455 | 2832 | 1199 |
| Peak-hour factor, PHF | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| Adj. Flow (vph) | 294 | 467 | 114 | 238 | 414 | 149 | 111 | 701 | 421 | 118 | 440 | 185 |
| RTOR Reduction (vph) | 0 | 14 | 0 | 0 | 0 | 116 | 0 | 0 | 108 | 0 | 0 | 58 |
| Lane Group Flow (vph) | 294 | 567 | 0 | 238 | 414 | 33 | 111 | 701 | 313 | 118 | 440 | 127 |
| Confl. Peds. (#/hr) | 9 | | 5 | 5 | | 9 | 3 | | 5 | 5 | | 3 |
| Heavy Vehicles (%) | 2% | 3% | 7% | 4% | 3% | 4% | 1% | 3% | 2% | 8% | 3% | 7% |
| Turn Type | Prot | NA | | Prot | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | 8 | 2 | | 2 | 6 | | 6 |
| Actuated Green, G (s) | 19.8 | 37.8 | | 17.1 | 35.1 | 35.1 | 80.4 | 71.6 | 71.6 | 83.8 | 73.3 | 73.3 |
| Effective Green, g (s) | 19.8 | 37.8 | | 17.1 | 35.1 | 35.1 | 80.4 | 71.6 | 71.6 | 83.8 | 73.3 | 73.3 |
| Actuated g/C Ratio | 0.13 | 0.24 | | 0.11 | 0.22 | 0.22 | 0.51 | 0.45 | 0.45 | 0.53 | 0.46 | 0.46 |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | 7.3 | 3.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 374 | 651 | | 317 | 729 | 265 | 437 | 1285 | 569 | 308 | 1316 | 557 |
| v/s Ratio Prot | c0.10 | c0.21 | | 0.08 | 0.13 | | 0.01 | 0.25 | | c0.03 | 0.16 | |
| v/s Ratio Perm | | | | | | 0.03 | 0.12 | | c0.25 | 0.18 | | 0.11 |
| v/c Ratio | 0.79 | 0.87 | | 0.75 | 0.57 | 0.13 | 0.25 | 0.55 | 0.55 | 0.38 | 0.33 | 0.23 |
| Uniform Delay, d1 | 66.9 | 57.6 | | 68.2 | 54.6 | 49.0 | 20.4 | 31.2 | 31.3 | 19.9 | 26.7 | 25.3 |
| Progression Factor | 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 | 10.1 | 12.1 | | 9.3 | 0.8 | 0.2 | 0.2 | 1.7 | 3.8 | 0.6 | 0.7 | 1.0 |
| Delay (s) | 77.0 | 69.7 | | 77.5 | 55.4 | 49.2 | 20.7 | 32.9 | 35.1 | 20.6 | 27.4 | 26.2 |
| Level of Service | E | E | | E | E | D | C | C | D | C | C | C |
| Approach Delay (s) | | 72.1 | | | 60.8 | | | 32.6 | | | 26.0 | |
| Approach LOS | | E | | | E | | | C | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 46.9 | HCM 2000 Level of Service | | | | D | | | | |
| HCM 2000 Volume to Capacity ratio | | | 0.66 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | Sum of lost time (s) | | | | 20.7 | | | | |
| Intersection Capacity Utilization | | | 81.8% | ICU Level of Service | | | | D | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total 10 Year Sensitivity
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  |  |  |  |  |
| Traffic Volume (vph) | 351 | 199 | 113 | 48 | 160 | 131 | 113 | 418 | 55 | 91 | 373 | 254 |
| Future Volume (vph) | 351 | 199 | 113 | 48 | 160 | 131 | 113 | 418 | 55 | 91 | 373 | 254 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 50.0 |
| Storage Lanes | 2 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 1 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 |
| Ped Bike Factor | 0.98 | 0.99 | | 0.99 | 0.99 | | 0.99 | 1.00 | | 1.00 | | 0.96 |
| Frt | | 0.946 | | | 0.932 | | | 0.983 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 2983 | 1291 | 0 | 1413 | 1321 | 0 | 1376 | 2683 | 0 | 1376 | 2832 | 1255 |
| Flt Permitted | 0.950 | | | 0.555 | | | 0.430 | | | 0.411 | | |
| Satd. Flow (perm) | 2935 | 1291 | 0 | 821 | 1321 | 0 | 617 | 2683 | 0 | 592 | 2832 | 1208 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 35 | | | 41 | | | 13 | | | | 279 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | | 50 |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | | 249.0 |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | | 17.9 |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Peak Hour Factor | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Adj. Flow (vph) | 386 | 219 | 124 | 53 | 176 | 144 | 124 | 459 | 60 | 100 | 410 | 279 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 386 | 343 | 0 | 53 | 320 | 0 | 124 | 519 | 0 | 100 | 410 | 279 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 7.2 | | | 7.2 | | | 3.6 | | | | 3.6 |
| 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 | | Yes | | | | | | | | | | Yes |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | | 9.4 |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | | 0.6 |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | | Cl+Ex |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | | 0.0 |

Queues
5: Niagara Street & Thorold Road

Total 10 Year Sensitivity
AM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT | SBR |
|------------------------|------|-------|------|-------|------|-------|------|-------|------|
| Lane Group Flow (vph) | 386 | 343 | 53 | 320 | 124 | 519 | 100 | 410 | 279 |
| v/c Ratio | 0.79 | 0.66 | 0.18 | 0.88 | 0.37 | 0.54 | 0.33 | 0.44 | 0.48 |
| Control Delay | 54.5 | 29.8 | 15.1 | 56.9 | 22.9 | 31.2 | 23.6 | 31.6 | 6.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 54.5 | 29.8 | 15.1 | 56.9 | 22.9 | 31.2 | 23.6 | 31.6 | 6.9 |
| Queue Length 50th (m) | 40.9 | 53.3 | 5.7 | 57.4 | 15.9 | 50.0 | 12.6 | 38.9 | 0.0 |
| Queue Length 95th (m) | 57.3 | 78.8 | 10.9 | #90.1 | 31.6 | 70.1 | 26.0 | 56.3 | 22.1 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 | |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | | 50.0 |
| Base Capacity (vph) | 540 | 592 | 302 | 437 | 338 | 966 | 300 | 928 | 583 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.71 | 0.58 | 0.18 | 0.73 | 0.37 | 0.54 | 0.33 | 0.44 | 0.48 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Total 10 Year Sensitivity
AM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  | |  |  | |  |  |  |
| Traffic Volume (vph) | 351 | 199 | 113 | 48 | 160 | 131 | 113 | 418 | 55 | 91 | 373 | 254 |
| Future Volume (vph) | 351 | 199 | 113 | 48 | 160 | 131 | 113 | 418 | 55 | 91 | 373 | 254 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | 6.3 |
| Lane Util. Factor | 0.97 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | 0.96 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.95 | | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 2983 | 1290 | | 1409 | 1322 | | 1371 | 2682 | | 1373 | 2832 | 1208 |
| Flt Permitted | 0.95 | 1.00 | | 0.55 | 1.00 | | 0.43 | 1.00 | | 0.41 | 1.00 | 1.00 |
| Satd. Flow (perm) | 2983 | 1290 | | 823 | 1322 | | 620 | 2682 | | 595 | 2832 | 1208 |
| Peak-hour factor, PHF | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 386 | 219 | 124 | 53 | 176 | 144 | 124 | 459 | 60 | 100 | 410 | 279 |
| RTOR Reduction (vph) | 0 | 22 | 0 | 0 | 30 | 0 | 0 | 9 | 0 | 0 | 0 | 189 |
| Lane Group Flow (vph) | 386 | 321 | 0 | 53 | 290 | 0 | 124 | 510 | 0 | 100 | 410 | 90 |
| Confl. Peds. (#/hr) | 13 | | 8 | 8 | | 13 | 8 | | 5 | 5 | | 8 |
| Heavy Vehicles (%) | 2% | 12% | 11% | 11% | 7% | 7% | 14% | 3% | 33% | 14% | 3% | 4% |
| Turn Type | Prot | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | 8 | | | 2 | | | 6 | | 6 |
| Actuated Green, G (s) | 17.1 | 40.2 | | 31.1 | 27.1 | | 44.2 | 36.2 | | 39.4 | 33.8 | 33.8 |
| Effective Green, g (s) | 17.1 | 40.2 | | 31.1 | 27.1 | | 44.2 | 36.2 | | 39.4 | 33.8 | 33.8 |
| Actuated g/C Ratio | 0.16 | 0.38 | | 0.30 | 0.26 | | 0.42 | 0.35 | | 0.38 | 0.32 | 0.32 |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | 6.3 |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | 2.1 |
| Lane Grp Cap (vph) | 486 | 494 | | 266 | 341 | | 318 | 926 | | 265 | 913 | 389 |
| v/s Ratio Prot | c0.13 | 0.25 | | 0.01 | c0.22 | | c0.03 | c0.19 | | 0.02 | 0.14 | |
| v/s Ratio Perm | | | | 0.05 | | | 0.13 | | | 0.12 | | 0.07 |
| v/c Ratio | 0.79 | 0.65 | | 0.20 | 0.85 | | 0.39 | 0.55 | | 0.38 | 0.45 | 0.23 |
| Uniform Delay, d1 | 42.2 | 26.5 | | 26.9 | 36.9 | | 19.5 | 27.7 | | 22.1 | 28.1 | 26.0 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 8.4 | 2.5 | | 0.3 | 17.1 | | 0.6 | 2.4 | | 0.7 | 1.6 | 1.4 |
| Delay (s) | 50.6 | 29.0 | | 27.2 | 54.0 | | 20.0 | 30.1 | | 22.7 | 29.7 | 27.4 |
| Level of Service | D | C | | C | D | | C | C | | C | C | C |
| Approach Delay (s) | | 40.4 | | | 50.2 | | | 28.2 | | | 28.0 | |
| Approach LOS | | D | | | D | | | C | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 34.9 | | | | HCM 2000 Level of Service | | | | C | |
| HCM 2000 Volume to Capacity ratio | | | 0.69 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | | Sum of lost time (s) | | | 18.8 | | |
| Intersection Capacity Utilization | | | 77.5% | | | | ICU Level of Service | | | D | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

Total 10 Year Sensitivity
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |   |   | |   |   |  |  |   |  |  |   |  |
| Traffic Volume (vph) | 371 | 538 | 171 | 543 | 583 | 195 | 171 | 763 | 406 | 251 | 1000 | 376 |
| Future Volume (vph) | 371 | 538 | 171 | 543 | 583 | 195 | 171 | 763 | 406 | 251 | 1000 | 376 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 110.0 | | 0.0 | 85.0 | | 80.0 | 95.0 | | 30.0 | 105.0 | | 20.0 |
| Storage Lanes | 2 | | 0 | 2 | | 1 | 1 | | 1 | 1 | | 1 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 0.97 | 0.95 | 0.95 | 0.97 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Ped Bike Factor | 0.97 | 0.99 | | 0.98 | | 0.95 | 1.00 | | 0.92 | 0.99 | | 0.96 |
| Frt | | 0.964 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 3013 | 2274 | 0 | 3013 | 3341 | 1248 | 1568 | 2859 | 1267 | 1523 | 2888 | 1305 |
| Flt Permitted | 0.950 | | | 0.950 | | | 0.112 | | | 0.164 | | |
| Satd. Flow (perm) | 2932 | 2274 | 0 | 2962 | 3341 | 1188 | 184 | 2859 | 1171 | 260 | 2888 | 1253 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 27 | | | | 189 | | | 160 | | | 89 |
| Link Speed (k/h) | | 60 | | | 60 | | | 50 | | | | 50 |
| Link Distance (m) | | 388.1 | | | 351.4 | | | 164.9 | | | | 265.2 |
| Travel Time (s) | | 23.3 | | | 21.1 | | | 11.9 | | | | 19.1 |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| 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 (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Adj. Flow (vph) | 382 | 555 | 176 | 560 | 601 | 201 | 176 | 787 | 419 | 259 | 1031 | 388 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 382 | 731 | 0 | 560 | 601 | 201 | 176 | 787 | 419 | 259 | 1031 | 388 |
| 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) | | 7.2 | | | 7.2 | | | 3.6 | | | | 3.6 |
| 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 | | | | | | | | Yes | | | | |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.09 | 1.35 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | | 9.4 |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | | 0.6 |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | | Cl+Ex |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | | 0.0 |

Lanes, Volumes, Timings
1: Niagara Street & Woodlawn Road

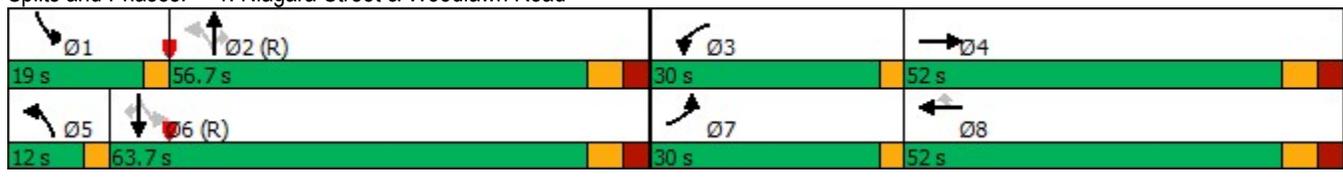
Total 10 Year Sensitivity
PM Peak Hour

| | ↖ | | → | | ↘ | | ↙ | | ← | | ↖ | | ↗ | | ↑ | | ↘ | | ↓ | | ↙ | |
|-------------------------|-------|-------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|--|---|--|---|--|---|--|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR | | | | | | | | | | |
| Turn Type | Prot | NA | | Prot | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | Perm | | | | | | | | | | |
| Protected Phases | 7 | 4 | | 3 | 8 | | | 2 | | | 1 | 6 | | | | | | | | | | |
| Permitted Phases | | | | | | 8 | 2 | | 2 | 6 | | 6 | | | | | | | | | | 6 |
| Detector Phase | 7 | 4 | | 3 | 8 | 8 | 5 | 2 | 2 | 1 | 6 | 6 | | | | | | | | | | |
| Switch Phase | | | | | | | | | | | | | | | | | | | | | | |
| Minimum Initial (s) | 6.0 | 8.0 | | 6.0 | 8.0 | 8.0 | 6.0 | 10.0 | 10.0 | 6.0 | 10.0 | 10.0 | | | | | | | | | | |
| Minimum Split (s) | 9.0 | 15.4 | | 9.0 | 15.4 | 15.4 | 9.0 | 17.3 | 17.3 | 9.0 | 17.3 | 17.3 | | | | | | | | | | |
| Total Split (s) | 30.0 | 52.0 | | 30.0 | 52.0 | 52.0 | 12.0 | 56.7 | 56.7 | 19.0 | 63.7 | 63.7 | | | | | | | | | | |
| Total Split (%) | 19.0% | 33.0% | | 19.0% | 33.0% | 33.0% | 7.6% | 36.0% | 36.0% | 12.0% | 40.4% | 40.4% | | | | | | | | | | |
| Maximum Green (s) | 27.0 | 44.6 | | 27.0 | 44.6 | 44.6 | 9.0 | 49.4 | 49.4 | 16.0 | 56.4 | 56.4 | | | | | | | | | | |
| Yellow Time (s) | 3.0 | 4.1 | | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | 4.1 | 3.0 | 4.1 | 4.1 | | | | | | | | | | |
| All-Red Time (s) | 0.0 | 3.3 | | 0.0 | 3.3 | 3.3 | 0.0 | 3.2 | 3.2 | 0.0 | 3.2 | 3.2 | | | | | | | | | | |
| 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 | | | | | | | | | | |
| Total Lost Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | 7.3 | 3.0 | 7.3 | 7.3 | | | | | | | | | | |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag | | | | | | | | | | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | | | | | | | | | | |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 | | | | | | | | | | |
| Recall Mode | None | None | | None | None | None | None | C-Max | C-Max | None | C-Max | C-Max | | | | | | | | | | |
| Walk Time (s) | | 12.0 | | | 12.0 | 12.0 | | 12.0 | 12.0 | | 12.0 | 12.0 | | | | | | | | | | |
| Flash Dont Walk (s) | | 20.0 | | | 20.0 | 20.0 | | 20.0 | 20.0 | | 20.0 | 20.0 | | | | | | | | | | |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 | | | | | | | | | | |
| Act Effct Green (s) | 23.9 | 44.6 | | 27.0 | 47.7 | 47.7 | 62.7 | 49.4 | 49.4 | 72.7 | 56.4 | 56.4 | | | | | | | | | | |
| Actuated g/C Ratio | 0.15 | 0.28 | | 0.17 | 0.30 | 0.30 | 0.40 | 0.31 | 0.31 | 0.46 | 0.36 | 0.36 | | | | | | | | | | |
| v/c Ratio | 0.84 | 1.10 | | 1.09 | 0.60 | 0.41 | 1.16 | 0.88 | 0.88 | 1.04 | 1.00 | 0.77 | | | | | | | | | | |
| Control Delay | 81.2 | 116.3 | | 124.5 | 50.3 | 9.5 | 151.1 | 63.5 | 51.8 | 99.5 | 77.7 | 45.6 | | | | | | | | | | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | | | | | | | | |
| Total Delay | 81.2 | 116.3 | | 124.5 | 50.3 | 9.5 | 151.1 | 63.5 | 51.8 | 99.5 | 77.7 | 45.6 | | | | | | | | | | |
| LOS | F | F | | F | D | A | F | E | D | F | E | D | | | | | | | | | | |
| Approach Delay | | 104.3 | | | 74.8 | | | 71.1 | | | 73.7 | | | | | | | | | | | |
| Approach LOS | | F | | | E | | | E | | | E | | | | | | | | | | | |

Intersection Summary

Area Type: Other
 Cycle Length: 157.7
 Actuated Cycle Length: 157.7
 Offset: 45 (29%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 120
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.16
 Intersection Signal Delay: 79.5 Intersection LOS: E
 Intersection Capacity Utilization 108.0% ICU Level of Service G
 Analysis Period (min) 15

Splits and Phases: 1: Niagara Street & Woodlawn Road



Queues
1: Niagara Street & Woodlawn Road

Total 10 Year Sensitivity
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|------------------------|-------|--------|--------|-------|------|-------|--------|--------|--------|--------|-------|
| Lane Group Flow (vph) | 382 | 731 | 560 | 601 | 201 | 176 | 787 | 419 | 259 | 1031 | 388 |
| v/c Ratio | 0.84 | 1.10 | 1.09 | 0.60 | 0.41 | 1.16 | 0.88 | 0.88 | 1.04 | 1.00 | 0.77 |
| Control Delay | 81.2 | 116.3 | 124.5 | 50.3 | 9.5 | 151.1 | 63.5 | 51.8 | 99.5 | 77.7 | 45.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 81.2 | 116.3 | 124.5 | 50.3 | 9.5 | 151.1 | 63.5 | 51.8 | 99.5 | 77.7 | 45.6 |
| Queue Length 50th (m) | 63.5 | ~140.5 | ~106.3 | 89.9 | 2.8 | ~46.1 | 129.9 | 88.4 | ~59.5 | 178.7 | 90.0 |
| Queue Length 95th (m) | 81.9 | #183.8 | #145.5 | 113.9 | 25.4 | #99.1 | #161.4 | #155.7 | #120.5 | #229.6 | 137.1 |
| Internal Link Dist (m) | | 364.1 | | 327.4 | | | 140.9 | | | 241.2 | |
| Turn Bay Length (m) | 110.0 | | 85.0 | | 80.0 | 95.0 | | 30.0 | 105.0 | | 20.0 |
| Base Capacity (vph) | 515 | 662 | 515 | 1009 | 490 | 152 | 895 | 476 | 248 | 1032 | 505 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.74 | 1.10 | 1.09 | 0.60 | 0.41 | 1.16 | 0.88 | 0.88 | 1.04 | 1.00 | 0.77 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Niagara Street & Woodlawn Road

Total 10 Year Sensitivity
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |  |  | |  |  |  |  |  |  |  |  |  |
| Traffic Volume (vph) | 371 | 538 | 171 | 543 | 583 | 195 | 171 | 763 | 406 | 251 | 1000 | 376 |
| Future Volume (vph) | 371 | 538 | 171 | 543 | 583 | 195 | 171 | 763 | 406 | 251 | 1000 | 376 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1776 | 1498 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | 7.3 | 3.0 | 7.3 | 7.3 |
| Lane Util. Factor | 0.97 | 0.95 | | 0.97 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.92 | 1.00 | 1.00 | 0.96 |
| 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 | 0.96 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 3013 | 2274 | | 3013 | 3341 | 1188 | 1568 | 2859 | 1171 | 1521 | 2888 | 1253 |
| Flt Permitted | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.11 | 1.00 | 1.00 | 0.16 | 1.00 | 1.00 |
| Satd. Flow (perm) | 3013 | 2274 | | 3013 | 3341 | 1188 | 186 | 2859 | 1171 | 263 | 2888 | 1253 |
| 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) | 382 | 555 | 176 | 560 | 601 | 201 | 176 | 787 | 419 | 259 | 1031 | 388 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 0 | 132 | 0 | 0 | 110 | 0 | 0 | 57 |
| Lane Group Flow (vph) | 382 | 712 | 0 | 560 | 601 | 69 | 176 | 787 | 309 | 259 | 1031 | 331 |
| Confl. Peds. (#/hr) | 25 | | 19 | 19 | | 25 | 19 | | 44 | 44 | | 19 |
| Heavy Vehicles (%) | 1% | 28% | 5% | 1% | 1% | 2% | 0% | 2% | 3% | 3% | 1% | 0% |
| Turn Type | Prot | NA | | Prot | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | | | 8 | 2 | | 2 | 6 | | 6 |
| Actuated Green, G (s) | 23.9 | 44.6 | | 27.0 | 47.7 | 47.7 | 58.4 | 49.4 | 49.4 | 68.4 | 56.4 | 56.4 |
| Effective Green, g (s) | 23.9 | 44.6 | | 27.0 | 47.7 | 47.7 | 58.4 | 49.4 | 49.4 | 68.4 | 56.4 | 56.4 |
| Actuated g/C Ratio | 0.15 | 0.28 | | 0.17 | 0.30 | 0.30 | 0.37 | 0.31 | 0.31 | 0.43 | 0.36 | 0.36 |
| Clearance Time (s) | 3.0 | 7.4 | | 3.0 | 7.4 | 7.4 | 3.0 | 7.3 | 7.3 | 3.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 2.6 | 2.5 | | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 | 2.6 | 2.5 | 2.5 |
| Lane Grp Cap (vph) | 456 | 643 | | 515 | 1010 | 359 | 147 | 895 | 366 | 241 | 1032 | 448 |
| v/s Ratio Prot | 0.13 | c0.31 | | c0.19 | 0.18 | | c0.07 | 0.28 | | c0.11 | 0.36 | |
| v/s Ratio Perm | | | | | | 0.06 | c0.37 | | 0.26 | 0.36 | | 0.26 |
| v/c Ratio | 0.84 | 1.11 | | 1.09 | 0.60 | 0.19 | 1.20 | 0.88 | 0.84 | 1.07 | 1.00 | 0.74 |
| Uniform Delay, d1 | 65.0 | 56.5 | | 65.3 | 46.8 | 40.7 | 42.1 | 51.3 | 50.6 | 35.8 | 50.6 | 44.2 |
| Progression Factor | 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 | 12.5 | 68.4 | | 65.5 | 0.8 | 0.2 | 136.9 | 12.0 | 20.6 | 79.2 | 27.8 | 10.4 |
| Delay (s) | 77.5 | 125.0 | | 130.8 | 47.6 | 40.9 | 179.0 | 63.3 | 71.2 | 115.0 | 78.4 | 54.6 |
| Level of Service | E | F | | F | D | D | F | E | E | F | E | D |
| Approach Delay (s) | | 108.7 | | | 80.8 | | | 80.5 | | | 78.6 | |
| Approach LOS | | F | | | F | | | F | | | E | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 85.6 | HCM 2000 Level of Service | | | | F | | | | |
| HCM 2000 Volume to Capacity ratio | | | 1.13 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 157.7 | Sum of lost time (s) | | | | 20.7 | | | | |
| Intersection Capacity Utilization | | | 108.0% | ICU Level of Service | | | | G | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
5: Niagara Street & Thorold Road

Total 10 Year Sensitivity
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------|---|---|---|---|---|---|--|---|---|---|---|---|
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |   |  | |   |   | |   |   | |   |   |  |
| Traffic Volume (vph) | 422 | 185 | 100 | 121 | 191 | 121 | 174 | 616 | 75 | 124 | 697 | 560 |
| Future Volume (vph) | 422 | 185 | 100 | 121 | 191 | 121 | 174 | 616 | 75 | 124 | 697 | 560 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Storage Length (m) | 50.0 | | 0.0 | 45.0 | | 0.0 | 55.0 | | 0.0 | 55.0 | | 50.0 |
| Storage Lanes | 2 | | 0 | 1 | | 0 | 1 | | 0 | 1 | | 1 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 7.5 | | | 7.5 | | |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 0.99 | | 0.99 | 1.00 | | 0.99 | | 0.95 |
| Frt | | 0.947 | | | 0.942 | | | 0.984 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 2983 | 1389 | 0 | 1568 | 1391 | 0 | 1452 | 2825 | 0 | 1466 | 2888 | 1292 |
| Flt Permitted | 0.950 | | | 0.579 | | | 0.254 | | | 0.267 | | |
| Satd. Flow (perm) | 2943 | 1389 | 0 | 943 | 1391 | 0 | 386 | 2825 | 0 | 409 | 2888 | 1233 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 28 | | | 29 | | | 14 | | | | 560 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | | 50 |
| Link Distance (m) | | 220.2 | | | 152.1 | | | 331.6 | | | | 249.0 |
| Travel Time (s) | | 15.9 | | | 11.0 | | | 23.9 | | | | 17.9 |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Adj. Flow (vph) | 440 | 193 | 104 | 126 | 199 | 126 | 181 | 642 | 78 | 129 | 726 | 583 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 440 | 297 | 0 | 126 | 325 | 0 | 181 | 720 | 0 | 129 | 726 | 583 |
| 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) | | 7.2 | | | 7.2 | | | 3.6 | | | | 3.6 |
| 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 | | Yes | | | | | | | | | | Yes |
| Headway Factor | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 | 1.20 | 1.31 | 1.31 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | | 9.4 |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | | 0.6 |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | | Cl+Ex |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | | 0.0 |

Queues
5: Niagara Street & Thorold Road

Total 10 Year Sensitivity
PM Peak Hour



| Lane Group | EBL | EBT | WBL | WBT | NBL | NBT | SBL | SBT | SBR |
|------------------------|-------|-------|------|--------|-------|-------|------|-------|------|
| Lane Group Flow (vph) | 440 | 297 | 126 | 325 | 181 | 720 | 129 | 726 | 583 |
| v/c Ratio | 0.92 | 0.62 | 0.35 | 0.93 | 0.74 | 0.70 | 0.52 | 0.70 | 0.73 |
| Control Delay | 69.2 | 32.6 | 20.5 | 68.7 | 39.7 | 32.7 | 25.3 | 33.7 | 9.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 69.2 | 32.6 | 20.5 | 68.7 | 39.7 | 32.7 | 25.3 | 33.7 | 9.0 |
| Queue Length 50th (m) | 48.3 | 46.9 | 14.9 | 61.6 | 23.0 | 69.0 | 15.7 | 70.6 | 3.3 |
| Queue Length 95th (m) | #77.6 | 76.4 | 26.5 | #113.2 | #51.5 | 91.6 | 28.0 | 93.3 | 41.2 |
| Internal Link Dist (m) | | 196.2 | | 128.1 | | 307.6 | | 225.0 | |
| Turn Bay Length (m) | 50.0 | | 45.0 | | 55.0 | | 55.0 | | 50.0 |
| Base Capacity (vph) | 483 | 502 | 359 | 373 | 246 | 1033 | 247 | 1032 | 800 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.91 | 0.59 | 0.35 | 0.87 | 0.74 | 0.70 | 0.52 | 0.70 | 0.73 |

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

5: Niagara Street & Thorold Road

Total 10 Year Sensitivity
PM Peak Hour

| |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
| Lane Configurations |   |  | |   |   | |   |   | |   |   |   |
| Traffic Volume (vph) | 422 | 185 | 100 | 121 | 191 | 121 | 174 | 616 | 75 | 124 | 697 | 560 |
| Future Volume (vph) | 422 | 185 | 100 | 121 | 191 | 121 | 174 | 616 | 75 | 124 | 697 | 560 |
| Ideal Flow (vphpl) | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 | 1651 | 1535 | 1535 |
| Total Lost time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | 6.3 |
| Lane Util. Factor | 0.97 | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | 1.00 |
| Frbp, ped/bikes | 1.00 | 0.99 | | 1.00 | 0.99 | | 1.00 | 1.00 | | 1.00 | 1.00 | 0.95 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 0.99 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.95 | | 1.00 | 0.94 | | 1.00 | 0.98 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 2983 | 1390 | | 1556 | 1391 | | 1450 | 2824 | | 1464 | 2888 | 1233 |
| Flt Permitted | 0.95 | 1.00 | | 0.58 | 1.00 | | 0.25 | 1.00 | | 0.27 | 1.00 | 1.00 |
| Satd. Flow (perm) | 2983 | 1390 | | 948 | 1391 | | 387 | 2824 | | 411 | 2888 | 1233 |
| Peak-hour factor, PHF | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Adj. Flow (vph) | 440 | 193 | 104 | 126 | 199 | 126 | 181 | 642 | 78 | 129 | 726 | 583 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 22 | 0 | 0 | 9 | 0 | 0 | 0 | 360 |
| Lane Group Flow (vph) | 440 | 278 | 0 | 126 | 303 | 0 | 181 | 711 | 0 | 129 | 726 | 223 |
| Confl. Peds. (#/hr) | 11 | | 18 | 18 | | 11 | 12 | | 11 | 11 | | 12 |
| Heavy Vehicles (%) | 2% | 1% | 8% | 0% | 1% | 6% | 8% | 1% | 2% | 7% | 1% | 1% |
| Turn Type | Prot | NA | | pm+pt | NA | | pm+pt | NA | | pm+pt | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | | | | 8 | | | 2 | | | 6 | | 6 |
| Actuated Green, G (s) | 16.9 | 34.8 | | 31.7 | 24.8 | | 44.8 | 38.0 | | 43.8 | 37.5 | 37.5 |
| Effective Green, g (s) | 16.9 | 34.8 | | 31.7 | 24.8 | | 44.8 | 38.0 | | 43.8 | 37.5 | 37.5 |
| Actuated g/C Ratio | 0.16 | 0.33 | | 0.30 | 0.24 | | 0.43 | 0.36 | | 0.42 | 0.36 | 0.36 |
| Clearance Time (s) | 3.0 | 6.5 | | 3.0 | 6.5 | | 3.0 | 6.3 | | 3.0 | 6.3 | 6.3 |
| Vehicle Extension (s) | 2.5 | 2.2 | | 2.5 | 2.2 | | 2.5 | 2.1 | | 2.5 | 2.1 | 2.1 |
| Lane Grp Cap (vph) | 481 | 461 | | 326 | 329 | | 234 | 1023 | | 235 | 1033 | 441 |
| v/s Ratio Prot | c0.15 | 0.20 | | 0.03 | c0.22 | | c0.05 | 0.25 | | 0.03 | 0.25 | |
| v/s Ratio Perm | | | | 0.09 | | | c0.28 | | | 0.20 | | 0.18 |
| v/c Ratio | 0.91 | 0.60 | | 0.39 | 0.92 | | 0.77 | 0.70 | | 0.55 | 0.70 | 0.51 |
| Uniform Delay, d1 | 43.2 | 29.2 | | 27.7 | 39.0 | | 23.0 | 28.5 | | 20.2 | 28.9 | 26.4 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 21.9 | 1.7 | | 0.6 | 29.8 | | 14.1 | 3.9 | | 2.1 | 4.0 | 4.1 |
| Delay (s) | 65.1 | 30.9 | | 28.3 | 68.9 | | 37.2 | 32.4 | | 22.3 | 32.9 | 30.5 |
| Level of Service | E | C | | C | E | | D | C | | C | C | C |
| Approach Delay (s) | | 51.3 | | | 57.5 | | | 33.3 | | | 31.0 | |
| Approach LOS | | D | | | E | | | C | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 2000 Control Delay | | | 39.2 | | | | HCM 2000 Level of Service | | | | D | |
| HCM 2000 Volume to Capacity ratio | | | 0.85 | | | | | | | | | |
| Actuated Cycle Length (s) | | | 104.8 | | | | Sum of lost time (s) | | | 18.8 | | |
| Intersection Capacity Utilization | | | 91.4% | | | | ICU Level of Service | | | F | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

c Critical Lane Group