SALVINI CONSULTING
Transportation Engineering and Planning

# Student Residential Apartment

## 1629-1655 Main Street West

## Transportation Impact, Transportation Demand Management Options and Parking Study

City of Hamilton

Prepared for:
**Society Developments**

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# 1 Introduction

This Transportation Impact, Transportation Demand Management Options and Parking Study ("TPS") has been prepared in support of applications for Official Plan and Zoning By-law Amendments for the lands owned by Society Developments on the south side of Main Street West between Ewen Road and Rifle Range Road in the City of Hamilton, municipally known as 1629 – 1655 Main Street West. The study was undertaken as a submission requirement in accordance with pre-submission consultation with City Transportation staff and is based on a Development Concept prepared by mcCallum Sather. The scope of the TPS was discussed and agreed upon with staff.

The primary purpose of this study is to assess the impact of the proposal on the transportation network in the area and identify any improvements that are needed to support the proposal. The study area includes the signalized intersections at Main/Rifle Range/Westbourne and Main/Fortinos/Shell along with the proposed site driveway on Rifle Range Road. The study also covers the Transportation Demand Management (TDM) aspects of the site and provides a justification for the proposed residential parking provision for the site.

It is the finding of this study that the proposal will generate about 129 and 274 trips in the weekday morning and afternoon peak hours, respectively. Site traffic can be accommodated at the study area intersections; however a westbound advance phase is recommended at the Main/Rifle Range/Westbourne intersection in the weekday afternoon peak period to improve traffic operations in the area. No changes are recommended to the area road network as a result of the proposal. In addition, the proposed parking provision is appropriate for the site.

# 2 Proposal and Site Transportation Context

The application proposes a purpose-built student housing development with some ground floor commercial uses. The proposal includes 583 residential units with a total of 948 bedrooms. The commercial area includes a total of 1,465 s.m. of gross floor area including 679 s.m. of office/business incubator space and 786 s.m. of retail uses all located on the ground floor. The tenants of the commercial uses are not known, but they are intended to be uses that support the residents of the building and the many pedestrians in the area.

A Site Location Plan and the Site Concept Plan are attached to this report as figures in Appendix A. A single driveway connection is proposed to serve the site from Rifle Range Road near the south edge of the site. The driveway is located approximately 60 metres from the Main/Rifle Range/Westbourne intersection.

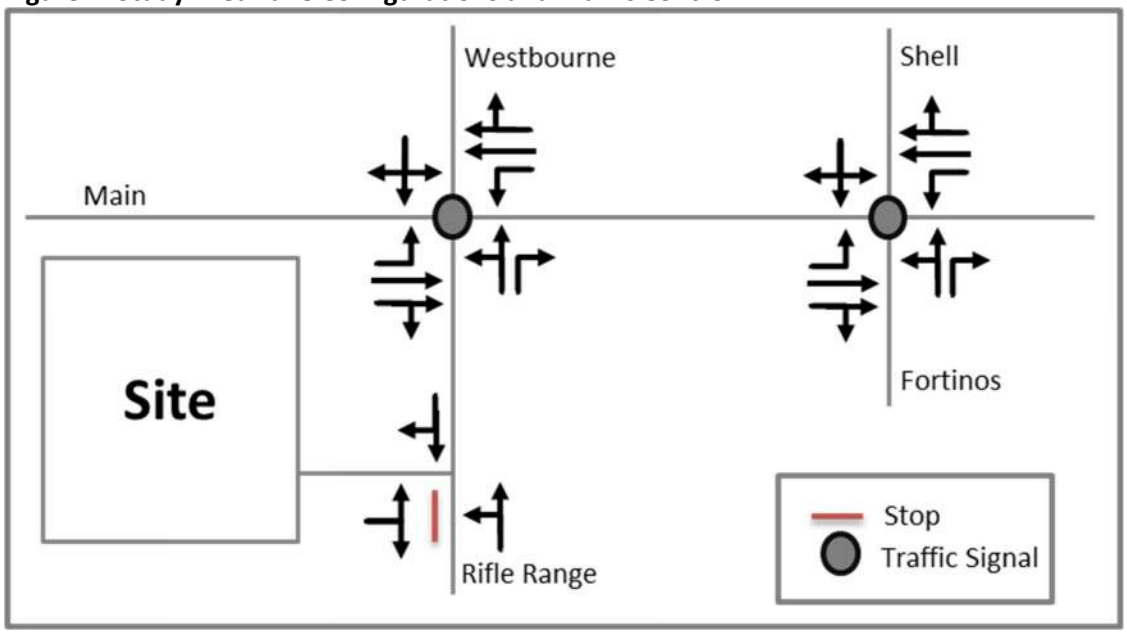
In consultation with City staff, the following intersections were chosen for analysis in this study:

- Main/Rifle Range/Westbourne
- Main/Fortinos/Shell
- Rifle Range/Site Driveway

The weekday morning and afternoon peak hours were chosen to represent peak traffic conditions for all of the proposed uses on the site. Traffic levels for both the residential and office uses are expected to be lower on the weekend when retail uses can also peak.

All the public roads in the study area are under the jurisdiction of the City of Hamilton. Main Street West is a major arterial road with a five-lane urban cross-section (including a centre left-turn-lane). Both Rifle Range Road and Westbourne Road are local roads with a two-lane urban cross section. Both the Fortinos driveway and the Shell driveway at the signalized intersection have a single lane in each direction. Both signalized intersections have auxiliary northbound right turn lanes. The lane configurations are illustrated in Figure 1 below.

**Figure 1: Study Area Lane Configurations and Traffic Control**




Several of the local roads in the area, including Rifle Range Road and Ewen Road, are signed bicycle routes, and the Hamilton-Brantford Rail Trail runs just south of the study area in an east-west direction providing for connections to many community and commercial amenities in the area. There are sidewalks on both sides of the public roads in the study area. Active transportation and the neighborhood land uses are discussed later in this report.

# 3 Existing Traffic

## 3.1 Existing Traffic Volumes

Traffic count data was obtained from the City of Hamilton for the two signalized intersections in the study area. The turning movement counts were from Tuesday, May 7, 2019. The morning peak hour occurred between 8 and 9 and the afternoon peak hour occurred between 4:30 and 5:30. The data was compared to a traffic count commissioned by Salvini Consulting in April of 2016 while classes at McMaster University were still in session and the May 2019 data was found to be higher.

Base 2020 traffic volumes were estimated by increasing the 2019 traffic data by two percent to account for one year of growth. The existing study area traffic volumes are illustrated in the figures in Appendix A.

## 3.2 Traffic Operations Assessment

Traffic operations were assessed at the two Main Street intersections in the two study peak hours using Synchro version 9.0. Existing lane configurations, heavy vehicle percentages, and pedestrian volumes were included in the analysis. Lane widths were reduced to 3.3 metres, in accordance with the City's Traffic Impact Study Guidelines, otherwise, the default Synchro parameters were included.

The existing traffic operations are summarized in the table below and the detailed worksheets are included in Appendix B.

**Table 1: Existing Traffic Operations**

| | Peak Hour | Measure of Effectiveness | Approach Lane | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | EBL | EBTR | WBL | WBTR | NBTL | NBR | SB |
| Main/Rifle Range/Westbourne | AM | Level of service | A | B | A | A | D | B | C |
| | | Delay (s) | 8.0 | 12.6 | 6.7 | 3.8 | 46.7 | 11.2 | 29.3 |
| | | Volume/capacity | 0.01 | 0.64 | 0.27 | 0.23 | 0.52 | 0.39 | 0.06 |
| | | 95$^{th}$ percentile Q (m) | 1.4 | 113.1 | 5.0 | 15.3 | 27.1 | 13.1 | 6.4 |
| | | Storage (m) | - | - | - | - | - | 18 | - |
| | PM | Level of service | A | A | A | A | D | A | C |
| | | Delay (s) | 5.5 | 5.9 | 3.9 | 4.2 | 46.7 | 9.3 | 26.4 |
| | | Volume/capacity | 0.03 | 0.36 | 0.15 | 0.45 | 0.61 | 0.30 | 0.09 |
| | | 95$^{th}$ percentile Q (m) | 2.2 | 42.6 | 3.7 | 19.5 | 35.7 | 11.3 | 8.4 |
| | | Storage (m) | - | - | - | - | - | 18 | - |
| Main/Fortinos/Shell | AM | Level of service | A | A | A | A | D | B | C |
| | | Delay (s) | 0.5 | 0.8 | 4.2 | 2.4 | 37.8 | 15.3 | 21.6 |
| | | Volume/capacity | 0.01 | 0.46 | 0.16 | 0.22 | 0.09 | 0.18 | 0.07 |
| | | 95$^{th}$ percentile Q (m) | 0.1 | 6.9 | 4.7 | 17.3 | 6.6 | 8.4 | 5.0 |
| | | Storage (m) | - | - | - | - | - | 15 | - |
| | PM | Level of service | A | A | A | A | D | B | C |
| | | Delay (s) | 2.3 | 2.3 | 6.1 | 4.2 | 43.4 | 11.6 | 25.8 |
| | | Volume/capacity | 0.01 | 0.32 | 0.33 | 0.40 | 0.40 | 0.38 | 0.02 |
| | | 95$^{th}$ percentile Q (m) | 0.3 | 16.3 | 18.6 | 44.6 | 22.3 | 13.3 | 3.3 |
| | | Storage (m) | - | - | - | - | - | 15 | - |

The analysis indicates that the two Main Street intersections are operating at acceptable levels in both the weekday morning and afternoon peak hours. The 95$^{th}$ percentile queues in the two northbound right turn lanes are not extending outside their available storage. The centre turn lane on Main Street is shared between westbound left turns at Rifle Range Road and eastbound left turns to the Shell station with about 90 metres of storage between the two intersections. The 95$^{th}$ percentile queues for those two movements are assessed to be less than one vehicle in both peak hours.

# 4 Background Traffic

## 4.1 Background Traffic Forecasts

A future horizon year of 2028 was chosen to represent five years beyond the anticipated build out date for the site of 2023. Background traffic for this study was estimated by including a general growth rate for traffic in the study area of two (2) percent per year compounded over the nine-year horizon (from the count date of 2019). In addition, site traffic from two proposed developments in the area at 1630 Main Street West and at 17 Ewen Road was included. Site traffic for 1630 Main Street West was taken from the Transportation Study undertaken by Nextrans Consulting Engineers dated June 2018.

Traffic for the project at 17 Ewen Road was estimated based on information from the Institute of Transportation Engineers (ITE) Trip Generation Manual (10th Edition) for Off-Campus Student Apartments (land use code 225). The project is under common ownership and is also intended to be an apartment building for students. The current plan includes about 275 units and 412 bedrooms. There is not intended to be any commercial space in the building. The traffic generation estimates are summarized in the table below.

**Table 2: Background Traffic Generation Rates and Estimated Trips – 17 Ewen Road**

| Land Use | Bdrm | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|
| | | In | Out | Total | In | Out | Total |
| Off-Campus Student Apartment (ITE LU 225) trips/bedroom | - | 0.05 | 0.07 | 0.12 | 0.13 | 0.13 | 0.25 |
| Residential trips | 412 | 20 | 29 | 49 | 52 | 52 | 103 |

The background traffic for 17 Ewen Road was assigned to the road network in accordance with the general pattern of traffic in the area in the following manner:

**Table 3: Trip Distribution - 17 Ewen Road**

| Direction | Peak Hour | |
|---|---|---|
| | AM | PM |
| Westbound on Main | 30% | 50% |
| Eastbound on Main | 60% | 40% |
| To and from the north on Westbourne | 0% | 0% |
| To and from the south on Rifle Range | 10% | 10% |
| Total | 100% | 100% |

Future background traffic volumes (growth, 1630 Main Street, 17 Ewen Road and future background) are illustrated in the figures in Appendix A.

## 4.2 Traffic Operations Assessment

Traffic operations were assessed at the two Main Street intersections in the weekday morning and afternoon peak hours under future background traffic conditions. The traffic operations are summarized in the table below and the detailed worksheets are included in Appendix C.

**Table 4: Future Background Traffic Operations**

| | Peak Hour | Measure of Effectiveness | Approach Lane | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | EBL | EBTR | WBL | WBTR | NBTL | NBR | SB |
| Main/Rifle Range/Westbourne | AM | Level of service | A | B | C | A | D | A | C |
| | | Delay (s) | 9.8 | 19.6 | 25.5 | 4.4 | 47.3 | 9.9 | 27.4 |
| | | Volume/capacity | 0.01 | 0.82 | 0.46 | 0.29 | 0.59 | 0.44 | 0.06 |
| | | 95th percentile Q (m) | 1.9 | 201.6 | 17.9 | 18.2 | 32.2 | 14.4 | 6.7 |
| | | Storage (m) | - | - | - | - | - | 18 | - |
| | PM | Level of service | A | A | A | A | D | B | C |
| | | Delay (s) | 8.0 | 8.5 | 7.8 | 6.4 | 47.3 | 10.3 | 23.2 |
| | | Volume/capacity | 0.06 | 0.47 | 0.35 | 0.58 | 0.70 | 0.35 | 0.09 |
| | | 95th percentile Q (m) | 3.2 | 69.0 | 14.5 | 80.7 | 44.9 | 15.0 | 8.7 |
| | | Storage (m) | - | - | - | - | - | 18 | - |
| Main/Fortinos/Shell | AM | Level of service | A | A | A | A | D | C | C |
| | | Delay (s) | 0.4 | 1.5 | 7.6 | 2.5 | 38.2 | 20.4 | 20.5 |
| | | Volume/capacity | 0.01 | 0.57 | 0.28 | 0.27 | 0.10 | 0.21 | 0.08 |
| | | 95th percentile Q (m) | 0.1 | 8.5 | 7.7 | 21.8 | 7.5 | 10.6 | 5.4 |
| | | Storage (m) | - | - | - | - | - | 15 | - |
| | PM | Level of service | A | A | B | A | D | B | C |
| | | Delay (s) | 2.8 | 3.0 | 12.4 | 6.0 | 44.2 | 19.7 | 24.0 |
| | | Volume/capacity | 0.02 | 0.42 | 0.53 | 0.53 | 0.45 | 0.46 | 0.03 |
| | | 95th percentile Q (m) | 0.3 | 20.9 | 34.4 | 66.6 | 25.0 | 20.8 | 3.5 |
| | | Storage (m) | - | - | - | - | - | 15 | - |

The two Main Street intersections are expected to continue to operate at acceptable levels in both the weekday morning and afternoon peak hours under future background traffic conditions. The 95th percentile queues for the two northbound right turn lanes are not extending outside their storage except in the weekday afternoon peak hour when the northbound right turn 95th percentile queue at the Fortinos driveway is expected to reach about 20 metres.

The centre turn lane on Main Street is shared between westbound left turns at Rifle Range Road and eastbound left turns to the Shell station with about 90 metres of storage between the two intersections. The 95th percentile queues for those two movements are expected to be less than 20 metres in both peak hours.

# 5 Site Traffic

The amount of traffic generated by the site was estimated based on a review of rates outlined in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition. Three categories were chosen to estimate traffic for the residential, retail and office uses. The Off-Campus Student Apartment (land use code 225) category was chosen for the residential, the Shopping Centre (land use code 820) category was chosen for the retail, and the General Office (land use code 710) category was chosen for the office uses. The traffic generation estimates for the site are summarized in the table below.

**Table 5: Site Traffic Generation Rates and Estimated Trips**

| Land Use | | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|
| | | In | Out | Total | In | Out | Total |
| Off-Campus Student Apartment (ITE LU 225) Trips/bedroom | - | 0.05 | 0.07 | 0.12 | 0.13 | 0.13 | 0.25 |
| Residential trips | 948 bdrm | 47 | 67 | 114 | 119 | 119 | 237 |
| Shopping Centre (ITE LU 820) Trips/1,000 s.f. | - | 0.58 | 0.36 | 0.94 | 1.83 | 1.98 | 3.81 |
| Retail trips | 7,511 s.f. | 4 | 3 | 7 | 14 | 15 | 29 |
| General Office (ITE LU 710) Trips/1,000 s.f. | - | 1.00 | 0.16 | 1.16 | 0.18 | 0.97 | 1.15 |
| Office trips | 7,317 s.f. | 7 | 1 | 8 | 1 | 7 | 8 |
| Total trips | - | 58 | 71 | 129 | 134 | 140 | 274 |

The resulting estimated site traffic is 129 and 274 vehicle trips in the weekday morning and afternoon peak hours, respectively.

The site traffic estimate is conservative for several reasons. Firstly, Salvini Consulting has collected trip generation data at purpose-built student apartment buildings in Waterloo and Hamilton that suggest trip generation rates that are far less than the ITE rates – about 25 to 30 percent of the ITE rates (a reduction of 70 to 75 percent). Staff indicated that ITE rates were to be used in this assessment to be conservative. Secondly, traffic volumes were not reduced for interaction among the uses. And finally, there are existing uses on the site today that are generating traffic that will be removed from the network when the site is redeveloped. The existing site traffic was not removed from the network in the analysis.

The site traffic trips were distributed in accordance with local traffic patterns through the study area in the following manner:

**Table 6: Site Trip Distribution**

| Direction | Peak Hour | |
|---|---|---|
| | AM | PM |
| Westbound on Main | 30% | 50% |
| Eastbound on Main | 60% | 40% |
| To and from the north on Westbourne | 0% | 0% |
| To and from the south on Rifle Range | 10% | 10% |
| Total | 100% | 100% |

Site traffic volumes are included in the figures in Appendix A.

# 6 Future Total Traffic

Future total traffic was determined by adding site traffic to future background traffic. The future total traffic volumes for the two study peak hours are illustrated in the figures in Appendix A.

## 6.1 Traffic Operations Assessment

The traffic operations for the two study area intersections in the two study peak hours are summarized in the table below and the detailed worksheets are included in Appendix D.

**Table 7: Future Total Traffic Operations – Signalized Main Street Intersections**

| | Peak Hour | Measure of Effectiveness | Approach Lane | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | EBL | EBTR | WBL | WBTR | NBTL | NBR | SB |
| Main/Rifle Range/Westbourne | AM | Level of service | B | C | C | A | D | B | C |
| | | Delay (s) | 11.8 | 27.2 | 25.5 | 4.9 | 47.2 | 14.4 | 25.4 |
| | | Volume/capacity | 0.01 | 0.91 | 0.51 | 0.30 | 0.64 | 0.54 | 0.06 |
| | | 95th percentile Q (m) | 2.2 | 226.7 | 16.7 | 18.2 | 36.4 | 22.7 | 6.4 |
| | | Storage (m) | - | - | - | - | - | 18 | - |
| | PM | Level of service | B | B | C | A | D | B | B |
| | | Delay (s) | 10.4 | 11.5 | 34.0 | 9.4 | 48.4 | 14.4 | 19.9 |
| | | Volume/capacity | 0.07 | 0.54 | 0.76 | 0.63 | 0.79 | 0.43 | 0.07 |
| | | 95th percentile Q (m) | 3.6 | 81.4 | 47.7 | 112.7 | 62.2 | 26.2 | 8.3 |
| | | Storage (m) | - | - | - | - | - | 18 | - |
| Main/Fortinos/Shell | AM | Level of service | A | A | A | A | D | C | C |
| | | Delay (s) | 0.8 | 2.7 | 8.3 | 2.6 | 38.2 | 20.4 | 20.5 |
| | | Volume/capacity | 0.01 | 0.58 | 0.29 | 0.28 | 0.10 | 0.21 | 0.08 |
| | | 95th percentile Q (m) | 0.1 | 26.8 | 8.2 | 22.5 | 7.5 | 10.6 | 5.4 |
| | | Storage (m) | - | - | - | - | - | 15 | - |
| | PM | Level of service | A | A | B | A | D | C | C |
| | | Delay (s) | 3.0 | 3.3 | 14.7 | 6.3 | 44.2 | 23.2 | 24.0 |
| | | Volume/capacity | 0.02 | 0.44 | 0.57 | 0.56 | 0.45 | 0.48 | 0.03 |
| | | 95th percentile Q (m) | 0.2 | 26.6 | 39.7 | 72.6 | 25.0 | 23.0 | 3.5 |
| | | Storage (m) | - | - | - | - | - | 15 | - |

The two Main Street intersections are expected to continue to operate at acceptable levels in both the weekday morning and afternoon peak hours under future total traffic conditions, however, there are some queuing considerations.

The 95th percentile queues northbound at the Main/Fortinos/Shell intersection are expected to exceed the available storage (about 15 metres) in the right turn lane in the afternoon peak hour. The queues for the right turning vehicles (95th percentile queue of 23 metres) and the through and left turning vehicles (95th percentile queue of 25 metres) in the northbound direction will combine at the end of the right turn lane resulting in slightly longer queues, but there is sufficient space to accommodate them. Extending the northbound right turn lane would be difficult because of the geometry at the intersection. Capacity at the intersection is good with volume to capacity ratios below 0.5 in both peak hours.

At the Main/Rifle Range/Westbourne intersection, the 95th percentile northbound right turn queues are also expected to exceed the available storage in the turn lane in both the morning and afternoon peak hours. In the morning, the 95th percentile right turn queue is only just extending beyond the available storage (22.7 metres versus 18 metres of available storage) and the through and left turn 95th percentile queue is not expected to be long (35.4 metres); there is room for the combined queue before any of the driveways, the closest being the site driveway

about 60 metres from the intersection. However, in the afternoon peak hour, the through and left turn 95th percentile queue is expected to be just over 60 metres. Additionally, in the westbound direction, the 95th percentile queue for through traffic is expected to be 112.7 metres, when the space between the two study area intersections is just over 90 metres.

To address this issue, the Main/Rifle Range/Westbourne intersection was assessed in the afternoon peak hour with a westbound advance phase to see if the additional phase would reduce the longer intersection queues. The results of the analysis are summarized in the table below and the detailed worksheets are included in Appendix D.

**Table 8: Future Total Traffic Operations – Main/Rifle Range/Westbourne, PM Peak Hour**

| Signal Timing | Measure of Effectiveness | Approach Lane | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | EBL | EBTR | WBL | WBTR | NBTL | NBR | SB |
| Existing | Level of service | B | B | C | A | D | B | B |
| | Delay (s) | 10.4 | 11.5 | 34.0 | 9.4 | 48.4 | 14.4 | 19.9 |
| | Volume/capacity | 0.07 | 0.54 | 0.76 | 0.63 | 0.79 | 0.43 | 0.07 |
| | 95th percentile Q (m) | 3.6 | 81.4 | 47.7 | 112.7 | 62.2 | 26.2 | 8.3 |
| | Storage (m) | - | - | - | - | - | 18 | - |
| Add WBLT Phase | Level of service | B | C | B | A | D | A | B |
| | Delay (s) | 16.7 | 21.2 | 19.8 | 9.8 | 46.4 | 8.7 | 19.3 |
| | Volume/capacity | 0.07 | 0.69 | 0.56 | 0.64 | 0.78 | 0.40 | 0.07 |
| | 95th percentile Q (m) | 4.5 | 108.5 | 32.1 | 59.5 | 59.9 | 18.0 | 8.0 |
| | Storage (m) | - | - | - | - | - | 18 | - |

The addition of a westbound advance phase to the signal timing at the Main/Rifle Range/Westbourne intersection in the afternoon peak hour and an adjustment to the splits results in a decrease in the 95th percentile queues in both the westbound and northbound directions so that the northbound right turn queue does not extend beyond the available storage and the northbound through and left turn queue does not extend beyond the proposed driveway. In addition, the westbound queues would not extend back to the Fortinos/Shell intersection.

As traffic grows in the study area and the planned development along with development of the subject site proceeds, the City should consider adding a westbound advance phase to the signal timing plan at the Main/Rifle Range/Westbourne intersection in the afternoon peak hour.

Traffic operations were also assessed at the site driveway under future total traffic conditions. The results are summarized in the table below and the detailed worksheets are attached in Appendix D.

**Table 9: Future Total Traffic Operations – Rifle Range/Site**

| Peak Hour | Measure of Effectiveness | Approach Lane | | |
|---|---|---|---|---|
| | | EB | NB | SB |
| AM | Level of service | B | A | - |
| | Delay (s) | 14.1 | 0.3 | - |
| | Volume/capacity | 0.16 | 0.01 | - |
| | 95$^{th}$ percentile Q (m) | 4.4 | 0.1 | - |
| PM | Level of service | C | A | - |
| | Delay (s) | 17.3 | 0.5 | - |
| | Volume/capacity | 0.34 | 0.01 | - |
| | 95$^{th}$ percentile Q (m) | 11.4 | 0.3 | - |

The site driveway is expected to operate at acceptable levels in both weekday peak hours under future total traffic conditions.

# 7 Transportation Demand Management

## 7.1 Site Context

The proposed building is meant to serve the post-secondary student population of nearby McMaster University and will be designed to meet the needs of the student demographic. The site is located about 750 metres from the University campus and will provide easy access for students to walk and cycle to school. The commercial uses in the building are intended to support the student population with 679 s.m. of office/incubator space for student entrepreneurs and the remaining 786 s.m. dedicated to retail commercial uses that would support the residents and the significant walking and cycling population nearby.

Nearby land uses generally include retail uses along Main Street West and residential uses to the north and south of Main Street. There are many commercial amenities nearby including restaurants, neighborhood commercial uses and a grocery store adjacent to the site. The University Plaza is located less than a kilometre to the west on Main Street and includes several retail outlets including Canadian Tire, LCBO and Dollarama. Students living in the proposed building would have access to their day-to-day commercial needs within close walking and cycling distance.

## 7.2 Existing TDM Opportunities

The Site is well-served by public transit and active transportation infrastructure (see attached Area Transit Plan and Area Cycling Map in Appendix A).

Several local transit routes provide options for travelling within Hamilton to McMaster University, to commercial centres where students may shop or work, to recreational amenities, and to GO Transit terminals where students can connect to regional transit. The local transit services are summarized in the table below.

**Table 10: Local Transit Service**

| Routes | | Frequency (minutes) | | |
|---|---|---|---|---|
| | | Weekday | Evening | Weekend/Holiday |
| Along Main | 1A (King) | 12-15 | - | - |
| | 10 (B Line Express) | 12-15 | 20 | 15 (Sat) |
| | 52,5 (Delaware) | 15 | 15-30 | 15-20 |
| Along Whitney | 51,5 (Delaware) | 15 | 30 | 30-40 |

Frequent local transit service is available connecting the site to many destinations within the City of Hamilton including Hamilton GO Centre. Bus stops are available at the corner of Main Street West and both Ewen Road and Rifle Range Road providing close access for residents of the proposed building. Additional stops servicing alternate routes are available at the Whitney/Rifle Range intersection less than 450 metres from the site.

GO Transit provides all day train and bus service from both the West Harbour GO Station and Hamilton GO Centre. In addition, close to 50 bus trips per weekday and 30 trips on Saturdays and Sundays in each direction are provided at the McMaster University GO Bus Terminal connecting students to the GTA and beyond.

Bicycle parking for the project is proposed at 270 spaces. In addition, Hamilton Bike Share hubs are located at the Fortinos driveway to Rifle Range Road very close to the site (about 150 metres away) and at 1686 Main Street West (about 200m away) providing additional access to bikes for students living in the building. There are many other Hamilton Bike Share hubs located beyond 200 metres, but within comfortable walking distance of the Site.

A number of significant cycling facilities are available in the area to facilitate and encourage cycling. Ewen Road, Rifle Range Road, West Park Avenue, Westbourne Road and Whitney Avenue are all designated cycling routes. At the north end of Westbourne Road, Sanders Boulevard provides dedicated bike lanes with direct access into the University lands through the Cootes Drive Trail.

The Hamilton-Brantford Rail Trail is located just south of the Site; it is an interurban multi-use trail that provides direct access to key destinations within Hamilton along with connecting to several municipalities in Southern Ontario over its 80 kilometre length. The University Plaza on Osler Drive is less than one kilometre away from the Site via the Trail, providing access to a number of commercial amenities for students in a right of way that is entirely protected for cyclists and pedestrians with the exception of crossing Ewen Road.

For pedestrian access within the local area, sidewalks are generally provided on both sides of all the area roads and protected crossing opportunities of Main Street are available in several locations, including at the Rifle Range Road signalized intersection.

## 7.3 Proposed TDM Measures

Transportation Demand Management, or TDM, includes measures that encourage non-auto driver modes, providing choices for how to travel, as well as a means of reducing the number of trips that are needed. Several TDM measures are proposed as part of the site development.

**Planning and Design**: The development concept that is being proposed has integrated several elements to improve transportation accessibility for all modes and to support TDM on the site.

The mix of uses provides commercial options for residents in the building, potentially reducing the number of external trips. The building has been oriented to the street with commercial frontages on both Main Street and Ewen Road and multiple pedestrian connections are available between the site and the street network. A single driveway on Rifle Range Road is proposed to serve the vehicular traffic for the site.

**Walking and Cycling**: Bicycle parking for the site is proposed in both a short-term at-grade format for visitors and a longer-term secure format for residents and employees. In addition, shower facilities and change rooms will be made available to employees of the commercial uses in the building. Sidewalks and landscaping around the site are planned to be retained or enhanced with multiple pedestrian connections to the adjacent pedestrian network.

**Transit**: The pedestrian connections from the building will provide the opportunity for access to the adjacent bus stops at the southwest corner of Main/Ewen, the northeast corner of Main/Westbourne and the southeast corner of Main/Rifle Range. There are also sidewalks connecting the site to the bus stops on Whitney Avenue on the northeast and southwest corners of the intersection with Rifle Range Road less than 450 metres from the site. Transit information will be provided in the management office on the site. McMaster University students typically receive a transit pass with their registration, but the program has been suspended for fall 2020, presumably because courses are predominantly virtual. It is likely that the University transit pass program will resume in the future when students return to campus.

**Parking**: A reduction in the required parking is being included with this application to address the reduced demand generated at purpose-built student apartments. Parking spaces will be sold separately from units and it is proposed that the parking for the commercial uses and residential visitors will all be shared. More detail on the parking for the site is included later in this report.

**Bikeshare**: Bikeshare is available through Hamilton Bike Share. Two bike share hubs are located within 200 metres of the site on Rifle Range Road near the rail trail and near the Main/Osler intersection just west of the site. Beyond 200 metres there are several hubs available in the area.

**Wayfinding and Trip Planning**: Wayfinding information will be provided throughout the site to ensure pedestrians find the best connections to and from the building and that the bicycle parking (both short-term and longer-term) is easily located. In addition, travel planning resources for transit and active transportation will be made available through the management office on-site.

**Education/Promotion**: The site's location relative to commercial amenities and McMaster University will be highlighted in the marketing materials for the building as well as the transportation options provided by nearby transit services and active transportation infrastructure.

The many TDM measures that have been incorporated into the proposal will serve to encourage travel options by transit, walking and cycling for residents, visitors and employees of the building. There is likely to be a reduction in the number of trips generated by the proposal along with a reduction in the parking demand as discussed in the following section of this report.

# 8 Parking Assessment

The proposal includes 307 parking spaces to serve the residential and commercial uses in the building. The recommendation of this study is that parking for the commercial uses be provided in accordance with the requirements in the City of Hamilton Zoning By-law and that the parking for the residential uses be provided at a rate of 0.25 spaces per bedroom or 0.40 spaces per unit (for 948 bedrooms and 583 units). The residential recommendation is based on data collected by Salvini Consulting at other purpose-built student apartments as outlined below.

The parking requirements in the Zoning By-law are summarized in the table below.

**Table 11: Parking Requirements and Provision**

| Use | Zoning By-law Requirement | | | Spaces Provided | Requirement Met? |
|---|---|---|---|---|---|
| | ZBL | Size | Spaces | | |
| Residential | 0.3 s/u for units <50 sm | 109 units | 32.7 | | |
| | 0.7 s/u for 1-14 units >50 sm | 14 units | 9.8 | | |
| | 0.85 s/u for 15-50 units >50 sm | 36 units | 30.6 | | |
| | 1 s/u for 51+ units >50 sm | 424 units | 424 | | |
| | Total | 583 units | 497 | 268 | No |
| Office | 0 for first 450 sm | 450 s.m. | 0 | | |
| | 1 s/30 sm >450 sm | 229 s.m. | 8 | | |
| | Total | 679 s.m. | 8 | 8 | Yes |
| Retail | 1 s/8 sm restaurant | 200 s.m. | 25 | | |
| | 3 s/unit for take out restaurant | 2 unit | 6 | | |
| | Retail <450 s.m. | 201 s.m. | 0 | | |
| | Total | 786 s.m. | 31 | 31 | Yes |
| Total | | | 536 | 307 | No |

The retail space was assessed as a combination of restaurant space, partly with and partly without seating, and general retail space to provide an estimate of the parking needs for the retail uses on the site. The retail uses are intended to be neighborhood related and may include restaurant or other retail uses.

Salvini Consulting Inc. has collected parking use data at many comparable purpose-built student apartment buildings in London and Waterloo in order to understand the demand for parking in these types of buildings. We know from discussion with clients who operate the buildings that students who live close to campus (within walking distance) primarily have cars to travel locally for groceries and other errands and to travel on weekends home or to other destinations. They do not typically drive to school.

The transportation context for students in Hamilton is considered most comparable to Waterloo given access to local transit, cycling infrastructure and GO Transit. Transit access in Hamilton both locally and regionally is as good as or better than Waterloo; in particular, there are better connections to the GTA from Hamilton for students travelling on weekends via GO buses and all-day GO Rail service. In Waterloo, GO Rail is only available in the peak direction in the peak periods during the week. At other times, GO buses offer service to the GTA via Mississauga on

an hourly basis. In London, local transit is available for in-town trips, but there is no GO Transit Service. Regional travel is available using VIA rail or private bus services.

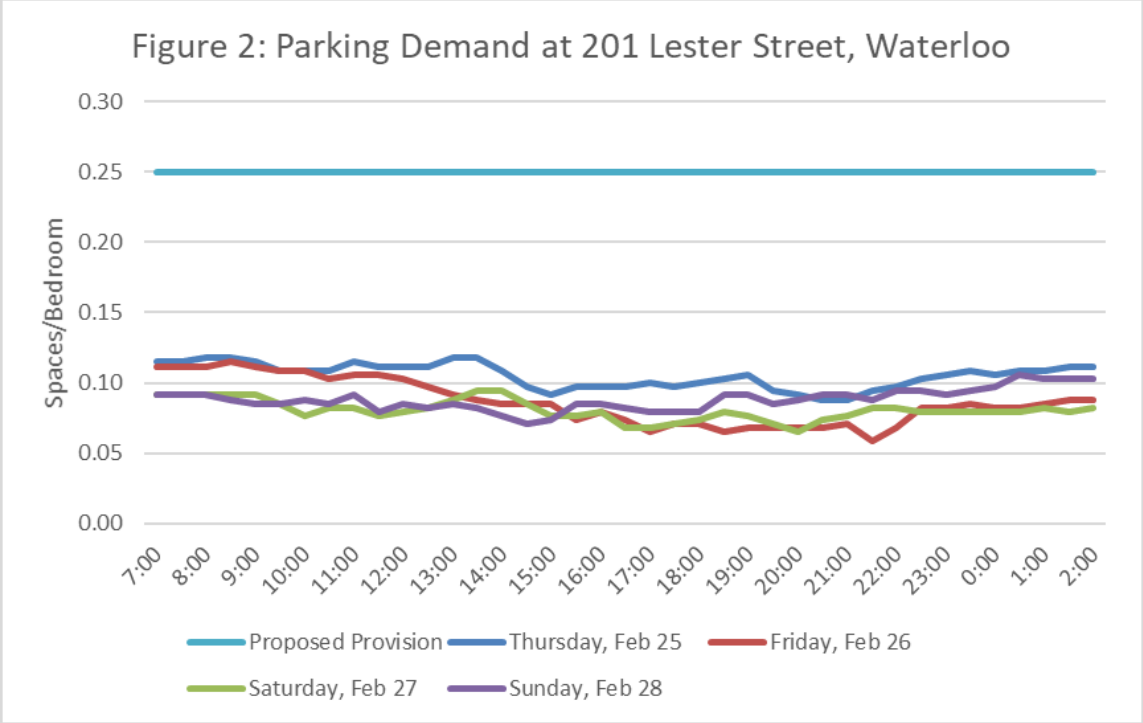
Extensive surveys were undertaken on Thursday to Sunday, February 25 to 28 of 2016 at three comparable student apartment buildings from 7:00 AM until 2:00 AM each day. The surveyor recorded the number of cars parked on-site every half hour over the course of the survey. Two of the buildings are located in Waterloo near the University of Waterloo and Wilfred Laurier University and the third is located in London, near the University of Western Ontario. The surveys were undertaken when school was in session and the owners confirmed that all three buildings were fully occupied at the time of the surveys.

The parking rates measured during the surveys are reported in spaces per bed and include visitor parking (which is free in all three buildings). In student apartment buildings there are sometimes rooms with more than one bed, so that the number of beds in the building is higher than the number of bedrooms. This is the case at 1235 Richmond Street in London, whereas at the two Waterloo buildings, the number of beds is the same as the number of bedrooms.

The peak parking use for each building occurred overnight during the week. The peak data is summarized in the table below and the more detailed profiles are shown in figures 2 through 5. Two profiles were included for the London site showing the data in spaces/bedroom and spaces/bed.

**Table 12: February 25-28, 2016 Surveyed Parking Use (including visitors)**

| Location | Peak Parking Demand (spaces/bed) | | | |
|---|---|---|---|---|
| | Thursday | Friday | Saturday | Sunday |
| 201 Lester, Waterloo | 0.12 | 0.11 | 0.09 | 0.11 |
| 202 Lester, Waterloo | 0.14 | 0.14 | 0.13 | 0.13 |
| 1235 Richmond, London | 0.18 | 0.17 | 0.17 | 0.18 |



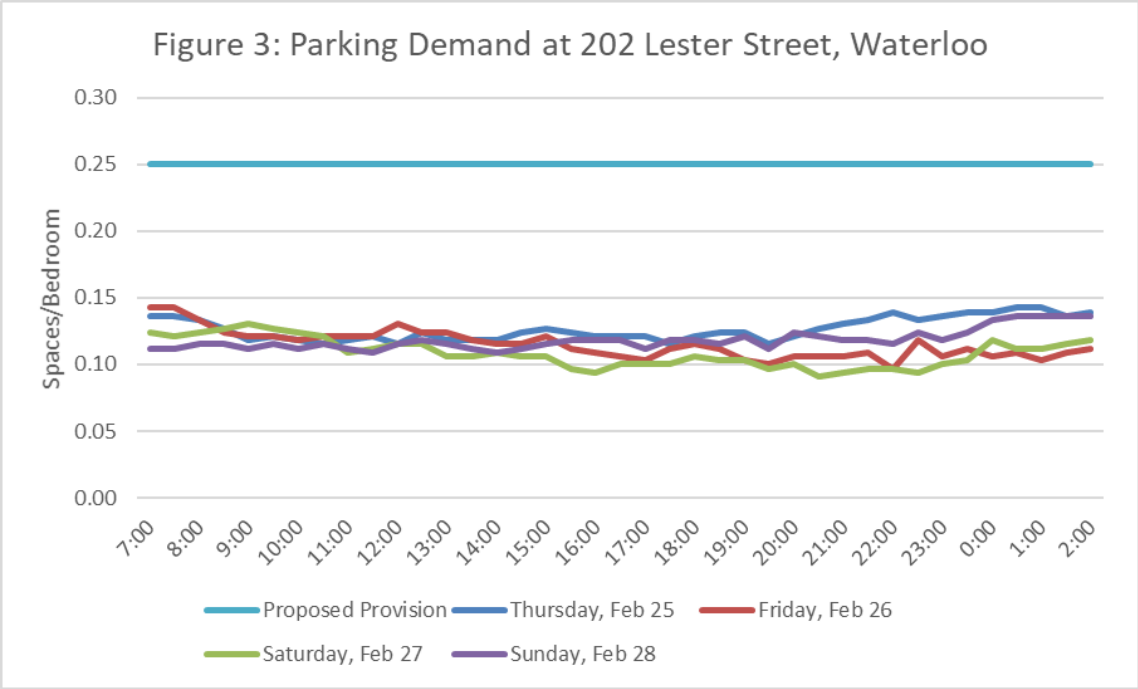


Figure 3: Parking Demand at 202 Lester Street, Waterloo
Spaces/Bedroom
0.30
0.25
0.20
0.15
0.10
0.05
0.00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
Proposed Provision
Thursday, Feb 25
Friday, Feb 26
Saturday, Feb 27
Sunday, Feb 28

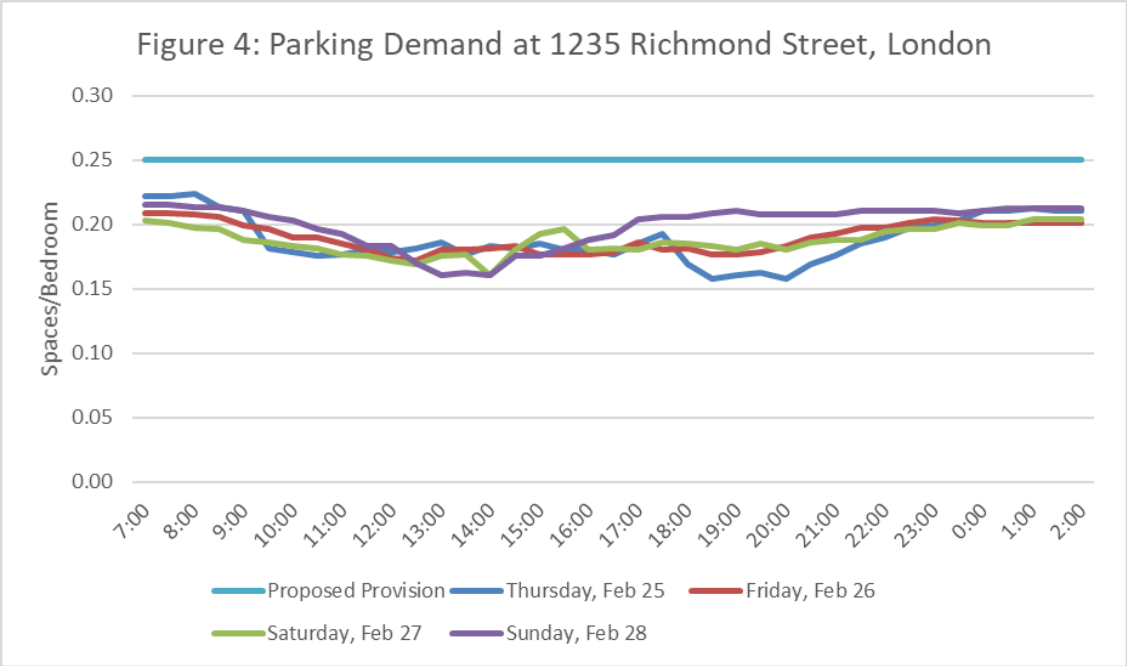


Figure 4: Parking Demand at 1235 Richmond Street, London
Spaces/Bedroom
0.30
0.25
0.20
0.15
0.10
0.05
0.00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
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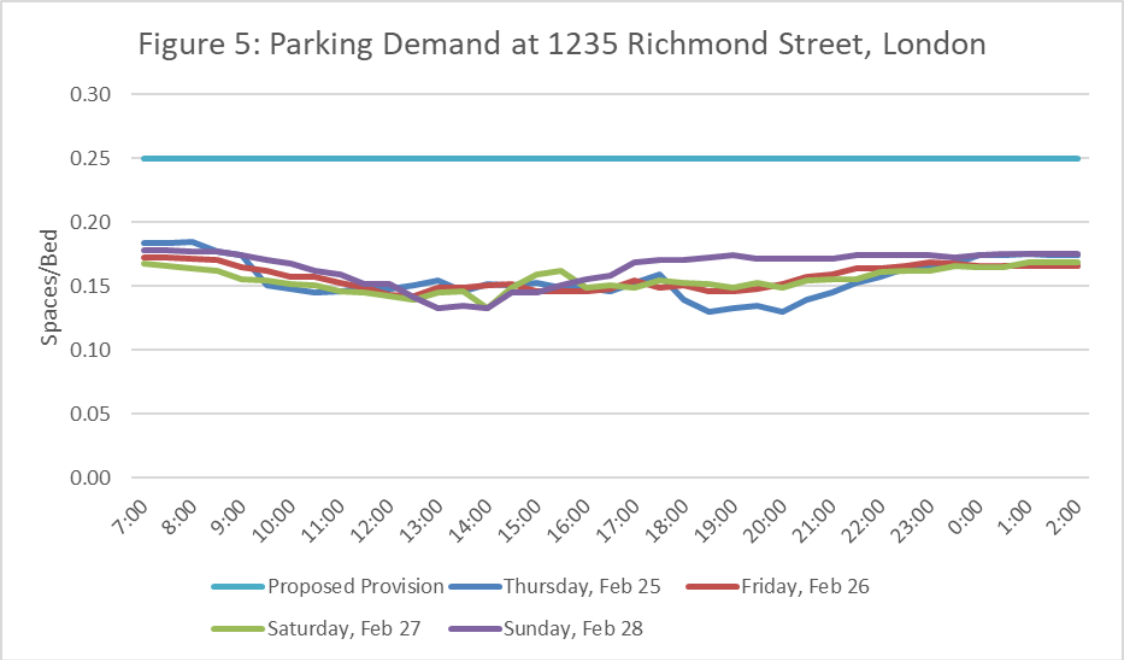
2:00
Proposed Provision
Thursday, Feb 25
Friday, Feb 26
Saturday, Feb 27
Sunday, Feb 28




The profiles are relatively flat with no pronounced peaks because the need to use a car is minimal even for those who have them and there is not a time when students would all generally be away in their cars. By contrast, in a typical apartment building, many of the residents use their cars to drive to work, so that there is a pronounced drop in parking occupancy during the weekday when most people work.

Students who have cars at University tend to use them to run short errands (which they can do any time they are not in class, including during the weekday) or to travel on weekends. But when they are travelling on the weekend, other students in the building have visitors who arrive by car for the weekend and can use available spaces by way of a permit system.

Additional data was gathered at multiple sites in Waterloo near the University of Waterloo and Wilfred Laurier University as a follow-up to the February 2016 parking surveys. The data was collected overnight on the morning of March 15, 2016 during the March Break, minimizing the influence of commercial parking; some of the buildings have commercial space. Information from the owner/operator of the properties confirms that parking levels are high during March Break; University students are still in school at that time, but many will request additional parking passes so that siblings and friends that are still high school students and are on March Break can visit and stay overnight.

The data, which also includes visitor parking (visitor parking is free), is reported in spaces per bedroom and also in spaces per bed, where there are bedrooms with more than one bed. The owner/operator of the buildings (one owner) confirmed that they were all fully occupied at the time of the survey. On-street parking is not permitted overnight on any of the local streets.

A summary of the data is included in the table below.

**Table 13: March 15, 2016 Surveyed Parking Use**

| Property | Distance to UW/WLU (m) | Units | Bdrms | Beds | Parking use | | |
|---|---|---|---|---|---|---|---|
| | | | | | Spc/unit | Spc/Bdrm | Spc/Bed |
| 208 Sunview | 600/160 | 57 | 285 | - | 0.75 | 0.15 | - |
| 202 Lester | 500/300 | 66 | 330 | - | 0.64 | 0.13 | - |
| 201 Lester | 550/350 | 68 | 340 | - | 0.54 | 0.11 | - |
| 203 Lester | 500/300 | 85 | 425 | - | 0.59 | 0.12 | - |
| 251-253 Lester | 550/350 | 52 | 257 | - | 0.65 | 0.13 | - |
| 261 Lester | 600/450 | 19 | 95 | - | 0.37 | 0.07 | - |
| 269-271 Lester | 700/500 | 20 | 100 | - | 0.10 | 0.02 | - |
| 250 Lester | 550/350 | 44 | 80 | 124 | 0.32 | 0.18 | 0.11 |
| 110 Columbia | 700/700 | 18 | 87 | - | 0.61 | 0.13 | - |
| 392 Albert | 1000/900 | 15 | 75 | - | 0.87 | 0.17 | - |

The highest parking demand rate in the Waterloo surveys was 0.17 spaces per bedroom at 392 Albert Street; this building is located furthest from campus at 900 to 1,000 metres. The subject site is closer to campus at 750 metres. In London, the peak parking demand was 0.18 spaces per bed. The demand in every case was less than the proposed parking provision of 0.25 spaces per bed/bedroom.

The City of Waterloo Zoning By-law applies a parking requirement of 0.25 spaces per bedroom (0.20 spaces per bedroom for residents and 0.05 spaces per bedroom for visitors) in the Northdale area of Waterloo, which is predominantly populated by students from the University of Waterloo and Wilfred Laurier University. It is the recommendation of this study that the proposed parking be allocated in the same way – 0.20 spaces per bedroom for residents and 0.05 spaces per bedroom for visitors.

The proposed parking provision of 237 spaces for 948 bedrooms (0.25 spaces per bedroom) and 583 units (0.40 spaces per unit) is appropriate for the use of the building as purpose-built student apartments based on data collected at comparable buildings in Waterloo and London.

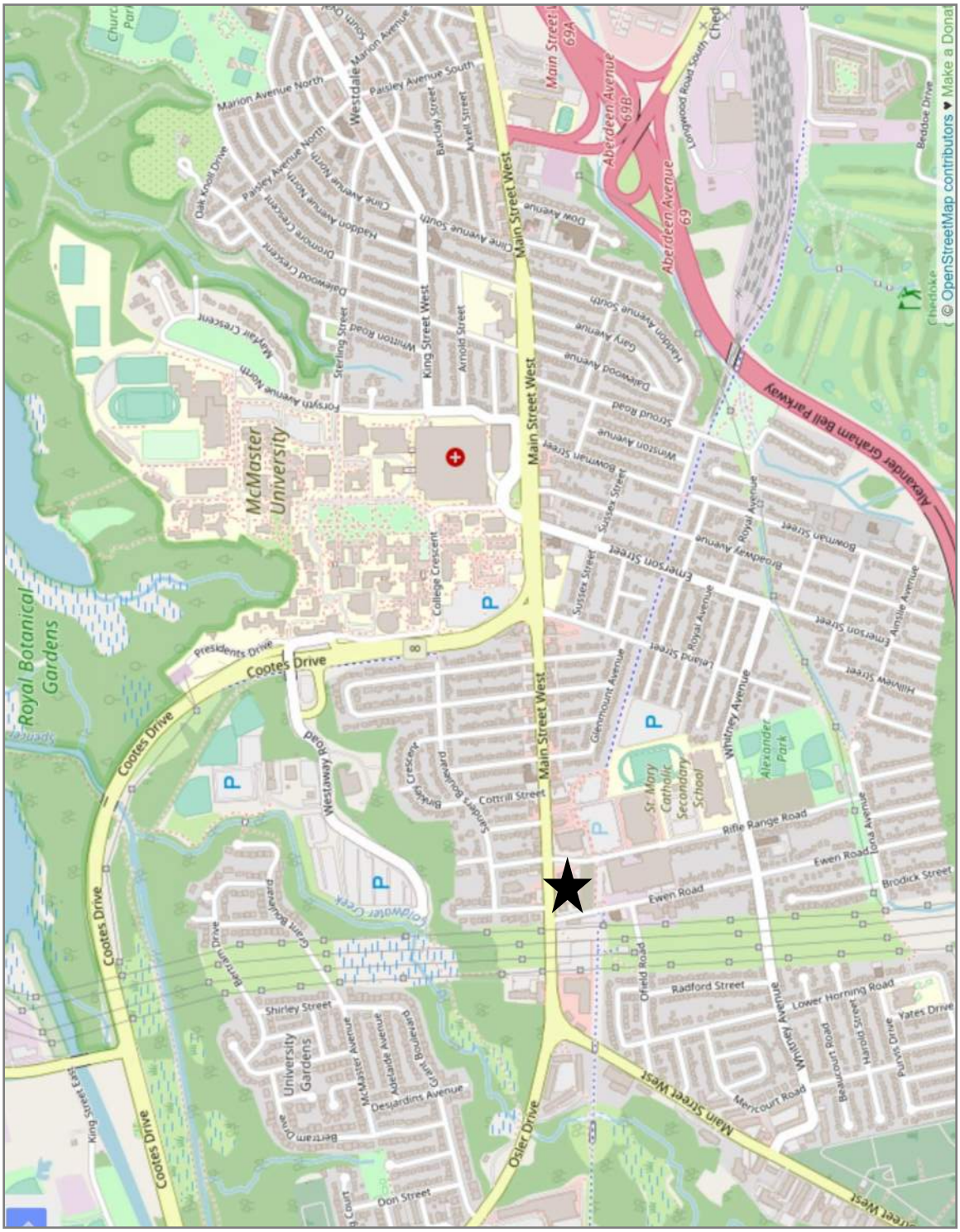
The proposed parking provision of 0.25 spaces per bedroom (237 spaces) plus the estimated parking provision based on the Zoning By-law requirements for the commercial uses (39 spaces) results in a requirement of 276 parking spaces. The current concept plan includes 307 parking spaces. The additional parking spaces are intended to be available in case the mix of commercial uses changes or if parking spaces are lost to site planning considerations.

# 9 Conclusions and Recommendations

This Transportation Impact, Transportation Demand Management Options and Parking Study has been undertaken in accordance with City requirements in order to understand the transportation context and infrastructure to support the proposed Official Plan and Zoning By-law amendments for the site. The conclusions of this study are based on a Development Concept that includes 583 residential apartment units purpose-built for students and 1,465 s.m. of commercial space, and are as follows:

- The Site is estimated to generate 129 and 274 vehicle trips in the weekday morning and afternoon peak hours, respectively. For reasons outlined in this study, the trip generation estimate is considered conservative.
- The Main/Rifle Range/Westbourne intersection is currently operating at acceptable levels of service in both weekday peak hours and is expected to continue to do so under future traffic conditions with and without the proposal. A westbound advance phase is recommended in the weekday afternoon peak period to address potential queues in the northbound and westbound directions that could impact adjacent intersection operations.
- The Main/Fortinos/Shell intersection is currently operating at acceptable levels of service in both weekday peak hours and is expected to continue to do so under future traffic conditions with and without the proposal.
- The site driveway is expected to operate at acceptable levels of service under future total traffic conditions in both weekday peak hours.
- The site is well located for travel by transit and active transportation. Its location nearby a mix of commercial and community amenities makes trips by walking and by cycling attractive. In addition, there are sidewalks on the nearby roadways and several signed cycling routes along with the Hamilton-Brantford Rail Trail nearby. The site has been designed with multiple pedestrian connections to the adjacent network.
- Bicycle parking on-site will be provided for both short-term and longer-term use by residents, visitors and employees.
- The many TDM measures that have been incorporated into the proposal will serve to encourage travel options by transit, walking and cycling for residents, visitors and employees of the building.
- Parking for the commercial uses on the site is proposed at the levels required in the Zoning By-law.
- The proposed provision of 237 parking spaces for the residential uses on the site (0.25 spaces per bedroom or 0.40 spaces per unit), is appropriate on the following basis:
  - The site is well-served by local transit and nearby connections to GO Transit and the Greater Toronto Area.
  - There is good cycling and pedestrian infrastructure in the area and many community and commercial amenities nearby to walk and cycle to.
  - Data collected by Salvini Consulting at purpose-built student apartments in Waterloo and London suggest peak demands that are less that the proposed provision.

# Appendix A: Figures




**Site Location Plan**

© OpenStreetMap contributors 2020

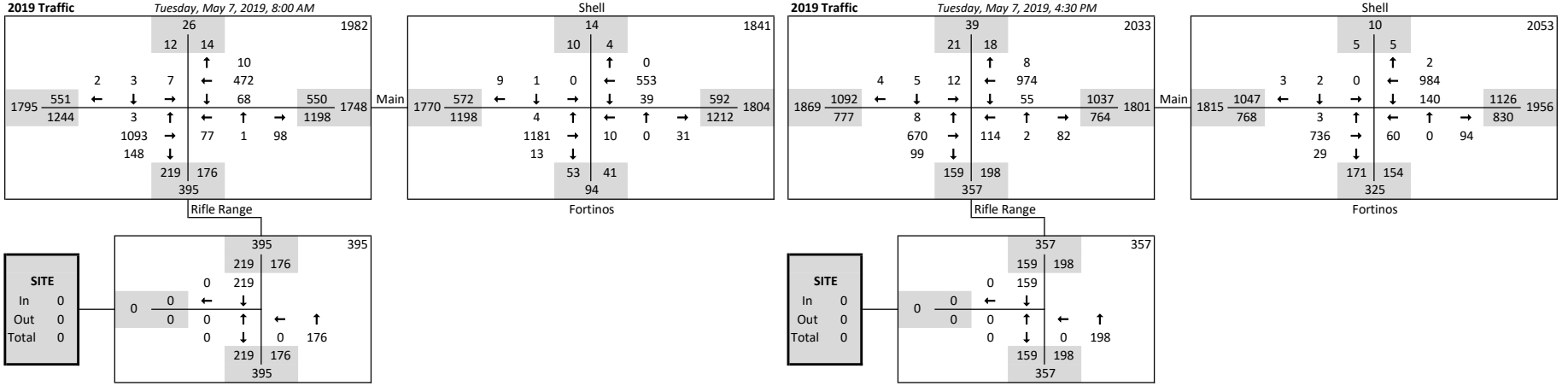
**Development Concept Plan**
mcCallum Sather

## 1629-1655 Main Street West Hamilton

**Traffic Volumes**

**AM Peak Hour**

**2019 Traffic** *Tuesday, May 7, 2019, 8:00 AM*

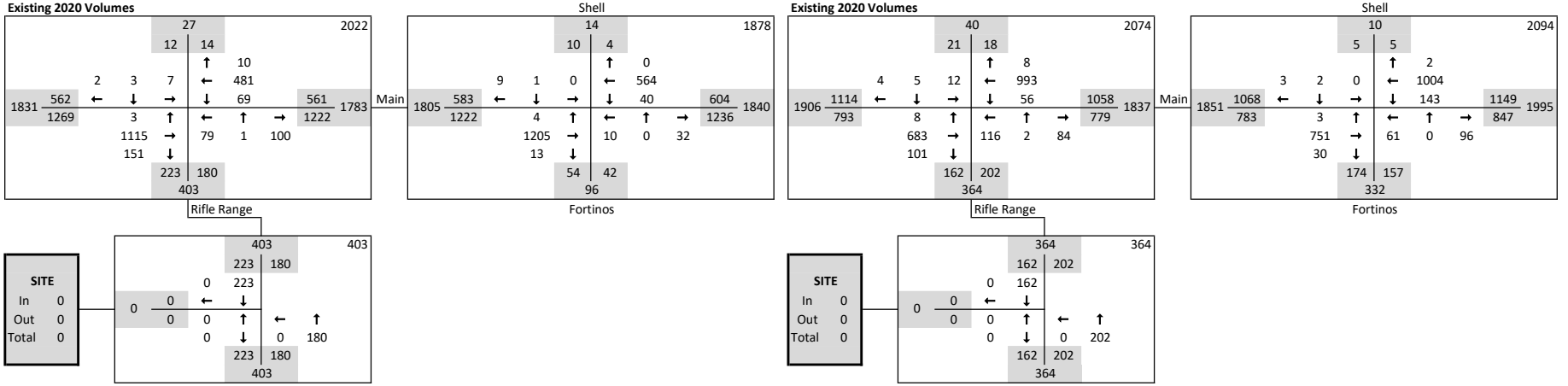



**PM Peak Hour**

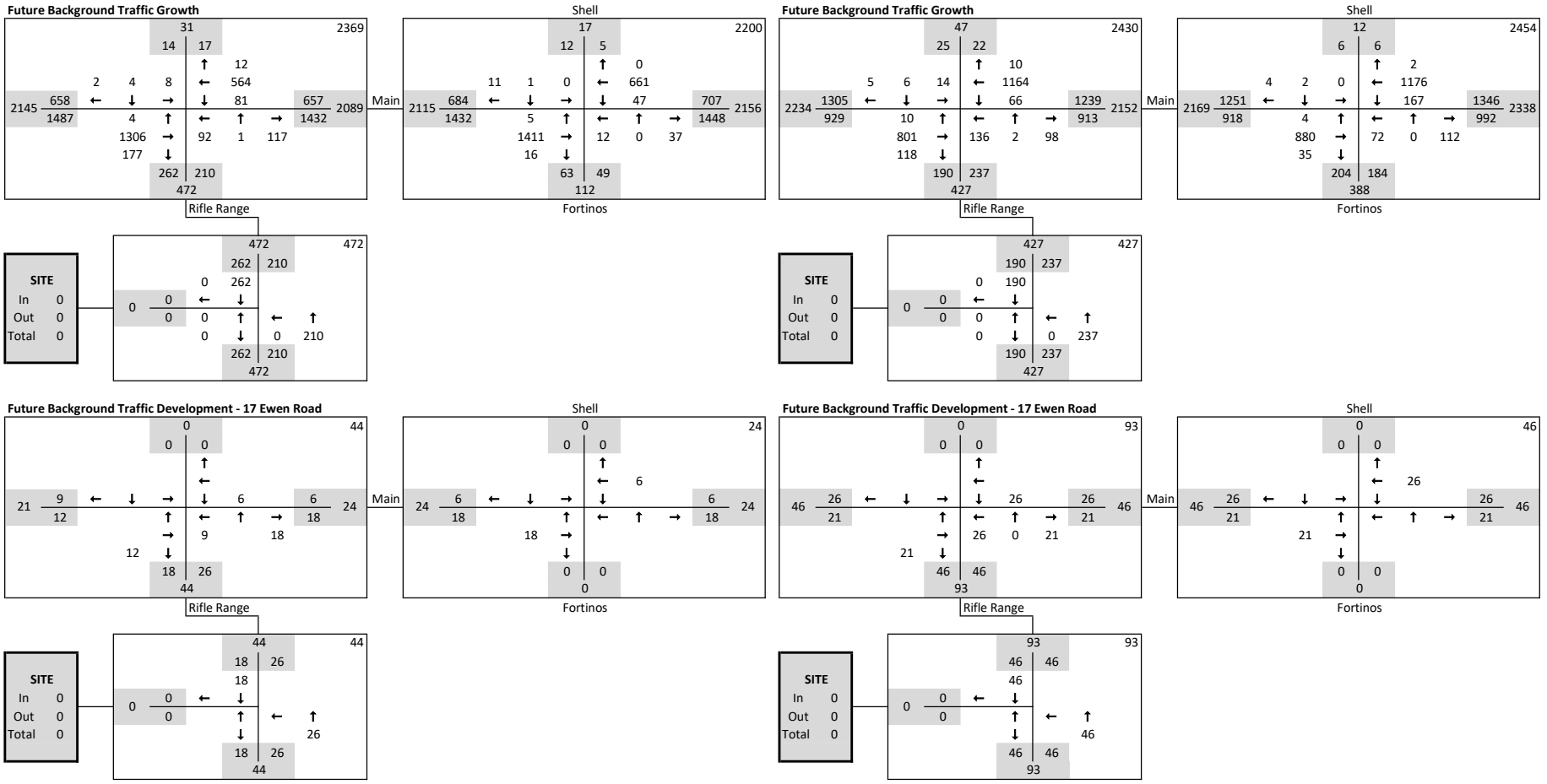
**2019 Traffic** *Tuesday, May 7, 2019, 4:30 PM*

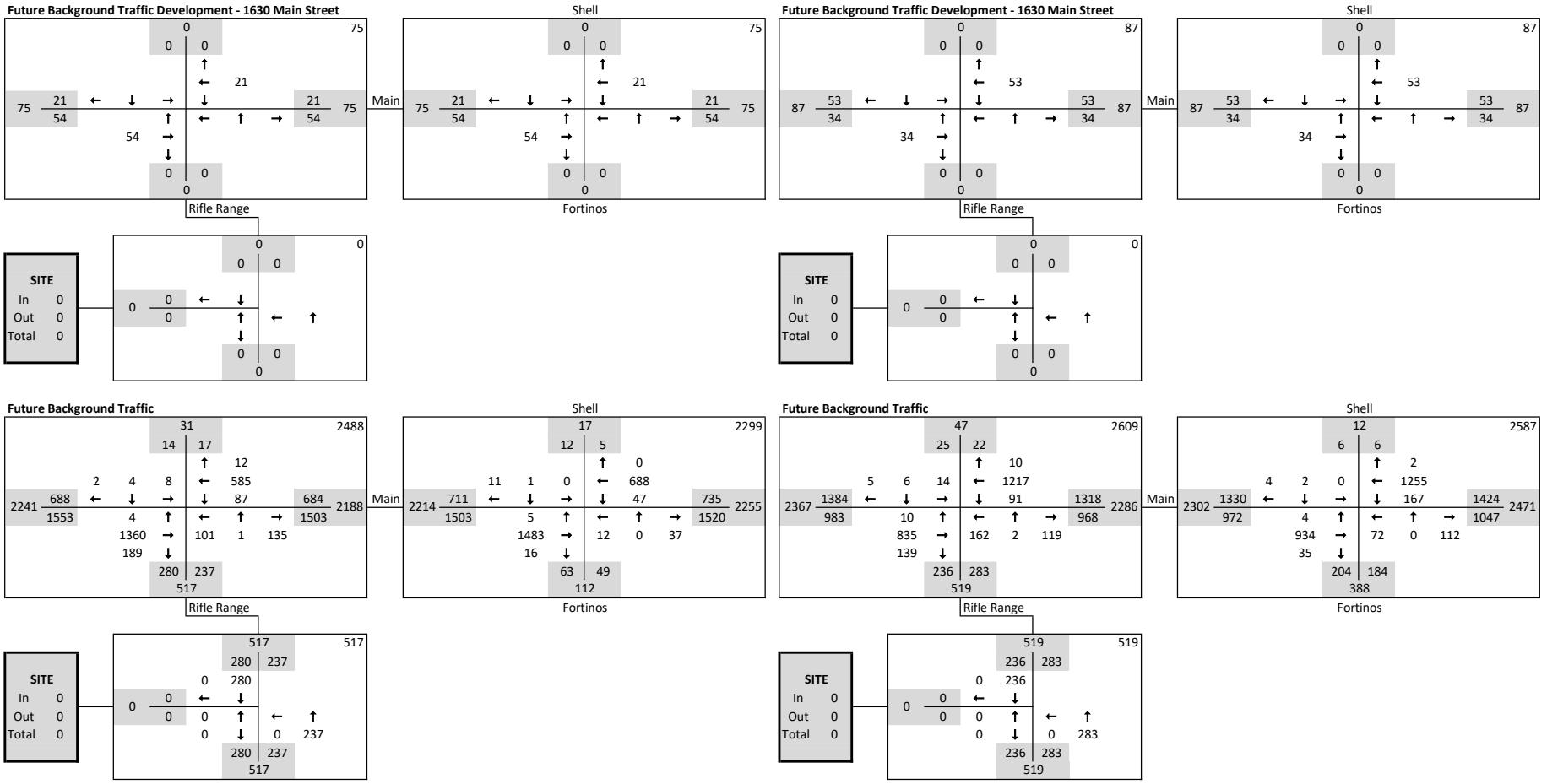



**Existing 2020 Volumes**




**Existing 2020 Volumes**


Future Background Traffic Growth
Shell
Main
Rifle Range
Fortinos
SITE
In 0
Out 0
Total 0
Future Background Traffic Growth
Shell
Main
Rifle Range
Fortinos
SITE
In 0
Out 0
Total 0
Future Background Traffic Development - 17 Ewen Road
Shell
Main
Rifle Range
Fortinos
SITE
In 0
Out 0
Total 0
Future Background Traffic Development - 17 Ewen Road
Shell
Main
Rifle Range
Fortinos
SITE
In 0
Out 0
Total 0


Future Background Traffic Development - 1630 Main Street
Shell
Main
Rifle Range
Fortinos
SITE
In 0
Out 0
Total 0
Future Background Traffic Development - 1630 Main Street
Shell
Main
Rifle Range
Fortinos
SITE
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Future Background Traffic
Shell
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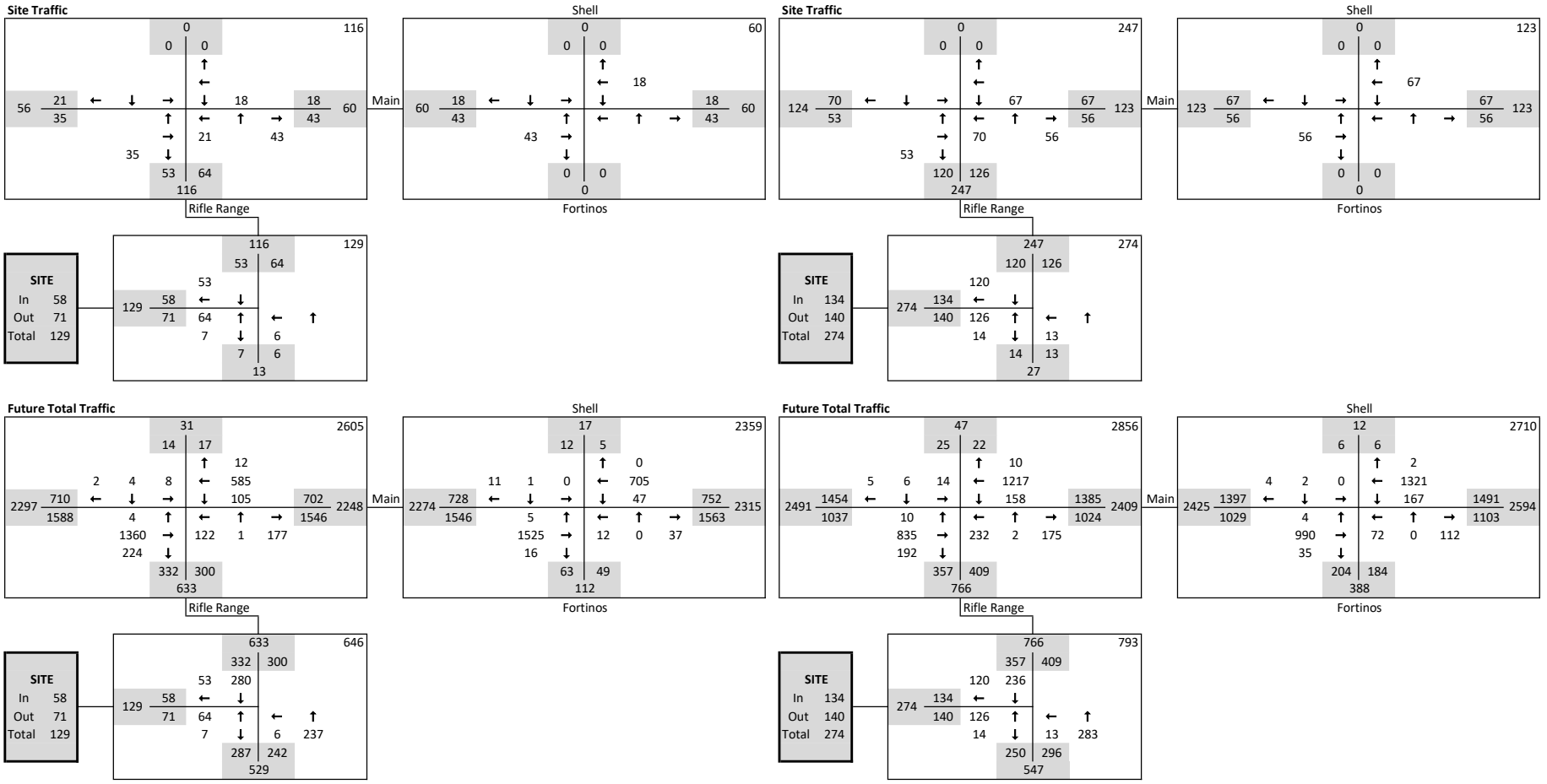
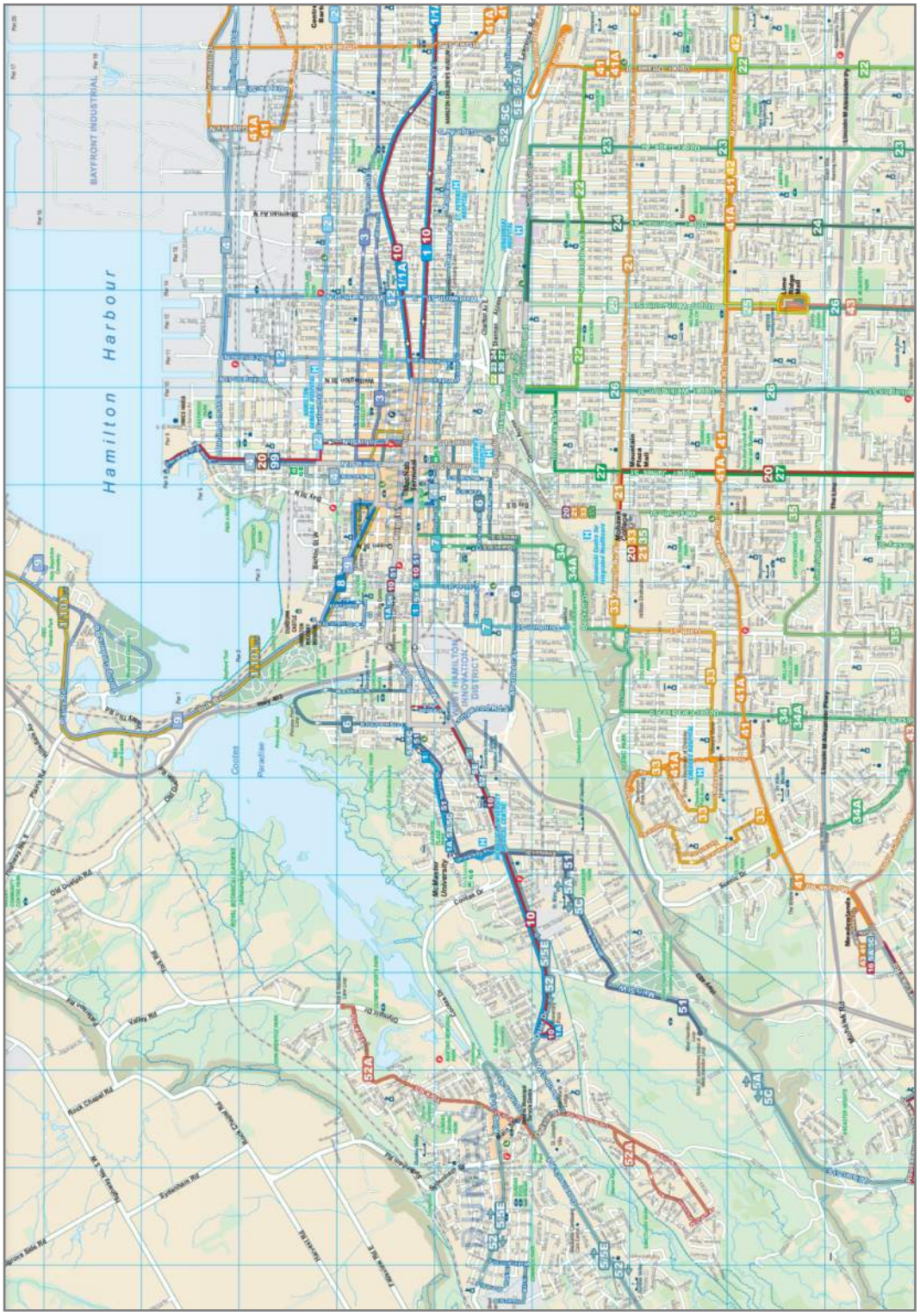
In 0
Out 0
Total 0

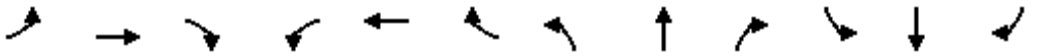

Site Traffic
Main
Shell
Fortinos
Rifle Range
SITE
In 58
Out 71
Total 129
Site Traffic
Main
Shell
Fortinos
Rifle Range
SITE
In 134
Out 140
Total 274
Future Total Traffic
Main
Shell
Fortinos
Rifle Range
SITE
In 58
Out 71
Total 129
Future Total Traffic
Main
Shell
Fortinos
Rifle Range
SITE
In 134
Out 140
Total 274




**Area Transit Map (HSR System Map)**
[www.hamilton.ca](http://www.hamilton.ca)

**Area Cycling Map (Cycling Routes Map)**
[www.hamilton.ca](http://www.hamilton.ca)

# Appendix B: Existing Capacity Analysis

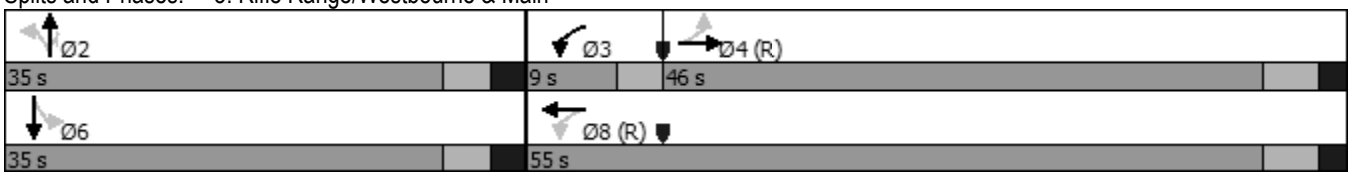


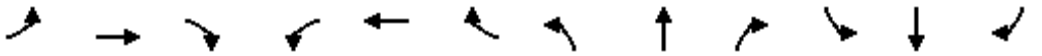
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 1115 | 151 | 69 | 481 | 10 | 79 | 1 | 100 | 7 | 3 | 2 |
| Future Volume (vph) | 3 | 1115 | 151 | 69 | 481 | 10 | 79 | 1 | 100 | 7 | 3 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 18.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.98 | 1.00 | | | 1.00 | | | 1.00 | 0.97 | | 0.99 | |
| Frt | | 0.982 | | | 0.997 | | | | 0.850 | | 0.979 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.953 | | | 0.970 | |
| Satd. Flow (prot) | 1745 | 3302 | 0 | 1631 | 3148 | 0 | 0 | 1576 | 1346 | 0 | 1740 | 0 |
| Flt Permitted | 0.453 | | | 0.134 | | | | 0.719 | | | 0.829 | |
| Satd. Flow (perm) | 818 | 3302 | 0 | 230 | 3148 | 0 | 0 | 1186 | 1311 | 0 | 1476 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 21 | | | 4 | | | | 109 | | 2 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 152.2 | | | 122.4 | | | 109.8 | | | 109.8 | |
| Travel Time (s) | | 11.0 | | | 8.8 | | | 7.9 | | | 7.9 | |
| Confl. Peds. (#/hr) | 21 | | 8 | 8 | | 21 | 3 | | 15 | 15 | | 3 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 6% | 7% | 10% | 30% | 10% | 100% | 16% | 0% | 0% | 0% |
| Adj. Flow (vph) | 3 | 1212 | 164 | 75 | 523 | 11 | 86 | 1 | 109 | 8 | 3 | 2 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 3 | 1376 | 0 | 75 | 534 | 0 | 0 | 87 | 109 | 0 | 13 | 0 |
| Turn Type | Perm | NA | | pm+pt | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | | 4 | | 3 | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 3 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 5.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.7 | 25.7 | | 8.0 | 25.7 | | 15.7 | 15.7 | 15.7 | 15.7 | 15.7 | |
| Total Split (s) | 46.0 | 46.0 | | 9.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 51.1% | 51.1% | | 10.0% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 40.3 | 40.3 | | 6.0 | 49.3 | | 29.3 | 29.3 | 29.3 | 29.3 | 29.3 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.0 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 2.0 | 2.0 | | 0.0 | 2.0 | | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.7 | 5.7 | | 3.0 | 5.7 | | | 5.7 | 5.7 | | 5.7 | |
| Lead/Lag | Lag | Lag | | Lead | | | | | | | | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | None | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 10.0 | 10.0 | | | 10.0 | | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 17.0 | 17.0 | | | 17.0 | | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 58.0 | 58.0 | | 68.6 | 65.9 | | | 12.7 | 12.7 | | 12.7 | |
| Actuated g/C Ratio | 0.64 | 0.64 | | 0.76 | 0.73 | | | 0.14 | 0.14 | | 0.14 | |
| v/c Ratio | 0.01 | 0.64 | | 0.27 | 0.23 | | | 0.52 | 0.39 | | 0.06 | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 8.0 | 12.6 | | 6.7 | 3.8 | | | 46.7 | 11.2 | | 29.3 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 8.0 | 12.6 | | 6.7 | 3.8 | | | 46.7 | 11.2 | | 29.3 | |
| LOS | A | B | | A | A | | | D | B | | C | |
| Approach Delay | | 12.6 | | | 4.1 | | | 26.9 | | | 29.3 | |
| Approach LOS | | B | | | A | | | C | | | C | |
| Queue Length 50th (m) | 0.2 | 68.5 | | 2.4 | 10.4 | | | 14.3 | 0.0 | | 1.7 | |
| Queue Length 95th (m) | 1.4 | 113.1 | | 5.0 | 15.3 | | | 27.1 | 13.1 | | 6.4 | |
| Internal Link Dist (m) | | 128.2 | | | 98.4 | | | 85.8 | | | 85.8 | |
| Turn Bay Length (m) | | | | | | | | | 18.0 | | | |
| Base Capacity (vph) | 527 | 2136 | | 279 | 2307 | | | 386 | 500 | | 481 | |
| Starvation Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.01 | 0.64 | | 0.27 | 0.23 | | | 0.23 | 0.22 | | 0.03 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 31 (34%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 60 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.64 | | | |
| Intersection Signal Delay: 11.6 | | Intersection LOS: B | |
| Intersection Capacity Utilization 74.4% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Rifle Range/Westbourne & Main



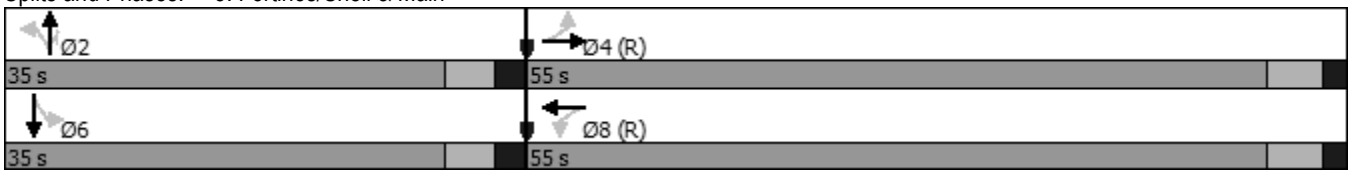


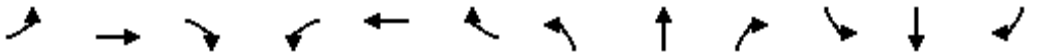
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 1205 | 13 | 40 | 564 | 0 | 10 | 0 | 32 | 0 | 1 | 9 |
| Future Volume (vph) | 4 | 1205 | 13 | 40 | 564 | 0 | 10 | 0 | 32 | 0 | 1 | 9 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 15.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 1.00 | | 1.00 | | | | 0.99 | 0.98 | | 0.98 | |
| Frt | | 0.998 | | | | | | | 0.850 | | 0.877 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | | |
| Satd. Flow (prot) | 1745 | 3346 | 0 | 1544 | 3202 | 0 | 0 | 1454 | 1473 | 0 | 1440 | 0 |
| Flt Permitted | 0.420 | | | 0.192 | | | | 0.750 | | | | |
| Satd. Flow (perm) | 763 | 3346 | 0 | 312 | 3202 | 0 | 0 | 1140 | 1448 | 0 | 1440 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 2 | | | | | | | 35 | | 10 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 122.4 | | | 7784.9 | | | 122.4 | | | 73.8 | |
| Travel Time (s) | | 8.8 | | | 560.5 | | | 8.8 | | | 5.3 | |
| Confl. Peds. (#/hr) | 20 | | 7 | 7 | | 20 | 7 | | 5 | 5 | | 7 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 4% | 8% | 13% | 9% | 0% | 20% | 0% | 6% | 0% | 0% | 11% |
| Adj. Flow (vph) | 4 | 1310 | 14 | 43 | 613 | 0 | 11 | 0 | 35 | 0 | 1 | 10 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 4 | 1324 | 0 | 43 | 613 | 0 | 0 | 11 | 35 | 0 | 11 | 0 |
| Turn Type | Perm | NA | | Perm | NA | | Perm | NA | Perm | | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 20.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.5 | 25.5 | | 25.5 | 25.5 | | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | |
| Total Split (s) | 55.0 | 55.0 | | 55.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 61.1% | 61.1% | | 61.1% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 49.5 | 49.5 | | 49.5 | 49.5 | | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.7 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 1.8 | 1.8 | | 1.8 | 1.8 | | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.5 | 5.5 | | 5.5 | 5.5 | | | 5.5 | 5.5 | | 5.5 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | C-Max | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 12.0 | 12.0 | | 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 | | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 77.4 | 77.4 | | 77.4 | 77.4 | | | 10.0 | 10.0 | | 10.0 | |
| Actuated g/C Ratio | 0.86 | 0.86 | | 0.86 | 0.86 | | | 0.11 | 0.11 | | 0.11 | |
| v/c Ratio | 0.01 | 0.46 | | 0.16 | 0.22 | | | 0.09 | 0.18 | | 0.07 | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 0.5 | 0.7 | | 4.2 | 2.4 | | | 37.8 | 15.3 | | 21.6 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 0.5 | 0.8 | | 4.2 | 2.4 | | | 37.8 | 15.3 | | 21.6 | |
| LOS | A | A | | A | A | | | D | B | | C | |
| Approach Delay | | 0.8 | | | 2.5 | | | 20.7 | | | 21.6 | |
| Approach LOS | | A | | | A | | | C | | | C | |
| Queue Length 50th (m) | 0.0 | 2.3 | | 1.6 | 12.6 | | | 1.7 | 0.0 | | 0.2 | |
| Queue Length 95th (m) | m0.1 | 6.9 | | 4.7 | 17.3 | | | 6.6 | 8.4 | | 5.0 | |
| Internal Link Dist (m) | | 98.4 | | | 7760.9 | | | 98.4 | | | 49.8 | |
| Turn Bay Length (m) | | | | | | | | | 15.0 | | | |
| Base Capacity (vph) | 656 | 2877 | | 268 | 2753 | | | 373 | 498 | | 478 | |
| Starvation Cap Reductn | 0 | 186 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.01 | 0.49 | | 0.16 | 0.22 | | | 0.03 | 0.07 | | 0.02 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 31 (34%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 50 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.46 | | | |
| Intersection Signal Delay: 1.9 | | Intersection LOS: A | |
| Intersection Capacity Utilization 69.6% | | ICU Level of Service C | |
| Analysis Period (min) 15 | | | |
| m Volume for 95th percentile queue is metered by upstream signal. | | | |

Splits and Phases: 8: Fortinos/Shell & Main



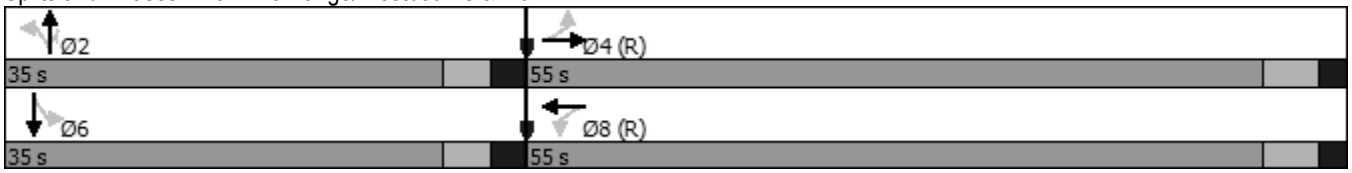


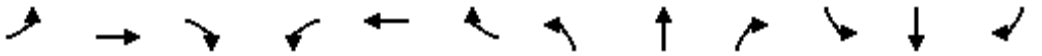
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 8 | 683 | 101 | 56 | 993 | 8 | 116 | 2 | 84 | 12 | 5 | 4 |
| Future Volume (vph) | 8 | 683 | 101 | 56 | 993 | 8 | 116 | 2 | 84 | 12 | 5 | 4 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 18.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | 1.00 | | | 0.98 | 0.96 | | 0.98 | |
| Frt | | 0.981 | | | 0.999 | | | | 0.850 | | 0.975 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.953 | | | 0.971 | |
| Satd. Flow (prot) | 1745 | 3312 | 0 | 1711 | 3413 | 0 | 0 | 1750 | 1473 | 0 | 1728 | 0 |
| Flt Permitted | 0.236 | | | 0.316 | | | | 0.713 | | | 0.815 | |
| Satd. Flow (perm) | 431 | 3312 | 0 | 564 | 3413 | 0 | 0 | 1279 | 1419 | 0 | 1432 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 29 | | | 1 | | | | 91 | | 4 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 152.2 | | | 122.4 | | | 109.8 | | | 109.8 | |
| Travel Time (s) | | 11.0 | | | 8.8 | | | 7.9 | | | 7.9 | |
| Confl. Peds. (#/hr) | 24 | | 22 | 22 | | 24 | 26 | | 27 | 27 | | 26 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 2% | 2% | 13% | 0% | 0% | 6% | 0% | 0% | 0% |
| Adj. Flow (vph) | 9 | 742 | 110 | 61 | 1079 | 9 | 126 | 2 | 91 | 13 | 5 | 4 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 9 | 852 | 0 | 61 | 1088 | 0 | 0 | 128 | 91 | 0 | 22 | 0 |
| Turn Type | Perm | NA | | Perm | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 20.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.7 | 25.7 | | 25.7 | 25.7 | | 15.7 | 15.7 | 15.7 | 15.7 | 15.7 | |
| Total Split (s) | 55.0 | 55.0 | | 55.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 61.1% | 61.1% | | 61.1% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 49.3 | 49.3 | | 49.3 | 49.3 | | 29.3 | 29.3 | 29.3 | 29.3 | 29.3 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.7 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.7 | 5.7 | | 5.7 | 5.7 | | | 5.7 | 5.7 | | 5.7 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | C-Max | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 10.0 | 10.0 | | 10.0 | 10.0 | | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 17.0 | 17.0 | | 17.0 | 17.0 | | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 63.8 | 63.8 | | 63.8 | 63.8 | | | 14.8 | 14.8 | | 14.8 | |
| Actuated g/C Ratio | 0.71 | 0.71 | | 0.71 | 0.71 | | | 0.16 | 0.16 | | 0.16 | |
| v/c Ratio | 0.03 | 0.36 | | 0.15 | 0.45 | | | 0.61 | 0.30 | | 0.09 | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 5.5 | 5.9 | | 3.9 | 4.1 | | | 46.7 | 9.3 | | 26.4 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.1 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 5.5 | 5.9 | | 3.9 | 4.2 | | | 46.7 | 9.3 | | 26.4 | |
| LOS | A | A | | A | A | | | D | A | | C | |
| Approach Delay | | 5.9 | | | 4.2 | | | 31.2 | | | 26.4 | |
| Approach LOS | | A | | | A | | | C | | | C | |
| Queue Length 50th (m) | 0.4 | 24.0 | | 1.7 | 16.5 | | | 20.9 | 0.0 | | 2.7 | |
| Queue Length 95th (m) | 2.2 | 42.6 | | 3.7 | 19.5 | | | 35.7 | 11.3 | | 8.4 | |
| Internal Link Dist (m) | | 128.2 | | | 98.4 | | | 85.8 | | | 85.8 | |
| Turn Bay Length (m) | | | | | | | | | 18.0 | | | |
| Base Capacity (vph) | 305 | 2357 | | 400 | 2421 | | | 416 | 523 | | 468 | |
| Starvation Cap Reductn | 0 | 0 | | 0 | 281 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.03 | 0.36 | | 0.15 | 0.51 | | | 0.31 | 0.17 | | 0.05 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 22 (24%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 45 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.61 | | | |
| Intersection Signal Delay: 7.7 | | Intersection LOS: A | |
| Intersection Capacity Utilization 74.5% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Rifle Range/Westbourne & Main



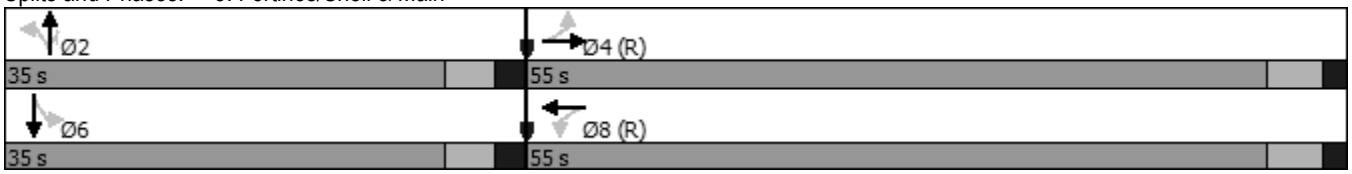


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 751 | 30 | 143 | 1004 | 2 | 61 | 0 | 96 | 0 | 2 | 3 |
| Future Volume (vph) | 3 | 751 | 30 | 143 | 1004 | 2 | 61 | 0 | 96 | 0 | 2 | 3 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 15.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 1.00 | | 0.99 | 1.00 | | | 0.98 | 0.95 | | 0.98 | |
| Frt | | 0.994 | | | | | | | 0.850 | | 0.919 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | | |
| Satd. Flow (prot) | 1745 | 3364 | 0 | 1728 | 3418 | 0 | 0 | 1711 | 1561 | 0 | 1653 | 0 |
| Flt Permitted | 0.246 | | | 0.327 | | | | 0.754 | | | | |
| Satd. Flow (perm) | 449 | 3364 | 0 | 589 | 3418 | 0 | 0 | 1326 | 1479 | 0 | 1653 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 7 | | | | | | | 104 | | 3 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 122.4 | | | 7784.9 | | | 122.4 | | | 73.8 | |
| Travel Time (s) | | 8.8 | | | 560.5 | | | 8.8 | | | 5.3 | |
| Confl. Peds. (#/hr) | 26 | | 26 | 26 | | 26 | 24 | | 43 | 43 | | 24 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 1% | 2% | 50% | 2% | 0% | 0% | 0% | 0% | 0% |
| Adj. Flow (vph) | 3 | 816 | 33 | 155 | 1091 | 2 | 66 | 0 | 104 | 0 | 2 | 3 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 3 | 849 | 0 | 155 | 1093 | 0 | 0 | 66 | 104 | 0 | 5 | 0 |
| Turn Type | Perm | NA | | Perm | NA | | Perm | NA | Perm | | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 20.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.5 | 25.5 | | 25.5 | 25.5 | | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | |
| Total Split (s) | 55.0 | 55.0 | | 55.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 61.1% | 61.1% | | 61.1% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 49.5 | 49.5 | | 49.5 | 49.5 | | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.7 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 1.8 | 1.8 | | 1.8 | 1.8 | | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.5 | 5.5 | | 5.5 | 5.5 | | | 5.5 | 5.5 | | 5.5 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | C-Max | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 12.0 | 12.0 | | 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 | | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 72.0 | 72.0 | | 72.0 | 72.0 | | | 11.2 | 11.2 | | 11.2 | |
| Actuated g/C Ratio | 0.80 | 0.80 | | 0.80 | 0.80 | | | 0.12 | 0.12 | | 0.12 | |
| v/c Ratio | 0.01 | 0.32 | | 0.33 | 0.40 | | | 0.40 | 0.38 | | 0.02 | |

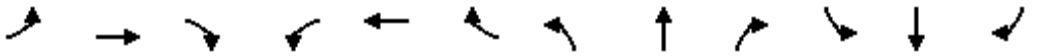
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 2.3 | 2.3 | | 6.1 | 4.2 | | | 43.4 | 11.6 | | 25.8 | |
| Queue Delay | 0.0 | 0.1 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 2.3 | 2.3 | | 6.1 | 4.2 | | | 43.4 | 11.6 | | 25.8 | |
| LOS | A | A | | A | A | | | D | B | | C | |
| Approach Delay | | 2.3 | | | 4.5 | | | 24.0 | | | 25.8 | |
| Approach LOS | | A | | | A | | | C | | | C | |
| Queue Length 50th (m) | 0.1 | 10.1 | | 6.7 | 26.7 | | | 10.9 | 0.0 | | 0.3 | |
| Queue Length 95th (m) | m0.3 | 16.3 | | 18.6 | 44.6 | | | 22.3 | 13.3 | | 3.3 | |
| Internal Link Dist (m) | | 98.4 | | | 7760.9 | | | 98.4 | | | 49.8 | |
| Turn Bay Length (m) | | | | | | | | | 15.0 | | | |
| Base Capacity (vph) | 359 | 2692 | | 471 | 2734 | | | 434 | 554 | | 543 | |
| Starvation Cap Reductn | 0 | 547 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.01 | 0.40 | | 0.33 | 0.40 | | | 0.15 | 0.19 | | 0.01 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 22 (24%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 45 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.40 | | | |
| Intersection Signal Delay: 5.2 | | Intersection LOS: A | |
| Intersection Capacity Utilization 78.4% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |
| m Volume for 95th percentile queue is metered by upstream signal. | | | |

Splits and Phases: 8: Fortinos/Shell & Main



# Appendix C: Future Background Capacity Analysis

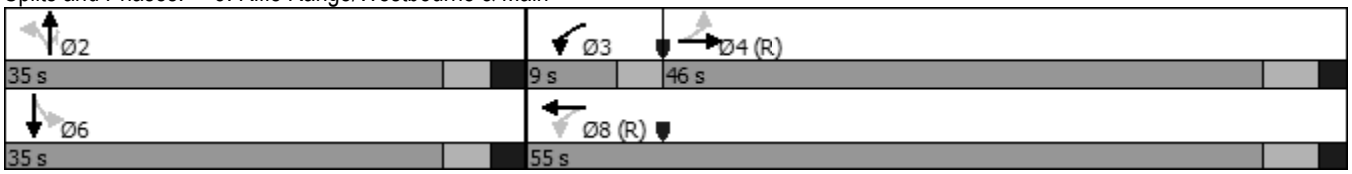


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 1360 | 189 | 87 | 585 | 12 | 101 | 1 | 135 | 8 | 4 | 2 |
| Future Volume (vph) | 4 | 1360 | 189 | 87 | 585 | 12 | 101 | 1 | 135 | 8 | 4 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 18.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 1.00 | | | 1.00 | | | 1.00 | 0.97 | | 0.99 | |
| Frt | | 0.982 | | | 0.997 | | | | 0.850 | | 0.982 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.953 | | | 0.971 | |
| Satd. Flow (prot) | 1745 | 3302 | 0 | 1631 | 3148 | 0 | 0 | 1580 | 1346 | 0 | 1748 | 0 |
| Flt Permitted | 0.405 | | | 0.069 | | | | 0.717 | | | 0.831 | |
| Satd. Flow (perm) | 733 | 3302 | 0 | 118 | 3148 | 0 | 0 | 1185 | 1311 | 0 | 1485 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 22 | | | 3 | | | | 147 | | 2 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 152.2 | | | 122.4 | | | 109.8 | | | 109.8 | |
| Travel Time (s) | | 11.0 | | | 8.8 | | | 7.9 | | | 7.9 | |
| Confl. Peds. (#/hr) | 21 | | 8 | 8 | | 21 | 3 | | 15 | 15 | | 3 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 6% | 7% | 10% | 30% | 10% | 100% | 16% | 0% | 0% | 0% |
| Adj. Flow (vph) | 4 | 1478 | 205 | 95 | 636 | 13 | 110 | 1 | 147 | 9 | 4 | 2 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 4 | 1683 | 0 | 95 | 649 | 0 | 0 | 111 | 147 | 0 | 15 | 0 |
| Turn Type | Perm | NA | | pm+pt | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | | 4 | | 3 | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 3 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 5.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.7 | 25.7 | | 8.0 | 25.7 | | 15.7 | 15.7 | 15.7 | 15.7 | 15.7 | |
| Total Split (s) | 46.0 | 46.0 | | 9.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 51.1% | 51.1% | | 10.0% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 40.3 | 40.3 | | 6.0 | 49.3 | | 29.3 | 29.3 | 29.3 | 29.3 | 29.3 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.0 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 2.0 | 2.0 | | 0.0 | 2.0 | | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.7 | 5.7 | | 3.0 | 5.7 | | | 5.7 | 5.7 | | 5.7 | |
| Lead/Lag | Lag | Lag | | Lead | | | | | | | | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | None | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 10.0 | 10.0 | | | 10.0 | | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 17.0 | 17.0 | | | 17.0 | | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 55.8 | 55.8 | | 67.0 | 64.3 | | | 14.3 | 14.3 | | 14.3 | |
| Actuated g/C Ratio | 0.62 | 0.62 | | 0.74 | 0.71 | | | 0.16 | 0.16 | | 0.16 | |
| v/c Ratio | 0.01 | 0.82 | | 0.46 | 0.29 | | | 0.59 | 0.44 | | 0.06 | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 9.8 | 19.6 | | 25.5 | 4.4 | | | 47.3 | 9.9 | | 27.4 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 9.8 | 19.6 | | 25.5 | 4.4 | | | 47.3 | 9.9 | | 27.4 | |
| LOS | A | B | | C | A | | | D | A | | C | |
| Approach Delay | | 19.6 | | | 7.1 | | | 26.0 | | | 27.4 | |
| Approach LOS | | B | | | A | | | C | | | C | |
| Queue Length 50th (m) | 0.3 | 109.0 | | 4.3 | 12.7 | | | 18.2 | 0.0 | | 2.0 | |
| Queue Length 95th (m) | 1.9 | #201.6 | | 17.9 | 18.2 | | | 32.2 | 14.4 | | 6.7 | |
| Internal Link Dist (m) | | 128.2 | | | 98.4 | | | 85.8 | | | 85.8 | |
| Turn Bay Length (m) | | | | | | | | | 18.0 | | | |
| Base Capacity (vph) | 454 | 2057 | | 209 | 2249 | | | 385 | 525 | | 484 | |
| Starvation Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.01 | 0.82 | | 0.45 | 0.29 | | | 0.29 | 0.28 | | 0.03 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 31 (34%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 65 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.82 | | | |
| Intersection Signal Delay: 16.8 | | Intersection LOS: B | |
| Intersection Capacity Utilization 83.3% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |
| # 95th percentile volume exceeds capacity, queue may be longer. | | | |
| Queue shown is maximum after two cycles. | | | |

Splits and Phases: 3: Rifle Range/Westbourne & Main

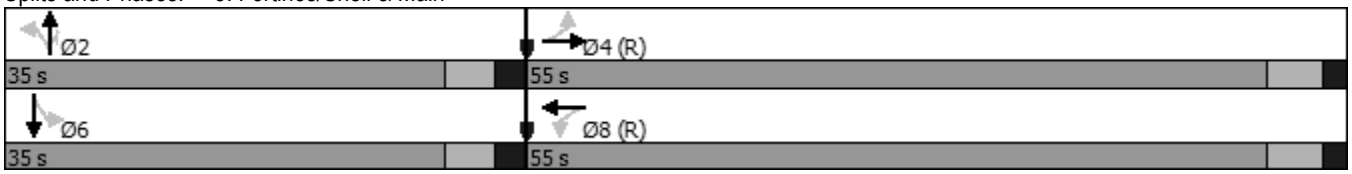


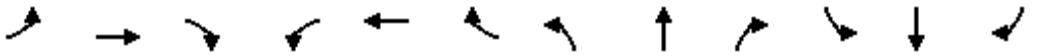
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 5 | 1483 | 16 | 47 | 688 | 0 | 12 | 0 | 37 | 0 | 1 | 11 |
| Future Volume (vph) | 5 | 1483 | 16 | 47 | 688 | 0 | 12 | 0 | 37 | 0 | 1 | 11 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 15.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 1.00 | | 1.00 | | | | 0.99 | 0.98 | | 0.98 | |
| Frt | | 0.998 | | | | | | | 0.850 | | 0.875 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | | |
| Satd. Flow (prot) | 1745 | 3346 | 0 | 1544 | 3202 | 0 | 0 | 1454 | 1473 | 0 | 1434 | 0 |
| Flt Permitted | 0.368 | | | 0.131 | | | | 0.749 | | | | |
| Satd. Flow (perm) | 670 | 3346 | 0 | 213 | 3202 | 0 | 0 | 1139 | 1448 | 0 | 1434 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 2 | | | | | | | 30 | | 12 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 122.4 | | | 7784.9 | | | 122.4 | | | 73.8 | |
| Travel Time (s) | | 8.8 | | | 560.5 | | | 8.8 | | | 5.3 | |
| Confl. Peds. (#/hr) | 20 | | 7 | 7 | | 20 | 7 | | 5 | 5 | | 7 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 4% | 8% | 13% | 9% | 0% | 20% | 0% | 6% | 0% | 0% | 11% |
| Adj. Flow (vph) | 5 | 1612 | 17 | 51 | 748 | 0 | 13 | 0 | 40 | 0 | 1 | 12 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 5 | 1629 | 0 | 51 | 748 | 0 | 0 | 13 | 40 | 0 | 13 | 0 |
| Turn Type | Perm | NA | | Perm | NA | | Perm | NA | Perm | | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 20.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.5 | 25.5 | | 25.5 | 25.5 | | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | |
| Total Split (s) | 55.0 | 55.0 | | 55.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 61.1% | 61.1% | | 61.1% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 49.5 | 49.5 | | 49.5 | 49.5 | | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.7 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 1.8 | 1.8 | | 1.8 | 1.8 | | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.5 | 5.5 | | 5.5 | 5.5 | | | 5.5 | 5.5 | | 5.5 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | C-Max | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 12.0 | 12.0 | | 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 | | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 77.4 | 77.4 | | 77.4 | 77.4 | | | 10.0 | 10.0 | | 10.0 | |
| Actuated g/C Ratio | 0.86 | 0.86 | | 0.86 | 0.86 | | | 0.11 | 0.11 | | 0.11 | |
| v/c Ratio | 0.01 | 0.57 | | 0.28 | 0.27 | | | 0.10 | 0.21 | | 0.08 | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 0.4 | 1.5 | | 7.6 | 2.5 | | | 38.2 | 20.4 | | 20.5 | |
| Queue Delay | 0.0 | 0.1 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 0.4 | 1.5 | | 7.6 | 2.5 | | | 38.2 | 20.4 | | 20.5 | |
| LOS | A | A | | A | A | | | D | C | | C | |
| Approach Delay | | 1.5 | | | 2.9 | | | 24.7 | | | 20.5 | |
| Approach LOS | | A | | | A | | | C | | | C | |
| Queue Length 50th (m) | 0.0 | 3.0 | | 2.1 | 16.3 | | | 2.1 | 1.6 | | 0.2 | |
| Queue Length 95th (m) | m0.1 | 8.5 | | 7.7 | 21.8 | | | 7.5 | 10.6 | | 5.4 | |
| Internal Link Dist (m) | | 98.4 | | | 7760.9 | | | 98.4 | | | 49.8 | |
| Turn Bay Length (m) | | | | | | | | | 15.0 | | | |
| Base Capacity (vph) | 576 | 2877 | | 183 | 2753 | | | 373 | 494 | | 478 | |
| Starvation Cap Reductn | 0 | 170 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.01 | 0.60 | | 0.28 | 0.27 | | | 0.03 | 0.08 | | 0.03 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 31 (34%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 60 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.57 | | | |
| Intersection Signal Delay: 2.6 | | Intersection LOS: A | |
| Intersection Capacity Utilization 77.4% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |
| m Volume for 95th percentile queue is metered by upstream signal. | | | |

Splits and Phases: 8: Fortinos/Shell & Main



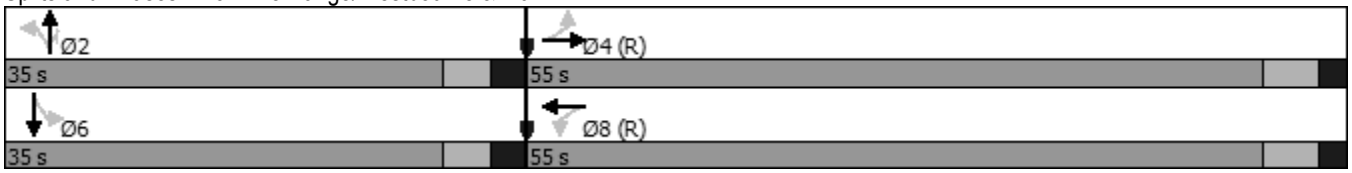


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 835 | 139 | 91 | 1217 | 10 | 162 | 2 | 119 | 14 | 6 | 5 |
| Future Volume (vph) | 10 | 835 | 139 | 91 | 1217 | 10 | 162 | 2 | 119 | 14 | 6 | 5 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 18.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 1.00 | 0.99 | | 0.99 | 1.00 | | | 0.98 | 0.96 | | 0.98 | |
| Frt | | 0.979 | | | 0.999 | | | | 0.850 | | 0.975 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.953 | | | 0.973 | |
| Satd. Flow (prot) | 1745 | 3304 | 0 | 1711 | 3413 | 0 | 0 | 1750 | 1473 | 0 | 1731 | 0 |
| Flt Permitted | 0.161 | | | 0.237 | | | | 0.709 | | | 0.815 | |
| Satd. Flow (perm) | 295 | 3304 | 0 | 424 | 3413 | 0 | 0 | 1272 | 1419 | 0 | 1434 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 33 | | | 1 | | | | 109 | | 5 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 152.2 | | | 122.4 | | | 109.8 | | | 109.8 | |
| Travel Time (s) | | 11.0 | | | 8.8 | | | 7.9 | | | 7.9 | |
| Confl. Peds. (#/hr) | 24 | | 22 | 22 | | 24 | 26 | | 27 | 27 | | 26 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 2% | 2% | 13% | 0% | 0% | 6% | 0% | 0% | 0% |
| Adj. Flow (vph) | 11 | 908 | 151 | 99 | 1323 | 11 | 176 | 2 | 129 | 15 | 7 | 5 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 11 | 1059 | 0 | 99 | 1334 | 0 | 0 | 178 | 129 | 0 | 27 | 0 |
| Turn Type | Perm | NA | | Perm | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 20.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.7 | 25.7 | | 25.7 | 25.7 | | 15.7 | 15.7 | 15.7 | 15.7 | 15.7 | |
| Total Split (s) | 55.0 | 55.0 | | 55.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 61.1% | 61.1% | | 61.1% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 49.3 | 49.3 | | 49.3 | 49.3 | | 29.3 | 29.3 | 29.3 | 29.3 | 29.3 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.7 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.7 | 5.7 | | 5.7 | 5.7 | | | 5.7 | 5.7 | | 5.7 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | C-Max | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 10.0 | 10.0 | | 10.0 | 10.0 | | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 17.0 | 17.0 | | 17.0 | 17.0 | | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 60.6 | 60.6 | | 60.6 | 60.6 | | | 18.0 | 18.0 | | 18.0 | |
| Actuated g/C Ratio | 0.67 | 0.67 | | 0.67 | 0.67 | | | 0.20 | 0.20 | | 0.20 | |
| v/c Ratio | 0.06 | 0.47 | | 0.35 | 0.58 | | | 0.70 | 0.35 | | 0.09 | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 8.0 | 8.5 | | 8.0 | 6.4 | | | 47.3 | 10.3 | | 23.2 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 8.0 | 8.5 | | 8.0 | 6.4 | | | 47.3 | 10.3 | | 23.2 | |
| LOS | A | A | | A | A | | | D | B | | C | |
| Approach Delay | | 8.5 | | | 6.5 | | | 31.7 | | | 23.2 | |
| Approach LOS | | A | | | A | | | C | | | C | |
| Queue Length 50th (m) | 0.6 | 38.7 | | 2.8 | 19.8 | | | 28.9 | 2.8 | | 3.1 | |
| Queue Length 95th (m) | 3.2 | 69.0 | | 14.5 | 80.7 | | | 44.9 | 15.0 | | 8.7 | |
| Internal Link Dist (m) | | 128.2 | | | 98.4 | | | 85.8 | | | 85.8 | |
| Turn Bay Length (m) | | | | | | | | | 18.0 | | | |
| Base Capacity (vph) | 198 | 2234 | | 285 | 2297 | | | 414 | 535 | | 470 | |
| Starvation Cap Reductn | 0 | 0 | | 0 | 93 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.06 | 0.47 | | 0.35 | 0.61 | | | 0.43 | 0.24 | | 0.06 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 22 (24%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 55 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.70 | | | |
| Intersection Signal Delay: 10.2 | | Intersection LOS: B | |
| Intersection Capacity Utilization 85.1% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Rifle Range/Westbourne & Main

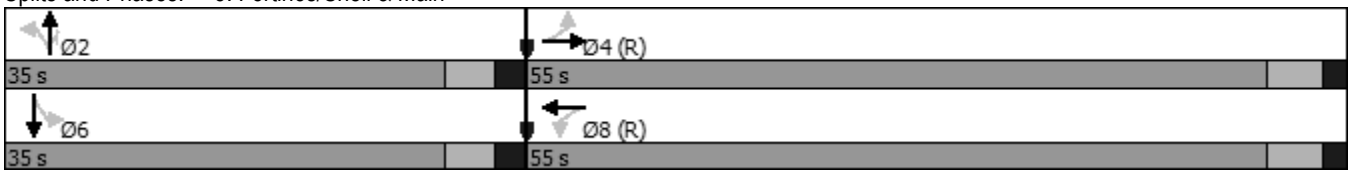


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 934 | 35 | 167 | 1255 | 2 | 72 | 0 | 112 | 0 | 2 | 4 |
| Future Volume (vph) | 4 | 934 | 35 | 167 | 1255 | 2 | 72 | 0 | 112 | 0 | 2 | 4 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 15.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 1.00 | 1.00 | | 0.99 | 1.00 | | | 0.98 | 0.95 | | 0.98 | |
| Frt | | 0.995 | | | | | | | 0.850 | | 0.910 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | | |
| Satd. Flow (prot) | 1745 | 3368 | 0 | 1728 | 3419 | 0 | 0 | 1711 | 1561 | 0 | 1633 | 0 |
| Flt Permitted | 0.170 | | | 0.253 | | | | 0.754 | | | | |
| Satd. Flow (perm) | 311 | 3368 | 0 | 457 | 3419 | 0 | 0 | 1327 | 1479 | 0 | 1633 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 7 | | | | | | | 83 | | 4 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 122.4 | | | 7784.9 | | | 122.4 | | | 73.8 | |
| Travel Time (s) | | 8.8 | | | 560.5 | | | 8.8 | | | 5.3 | |
| Confl. Peds. (#/hr) | 26 | | 26 | 26 | | 26 | 24 | | 43 | 43 | | 24 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 1% | 2% | 50% | 2% | 0% | 0% | 0% | 0% | 0% |
| Adj. Flow (vph) | 4 | 1015 | 38 | 182 | 1364 | 2 | 78 | 0 | 122 | 0 | 2 | 4 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 4 | 1053 | 0 | 182 | 1366 | 0 | 0 | 78 | 122 | 0 | 6 | 0 |
| Turn Type | Perm | NA | | Perm | NA | | Perm | NA | Perm | | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 20.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.5 | 25.5 | | 25.5 | 25.5 | | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | |
| Total Split (s) | 55.0 | 55.0 | | 55.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 61.1% | 61.1% | | 61.1% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 49.5 | 49.5 | | 49.5 | 49.5 | | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.7 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 1.8 | 1.8 | | 1.8 | 1.8 | | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.5 | 5.5 | | 5.5 | 5.5 | | | 5.5 | 5.5 | | 5.5 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | C-Max | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 12.0 | 12.0 | | 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 | | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 67.3 | 67.3 | | 67.3 | 67.3 | | | 11.7 | 11.7 | | 11.7 | |
| Actuated g/C Ratio | 0.75 | 0.75 | | 0.75 | 0.75 | | | 0.13 | 0.13 | | 0.13 | |
| v/c Ratio | 0.02 | 0.42 | | 0.53 | 0.53 | | | 0.45 | 0.46 | | 0.03 | |

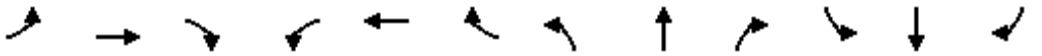
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 2.8 | 2.9 | | 12.4 | 6.0 | | | 44.2 | 19.7 | | 24.0 | |
| Queue Delay | 0.0 | 0.1 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 2.8 | 3.0 | | 12.4 | 6.0 | | | 44.2 | 19.7 | | 24.0 | |
| LOS | A | A | | B | A | | | D | B | | C | |
| Approach Delay | | 3.0 | | | 6.7 | | | 29.2 | | | 24.0 | |
| Approach LOS | | A | | | A | | | C | | | C | |
| Queue Length 50th (m) | 0.1 | 14.1 | | 10.0 | 39.5 | | | 12.8 | 6.2 | | 0.3 | |
| Queue Length 95th (m) | m0.3 | 20.8 | | 34.4 | 66.6 | | | 25.0 | 20.8 | | 3.5 | |
| Internal Link Dist (m) | | 98.4 | | | 7760.9 | | | 98.4 | | | 49.8 | |
| Turn Bay Length (m) | | | | | | | | | 15.0 | | | |
| Base Capacity (vph) | 232 | 2518 | | 341 | 2555 | | | 434 | 540 | | 537 | |
| Starvation Cap Reductn | 0 | 265 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 58 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.02 | 0.47 | | 0.53 | 0.55 | | | 0.18 | 0.23 | | 0.01 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 22 (24%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 60 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.53 | | | |
| Intersection Signal Delay: 7.0 | | Intersection LOS: A | |
| Intersection Capacity Utilization 85.5% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |
| m Volume for 95th percentile queue is metered by upstream signal. | | | |

Splits and Phases: 8: Fortinos/Shell & Main



# Appendix D: Future Total Capacity Analysis

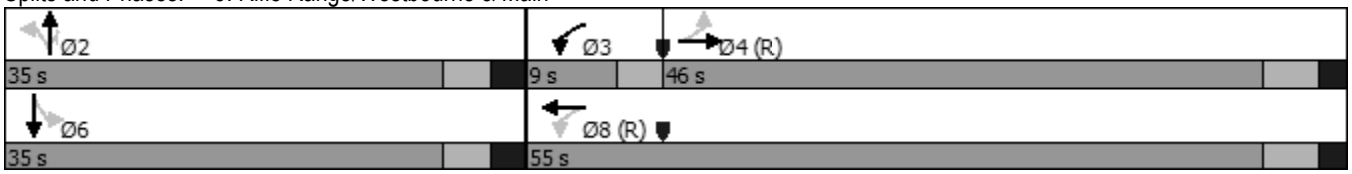


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 1360 | 224 | 105 | 585 | 12 | 122 | 1 | 177 | 8 | 4 | 2 |
| Future Volume (vph) | 4 | 1360 | 224 | 105 | 585 | 12 | 122 | 1 | 177 | 8 | 4 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 18.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 1.00 | | | 1.00 | | | 1.00 | 0.97 | | 0.99 | |
| Frt | | 0.979 | | | 0.997 | | | | 0.850 | | 0.982 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.953 | | | 0.971 | |
| Satd. Flow (prot) | 1745 | 3288 | 0 | 1631 | 3148 | 0 | 0 | 1582 | 1346 | 0 | 1748 | 0 |
| Flt Permitted | 0.405 | | | 0.073 | | | | 0.717 | | | 0.833 | |
| Satd. Flow (perm) | 733 | 3288 | 0 | 125 | 3148 | 0 | 0 | 1187 | 1311 | 0 | 1489 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 27 | | | 3 | | | | 151 | | 2 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 152.2 | | | 122.4 | | | 109.8 | | | 109.8 | |
| Travel Time (s) | | 11.0 | | | 8.8 | | | 7.9 | | | 7.9 | |
| Confl. Peds. (#/hr) | 21 | | 8 | 8 | | 21 | 3 | | 15 | 15 | | 3 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 6% | 7% | 10% | 30% | 10% | 100% | 16% | 0% | 0% | 0% |
| Adj. Flow (vph) | 4 | 1478 | 243 | 114 | 636 | 13 | 133 | 1 | 192 | 9 | 4 | 2 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 4 | 1721 | 0 | 114 | 649 | 0 | 0 | 134 | 192 | 0 | 15 | 0 |
| Turn Type | Perm | NA | | pm+pt | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | | 4 | | 3 | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 3 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 5.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.7 | 25.7 | | 8.0 | 25.7 | | 15.7 | 15.7 | 15.7 | 15.7 | 15.7 | |
| Total Split (s) | 46.0 | 46.0 | | 9.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 51.1% | 51.1% | | 10.0% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 40.3 | 40.3 | | 6.0 | 49.3 | | 29.3 | 29.3 | 29.3 | 29.3 | 29.3 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.0 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 2.0 | 2.0 | | 0.0 | 2.0 | | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.7 | 5.7 | | 3.0 | 5.7 | | | 5.7 | 5.7 | | 5.7 | |
| Lead/Lag | Lag | Lag | | Lead | | | | | | | | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | None | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 10.0 | 10.0 | | | 10.0 | | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 17.0 | 17.0 | | | 17.0 | | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 51.7 | 51.7 | | 65.3 | 62.6 | | | 16.0 | 16.0 | | 16.0 | |
| Actuated g/C Ratio | 0.57 | 0.57 | | 0.73 | 0.70 | | | 0.18 | 0.18 | | 0.18 | |
| v/c Ratio | 0.01 | 0.91 | | 0.51 | 0.30 | | | 0.64 | 0.54 | | 0.06 | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 11.8 | 27.2 | | 25.5 | 4.9 | | | 47.2 | 14.4 | | 25.4 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 11.8 | 27.2 | | 25.5 | 4.9 | | | 47.2 | 14.4 | | 25.4 | |
| LOS | B | C | | C | A | | | D | B | | C | |
| Approach Delay | | 27.2 | | | 7.9 | | | 27.9 | | | 25.4 | |
| Approach LOS | | C | | | A | | | C | | | C | |
| Queue Length 50th (m) | 0.3 | 123.4 | | 7.2 | 13.7 | | | 21.8 | 6.1 | | 1.9 | |
| Queue Length 95th (m) | 2.2 | #226.7 | | 16.7 | 18.2 | | | 36.4 | 22.7 | | 6.4 | |
| Internal Link Dist (m) | | 128.2 | | | 98.4 | | | 85.8 | | | 85.8 | |
| Turn Bay Length (m) | | | | | | | | | 18.0 | | | |
| Base Capacity (vph) | 420 | 1898 | | 224 | 2191 | | | 386 | 528 | | 486 | |
| Starvation Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.01 | 0.91 | | 0.51 | 0.30 | | | 0.35 | 0.36 | | 0.03 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 31 (34%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 75 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.91 | | | |
| Intersection Signal Delay: 22.1 | | Intersection LOS: C | |
| Intersection Capacity Utilization 86.0% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |
| # 95th percentile volume exceeds capacity, queue may be longer. | | | |
| Queue shown is maximum after two cycles. | | | |

Splits and Phases: 3: Rifle Range/Westbourne & Main

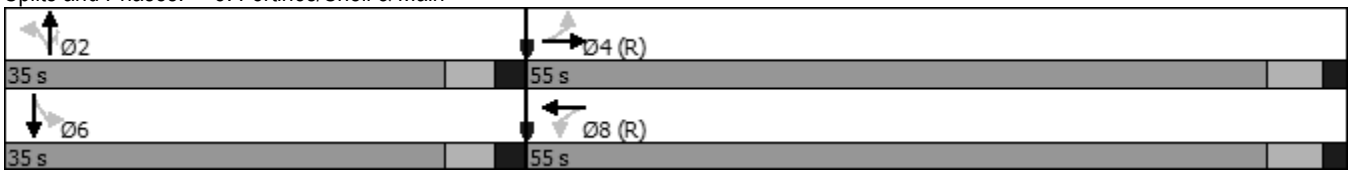


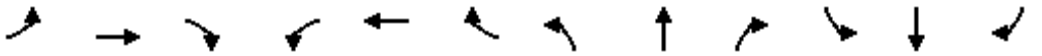
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 5 | 1525 | 16 | 47 | 705 | 0 | 12 | 0 | 37 | 0 | 1 | 11 |
| Future Volume (vph) | 5 | 1525 | 16 | 47 | 705 | 0 | 12 | 0 | 37 | 0 | 1 | 11 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 15.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 1.00 | | | | | | 0.99 | 0.98 | | 0.98 | |
| Frt | | 0.998 | | | | | | | 0.850 | | 0.875 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | | |
| Satd. Flow (prot) | 1745 | 3346 | 0 | 1544 | 3202 | 0 | 0 | 1454 | 1473 | 0 | 1434 | 0 |
| Flt Permitted | 0.361 | | | 0.124 | | | | 0.749 | | | | |
| Satd. Flow (perm) | 657 | 3346 | 0 | 202 | 3202 | 0 | 0 | 1139 | 1448 | 0 | 1434 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 2 | | | | | | | 30 | | 12 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 122.4 | | | 7784.9 | | | 122.4 | | | 73.8 | |
| Travel Time (s) | | 8.8 | | | 560.5 | | | 8.8 | | | 5.3 | |
| Confl. Peds. (#/hr) | 20 | | 7 | 7 | | 20 | 7 | | 5 | 5 | | 7 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 4% | 8% | 13% | 9% | 0% | 20% | 0% | 6% | 0% | 0% | 11% |
| Adj. Flow (vph) | 5 | 1658 | 17 | 51 | 766 | 0 | 13 | 0 | 40 | 0 | 1 | 12 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 5 | 1675 | 0 | 51 | 766 | 0 | 0 | 13 | 40 | 0 | 13 | 0 |
| Turn Type | Perm | NA | | Perm | NA | | Perm | NA | Perm | | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 20.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.5 | 25.5 | | 25.5 | 25.5 | | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | |
| Total Split (s) | 55.0 | 55.0 | | 55.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 61.1% | 61.1% | | 61.1% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 49.5 | 49.5 | | 49.5 | 49.5 | | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.7 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 1.8 | 1.8 | | 1.8 | 1.8 | | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.5 | 5.5 | | 5.5 | 5.5 | | | 5.5 | 5.5 | | 5.5 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | C-Max | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 12.0 | 12.0 | | 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 | | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 77.4 | 77.4 | | 77.4 | 77.4 | | | 10.0 | 10.0 | | 10.0 | |
| Actuated g/C Ratio | 0.86 | 0.86 | | 0.86 | 0.86 | | | 0.11 | 0.11 | | 0.11 | |
| v/c Ratio | 0.01 | 0.58 | | 0.29 | 0.28 | | | 0.10 | 0.21 | | 0.08 | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 0.8 | 2.6 | | 8.3 | 2.6 | | | 38.2 | 20.4 | | 20.5 | |
| Queue Delay | 0.0 | 0.1 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 0.8 | 2.7 | | 8.3 | 2.6 | | | 38.2 | 20.4 | | 20.5 | |
| LOS | A | A | | A | A | | | D | C | | C | |
| Approach Delay | | 2.7 | | | 2.9 | | | 24.7 | | | 20.5 | |
| Approach LOS | | A | | | A | | | C | | | C | |
| Queue Length 50th (m) | 0.0 | 7.3 | | 2.2 | 16.7 | | | 2.1 | 1.6 | | 0.2 | |
| Queue Length 95th (m) | m0.1 | m26.8 | | 8.2 | 22.5 | | | 7.5 | 10.6 | | 5.4 | |
| Internal Link Dist (m) | | 98.4 | | | 7760.9 | | | 98.4 | | | 49.8 | |
| Turn Bay Length (m) | | | | | | | | | 15.0 | | | |
| Base Capacity (vph) | 565 | 2877 | | 173 | 2753 | | | 373 | 494 | | 478 | |
| Starvation Cap Reductn | 0 | 217 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.01 | 0.63 | | 0.29 | 0.28 | | | 0.03 | 0.08 | | 0.03 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 31 (34%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 60 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.58 | | | |
| Intersection Signal Delay: 3.3 | | Intersection LOS: A | |
| Intersection Capacity Utilization 78.5% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |
| m Volume for 95th percentile queue is metered by upstream signal. | | | |

Splits and Phases: 8: Fortinos/Shell & Main



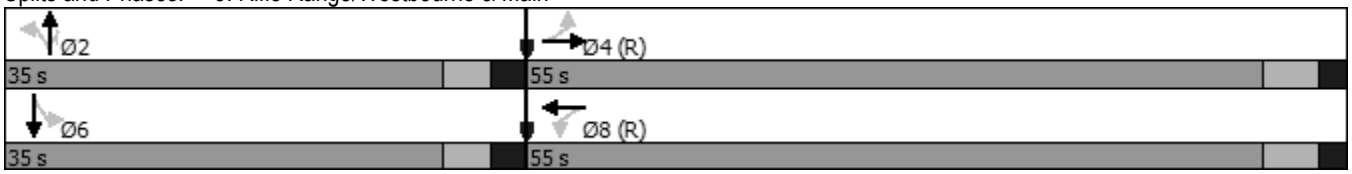


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 835 | 192 | 158 | 1217 | 10 | 232 | 2 | 175 | 14 | 6 | 5 |
| Future Volume (vph) | 10 | 835 | 192 | 158 | 1217 | 10 | 232 | 2 | 175 | 14 | 6 | 5 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 18.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 1.00 | 0.99 | | 0.99 | 1.00 | | | 0.98 | 0.96 | | 0.98 | |
| Frt | | 0.972 | | | 0.999 | | | | 0.850 | | 0.975 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.953 | | | 0.973 | |
| Satd. Flow (prot) | 1745 | 3277 | 0 | 1711 | 3413 | 0 | 0 | 1750 | 1473 | 0 | 1731 | 0 |
| Flt Permitted | 0.146 | | | 0.205 | | | | 0.708 | | | 0.810 | |
| Satd. Flow (perm) | 267 | 3277 | 0 | 367 | 3413 | 0 | 0 | 1270 | 1419 | 0 | 1428 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 49 | | | 1 | | | | 109 | | 5 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 152.2 | | | 122.4 | | | 109.8 | | | 109.8 | |
| Travel Time (s) | | 11.0 | | | 8.8 | | | 7.9 | | | 7.9 | |
| Confl. Peds. (#/hr) | 24 | | 22 | 22 | | 24 | 26 | | 27 | 27 | | 26 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 2% | 2% | 13% | 0% | 0% | 6% | 0% | 0% | 0% |
| Adj. Flow (vph) | 11 | 908 | 209 | 172 | 1323 | 11 | 252 | 2 | 190 | 15 | 7 | 5 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 11 | 1117 | 0 | 172 | 1334 | 0 | 0 | 254 | 190 | 0 | 27 | 0 |
| Turn Type | Perm | NA | | Perm | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 20.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.7 | 25.7 | | 25.7 | 25.7 | | 15.7 | 15.7 | 15.7 | 15.7 | 15.7 | |
| Total Split (s) | 55.0 | 55.0 | | 55.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 61.1% | 61.1% | | 61.1% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 49.3 | 49.3 | | 49.3 | 49.3 | | 29.3 | 29.3 | 29.3 | 29.3 | 29.3 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.7 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.7 | 5.7 | | 5.7 | 5.7 | | | 5.7 | 5.7 | | 5.7 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | C-Max | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 10.0 | 10.0 | | 10.0 | 10.0 | | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 17.0 | 17.0 | | 17.0 | 17.0 | | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 55.8 | 55.8 | | 55.8 | 55.8 | | | 22.8 | 22.8 | | 22.8 | |
| Actuated g/C Ratio | 0.62 | 0.62 | | 0.62 | 0.62 | | | 0.25 | 0.25 | | 0.25 | |
| v/c Ratio | 0.07 | 0.54 | | 0.76 | 0.63 | | | 0.79 | 0.43 | | 0.07 | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 10.4 | 11.5 | | 34.0 | 9.3 | | | 48.4 | 14.4 | | 19.9 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.1 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 10.4 | 11.5 | | 34.0 | 9.4 | | | 48.4 | 14.4 | | 19.9 | |
| LOS | B | B | | C | A | | | D | B | | B | |
| Approach Delay | | 11.5 | | | 12.2 | | | 33.9 | | | 19.9 | |
| Approach LOS | | B | | | B | | | C | | | B | |
| Queue Length 50th (m) | 0.7 | 51.3 | | 11.8 | 74.8 | | | 40.7 | 11.0 | | 2.9 | |
| Queue Length 95th (m) | 3.6 | 81.4 | | #47.7 | 112.7 | | | 62.2 | 26.2 | | 8.3 | |
| Internal Link Dist (m) | | 128.2 | | | 98.4 | | | 85.8 | | | 85.8 | |
| Turn Bay Length (m) | | | | | | | | | 18.0 | | | |
| Base Capacity (vph) | 165 | 2051 | | 227 | 2117 | | | 413 | 535 | | 468 | |
| Starvation Cap Reductn | 0 | 0 | | 0 | 125 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.07 | 0.54 | | 0.76 | 0.67 | | | 0.62 | 0.36 | | 0.06 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 22 (24%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 75 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.79 | | | |
| Intersection Signal Delay: 15.1 | | Intersection LOS: B | |
| Intersection Capacity Utilization 87.2% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |
| # 95th percentile volume exceeds capacity, queue may be longer. | | | |
| Queue shown is maximum after two cycles. | | | |

Splits and Phases: 3: Rifle Range/Westbourne & Main

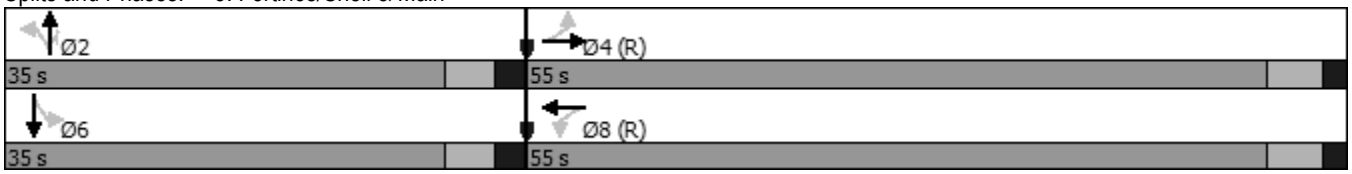


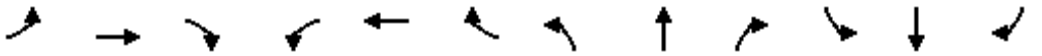
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 990 | 35 | 167 | 1321 | 2 | 72 | 0 | 112 | 0 | 2 | 4 |
| Future Volume (vph) | 4 | 990 | 35 | 167 | 1321 | 2 | 72 | 0 | 112 | 0 | 2 | 4 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 15.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 1.00 | 1.00 | | 0.99 | 1.00 | | | 0.98 | 0.95 | | 0.98 | |
| Frt | | 0.995 | | | | | | | 0.850 | | 0.910 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | | |
| Satd. Flow (prot) | 1745 | 3368 | 0 | 1728 | 3419 | 0 | 0 | 1711 | 1561 | 0 | 1633 | 0 |
| Flt Permitted | 0.155 | | | 0.235 | | | | 0.754 | | | | |
| Satd. Flow (perm) | 284 | 3368 | 0 | 425 | 3419 | 0 | 0 | 1327 | 1479 | 0 | 1633 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 6 | | | | | | | 71 | | 4 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 122.4 | | | 7784.9 | | | 122.4 | | | 73.8 | |
| Travel Time (s) | | 8.8 | | | 560.5 | | | 8.8 | | | 5.3 | |
| Confl. Peds. (#/hr) | 26 | | 26 | 26 | | 26 | 24 | | 43 | 43 | | 24 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 1% | 2% | 50% | 2% | 0% | 0% | 0% | 0% | 0% |
| Adj. Flow (vph) | 4 | 1076 | 38 | 182 | 1436 | 2 | 78 | 0 | 122 | 0 | 2 | 4 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 4 | 1114 | 0 | 182 | 1438 | 0 | 0 | 78 | 122 | 0 | 6 | 0 |
| Turn Type | Perm | NA | | Perm | NA | | Perm | NA | Perm | | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 8 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 20.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.5 | 25.5 | | 25.5 | 25.5 | | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | |
| Total Split (s) | 55.0 | 55.0 | | 55.0 | 55.0 | | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | |
| Total Split (%) | 61.1% | 61.1% | | 61.1% | 61.1% | | 38.9% | 38.9% | 38.9% | 38.9% | 38.9% | |
| Maximum Green (s) | 49.5 | 49.5 | | 49.5 | 49.5 | | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.7 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 1.8 | 1.8 | | 1.8 | 1.8 | | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.5 | 5.5 | | 5.5 | 5.5 | | | 5.5 | 5.5 | | 5.5 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | C-Max | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 12.0 | 12.0 | | 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 | | 16.0 | 16.0 | 16.0 | 16.0 | 16.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 67.3 | 67.3 | | 67.3 | 67.3 | | | 11.7 | 11.7 | | 11.7 | |
| Actuated g/C Ratio | 0.75 | 0.75 | | 0.75 | 0.75 | | | 0.13 | 0.13 | | 0.13 | |
| v/c Ratio | 0.02 | 0.44 | | 0.57 | 0.56 | | | 0.45 | 0.48 | | 0.03 | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 3.0 | 3.2 | | 14.7 | 6.3 | | | 44.2 | 23.2 | | 24.0 | |
| Queue Delay | 0.0 | 0.1 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 3.0 | 3.3 | | 14.7 | 6.3 | | | 44.2 | 23.2 | | 24.0 | |
| LOS | A | A | | B | A | | | D | C | | C | |
| Approach Delay | | 3.3 | | | 7.2 | | | 31.4 | | | 24.0 | |
| Approach LOS | | A | | | A | | | C | | | C | |
| Queue Length 50th (m) | 0.1 | 19.2 | | 10.5 | 43.0 | | | 12.8 | 8.2 | | 0.3 | |
| Queue Length 95th (m) | m0.2 | 26.6 | | 39.7 | 72.6 | | | 25.0 | 23.0 | | 3.5 | |
| Internal Link Dist (m) | | 98.4 | | | 7760.9 | | | 98.4 | | | 49.8 | |
| Turn Bay Length (m) | | | | | | | | | 15.0 | | | |
| Base Capacity (vph) | 212 | 2518 | | 317 | 2555 | | | 434 | 532 | | 537 | |
| Starvation Cap Reductn | 0 | 285 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 76 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.02 | 0.50 | | 0.57 | 0.58 | | | 0.18 | 0.23 | | 0.01 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 22 (24%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 60 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.57 | | | |
| Intersection Signal Delay: 7.4 | | Intersection LOS: A | |
| Intersection Capacity Utilization 87.3% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |
| m Volume for 95th percentile queue is metered by upstream signal. | | | |

Splits and Phases: 8: Fortinos/Shell & Main



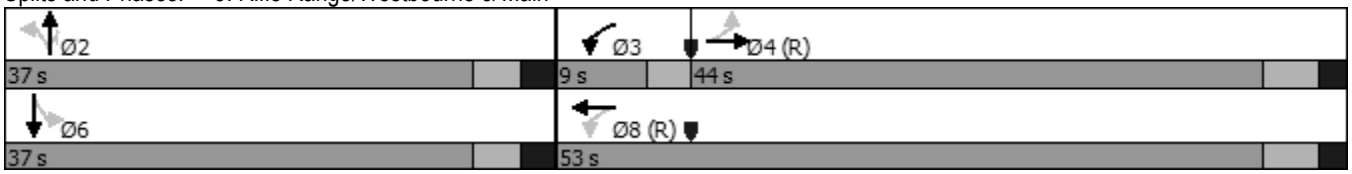


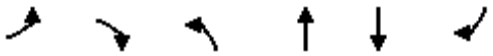
| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 835 | 192 | 158 | 1217 | 10 | 232 | 2 | 175 | 14 | 6 | 5 |
| Future Volume (vph) | 10 | 835 | 192 | 158 | 1217 | 10 | 232 | 2 | 175 | 14 | 6 | 5 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 18.0 | 0.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 1 | | 0 | 0 | | 1 | 0 | | 0 |
| Taper Length (m) | 2.5 | | | 2.5 | | | 2.5 | | | 2.5 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 1.00 | 0.99 | | 1.00 | 1.00 | | | 0.98 | 0.96 | | 0.98 | |
| Frt | | 0.972 | | | 0.999 | | | | 0.850 | | 0.975 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.953 | | | 0.973 | |
| Satd. Flow (prot) | 1745 | 3277 | 0 | 1711 | 3413 | 0 | 0 | 1750 | 1473 | 0 | 1731 | 0 |
| Flt Permitted | 0.182 | | | 0.148 | | | | 0.708 | | | 0.811 | |
| Satd. Flow (perm) | 333 | 3277 | 0 | 265 | 3413 | 0 | 0 | 1270 | 1419 | 0 | 1429 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 38 | | | 1 | | | | 155 | | 5 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 152.2 | | | 122.4 | | | 109.8 | | | 109.8 | |
| Travel Time (s) | | 11.0 | | | 8.8 | | | 7.9 | | | 7.9 | |
| Confl. Peds. (#/hr) | 24 | | 22 | 22 | | 24 | 26 | | 27 | 27 | | 26 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 2% | 2% | 13% | 0% | 0% | 6% | 0% | 0% | 0% |
| Adj. Flow (vph) | 11 | 908 | 209 | 172 | 1323 | 11 | 252 | 2 | 190 | 15 | 7 | 5 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 11 | 1117 | 0 | 172 | 1334 | 0 | 0 | 254 | 190 | 0 | 27 | 0 |
| Turn Type | Perm | NA | | pm+pt | NA | | Perm | NA | Perm | Perm | NA | |
| Protected Phases | | 4 | | 3 | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | 2 | 6 | | |
| Detector Phase | 4 | 4 | | 3 | 8 | | 2 | 2 | 2 | 6 | 6 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 20.0 | 20.0 | | 5.0 | 20.0 | | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | |
| Minimum Split (s) | 25.7 | 25.7 | | 9.5 | 25.7 | | 15.7 | 15.7 | 15.7 | 15.7 | 15.7 | |
| Total Split (s) | 44.0 | 44.0 | | 9.0 | 53.0 | | 37.0 | 37.0 | 37.0 | 37.0 | 37.0 | |
| Total Split (%) | 48.9% | 48.9% | | 10.0% | 58.9% | | 41.1% | 41.1% | 41.1% | 41.1% | 41.1% | |
| Maximum Green (s) | 38.3 | 38.3 | | 6.0 | 47.3 | | 31.3 | 31.3 | 31.3 | 31.3 | 31.3 | |
| Yellow Time (s) | 3.7 | 3.7 | | 3.0 | 3.7 | | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 | |
| All-Red Time (s) | 2.0 | 2.0 | | 0.0 | 2.0 | | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 | | 0.0 | |
| Total Lost Time (s) | 5.7 | 5.7 | | 3.0 | 5.7 | | | 5.7 | 5.7 | | 5.7 | |
| Lead/Lag | Lag | Lag | | Lead | | | | | | | | |
| Lead-Lag Optimize? | Yes | Yes | | Yes | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | C-Max | C-Max | | None | C-Max | | None | None | None | None | None | |
| Walk Time (s) | 10.0 | 10.0 | | | 10.0 | | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | |
| Flash Dont Walk (s) | 17.0 | 17.0 | | | 17.0 | | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | | 0 | | 0 | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 43.9 | 43.9 | | 58.1 | 55.4 | | | 23.2 | 23.2 | | 23.2 | |
| Actuated g/C Ratio | 0.49 | 0.49 | | 0.65 | 0.62 | | | 0.26 | 0.26 | | 0.26 | |
| v/c Ratio | 0.07 | 0.69 | | 0.56 | 0.64 | | | 0.78 | 0.40 | | 0.07 | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Delay | 16.7 | 21.2 | | 19.8 | 9.7 | | | 46.4 | 8.7 | | 19.3 | |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.1 | | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 16.7 | 21.2 | | 19.8 | 9.8 | | | 46.4 | 8.7 | | 19.3 | |
| LOS | B | C | | B | A | | | D | A | | B | |
| Approach Delay | | 21.2 | | | 10.9 | | | 30.2 | | | 19.3 | |
| Approach LOS | | C | | | B | | | C | | | B | |
| Queue Length 50th (m) | 1.0 | 76.1 | | 7.5 | 35.0 | | | 40.6 | 4.6 | | 2.9 | |
| Queue Length 95th (m) | 4.5 | 108.5 | | #32.1 | 59.5 | | | 59.9 | 18.0 | | 8.0 | |
| Internal Link Dist (m) | | 128.2 | | | 98.4 | | | 85.8 | | | 85.8 | |
| Turn Bay Length (m) | | | | | | | | | 18.0 | | | |
| Base Capacity (vph) | 162 | 1618 | | 306 | 2100 | | | 441 | 594 | | 500 | |
| Starvation Cap Reductn | 0 | 0 | | 0 | 122 | | | 0 | 0 | | 0 | |
| Spillback Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Storage Cap Reductn | 0 | 0 | | 0 | 0 | | | 0 | 0 | | 0 | |
| Reduced v/c Ratio | 0.07 | 0.69 | | 0.56 | 0.67 | | | 0.58 | 0.32 | | 0.05 | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 90 | | | |
| Actuated Cycle Length: 90 | | | |
| Offset: 22 (24%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green | | | |
| Natural Cycle: 60 | | | |
| Control Type: Actuated-Coordinated | | | |
| Maximum v/c Ratio: 0.78 | | | |
| Intersection Signal Delay: 17.5 | | Intersection LOS: B | |
| Intersection Capacity Utilization 87.2% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |
| # 95th percentile volume exceeds capacity, queue may be longer. | | | |
| Queue shown is maximum after two cycles. | | | |

Splits and Phases: 3: Rifle Range/Westbourne & Main

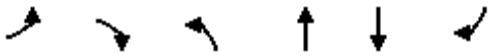




| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 64 | 7 | 6 | 237 | 280 | 53 |
| Future Volume (Veh/h) | 64 | 7 | 6 | 237 | 280 | 53 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 70 | 8 | 7 | 258 | 304 | 58 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | 110 | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 605 | 333 | 362 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 605 | 333 | 362 | | | |
| tC, single (s) | 6.4 | 6.2 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 85 | 99 | 99 | | | |
| cM capacity (veh/h) | 458 | 709 | 1197 | | | |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 78 | 265 | 362 |
| Volume Left | 70 | 7 | 0 |
| Volume Right | 8 | 0 | 58 |
| cSH | 475 | 1197 | 1700 |
| Volume to Capacity | 0.16 | 0.01 | 0.21 |
| Queue Length 95th (m) | 4.4 | 0.1 | 0.0 |
| Control Delay (s) | 14.1 | 0.3 | 0.0 |
| Lane LOS | B | A | |
| Approach Delay (s) | 14.1 | 0.3 | 0.0 |
| Approach LOS | B | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.7 | | |
| Intersection Capacity Utilization | 28.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 126 | 14 | 13 | 283 | 236 | 120 |
| Future Volume (Veh/h) | 126 | 14 | 13 | 283 | 236 | 120 |
| 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) | 137 | 15 | 14 | 308 | 257 | 130 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | 110 | |
| pX, platoon unblocked | 0.98 | 0.98 | 0.98 | | | |
| vC, conflicting volume | 658 | 322 | 387 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 637 | 292 | 359 | | | |
| tC, single (s) | 6.4 | 6.2 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 68 | 98 | 99 | | | |
| cM capacity (veh/h) | 426 | 729 | 1170 | | | |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 152 | 322 | 387 |
| Volume Left | 137 | 14 | 0 |
| Volume Right | 15 | 0 | 130 |
| cSH | 444 | 1170 | 1700 |
| Volume to Capacity | 0.34 | 0.01 | 0.23 |
| Queue Length 95th (m) | 11.4 | 0.3 | 0.0 |
| Control Delay (s) | 17.3 | 0.5 | 0.0 |
| Lane LOS | C | A | |
| Approach Delay (s) | 17.3 | 0.5 | 0.0 |
| Approach LOS | C | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.2 | | |
| Intersection Capacity Utilization | 40.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |